DECREE
OF THE PRESIDENT OF THE RUSSIAN FEDERATION
NO. 1268 OF AUGUST 26, 1996
ON THE CONTROL OVER EXPORT FROM THE RUSSIAN FEDERATION OF DUAL-PURPOSE GOODS AND KNOW-HOW
(with the Amendments and Additions of January 4, 1999, February 29, August 9, 2000, September 28, 2001)

Order of the State Customs Committee of the Russian Federation No. 700 of November 20, 1996 was issued to implement the present Decision

Pursuant to Article 16 of the Federal Law on the State Regulation of Foreign Economic Activities (Collection of Laws of the Russian Federation, 42, item 3923, 1995) and for the purpose of ensuring the fulfillment of the international obligations of the Russian Federation ensuing the Vassenaar agreements on export control on conventional weapons, dual-purpose goods, and know-how, I hereby resolve:

1. To approve the List of Dual-Purpose Goods and Know-How Subject to Export Control submitted by the Government of the Russian Federation (attached).

2. The Government of the Russian Federation shall approve the Regulations on the Procedure for the Control over the Exportation from the Russian Federation of Dual-Purpose Goods and Technologies Whose Export Is Subject to Control, while ensuring the putting into effect of the said Regulations simultaneously with the entry into force of the present Decree.

See the Regulations on Monitoring Foreign Economic Activities in Respect of Dual-Purpose Goods and Technologies Which Can Be Used to Create Weapons and Military Equipment, endorsed by Decision of the Government of the Russian Federation No. 447 of June 7, 2001

3. To establish that the foreign economic nomenclature codes as listed in the List of Dual-Purpose Goods and Know-How Subject to Export Control may be updated if necessary by the State Customs Committee of the Russian Federation on approval of the Federal Service of Russia for Currency and Export Control.

4. To consider invalid the Order of the President of the Russian Federation No. 74-rp of February 11, 1994 on the Control over Export from the Russian Federation of Specific Kinds of Raw Materials, Materials, Equipment, Know-How and Scientific and Technical Information that Can be Used in Creation of Weapons and Military Equipment (Collection of Acts of the President and the Government of the Russian Federation, 8, item 591, 1994).

5. The present Decree shall be come effective (excluding Item 2) in three months after the official Publication thereof.

President
of the Russian Federation B. Yeltsin
Moscow, the Kremlin

Decree of the President of the Russian Federation No. 1156 of September 28, 2001 amended this List

The amendments shall come into force three months after the date of the official publication this Decree

See the previous text of the List

LIST
OF DUAL-PURPOSE COMMODITIES AND TECHNOLOGIES EXPORT OF WHICH IS CONTROLLED
(Endorsed by the Decree of the President of the Russian Federation

No. 1268 of August 26, 1996)
(with the Amendments and Additions of January 4, 1999, February 29, August 9, 2000, September 28, 2001)

See also the List of dual-purpose commodities and technologies given in the Order of the State Customs Committee of Russia No. 315 of May 23, 1996 (in the wording of the Order No. 43 of January 31, 1997)

Item No.	Description*1	Item code in the foreign-trade classification
1	2	3

Section 1

Category 1. Perspective Materials

1.1. Systems, equipment, and components

1.1.1. Components made of fluorinated compounds, such as:	
1.1.1.1. Seals, gaskets, packing materials, or tubular seals designed for application in aviation or aerospace equipment and made of materials containing more than 50% (by weight) of any of materials controlled under Subitems (b) and (c) of Item 1.3.9;	39190900
1.1.1.2. Piezoelectric polymers and copolymers made of	392190900

fluorine-containing vinylidene materials controlled under SubItem (a) of Item 1.3.9:

a) in the form of a film or sheet; and

b) with the thickness of more than 200 cm;

1.1.1.3. Seals, gaskets, valve seats, tubular seals of diaphragms made of fluoroelastomers containing at least one group of vinyl ether as a structural unit specially designed for aviation, aerospace, or missile equipment — 391990900

1.1.2. Composite structures or lamellar structures (laminates) which have one of the following components:

1.1.2.1. Organic matrix and made of materials controlled under Items 1.3.10.3, 1.3.10.4, or 1.3.10.5 — 392690100

Note:

In Item 1.1.2.1, control shall not apply to finished or semifinished items specially designed for the following, strictly civilian, use:

a) for sports purposes;

b) in automotive industry;

c) in machine-tool making;

d) for medical purposes;

1.1.2.2. Metallic or carbon matrix and made of:

1.1.2.2.1. Carbon fiber or filamentous materials: — 3801; 392690100; 690310000

a) with specific elasticity modulus of more than 10.15x10(6) m; and

b) specific tensile strength of 17.7x10(4) m; or

1.1.2.2.2. Materials controlled under Item 1.3.10.3

Note:

In Item 1.1.2.2, control shall not apply to finished or semifinished items specially designed for the following, strictly civilian, uses:

a) for sports purposes:

b) in automotive industry;

c) in machine-tool industry;

d) for medical purposes

Technical notes:

1. Specific modulus of elasticity - Young's modulus expressed in Pa or N/m2 divided by specific weight in N/m3 and measured at temperature (296 -+ 2) K [(23 -+ 2) degrees C] and relative humidity (50 -+ 5)%

2. Specific tensile strength - maximum breaking strength expressed in Pa or N/m2 divided by specific weight in N/m3 and measured at (296+-2) K [(23 +- 2)° C] and relative humidity of (50 +- 5)%

Note:

In Item 1.1.2, control shall not apply to composite structures or laminates made of carbon-impregnated epoxy resin, fibrous or filamentous materials used to repair structures of flying vehicles or laminates sizing less than 1 m2

1.1.3. Items of non-fluorine polymer substances controlled under Item 1.3.8.1.3 in the form of a film, sheet, tape, or strip:	391990900; 392099900
1.1.3.1. With the thickness of more than 0.254 mm;	
1.1.3.2. Coated with carbon, graphite, metals, or magnetic substances	

Note:

In Item 1.1.3, control shall not apply to Items coated or laminated with copper and designed to make electronic printed circuits

1.1.4. Protective and detection equipment and parts of it not designed especially for military uses, such as:	
1.1.4.1. Gas masks, gas mask boxes with filters, and decontamination equipment designed or modified for protection against biological factors or radioactive materials fit for use for military purposes, or combat chemical agents and components specially designed for it;	902000900
1.1.4.2. Protective suites, gloves and shoes designed or modified for protection against biological factors or radioactive materials fit for use for military purposes, of combat chemical agents;	620429900; 621600000; 640590
1.1.4.3. Nuclear, biological, and chemical detection systems specially designed or modified to detect or recognize biological factors or radioactive materials fit for use for military purposes, or combat chemical agents and components specially designed for it	902710100; 902710900; 902790900; 903010900

Note:

In Item 1.1.4, control shall not apply to:

a) personal radiation monitoring dosimeters;

b) equipment restricted by design or functionally to protection against toxic substances specific to civilian industry: mining, quarry works, agriculture, pharmacy, medical, veterinary use, waste utilization, or for food industry

1.1.5. Life jackets and special-purpose components made other than to military standards or specifications and not of equal design	

Note:

1. In Item 1.1.5, control shall not apply to personal life jackets and accessories for them exported by users for own personal protection

2. In Item 1.1.5, control shall not apply to life jackets designed to protect only against frontal protection against both fragments and explosion of non-military explosive devices

1.2. Testing, checking, and production equipment

1.2.1. Equipment used to make fiber, prepregs, preforms, or composite materials or items controlled under Items 1.1.2 or	

1.3.10, as well as specially designed components and auxiliary devices:	
1.2.1.1. Fiber winding machines which have motions pertaining to fiber positioning, enveloping, and winding coordinated and programmed along three or more axes and designed especially to make composite structures or laminates of fiber or filamentous materials;	844630000
1.2.1.2. Tape or rope winding machines which have motions pertaining to tape, rope, or roll positioning and winding coordinated or programmed along two or more axes and especially designed to make elements of bodies of combat missiles or flying vehicles of composite materials;	844630000
1.2.1.3. Weaving or netting machines operating within different dimensions or directions, including adapters and devices changing machine functions, designed for fiber weaving, interlacing, or interweaving to make composite materials	844621000

Note:
In Item 1.2.1.3, control shall not apply to textile machines not modified for the above finite use;

1.2.1.4. Equipment specially designed or modified to make reinforced fibers, such as:	
1.2.1.4.1. Equipment used to transform polymer fibers, such as polyacrylonitrile, viscose, pitch, or polycarbosilane, into carbon or silicon carbide fibers, including special equipment for fiber reinforcement by heating;	845610000; 845690000; 851580900
1.2.1.4.2. Equipment used to precipitate vapors of chemical elements or complex substances on a heated filamentous base to make silicon carbide fibers;	841780900
1.2.1.4.3. Equipment used to make heat-resistant ceramics, such as aluminium oxide, by wet winding;	844590000; 845180900
1.2.1.4.4. Equipment used to transform fibers of aluminium-containing precursors into fibers containing alumina (aluminium oxide) by thermal treatment	845180900
1.2.1.5. Equipment used to make prepregs controlled under Item 1.3.10.5 by hot melting;	845180900; 847759100; 847759900
1.2.1.6. Equipment for nondestructive monitoring capable of three-dimensional defect detection using ultrasonic or X-ray tomography methods, specially designed for composite materials	902219000; 902229000; 903180390
1.2.2. Equipment for making metallic alloys, powder metallic alloys or sintered materials specially intended	

for pollution prevention and specially designed for use in one of the processes mentioned in Item 1.3.2.3.2;

1.2.3. Tools, press-forms, dyes, or fixtures for superplastic forming or diffusion welding of titanium, aluminium, or their alloys, specially designed to make: 820730100

a) bodies of flying vehicles or aerospace structures;

b) engines of flying or aerospace vehicles;

c) components specially designed for such structures or engines

1.3. Materials

Technical note:

Unless there are essential objections, the terms "metals" and "alloys" shall cover the following not-treated and semi-finished forms:

non-treated forms - anodes, balls, strips (including cut-out strips and wire strips), metal blanks, blocks, steel pigs, briquettes, bars, cathodes, crystals, cubes, cups, grain, granules, ingots, clods, pellets, billets, powder, rings, grit, slabs, irregular-shape metal pieces, sponge, rods;

semi-finished forms (regardless of whether they are coated, anodized, drilled, or pressed or not):

a) of definite shape or treated materials obtained by rolling, drawing, hot extruding, forging, pulse extrusion, pressing, crushing, spraying and milling, in particular: angle pieces, channels, rings, disks, dust, flocs, foil and sheet, forgings, plates, powder, press- or die-treated items, tapes, flanges, rods (including welded rods, wire rods, and rolled wire), shaped metal pieces, forms, sheets, strips, pipes, and tubes (including tubular rings, tubular rectangles, and tubular strips), drawn or extruded wire;

b) casting material (castings) obtained in dry sand, matrix, metal, plastic, or other type of materials, including die casting, "slag moulds" (fused models), and moulds obtained by powder-metallurgy techniques.

The goal of control measures may not be violated by the export of moulds claimed as finished items not mentioned in the List which actually fall in the controlled category of blanks or semi-finished items.

1.3.1. Materials specially designed to absorb electromagnetic waves, or current-conducting polymers, such as:

1.3.1.1. Materials designed to absorb waves at frequencies over 2x10(8) Hz, however, less than 3x10(12) Hz 381519000; 391000000

Note 1:

Per Item 1.3.1.1 no control shall extend to the following:

a) hair-type absorbers manufactured from natural or synthetic fibers, with non-magnetic absorption filler;

b) absorbers not featuring magnetic losses the working surface of which is not flat including pyramids, cones, edges and spiral surfaces;

c) flat absorbers having all below characteristics:

1) manufactured from any of the following materials: plastic foam materials (flexible or non-flexible) with carbon filler or organic materials including binding additives providing a reflection coefficient of over 5 per cent in comparison with metal within a frequency range differing from the central frequency of falling energy by more than -+ 15 per cent and not capable to withstand temperature exceeding 450 K (177 degrees C);

or

ceramic materials providing reflection of over 20 per cent in comparison with metal within a frequency range differing from the central frequency of falling energy by more than -+ 15 per cent and not capable to withstand temperature exceeding 800 K (527 degrees C)

Technical note.

The specimens for conducting tests for absorption as per the last subitem of the note to Item 1.3.1.1 must have the shape of a square with the side of at least five times the wavelength of the central frequency located in the remote zone of the radiating element

2) tensile strength of less than 7 x 10 (6) N/sq.m; and

3) compression strength of less than 14 x 10 (6) N/sq.m

d) flat absorbers manufactured from baked ferrite and having:

1) specific weight of over 4.4; and

2) the maximum operating temperature of 548 K (275 degrees C)

Note 2.

The wave absorption magnetic materials specified in Note 1 to Item 1.3.1.1 are not exempt from control if contained in paints;

1.3.1.2. Material for waver absorption at frequencies over 1.5x10(14) Hz, however, less than 3,7x10(14) Hz, not transparent for visible light;	381519000; 391000000
1.3.1.3. Current conducting polymer materials with the bulk electric conductivity of more than 10,000 S/m or surface resistivity less than 100 ъ/m2 made on the basis of any of the following polymers:	
1.3.1.3.1. Polyaniline;	390930000
1.3.1.3.2. Polypyrol;	391190900
1.3.1.3.3. Polythiophen;	391190900
1.3.1.3.4. Polyphenylene-vinylene; or	391190900
1.3.1.3.5. Polythienylene-vinylene	391990900

Technical note:

Bulk electric conductivity and surface resistivity ought to be determined in accordance with the standard ASTM technique D-257 or its national equivalent

1.3.2. Metallic alloys, powders of metallic alloys or sintered materials of the following type:

Note:

In Item 1.3.2, control shall not apply to metallic alloys, powders of metallic alloys or sintered materials designed for grounding coatings

Technical Notes:

1. Metallic alloys mentioned in Item 1.3.2 include those containing a larger percent (by weight) of the mentioned metal as compared to other elements

2. Service life before breaking should be determined according to the standard method ASTM E-139 or its national equivalent

3. Cyclic fatigue factor must be determined according to the standard method ASTM E-606 "Recommendations for Fatigue Testing with a Small Number of Tests and Constant Amplitude" or its national equivalent.

The testing should be carried out in the axial direction with the average load indicator equal to one and the load concentration factor (Kt) equal to one. The average load is defined as the ratio of division of the difference of the maximum and minimum loads by the maximum load

1.3.2.1. Aluminides, such as:	
1.3.2.1.1. Nickel aluminides containing a minimum of 15% (by weight) and a maximum of 38% (by weight) of aluminium and at least one additional alloy element;	7502200000
1.3.2.1.2. Titanium aluminides containing 10% (by weight) or more of aluminium and at least one of additional alloy element	810810100
1.3.2.2. Metal alloys made of materials controlled under Item 1.3.2.3, such as:	
1.3.2.2.1. Nickel alloys:	7502200000
a) with the service life of 10,000 hours or more before breaking under the load of 676 MPa at 923 K (650°C); or	
b) with the lower cyclic fatigue indicator - 10,000 cycles or more - at 823 K (550°C) and maximum load of 1,095 MPa;	
1.3.2.2.2. Niobium alloys:	8112913100;
a) with the service life of 10,000 hours or more before breaking under the load of 400MPa at 1,073 K (800°C); or	8112993000
b) low cyclic fatigue indicator - 10,000 cycles or more - at 973 K (700°C) and maximum load of 700 MPa;	
1.3.2.2.3. Titanium alloys:	810810100
a) with the service life of 10,000 hours or more before breaking under the load of 200 MPa at 723 K (450°C); or	
b) low cyclic fatigue indicator - 10,000 cycles or more - at 723 K (450°C) and maximum load of 400 MPa;	
1.3.2.2.4. Aluminium alloys with the maximum tensile strength:	760120; 7604291000;
a) 240 MPa or more at 473 K (200°C); or	7608209100;
b) 415 MPa or more at 298 K (25°C);	7608209900
1.3.2.2.5. Magnesium alloys:	8104
a) with the maximum tensile strength of 345 MPa or more; and	
b) corrosion rate less than 1 mm per year in the 3% water solution of sodium chloride measured according to the standard method ASTM G-31 or its national equivalent	
1.3.2.3. Powders of metal alloys or particles of materials featuring all of the following characteristics:	
1.3.2.3.1. Made of any of the following composite systems:	
Technical Note:	
X hereinafter stands for one or more elements making	

the alloy composition	
1.3.2.3.1.1. Nickel alloys (Ni-Al-X, Ni-X-Al) qualified for use as parts or components of turbine engines, i.e. with less than three non-metallic particles (incorporated in the process of production) larger than 100 mcm in 109 alloy particles;	7504000000
1.3.2.3.1.2. Niobium alloys (Nb-Al-X or Nb-X-Al, Nb-Si-X or Nb-X-Si, Nb-Ti-X or Nb-X-Ti);	8112913100; 8112993000
1.3.2.3.1.3. Titanium alloys (Ti-Al-X or Ti-X-Al);	810810100
1.3.2.3.1.4. Aluminium alloys (Al-Mg-X or Al-X-Mg, Al-Zn-X or Al-X-Zn, Al-Fe-X or Al-X-Fe); or	7603
1.3.2.3.1.5. Magnesium alloys (Mg-Al-X or Mg-X-Al); and	8104300000
1.3.2.3.2. Made in controlled medium using one of the following processes: a) vacuum spraying; b) gas spraying; c) centrifugal spraying; d) quick cooling; e) smelt spinning and crystallization; f) smelt extraction and crystallization; or g) mechanical alloying	
1.3.2.3.3. Capable of forming materials controlled under Items 1.3.2.1 or 1.3.2.2;	
1.3.2.4. Sintered materials featuring any of the following characteristics: a) made of any of the composite systems defined in Item 1.3.2.3.1; b) in the form of unground flakes, tapes or thin rods; and c) made in controlled environment using any of the following methods: 1) quick cooling; 2) smelt spinning; or 3) smelt extraction;	7503009000; 7504000000; 7505120000; 7506; 7603200000; 7604291000; 7606129100; 7606920000; 760719; 8104300000; 8104900000; 810810100; 8108109000; 8108903000; 8112913100; 8112913900; 8112993000
1.3.3. Magnetic materials of all types and any shape featuring any of the following characteristics:	
1.3.3.1. Relative initial magnetic permeability of 120,000 or more and thickness 0.05 mm or less	850511000; 850519; 850519100; 850519900

Technical note:

The measuring of the relative initial magnetic permeability ought to be done using fully annealed materials;

1.3.3.2. Magnetostrictive alloys featuring any of the	720690000

following characteristics:
a) magnetostrictive saturation of more than 5x10(-4); or
b) magnetomechanical adhesion coefficient (k) more than 0.8; or

1.3.3.3. Amorphous or nanocrystal alloy tape featuring all of the following characteristics: 7206; 7506; 8105
a) at least 75% content (by weight) of iron, cobalt, or nickel;
b) saturation induction (Bs) 1.6 T or more; and
c) any of the following:
1) tape thickness not more than 0.02 mm; or
2) specific electric resistance 2x10(-4) ъ/cm or more

Note:
Nanocrystal materials mentioned in Item 1.3.3.3 are materials which have the size of the crystal grain 50 nm or less as determined by X-ray diffraction

1.3.4. Uranium-titanium alloys or tungsten alloys with an iron-, nickel-, or copper-based matrix which have all of the following characteristics: 284410000; 810810100; 810199000
a) density more than 17.5 g/cm3;
b) maximum elasticity more than 880 MPa;
c) maximum tensile strength more than 1,270 MPa;
d) relative elongation more than 8%

1.3.5. Superconducting composite materials with the length of more than 100 m or weight over 100 g, such as:

1.3.5.1. Multi-core superconducting composite materials containing one or several niobium-titanium threads: 811299300; 854419900
a) placed in a matrix of non-copper or non-copper-containing materials; or
b) which have cross-section area less than 0.28x10(-4) mm2 (6 mcm in diameter with circular-section threads);

1.3.5.2. Superconducting composite materials consisting of one or more superconducting threads made of other than niobium-titanium, which have all of the following characteristics: 854419900
a) with a critical temperature at zero induction more than 9.85 K (-263.31°C), however, no less than 24 K (-249.16°C);
b) cross-section area less than 0.28x10(-4) mm2;
c) retaining superconductivity at 4.2 K (-268.96°C) while in a magnetic field corresponding to 12 T magnetic induction

1.3.6. Fluids and lubricants, such as:

1.3.6.1. Hydraulic fluids containing any of the following substances and materials as their main components:

1.3.6.1.1. Silicon-hydrocarbon oils which have all of the following characteristics:
a) ignition point above 477 K (204°C); 391000000
b) freezing point 239 K (-34°C) or below;
c) viscosity coefficient 75 or more;
d) thermostability at 616 K (343°C); or

1.3.6.1.2. Carbon chlorides and fluorides which have all of the following characteristics: 381900000; 382390960; 2812; 2826
a) no ignition point;
b) autoignition point above 977 K (704°C);
c) freezing point 219 K (-54°C) or below;
d) viscosity coefficient 80 or more; and
e) boiling point 473 K (200°C) or more

Notes:

1. For the purposes indicated in Item 1.3.6.1.1, silicon-hydrocarbon oils contain silicon, hydrogen, and carbon exclusively

2. For the purposes indicated in Item 1.3.6.1.2, carbon chlorides and fluorides contain carbon, fluorine, and chlorine exclusively

1.3.6.2. Lubricants containing the following substances or materials as their main components:

1.3.6.2.1. Phenylene or alkylphenylene ethers of thioethers or their mixtures containing more than two ether or thioether functions or their mixtures; or 290930900; 293090800

1.3.6.2.2. Fluorinated silicon-containing fluids featuring a kinematic viscosity less than 5,000 mm2/s (5,000 centistockes) at 298 K (25°C) 391000000

1.3.6.3. Moisturizing or flotation fluids with the purity index more than 99.8%, containing less than 25 particles sizing 200 mcm or more per 100 ml and made at least 85% of any of the following compounds and materials:

1.3.6.3.1. Dibromtertrafluorethane; 290340800

1.3.6.3.2. Polychlortrifluorethylene (only oily and waxiform modifications); or 390469000

1.3.6.3.3. Polybromtrifluorethylene 390469000

1.3.6.4. Carbon-fluoride cooling fluids for electronics which ave all of the following characteristics: 382390980

1.3.6.4.1. Containing 85% (by weight) or more of any of the following substances or their mixtures:

1.3.6.4.1.1. Monomeric forms of perfluoropolyalkylethertriazines or perfluoroaliphatic ethers;

1.3.6.4.1.2. Perfluoroalkylamines;

1.3.6.4.1.3. Perfluorocycloalkanes; or

1.3.6.4.1.4. Perfluoroalkanes

1.3.6.4.2. Density of 1.5 g/ml or more at 298 K (25°C);

1.3.6.4.3. Liquid state at 273 K (0°C); and

1.3.5.4.4. Containing 60% (by weight) or more of fluorine

Technical notes:

For the purposes indicated in Item 1.3.6:

a) ignition point is determined using the Cleveland open-cup technique described in the standard ASTM technique D-92 or its national equivalents;

b) melting point is determined using the special technique described in the standard ASTM technique D-97 or its national equivalents;

c) viscosity coefficient is determined using the special technique described in the standard ASTM technique D-2270 or its national equivalents;

d) thermostability is determined according to the following testing method or its national equivalents: 20 ml of tested fluid is placed in a chamber 46 ml in volume made of type 317 stainless steel containing balls with the nominal diameter of 12.5 mm made of tool steel M-10, mark 52100 steel, and admiralty bronze (60% Cu, 39% Zn, 0.75% Sn); the chamber is blown down with nitrogen, pressurized at atmospheric pressure and temperature raised to 644+-6 K (371+-6°C) and seasoned for six hours; the sample is recognized to be thermostable if the following conditions are met upon termination of the above procedure:

1) weight loss for each ball is not more than 10 mg/mm2 of its surface;

2) change of initial viscosity determined at 311 K (38°C) is not more than 25%;

3) total acid or base number is not more than 0.40;

e) autoignition temperature is determined using the special technique described in the standard ASTM method E-659 or its national equivalents

1.3.7. Ceramics-based materials, non-composite ceramics material, composite materials with ceramics matrix, and their precursor materials, such as:

1.3.7.1. Basic materials of simple or complex titanium borides which have the total of metallic impurities, except for special additives, at the level of less than 5,000 ppm with the average particle size equal to or less than 5 mcm and not more than 10% of particles having the size more than 10 mcm; — 285000900

1.3.7.2. Non-composite ceramics materials in raw form or in the form of semi-finished items made on the basis of titanium borides with 98% density or more from hypothetical maximum — 285000900

Note:

In Item 1.3.7.2, control shall not apply to abrasive materials;

1.3.7.3. Composite materials of ceramics-ceramics type with a glass or oxide matrix reinforced with fiber having the — 2849; 285000;

maximum specific tensile strength of 12.7x10(3) m of any of the below systems: a) Si-N; b) Si-C; c) Si-Al-O-N; or d) Si-O-N;	880390990; 930690
1.3.7.4. Composite materials of ceramics-ceramics type with a permanent metal phase or without it including particles, filamentous crystals or fiber in which the matrix is formed from silicon, zirconium, or boron carbides or nitrides;	880390990; 930690
1.3.7.5. Precursor materials (i.e. specialized polymer or organometallic materials) used to make any phase or phases of materials controlled under Item 1.3.7.3, such as: a) polydiorganosilanes (used to make silicon carbide); b) polysilazanes (used to make silicon nitride); c) polycarbosilazanes (used to make ceramics with silicon, carbon, or nitrogen components);	391000000
1.3.7.6. Composite materials of ceramics-ceramics type with oxide or glass matrices reinforced with continuous fiber of any of the following systems:	6903; 691490900
1.3.7.6.1. Al2O3; or	
1.3.7.6.2. Si-C-N	

Note:

In Item 1.3.7.6, control shall not apply to composite material containing fiber made of these systems having the maximum tensile strength less than 700 MPa at 1,273 K (1,000°C) or relative elongation more than 1% at 100 MPa load and 1,273 K (1,000°C) per 100 h

1.3.8. Polymer substances without fluorine, such as:	
1.3.8.1.1. Bismaleimides;	292519900
1.3.8.1.2. Aromatic polyamidimides;	390890000
1.3.8.1.3. Aromatic polyimides;	390930000
1.3.8.1.4. Aromatic polyetheramides with the glass-transition temperature (Tg) more than 513 K (240°C) measured the dry technique described in the standard ASTM technique D 3418	390720900; 390791900

Note:

In Item 1.3.8.1, control shall not apply to non-melting powders used to make pressure dies or shape moulds

1.3.8.2. Thermoplastic liquid-crystal copolymers with the thermal-strain temperature more than 523 K (250°C) measured according to the standard ASTM technique D-648, method A, or its national equivalent, at 1.82 N/mm2 load and formed by a combination of:	390791900

a) any of the following substances:
1) phenylene, biphenylene, or naphthalene; or
2) methyl, tetrabutyl, or phenyl-replaced phenylene, biphenylene or naphthalene; and
b) any of the following acids:
1) terephthalic acid;
2) 6-hydroxyl-2-naphthoic acid;
3) 4-hydroxylbenzoic acid;

1.3.8.3. Polyarylene ether ketones, such as:

1.3.8.3.1. Polyetheretherkektone (PEEK); 390791900

1.3.8.3.2. Polyetherketone-ketone (PEKK); 390791900

1.3.8.3.3. Polyetherketone (PEK); 380791900

1.3.8.3.4. Polyetherketone ether-ketone-ketone (PEKEKK) 380791900

1.3.8.4. Polyarylene ketones; 390799000

1.3.8.5. Polyarylene sulphides in which the arylene group is represented by byphenylene, triphenylene, or their combinations; 391190900

1.3.8.6. Polybiphenyleneethersulphon 391190900

Technical note:

Glass-transition temperature (Tg) for material controlled under Item 1.3.8 is determined using the method described in the standard ASTM technique D 3418 which applies the dry method

1.3.9. Untreated fluorine compounds, such as: 390469000
a) vinylidene fluoride copolymers containing 75% or more of beta-crystalline structure obtained without stretching;
b) fluorinated polyimides containing 10% (by weight) or more of fixed fluorine;
c) fluorinated phosphasene elastomers containing 30% (by weight) or more of fixed fluorine

1.3.10. Filamentous of fiber materials which can be used in organic, metallic, or carbon matrix composite materials or lamellar structures, such as:

1.3.10.1. Organic fiber or filamentous materials which have all of the following characteristics: 392690100
a) specific modulus of elasticity more than 12.7x10(6) m; and
b) specific tensile strength more than 23.5x10(4) m

Note:

In Item 1.3.10.1, control shall not apply to polyethylene;

1.3.10.2. Carbon fiber or filamentous materials which have all of the following characteristics; 3801; 392690100;

a) specific modulus of elasticity more than 12.7x10(6) m; and b) specific tensile strength over 23.5x10(4) m	540210100; 540490900; 681510000; 690310000

Technical note:

Properties of material mentioned in Item 1.3.10.2 ought to be determined using methods 12-17 (SRM 12-17) recommended by Association of Advanced Composite Material Manufacturers (SACMA) or its national equivalents and must be based on an average value out of a greater number of tests

Note:

In Item 1.3.10.2, control shall not apply to items made of fibrous or filamentous materials used to repair flying vehicle structures or to laminates with the size of a single sheet not more than 50x90 cm;

1.3.10.3. Non-organic fibrous or filamentous materials which have all of the following characteristics: a) specific modulus of elasticity over 2.54x10(6) m; and b) melting, softening, decomposition, or sublimation point in inert medium more than 1,922 K (1,649°C)	392690100; 810192000; 810890300- 810890700

Note:

In Item 1.3.10.3, control shall not apply to:

a) discrete, multi-phase, polycrystalline alumina fibers containing 3% or more (by weight) of silica which have specific modulus of elasticity less than 10x10(6) m;

b) molybdenum fibers and fibers of molybdenum alloys;

c) boron-based fibers;

d) discrete ceramics fibers with the melting, softening, decomposition, or sublimation temperature in inert medium less than 2,043 K (1,770°C);

1.3.10.4. Fibrous or filamentous materials:	
1.3.10.4.1. Made of any of the following materials:	
1.3.10.4.1.1. Polyetherimides controlled under Items 1.3.8.1.1 - 1.3.8.1.4 or	540249990; 550190000; 550390900
1.3.10.4.1.2. Materials controlled under Items 1.3.8.2, 1.3.8.3, 1.3.8.4, 1.3.8.5, or 1.3.8.6; or	540224990; 550190900; 550390900
1.3.10.4.2. Made of materials controlled under Items 1.3.10.4.1.1 or 1.3.10.4.1.2 and bound with other types of fibers controlled under Items 1.3.10.1, 1.3.10.2, or 1.3.10.3	
1.3.10.5. Fibers impregnated with resin or pitch (prepregs), fibers coated with metal or carbon (preforms), or preforms made of carbon fibers of the following type: a) made of fibrous or filamentous material controlled under Items 1.3.10.1, 1.3.10.2, or 1.3.10.3; b) made of organic or carbon fibrous or filamentous	3801; 392690100; 681510000; 681599900; 690310000; 701910;

materials: 701920

1) with specific tensile strength more than 17.7x10(4) m;

2) with specific modulus of elasticity more than 10.15x10(6) m;

3) not controlled under Items 1.3.10.1 or 1.3.10.2; and

4) impregnated with the materials controlled under Item 1.3.8 or Subitem "b" of Item 1.3.9, having the temperature of transition into glass-like state (Tg) over 383 K (110 degrees C), phenol or epoxy resins having the temperature of transition into glass-like state (Tg) equal or exceeding 418 K (145 degrees C)

Note:

In Item 1.3.10.5, control shall not apply to:

a) matrices of epoxy resin impregnated with carbon fibrous materials or filamentous materials (prepregs) used to repair flying vehicle structures or laminates with the size of a single sheet not more than 50x90 cm;

b) prepregs impregnated with phenol or epoxy resins which have glass-transition temperature (Tg) less than 433 K (160°C) and hardening temperature less than glass-transition temperature

Technical note:

Glass-transition temperature (Tg) for materials controlled under Item 1.3.10.5 is determined using the method described in ASTM method D 3418 using the dry technique. Glass-transition temperature for phenol epoxy resins is determined using the method described in ASTM method D 4065 at 1Hz frequency and heating rate 2°C per minute using the dry technique

Technical notes:

1. Specific modulus of elasticity is determined as Young's modulus expressed in Pa or N/m2 divided by specific weight in N/m3 measured at 296+-2 K (23+-2°C) and relative humidity 50+-5%

2. Specific tensile strength is determined as the critical breaking strength expressed in Pa or N/m2 divided by specific weight in N/m3 measured at 296+-2 K (23+-2°C) and relative humidity 50+-5%

1.3.11. Metals and compounds, such as:

1.3.11.1. Metals in the form of particles with the size less 810430000; than 60 mcm which have a spherical, dust-type, spheroidal 810910100 form, delaminated or milled, made of material containing 99% or more of zirconium, magnesium, or their alloys

Note:

Metals or alloys mentioned in Item 1.3.11.1 are subject to control regardless of whether they are encapsulated or not in aluminium, magnesium, zirconium, or beryllium;

Technical notes.

When zirconium content is being determined it shall include a natural hafnium admixture (normally, 2 - 7%);

1.3.11.2. Boron or boron carbide with the purity of 85% or higher and particle size of 60 mcm or less 280450100; 284990100

Note:

Metals or alloys mentioned in Item 1.3.11.2 are subject to control regardless of whether they are encapsulated or not in aluminium, magnesium, zirconium, or beryllium;

1.3.11.3. Guanidine nitrate 282510000; 283429900; 2904

Technical note.
The materials specified under Item 1.3.12 are normally used for nuclear thermal sources;

1.3.12.1. Plutonium in any form containing more than 50% (by weight) of Plutonium-238 isotope

Note:
In Item 1.3.12.1, control shall not apply to:
a) supplies containing one gram of plutonium of less;
b) supplies containing three "effective grams" of plutonium or less when used as a sensing element in instruments;

1.3.12.2. Pre-purified Neptunium-237 in any form 284440000

Note:
In Item 1.3.12.2, control shall not apply to supplies containing one gram of Neptunium-237 or less

1.4. Software

1.4.1. Software specially designed or modified to develop, produce, or apply equipment controlled under Item 1.2

1.4.2. Software designed to develop organic matrices, metal matrices, or carbon matrix laminates or composite materials

1.5. Technology

1.5.1. Technologies designed, according to the General Technological Note, to develop or produce equipment or material controlled under Items 1.1.1.2, 1.1.1.3, 1.1.2-1.1.5, 1.2, or 1.3

1.5.2. Other technologies, such as:

1.5.2.1. Technologies used to develop or produce polybezothiazoles or polybenzoxazoles;

1.5.2.2. Technologies used to develop or produce fluorine elastomer compounds containing at least one vinylether monomer;

1.5.2.3. Technologies used to develop or produce the following basic materials or non-composite ceramics materials:

1.5.2.3.1. Basic materials featuring all of the listed below:

1.5.2.3.1.1. Any of the following structures:
a) simple or complex zirconium oxides or complex

silicon or aluminium oxides;
b) simple boron nitrides (with cubic shape crystals);
c) simple or complex silicon or boron carbides; or
d) simple or complex silicon carbides;

1.5.2.3.1.2. Total metal admixtures, including intentionally introduced additives, in amounts not more than:
a) 1,000 ppm for simple oxides or carbides; or
b) 5,000 ppm for complex compounds or simple nitrides; and

1.5.2.3.1.3. Being any of the below:
a) zirconium featuring particle grades equal or below 1 micrometre and up to 10% of particles exceeding 5 micrometres in size;
b) other base materials featuring particle grades equal or below 5 micrometres and up to 10% of particles exceeding 10 micrometres; or
c) having all of the following:
1) protective plates with length-to-thickness ratio over 5;
2) short rods ("moustache") with length-to-diameter ratio exceeding 10 for rod diameters less than 2 micrometres; and
3) long or chopped fibers with a diameter less than 10 micrometres;

1.5.2.3.2. Non-composite ceramics materials made of materials mentioned in Item 1.5.2.3.1

Note:
In Item 1.5.2.3.2, control shall not apply to abrasive materials

1.5.2.4. Technologies used to make aromatic polyamide fiber;

1.5.2.5. Technologies used to assemble, operate, or restore material controlled under Item 1.3.1;

1.5.2.6. Technologies used to restore composite materials, lamellar structures, or materials controlled under Items 1.1.2, 1.3.7, or 1.3.7.4

Note:
In Item 1.5.2.6, control shall not apply to technologies used to repair structures of civil flying vehicles applying carbonic fibrous or filamentous materials and epoxy resins contained in aviation items

Category 2. Material Treatment

2.1. Systems, equipment, and components

2.1.1. Anti-friction bearings or bearing systems and their components, such as:

Note:

In Item 2.1, control shall not apply to ball bearings with allowances fixed by the maker in accordance with the international ISO standard 3290 as Class 5 or worse

2.1.1.1. Ball and hard-roller bearings with allowances fixed by the maker in accordance with the international ISO 492 class of accuracy standard as Class 4 or better, or its national equivalent which have rings, balls or rollers made of copper-nickel alloy or beryllium	848210900; 848250000

Note:

In Item 2.1.1.1, control shall not apply to conical roller bearings;

2.1.1.2. Other ball and hard-roller bearings with allowances fixed by the maker in accordance with International ISO 492 class of accuracy standard as Class 2 or better or its national equivalent	848280000

Note:

In Item 2.1.1.2, control shall not apply to conical roller bearings;

2.1.1.3. Active magnetic bearing systems which have any of the following components: a) materials with a 2 T magnetic induction or more and yield strength more than 414 MPa; b) outfitted with electromagnetic device for a drive with a tree-dimensional unipolar high-frequency biasing; c) high-temperature - 450 K (177°C) or higher - position sensors	848330100; 848330900

2.2. Testing, checking, and production equipment

Technical notes:

1. Secondary parallel horizontal axes (for example, W-axis on horizontal boring cutters or secondary axis of rotation parallel to the primary axis of rotation) is not included in the total number of horizontal axes

An axis of rotation does not necessarily imply a more than 360° rotation angle. Axis of rotation may control a linear travel device (for example, a screw or rack)

2. For the purposes of Item 2.2, the number of axes to be simultaneously coordinated for contour control is the number of axes with relative motion between the worked piece and the tool, cutting piece or the grinding wheel cutting or removing material from the worked piece. This does not include any of the following additional axes making other relative motions within the boundaries of the machine-tool: a) wheel dressing systems in grinding machine-tools; b) parallel rotating axes intended for mounting individual worked pieces; c) jointly rotating axes intended to control the like worked pieces by fixing them in the chuck on different ends;

3. Axis classification is determined in accordance with international ISO standard 841 "Numerical Control Machine-Tools, Classification of Axes and Types of Motion"

4. For this category, the tilting spindles are regarded as axes of rotation

5. For all the machine tools of each model there may be used the value of stated positioning precision obtained not as a result of individual mechanical testing but rather computed in compliance with the international standard ISO 230/2 (1997) or a national equivalent thereof;

The stated positioning precision means a precision value set by the manufacturer as an indicator reflecting the precision of all the machine tools of a specific model.

The precision indicator shall be determined as follows:

a) Five machine tools of the model subject to appraisal shall be picked up

b) The linear axis precision shall be measured in compliance with the international standard ISO 230/2 (1997)

c) The value of Indicator A shall be determined for each axis of each machine tool. The method whereby the value of Indicator A is to be determined is described in the ISO standard

d) The mean value of Indicator A shall be determined for each axis. The mean value of Indicator A shall become the stated value (Ax, Ay ...) for all the machine tools of a given model

i) Since the machine tools specified under Category 2 of the present List have several linear axes the number of stated values of precision indicator is equal to the number of linear axes

f) If the axis parameters of a specific machine tool model are not subject to control under Items 2.2.1.1 - 2.2.1.3 and Indicator A is equal to or below (better than) 5 mcm for grinding machine tools,

- 6.5 mcm for milling and turning machine tools the manufacturer shall confirm the precision value every 18 months;

2.2.1. Machine-tools mentioned below and any of their combinations used to machine or cut metal, ceramics, and composite materials which, according to maker technical specification, can be outfitted with electronic numerical control devices:

Notes:

1. In Item 2.2.1, control shall not apply to special-purpose machine-tools restricted to gear wheel cutting. See Item 2.2.3 for such machine-tools

2. In Item 2.2.1, control shall not apply to special-purpose machine-tools restricted to the processing of the following parts:

a) crankshafts or camshafts;

b) cutters or mills;

c) extruder worms;

d) engraved or cut parts of jewellery;

2.2.1.1. Lathes which have all of the following characteristics: 8458; 846490900; 846599100

a) positioning accuracy with all available compensation equal to or below (better than) 4.5 mcm under the international standard ISO 230/2 (1997) or a national equivalent thereof;
along any linear axis;
and

b) two or more axes capable of simultaneous coordination for contour control

Note:

In Item 2.2.1.1, control shall not apply to lathes specially designed to make contact lenses;

2.2.1.2. Milling machine-tools which have any of the following characteristics: 845931000; 845939000;

a) featuring any of the following characteristics:

1) positioning accuracy with all available compensation equal to or less (better) than 4.5 mcm according to the international standard ISO 230/2 (1997) or its national equivalent along any of the linear axis; and

2) three linear axes plus one rotating axis that may

be coordinated simultaneously for contour control;

b) five or more axes which can be simultaneously coordinated for contour control; or

c) positioning accuracy for coordinate boring machine-tools with all available compensation equal to or below (better than) 3 mcm under the international standard ISO 230/2 (1997) or a national equivalent thereof along any linear axis;

d) machine-tools with the fly cutter featuring any of the following characteristics:

1) spindle bounce and eccentricity less (better) than 0.0004 mm of the full indicator reading (FIR); and

2) angular deviation of the support motion (yawing, pitch and rotation along the longitudinal axis) less (better) than two FIR arc seconds for more than 300 mm of travel;

2.2.1.3. Grinding machine-tools which have any of the following characteristics: 846011000; 846019000;

a) featuring all of the following characteristics:

1) positioning accuracy with all available compensation equal to or less (better) than 3 mcm according to the international standard ISO 230/2 (1997) or its national equivalent along any of the linear axes;

2) three or more than three axes that may be simultaneously coordinated for contour control; or;

b) five or more axes which can be simultaneously coordinated for contour control

Note:

In Item 2.2.1.3, control shall not apply to the following grinding machine-tools:

a) cylindrical outer, inner, and inner-and-outer grinding machinetools which have all of the following characteristics:

1) restricted to cylindrical grinding; and

2) with a maximum permitted work-piece length and diameter 150 mm;

b) machine-tools specially designed for template grinding which have any of the following characteristics:

1) C-axis is used to adjust the grinding wheel against the working surface; or

2) A-axis determines the configuration of the cylindrical cam;

c) surface grinding machine-tools;

2.2.1.4. Wireless electrospark-treatment machine-tools which have two or more axes of rotation which can be simultaneously coordinated for contour control; 845630000

2.2.1.5. Machine-tools used to treat metals, ceramics, or composite materials featuring all of the following characteristics: 842430900;

a) processing of materials is done using any of the following:

1) water or other liquid jets including abrasive-additive jets;

2) electronic beam ; or

3) laser beam; and

b) which have two or more axes of rotation capable of:
1) simultaneous coordination for contour control; and
2) positioning accuracy less (better) than 0.003°;

2.2.1.6. Machine-tools for deep drilling or lathes modified for deep drilling providing for a maximum hole drilling depth of 5,000 mm or more and components specially designed for them	8458; 845921
2.2.2. Excluded	
2.2.3. Numerical-control or manual-control machine-tools and components specially designed for them, checking equipment, and equipment specially designed for shaving, finish treatment, grinding or honing of hardened (Rc=40 or more) single- and double-cut spur pinions with the pitch of more than 1,250 mm and frontal width equal to 15 % of the pitch or more and quality after finish treatment in accordance with the international ISO standard 1328 as Class 3	846140710; 846140790
2.2.4. Hot isostatic presses featuring all of the following components and accessories specifically designed for them; a) chambers with controlled thermal conditions in the closed cavity and cavity inner diameter 406 mm and more; and b) any of the following characteristics: 1) maximum working pressure more than 207 MPa; 2) controlled temperature conditions over 1,773 K (1,500°C); or 3) equipment for hydrocarbon saturation and removal of gaseous products of decomposition	846299

Technical note:

The chamber inner diameter refers to the chamber where the working pressure and temperature are obtained; the chamber size does not include the size of the gripping devices. The above size shall be the minimum of the two - the inner diameter of the high-pressure chamber or the inner diameter of the isolated high-temperature chamber depending on which of the two chambers is found within the other

2.2.5. Equipment specially designed to outfit, implement, and control the process of laying a non-organic coating, protective coatings, and surface modifications, for example, lower layers using non-electronic methods or processes given in the Table and mentioned in the notes after Item 2.5.3.4 and also specially designed means of automatic adjustment, installation, manipulation, and control components, including:	
2.2.5.1. Process equipment for chemical vapor deposition (CVD) operated by an in-built program with all of the following features: a) the process has been modified for one of the following methods: 1) pulsing CVD;	845690000; 842420100

2) controlled thermal sedimentation with the creation of crystallization centers CNTD); or

3) plasma or plasma-enhanced CVD; and

b) includes any of the following methods:

1) using high vacuum (equal to or less than 0.01 Pa) for rotational packing; or

2) using the means of on-site coating thickness control;

2.2.5.2. Ion-implantation production equipment with the beam current of 5 mA or more operated by an in-built program;	845610000
2.2.5.3. Built-in program-controlled production equipment for electron beam physical vapor precipitation (EB-PVD) including power systems with power rating over 80kW featuring any of the following components: a) level control laser system in the fill-in tank allowing a precision control of initial substance feed velocity; or b) computer-controlled velocity recorder based on ionized atom photofluorescence in vapor flux required to control the velocity of precipitation of a coating containing two or more elements;	854389900;
2.2.5.4. Plasma-deposition production equipment operated by an in-built program which has any of the following characteristics: a) operating under falling-pressure conditions of a controlled atmosphere (equal to or less than 10 kPa measured above or inside the 300 mm outlet section of the nozzle of the plasma torch) in a vacuum chamber capable of pressure reduction to 0.01 Pa before the beginning of the spaying process; or b) outfitted with means of coating thickness control;	845690000
2.2.5.5. Production equipment for metal spraying operated by an in-built program capable of producing current density of 0.1 mA/mm2 or more with the spraying capacity 15 cm/h or more;	845690000
2.2.5.6. Production equipment for cathode-arc spaying operated by an in-built program which includes a system of electric magnets to control the cathode-arc current density;	851580900
2.2.5.7. Production equipment for ion metal spaying operated by an in-built program capable of producing on site any of the following measurements: a) base thickness and productivity values; b) optical characteristics	845610000

Note:

In Items 2.2.5.1, 2.2.5.2, 2.2.5.5, 2.2.5.6, and 2.2.5.7, control shall not apply to equipment of chemical vapor deposition, cathode-arc spraying, wet deposition, ion metallization, or ion implantation specially designed to coat cutting tools or for mechanical treatment

2.2.6. Systems or equipment for dimension measuring and control, such as:	
2.2.6.1. Computer-control, numerical control, or operated by an in-built program dimension-monitoring machines which have a three-axis length measuring error equal to or less (better) than 1.7+L/1,000 mcm (L - length in mm) tested according to the international ISO standard 10360-2;	903180310
2.2.6.2. Measuring instruments for linear or angular movements, such as:	
2.2.6.2.1. Measuring instruments for linear motions which have any of the following components: a) contact-free measuring systems with the resolution equal to or less (better) than 0.2 cm with the measuring range up to 0.2 mm; b) systems with a linear, adjustable, differential voltage converter which have two following characteristics: 1) linearity equal to or less (better) than 0.1% in the measuring range up to 5 mm; and 2) deviation equal to or less (better) than 0.1% a day in the presence of standard conditions with the ambient temperature fluctuations of +-1 K; or c) measuring systems which have any of the following components: 1) containing a laser; and 2) operated continuously for at least 12 hours in the presence of ambient temperature fluctuations of +-1 K and standard temperature and pressure, which have any of the following characteristics: resolution at their full scale 0.1 mcm or less (better); and measuring error equal to or less (better) than (0.2+L/2,000) mcm (L - length in mm)	903140000

Note:

In Item 2.2.6.2.1, control shall not apply to the measuring interferometer systems without feedback and with a closed or open contour containing a laser to measure the positioning error of the moving parts of machine-tools, means of dimension control, or similar equipment;

2.2.6.2.2. Angular measuring instruments with the deviation of the angular position equal to or less (better) than 0.00025°	903140000; 903180310; 903180910

Note:

In Item 2.2.6.2.2, control shall not apply to optical instruments, such as autocollimators using collimated light to register the mirror angular displacement

2.2.6.3. Equipment used to measure surface irregularities	903140000

relying on optical scattering as the angle function with the sensitivity 0.5 nm or less (better)

Note:

1. Machine-tools which can be used as measuring instruments shall be subject to control if their parameters correspond to or surpass criteria adopted for the functions of machine-tool or measuring instruments 2. Systems mentioned in Item 2.2.6, shall be subject to control if they surpass, in their parameters, the level subject to control anywhere in their working range

2.2.7. Robots listed below and controllers and tools specially designed for them: 847989500; 853710100;
a) capable of full real-time representation of the process or object in three dimensions while generating or modifying the programs, or while generating or modifying the digital programmable data 853710910; 853710990

Technical note:

Restrictions for the mentioned process or object do not include the third-dimension approximation through a given angle or the interpretation through a restricted scale used for task modification depth or texture perception (2 1/2 D);

b) specially designed to national security standards, fit for making military explosive items; or

c) specially designed or qualified as radiation-resistant, capable of withstanding more than 5 x 10 (3) Gr (silicon) [5 x 10 (5) rad (silicon)];

d) specially designed for operation at altitudes over 30,000 m

2.2.8. Units or blocks specially developed for machine-tools or dimension checking or measuring systems and equipment, such as:

2.2.8.1. Units for linear positioning assessment with feedback (e.g. induction-type instruments, calibrated scales, infrared or laser systems) which have full accuracy less (better) than 800+(600xLx10(-3)) nm (L- effective length in mm) 8466

Special note:

For laser systems, Note to Item 2.2.6.2.1 shall also apply;

2.2.8.2. Units for rotational positioning assessment with feedback (e.g. induction-type instruments, calibrated scales, infrared or laser systems) with accuracy less (better) than 0.00025° 8466

Special note:

For laser systems, Note to Item 2.2.6.2.1 shall also apply;

2.2.8.3. Combined tilting tables or tilting spindles whose application, according to maker specification, can modify machine-tools to the level mentioned in Item 2.2 or higher

2.2.9. Rolling or bending machine-tools which, according to maker technical specification, can be outfitted with numerical-control or computer-control units and which have all of the following characteristics: 846229100; 846390100; 846390900
a) with two or more controllable axes which can be

coordinated simultaneously for contour control; and
b) with a torque of more than 60 kN

Technical note:

For the purposes of Item 2.2.9, machine-tools combining the functions of rolling and bending machine-tools shall be regarded as bending machine-tools

2.3. Materials - no data

2.4. Software

2.4.1. Software different from the software subject to control under Item 2.4.2, specially designed or modified to develop, produce, or apply equipment controlled under Items 2.1 or 2.2;

2.4.2. Software for electronic devices, including in-built one, permitting such devices or systems to function as numerical-control units capable to coordinate simultaneously more than four axes for contour control;

Note:

In Item 2.4.2, control shall not apply to software specially designed or modified for machine-tools not covered in Category 2 Items

2.5. Technology

2.5.1. Technologies designed, according to the General Technological Note, to develop equipment or software controlled under Items 2.1, 2.2, or 2.4

2.5.2. Technologies designed, according to the General Technological Note, to produce equipment controlled under Items 2.1 or 2.2

2.5.3. Other technologies, such as:

2.5.3.1. Technologies used to develop interactive graphics as an integrating part of numerical control units used to prepare or modify program elements;

2.5.3.2. Listed below technologies used in metal-treatment production processes:

2.5.3.2.1. Technologies used to design tools, press-forms, or gripping devices specially designed for any of the following processes:
a) superplastic forming;
b) diffusion welding; or
c) direct hydraulic pressing;

2.5.3.2.2. Technical data including parameters or methods of process implementation listed below and used to control:
a) superplastic forming of aluminium, titanium alloys

or superalloys:
1) data on surface preparation;
2) data on strain degree;
3) temperature;
4) pressure;
b) diffusion welding of titanium alloys or superalloys:
1) data on surface preparation;
2) temperature;
3) pressure;
c) direct hydraulic pressing of aluminium or titanium alloys:
1) pressure;
2) cycle time;
d) hot isostatic modification of titanium, aluminium alloys or superalloys:
1) temperature;
2) pressure:
3) cycle time

2.5.3.3. Development or production technologies for hydraulic stretch-moulding machines and respective dies used to make body structures of flying vehicles;

2.5.3.4. Technologies used to develop machine command generators (i.e program elements) from design data available inside numerical control units;

2.5.3.5. Technologies used to develop integrating software to combine expert systems improving operational capabilities of numerical-control units at factories;

2.5.3.6. Technologies intended for use in non-organic, purely superficial coatings or non-organic coatings modifying item surface marked in column "Resulting Coating" of the below Table; nonelectronic layer coatings (substrates) marked in column "Sublayers" of the below Table; processes marked in column "Name of the Coating Process" of the below table and defined in the Technical Note

Special Note.

The below table provides that the know-how of a specific coating application process is subject to export control only if the entry in column "Resulting Coating" directly corresponds to the entry in column "Substrate". For instance, substrates of the type "carbon-to-carbon, ceramic and composite materials with metal matrix" can be processed by chemical vapor precipitation to produce a silicide coating which cannot be produced when the same coating application method is used with a substrate of the type "cemented tungsten carbide, silicon carbide". In the second case the entry in column "Resulting Coating" is not located directly opposite to the entry "cemented tungsten carbide, silicon carbide" in column "Substrates";

Table to Item 2.5.3.6.
Technical Methods of Coating Deposition

Name of the coating process	Sublayers	Resulting coating
1	2	3
1. Chemical vapor deposition	superalloys	aluminides for internal canals
	ceramics (19) and glass with a low coefficient of expansion (14)*2, diamond, diamond-like carbon (17)	silicides, carbides, dielectric layers (15)
	carbon-carbon, ceramics, and composite materials with a metal matrix	silicides, carbides, refractory metals, mixtures of materials listed above (4), dielectric layers (15), aluminides, aluminide alloys (2) boron nitride
	carburized tungsten carbide (16), silicon carbide (18)	carbides, tungsten, mixtures of materials listed above (4), dielectric layers (15)
	molybdenum and its alloys	dielectric layers (15)
	beryllium and its alloys	dielectric layers (15)
	sensor window materials (9)	dielectric layers (15)
2. Physical vapor deposition by thermal evaporation		
2.1. Physical, electronic beam vapor deposition	superalloys	silicide alloys, aluminide alloys (2), MCrAlX (5), modified types of zirconium (12), silicides, aluminides, mixtures of materials listed above (4)
	ceramics and glass with a low coefficient of expansion (14)	dielectric layers (15)
	corrosion-resistant steels (7)	MCrAlX (5), modified types of zirconium

		(12), mixtures of materials listed above (4)
	carbon-carbon, ceramics, and composite material with a metal matrix	silicides, carbides, refractory metals, mixtures of materials listed above (4), dielectric layers (15) boron nitride
	carburized tungsten carbide (16), silicon carbide	carbides, tungsten, mixtures of materials listed above (4), dielectric layers (15)
	molybdenum and its alloys	dielectric layers (15)
	beryllium and its alloys	dielectric layers (15), borides beryllium
	sensor window materials (9)	dielectric layers (15)
	titanium alloys (13)	borides, nitrides
2.2. Physical vapor deposition with ionization by resistive heating (ion electroplating)	ceramics and glass with a low coefficient of expansion (14)	dielectic layers (15)
		diamond-like carbon
	carbon-carbon, ceramics, and composite materials with a metal matrix	dielectric layers (15)
	carburized tungsten carbide (16), silicon carbide	dielectric layers (15)
	molybdenum and its alloys	dielectric layers (15)
	beryllium and its alloys	dielectric layers (15)
	sensor window materials (9)	dielectric layers (15)
		diamond-like carbon
2.3. Physical vapor deposition: laser	ceramics and glass with a low coefficient	silicides, dielectric layers (15)

evaporation	of expansion (14)	diamond-like carbon
	carbon-carbon, ceramics, and composite materials with a metal matrix	dielectric layers (15)
	carburized tungsten carbide (16), silicon carbide	dielectric layers (15)
	molybdenum and its alloys	dielectric layers (15)
	beryllium and its alloys	dielectric layers (15)
	sensor window materials (9)	dielectric layers (15), diamond-like carbon
2.4. Physical vapor deposition: cathode arc discharge	superalloys	silicide alloys, aluminide alloys (2), MCrAlX (5)
	polymers (11) and composite material with an organic matrix	borides, carbides, nitrides, diamond-like carbon
3. Carburization (10)	carbon-carbon, ceramics, and composite materials with metal matrix	silicides, carbides, mixtures of materials listed above (4)
	titanium alloys (13)	silicides, aluminides, aluminide alloys (2)
	refractory metals and alloys (8)	silicides, oxides
4. Plasma spraying	superalloys	MCrAlX (5), modified types of zirconium (12), mixtures of materials listed above (4), erosion-resistant nickel-graphite, erosion-proof materials containing nickel-chromium--aluminum, erosion-resistant aluminium-silicon-polyether, aluminide

		alloys (2)
	aluminium alloys (6)	MCrAlX (5), modified types of zirconium (12), silicides, mixtures of materials listed above (4)
	refratory metals and alloys (8)	aluminides, silicides, carbides
	corrosion-resistant steels (7)	modified types of zirconium (12), mixtures of materials listed above (4)
	titanium alloys (13)	MSgA1X (5) carbides, aluminides, silicides, aluminid alloys (2), erosion-resistant nickel-graphite, erosion-proof materials containing nickel-chromium--aluminum, erosion-resistant luminium-silicon-polyether
5. Suspension (slime) precipitation	refratory metal and alloys (8)	fusible silicides, fusible aluminides (except for materials used for heat-resistant elements)
	carbon-carbon, ceramics, and composite materials with a metal matrix	silicides, carbides, mixtures of materials listed above (4)
6. Metal spraying	superalloys	silicide alloys, aluminide alloys (2), aluminide-modified noble metals (3), MCrAlX (5), modified types of zirconium (12), platinum, mixtures of materials listed above (4)
	ceramics and glass with a low coefficient of expansion (14)	silicides, platinum, mixtures of materials listed above (4),

		dielectric layers (15) diamond-like carbon
	titanium alloys (13)	borides, nitrides, oxides, silicides, aluminides, aluminide alloys (2), carbides
	carbon-carbon, ceramics, and composite materials with metal matrix	silicides, carbides, refratory metals, mixtures of materials listed above (4), dielectric layers (15) boron nitride
	carburized tungsten carbide (16), silicon carbide	carbides, tungsten, mixtures of materials listed above (4), dielectric layers (15) boron nitride
	molybdenum and its alloys	dielectric layers (15)
	beryllium and its alloys	borides, dielectric layers (15) beryllium
	sensor window materials (9)	dielectric layers (15)
	refractory metals and alloys (8)	aluminides, silicides, oxides, carbides
7. Ion implantation	high-temperature resistant steels	additives of chromium, tantalum, or nyobium (columbium in the USA)
	titanium alloys (13)	borides, nitrides
	beryllium and its alloys	borides
	carburized tungsten carbide (16),	carbides, nitrides

Notes to the Table:

1. The process of coating application includes both laying a new coating and a repair and renewal of existing coatings

2. A coating of aluminide alloys includes a single or multiple application during which an element or elements are being coated before or in the course of application of aluminide coating, even if these elements had been coated using other processes. This, however, excludes a multiple use of the single-step process of packet carburizing to obtain aluminide alloys

3. A coating of noble metals, modified aluminides includes a multistep coating application in which the noble metal or noble metals had been applied earlier using any other process before applying aluminide

4. The mixtures include infiltrating material, compositions levelling the process temperature, additives and multilevel materials and are obtained in the course of one or several processes of coating application listed in the Table

5. MCrAlX corresponds to a complex coating composition, where M stands for cobalt, iron, nickel, or a combination of them, and X stands for hafnium, yttrium, silicon, tantalum, in any amount or other specially introduced additives in excess of 0.01% (by weight) in various proportions and combinations, except for:

a) CoCrAlY - coatings containing less than 22% (be weight) of chromium, less than 7% (by weight) of aluminium, and less than 2% (by weight) of yttrium; or

b) CoCrAlY - coatings containing 22-24% (by weight) of chromium, 10-12% (by weight) of aluminiunm, and 0.5-0.7% (by weight) of yttrium; or

c) NiCrAlY - coatings containing 21-23% (by weight) of chromium, 10-12% (by weight) of aluminium, and 0.9-1.1% (be weight) of yttrium

6. The term "aluminium alloys" corresponds to alloys with the maximum breaking strength of 190 MPa or more measured at 293 K (20°C)

7. The term "corrosion-resistant steel" refers to steels meeting the requirements of the standard of American Iron and Steel Institute used to assess 300 various parameters, or the requirements of respective national standards for steels

8. Refractory metals and alloys include the following metals and their alloys: nyobium (columbium, in the USA), molybdenum, tungsten, and tantalum

9. Materials used for sensor windows are: alumin (aluminium oxide), silicon, germanium, zinc sulphide, zinc selenide, gallium arsenide, diamond, gallium phosphide, sapphire, and for sensor openings of over 40 mm diameter - zirconium fluoride and hafnium fluoride;

10. Technology used for single-step packet carburizing of wing hard sections does not fall in the scope of Category 2 restrictions

11. Polymers include: polyamide, polyether, polysulphide, polycarbonates, and polyurethanes

12. The term "modified types of zirconium" means zirconium with oxide additives of other metals introduced in it (such as oxides of calcium, magnesium, yttrium, hafnium, rare-earth metals) in accordance with stability conditions of certain crystallographic phases and the bias phase. Heat-resistant coatings of zirconium modified with calcium or magnesium oxide by biasing or melting shall not be controlled

13. Titanium alloys shall be defined exclusively as aerospace alloys with the maximum breaking strength of 900 MPa or more measured at 293 K (20°C)

14. Glass with a low coefficient of expansion shall be defined as glass which has a temperature expansion coefficient of 10(-7) K(-1) or less measured at 293 K (20°C)

15. Dielectric layer coatings shall refer to multilayer insulation materials in which design interference properties are combined with various repeated reflection indices, which is used to reflect, transmit, or absorb various wavelengths. Dielectric layer coatings consist of four or more dielectric layers or dielectric-metal layer compositions

16. Carburized tungsten carbide does not include materials used for metal cutting or forming consisting of tungsten carbide/(cobalt-nickel), titanium carbide/(cobalt-nickel), chromium carbide/(nickel-chromium), and chromium carbide/nickel

17. Not subject to control shall be the know-how specifically designed for the application of diamond-like carbon on any of the following: magnetic disc drivers and heads, equipment for manufacture of expendable materials, tap valves, acoustic loudspeaker diaphragms, automobile engine parts, cutting tools, dies for forming and extrusion, office automation equipment, microphones or medical instruments.

18. Silicon carbide does not include materials for cutting and bending tools.

19. Ceramic substrates in the sense of the term used for the purposes of the present item do not include ceramic materials with 5 per cent or more content by weight of an adhesive or cement as a specific component and also combinations thereof;

Technical notes to the Table:

The processes presented in Column "Name of the Coating Process" shall be defined as follows:

1. Chemical vapor deposition - process of applying a purely superficial coating or a coating modifying the coated surface when the metal, alloy, composite material, dielectric material, or ceramics are applied to a heated workpiece. Gaseous chemical agents are decomposed or bound on the surface of the workpiece producing on it, as a result, the desired elements, alloys, or compounds. The energy for such decomposition or chemical reaction may be provided through heating the workpiece by an arc discharge or laser beam

Special notes:

a) chemical vapor deposition includes the following processes:

Non-packet coating application by a direct gas flow, pulse chemical vapor deposition, controlled thermal sedimentation with the creation of crystallization centers, with a powerful plasma flow, or chemical vapor deposition using plasma;

b) a packet means workpiece dipping into a powder of several components;

c) gaseous products (vapors, chemical agents) used in the non-packet process are used with several basic reactions and parameters, such as packet carburizing, except for the case when the workpiece is coated without contacting the powder mixture

2. Physical vapor deposition with ionization by resistive heating - process of applying a purely superficial coating in vacuum with a less than 0.1 Pa pressure when the source of the thermal energy is used to vaporize the applied material. As a result of the process, the condensate or coating is deposited to respective parts of the workpiece surface. The gases emerging in the vacuum chamber during deposition are absorbed, in the majority of process versions, by the elements of the complex coating composition. Use of ion or electronic radiation or plasma to activate the coating application or participation in the process is also a common feature for the majority of versions of the process of physical vapor deposition with ionization by resistive heating. Use of monitors to ensure measurement of optical characteristics or layer thickness during the process may be implemented in the future. The particular feature of the physical vapor deposition with ionization by resistive heating lies in the following:

a) in cases of electronic-beam physical deposition, an electronic beam is used to heat up and vaporize the material used to coat the workpiece;

b) in cases of physical deposition with a temperature-sensitive resistor used as source of heat combined with ion flux collision providing a controlled and uniform (homogeneous) flow of coating material vapors, an electric resistor is used;

c) In case of laser vaporization, a chopped or uninterrupted laser beam is used for the purpose of vaporizing the material forming the coating;

d) in a cathode arc coating process, a consumable cathode is used as the material which forms the coating and features a stable arc discharge on the cathode surface after an instantaneous contact with a grounded starter device (trigger). A controlled arc erosion of the cathode surface results in the forming of a high-ionized plasma. The anode may be of a conical shape and be placed along the cathode periphery through an insulator, or the chamber itself may play the role of the anode. Items with regulated position are used for non-linear control of insulation application.

Special note:

The process described in Subitem (d) is not included in erratic-arc coating application with a rigid workpiece position

e) Ion implantation - special version of the general process in which the plasma or ion source is used to ionize the material of applied coatings, and the negative bias (charge) of the workpiece contributes to deposition of the coating components from plasma. Introduction of active chemical agents, evaporation of hard materials in the chamber, as well as use of monitors providing for measurement of optical characteristics and coating thickness (during coating application) are common to ordinary versions of the process of physical vapor deposition by thermal evaporation

3. Packet carburizing - a modification of the method of coating application to a surface or a process of applying a purely superficial coating when the workpiece is submerged into a powder - a mixture (a packet) of several components which consist of:

a) metal powders which comprise the coating content (usually, aluminium, chromium, silicon, or combinations of them);

b) activator (in most cases, a halide); and

c) inert powder, most often, alumin (aluminium oxide)

The workpiece and the powder mixture are kept inside a retort (chamber) heated up to the temperature of 1,030 K (757°C) to 1,375 K (1,102°C) for the time necessary to apply the coating

4. Plasma spraying - the process of applying a purely superficial coating when the plasma gun (spraying burner) which forms and controls the plasma receives the powder or a rod made of the coating material, melts them and conveys to the workpiece, where an integral coating is formed. Plasma spraying may be based on low-pressure plasma spraying or high-speed plasma.

Special notes:

a) low pressure means a presser below the atmospheric one

b) high-speed plasma is determined by the gas speed at the nozzle section (spray burner) exceeding 750 m/s estimated at 293 K (20°C) and 0.1 MPa pressure

5. Suspension (slime) precipitation - process of applying a coating modifying the coated surface or of a purely superficial coating when the metal or ceramics powder with an organic binder suspended in a liquid are bound to the workpiece by spraying, submersion, or dying followed by a subsequent air or furnace drying and thermal treatment to obtain the necessary coating properties

6. Metal spraying - process of applying a purely superficial coating based on momentum transfer phenomenon when positive ions are being accelerated in an electric field towards the target surface (coating material). Kinetic energy of ion impacts provides for the forming of the required coating on the target surface

Special notes:

a) the Table provides information only on triode, magnetrone, or reaction-type metal spraying used to increase the adhesion of the coating material and the rate of its application, as well as on radio-frequency spraying enhancing used when applying vapor-generating, non-metallic coating materials;

b) low-energy ion beams (less than 5 KeV) may be used to accelerate (activate) the process of coating application

7. Ion implantation - process of applying a coating modifying the workpiece surface when the material (alloy) is ionized, accelerated by the system featuring a potential gradient, and implanted onto a part of the workpiece surface.

Technical terminology used in the Table of technical methods of coating deposition:

It is assumed that the technical information below pertaining to the Table of technical methods of coating deposition is used if necessary

1. Terminology used in sublayers preliminary treatment technologies mentioned in the Table:

1.1. Parameters of chemical stripping of coatings and cleaning in a bath:
1.1.1. Composition of the solution for the bath:
1.1.1.1. To remove old or damaged coatings, products of corrosion, or foreign matter;
1.1.1.2. To prepare clean sublayers
1.1.2. Time for treatment in the bath;
1.1.3. Temperature in the bath;
1.1.4. Number and sequence of washing cycles
1.2. Visual and macroscopic criteria to determine the amount of the cleaning dose;

1.3. Parameters of thermal treatment cycles:
1.3.1. Atmospheric parameters:
1.3.1.1. Atmosphere composition:
1.3.1.2. Atmospheric pressure
1.3.2. Temperature for thermal treatment
1.3.3. Duration of thermal treatment
1.4. Sublayer parameters for surface treatment:
1.4.1. Sandblast cleaning parameters:
1.4.1.1. Sand composition;
1.4.1.2. Size and shape of sand particles;
1.4.1.3. Sand feeding rate
1.4.2. Time and sequence of cleaning cycles after sandblast cleaning;
1.4.3. Parameters of finally treated surface
1.4.4. The use of adhesion-enhancement bonding substances
1.5. Technical parameters of the protective coating:
1.5.1. Material of the protective coating;
1.5.2. Location of the protective coating

2. Terminology used to define technological parameters providing for the coating quality for the methods mentioned in the Table:
2.1. Atmospheric parameters:
2.1.1. Atmosphere composition;
2.1.2. Atmospheric pressure
2.2. Time parameters;
2.3. Temperature parameters;
2.4. Layer parameters;
2.5. Refraction parameter coefficient
2.6. Coating structure monitoring

3. Terminology used in fine-grain sandstone setting technologies applied to treat the coated sublayers mentioned in the Table
3.1. Parameters of shot peening:
3.1.1. Shot composition;
3.1.2. Shot size;
3.1.3. Shot feeding rate
3.2. Parameters of fine-grain sandstone setting;
3.3. Parameters of hot-working cycle:
3.3.1. Atmospheric parameters:
3.3.1.1. Atmospheric composition;
3.3.1.2. Atmospheric pressure
3.3.2. Temperature and time cycles
3.4. Visual and microscopic hot-working criteria for subsequent coating application to sublayer

4. Terminology used in technologies to define technical methods guaranteeing the coating quality of sublayers mentioned in the Table:
4.1. Criteria for statistic selective control;
4.2. Microcsopic criteria for:
4.2.1. Strengthening;
4.2.2. Uniformity of the coating thickness;
4.2.3. Coating intergity;
4.2.4. Coating compostiion;
4.2.5. Coating and sublayer adhesion;
4.2.6. Microstructure uniformity

4.3. Criteria for assessing optical properties (wavelength being the parameter measurement unit):

4.3.1. Reflectivity;
4.3.2. Transparency;
4.3.3. Absorbsion;
4.3.4. Scattering

5. Terminology used in technologies and parameters pertaining to specific coatings and to processes of surface transformation mentioned in the Table:

5.1. For chemical vapor depostion:
5.1.1. Composition and formula of the coating source;
5.1.2. Composition of the carrying gas;
5.1.3. Sublayer temperature;
5.1.4. Temperature-and-time cycles and pressure cycles;
5.1.5. Control and adjustment of gas dosage
5.2. For thermal condensation - physical vapor settling:
5.2.1. Compositon of ingot or source of the coating material;
5.2.2. Sublayer temperature;
5.2.3. Compostion of the chemically active gas;
5.2.4. Ingot or evaporated material feeding rate;
5.2.5. Temperature-and-time cycles and pressure cycles;
5.2.6. Control and changeing of the gas dosage;
5.2.7. Laser parameter:
5.2.7.1. Wavelength;
5.2.7.2. Power density;
5.2.7.3. Pulse duration;
5.2.7.4. Pulsing frequency;
5.2.7.5. Source;
5.3. For carburizing with preliminary luting:
5.3.1. Lute composition and formula;
5.3.2. Gas-carrier composition;
5.3.3. Temperature-and-time cycles and pressure cycles
5.4. For plasma spraying:
5.4.1. Powder composition, preparation, and allocated volumes;
5.4.2. Composition and parameters of the feeded gas;
5.4.3. Sublayer temperature;
5.4.4. Plasma gun power parameters;
5.4.5. Spraying distance;
5.4.6. Spraying angle;
5.4.7. Composition of the covering gas, flow pressure and speed;
5.4.8. Plasma gun dosage control and adjustment
5.5. For metal spraying:
5.5.1. Target compostion and structure;
5.5.2. Geometric adjustment of parts and target position;
5.5.3. Composition of chemically active gas;
5.5.4. High-frequency biasing;
5.5.5. Temperature-and-time cycles and pressure cycles;
5.5.6. Triode power;
5.5.7. Dosage adjustment
5.6. For ion implantation:
5.6.1. Beam dosage control and adjustment;
5.6.2. Ion source design elements;
5.6.3. Instruments for ion beam and deposition rate parameter control;
5.6.4. Temperature-and-time cycles and pressure cycles

5.7. For ion electroplating:
5.7.1. Beam dosage control and adjustment;
5.7.2. Ion source design elements;
5.7.3. Instruments for ion beam and depositon rate parameter control;
5.7.4. Temperature-and-time cycles and pressure cycles;
5.7.5. Feeding and evaporation rate of the covering material;
5.7.6. Sublayer temperature;
5.7.7. Sublayer incline parameteres

Item No.	Description	Item code in the foreign-trade classification

Category 3. Electronics

3.1. Systems, equipment, and components

Notes:

1. Control status of equipment and components mentioned in Item 3.1, besides those mentioned in Items 3.1.1.1.3-3.1.1.1.10 or in Item 3.1.1.1.12, specially designed or which have the same functional characteristics as other equipment, is determined according to the control status of other equipment

2. Control status of integrated circuits mentioned in Items 3.1.1.1.3-3.1.1.1.9 or in Item 3.1.1.1.12 whose programs cannot be changed, or those developed to fulfil particular functions for other equipment, is determined according to the control status of other equipment

Special note:

In cases when the maker or applicant cannot determine the control status of other equipment, this status is determined by the control status of integrated circuits mentioned in Items 3.1.1.1.3-3.1.1.1.9 or Item 3.1.1.1.12; if the integrated circuit is a silicon integrated circuit of a micrcomputer or an integrated circuit of a microcontroller mentioned in Item 3.1.1.1.3 and has an 8-bit or less operand wordlength, its control status ought to be determined as described in Item 3.1.1.1.3

3.1.1. Electronic components, such as:

3.1.1.1. Listed below general-purpose integrated circuits:

Note:

1. Control status of ready-made plates or semi-finished items for their production which reproduce a particular function is assessed using parameters mentioned in Item 3.1.1.1

2. The notion "integrated circuits" includes the following types:
solid-state integrated circuits;
hybrid integrated ciruits;
multichip integragted curcuits

film integrated circuits including the ones of the "silicon-onsaphire" type
optical integrated circuits

3.1.1.1.1. The integral circuits designed or qualifying as radiation-proof withstanding any of the following effects:
a) a total dose 5 x 10 (3) Gr (silicon) [5 x 10 (5) rad (silicon)] or higher; or
b) the extreme dose 5 x 10 (6) Gr/sec (silicon) [5 x 10 (8) rad (silicon)]/ sec or higher; 8542;

3.1.1.1.2. Microprocessor microchips, microcomputer microchips, microcontroller microchips, integral memory chips manufactured on semiconductor compounds, analog-digital converters, digital -analog converters, electronic optical or optical integral circuits intended for signal processing, logical devices, integral circuits for neuron networks, customer integral circuits with unknown function or in respect to which the manufacturer does not know if the control status extends to the equipment where these integral circuits are going to be used , swift Fourier transform processors, integral circuits, permanent memory electrically-programmable device integral circuits, ultraviolet deletion programmable and static memory devices with random access having any of the following characteristics: 8542
a) operable under ambient temperature over 398 K (+125 degrees C);
b) operable under ambient temperature below 218 K (- 55 degrees C); or
c) operable under ambient temperature beyond the range from 218 K (-55 degrees C) to 398 K (+125 degrees C)

Note.
Item 3.1.1.1.2 shall not extend to integral circuits used for civilian automobiles and railway trains;

3.1.1.1.3. Microprocessor integrated circuits, microcomputer integratred circuits, and microcontoller integrated circuits which have any of the following characteristics:

Note:
Item 3.1.1.1.3 includes digital signal processors, matrix digital processors, and digital coprocessors

3.1.1.1.3.1. Total theoretical productivity (TTP) of 6500 million theoretical operations per second (mtops) or more and an arithmetic logical device with a 32-bit or more access; 854211870

3.1.1.1.3.2. Made on semiconductor connections and working at clock frequency over 40 MHz; or 8542

3.1.1.1.3.3. More than one data or command bus or links providing for direct external interconnection between parallel microprocessor chips with the transfer rate greater than 150 Mbit/s; 854211760

3.1.1.1.4. Memory integrated circuits made on semiconductor connections; — 854211550; 854211720; 854211760

3.1.1.1.5. Integrated circuits for analogue-to-digital and digital-to-analogue converters, such as: — 854211830-854211870;
a) analogue-to-digital converters which have any of the following characteristics: — 854211990; 854220100;
1) 8-bit or higher resolution, however, less than 12 bits, with the overall convertion time than 5 ns; — 854220900
2) 12-bit resolution with the overall conversion time less than 200 ns; or
3) more than 12 bits resolution with the total conversion time less than 2 mcs;
b) digital-to-analogue converters with a 12-bit or more resolution and a time to stable regime less than 10 ns;

Technical notes:

1. The resolution of n bits corresponds to 2 (n) quantization levels

2. The general transformation time is a reverse value of resolution;

3.1.1.1.6. Optoelectronic and optical integrated circuits for signal processing featuring simultaneously all of the listed components: — 854219
a) one or more internal laser diodes;
b) one or more internal light-sensitive elements; and
c) light pipes;

3.1.1.1.7. User-programmable logical devices have any of the following characteristics: — 854211300
a) 30,000-worth of gates (in two-pin equivalent);
b) typical delay time of the main logical element less than 0.4 ns; or
c) switching frequency exceeding 133 MHz

Note.

Item 3.1.1.1.7 shall include:
simple programmable logical devices;
complex programmable logical devices;
user-programmable valve matrixes;
user-programmable logical matrixes;
user-programmable interconnections

Special note.

User-programmable logical devices are also known as user-programmable valve matrixes or user-programmable logical matrixes;

3.1.1.1.8. *Excluded*

3.1.1.1.9. Integrated circuits for neuron networks; — 854219

3.1.1.1.10. Intergrated circuits made to order with unknown function, or the maker does not know if the control status applies to equipment expected to be used with the given integrated circuits, which have any of the following characteristics. — 854219

a) more than 1000 pins;
b) typical delay time of the main logical element less than 0.35 ns; or
c) working frequency over 3 GHz;

3.1.1.1.11. Digital integrated circuits other than those mentioned in Items 3.1.1.1.3-3.1.1.1.10 and 3.1.1.1.12 made on the basis of any semiconductor connection and which have any of the following characteristics: 854211990
a) 3000-worth of gates (in two-pin equivalent); or
b) switching frequency over 1.2 GHz;

3.1.1.1.12. Fourier fast-transform processors which have estimated time of performing the complex N-point fast Fourier transform less than (N log2 N)/20480 ms, where N is the number of points 854211810; 854211830

3.1.1.2. Components of microwave or millimeter range, such as:

3.1.1.2.1. Listed below electronic vacuum valves and cathodes:

Note:
In Item 3.1.1.2.1, contol shall not apply to valves developed or designed for operaton in the frequency range set by the International Telecommunication Union, with frequencies not more than 31 GHz

3.1.1.2.1.1. Pulse or continuous action travelling-wave valves, such as: 854049000
a) working in the frequencey range over 31 GHZ;
b) which have a cathode heating element with a turn-on-to-maximum-radiofrequency-power time less than 3 s;
c) valves with integratged resonators or their modifications with a relative frequency bandwidth over 7%, or power peak over 2.5 kW;
d) spiral valves or their modifications which have any of the following characteristics:
1) instantaneous bandwidth more than one octave and a product of average power (in kW) by working frequency (in GHz) over 0.5;
2) instantaneous bandwidth of one octave or less and a product of average power (in kW) by working frequency (in GHz) over 1; or
3) fit for use in the outer space;

3.1.1.2.1.2. Magnetrone type amplifier lamps with amplification coefficient more than 17 dB; 854041000

3.1.1.2.1.3. Impregnated cathodes designed for electron valves featuring current density at continuous emission and regular operating conditions in excess of 5 A/sq. cm 8450990000;

3.1.1.2.2. Microwave integrated circuits or modules featuring all of the following: 854049000

a) incorporating solid-state integral circuits with one or more than one element of active circuits; and
b) operating on frequencies over 3 GHz

Notes:

1. In Item 3.1.1.2.2, control shall not apply to circuits or modules for equipment developed or designed for operation in any frequency range meeting all of the following characteristics:
a) not greater than 31 GHz; and
b) allocated by the International Telecommunication Union for serving radio communication but not for radiodetermination
2. In Item 3.1.1.2.2, control shall not apply to radio transmission satellite equipment developed or designed for operation in the frequency range from 40.5 to 42.5 GHz;

3.1.1.2.3. Microwave transistors designed for operation at frequencies over 31 GHz; 854049000

3.1.1.2.4. Microwave solid-state amplifiers which have any of the following charateristics: 854049000

a) operating at frequencies over 10.5 GHz which have an instanteneous frequency bandwidth more than half of octave;
b) operating at frequencies over 31 GHz;

3.1.1.2.5. Filters with electronic or magnetic tuning containing more than five adjustable resonators ensuring the tuning in the frequency band with a maximum-to-minimum frequency ratio of 1.5:1 (fmax/fmin) within less than 10 mcs which have any of the following components: 854049000

a) band-pass filters which have a transmission band more than 0.5% of the resonance frequency; or
b) rejection filters which have frequency suppresion bandwidth less than 0.5% of the resonance frequency;

3.1.1.2.6. Microwave assemblies capable of operation at frequencies over 31 GHz; 854049000

3.1.1.2.7. Mixers and converters designed to expand the frequency bandwidth of equipment mentioned in Items 3.1.2.3, 3.1.2.5, or 3.1.2.6; 854049000

3.1.1.2.8. Microwave power amplifiers containing valves controlled under Item 3.1.1.2 which have all of the following characteristics: 854081000

a) working frequencies over 3 GHz;
b) average output power density over 80 W/kg; and
c) volume less than 400 cm3

Note:

In Item 3.1.1.2.8, control shall not apply to equipment developed or designed for operation in any of the frequency ranges allocated by the International Telecommunication Union for serving radio

communication but not for radiodetermination;

3.1.1.3. Instruments using sound waves and specially desinged components for them, such as:

3.1.1.3.1. Instruments using surface sound waves and sound waves in the thin sublayer (i.e. signal processing instruments using elastic waves in the material) which have any of the following characteristics: 854160000

a) carrier frequency over 2.5 GHz; or

b) carrier frequency over 1 GHz, however, not more than 2.5 GHz which have, in addition, any of the following characteristics:

1) beam lobe frequency suppresion over 55 dB;

2) a product of maximum delay time (in mcs) by frequency bandwidth (in MHz) more than 100;

3) frequency bandwidth more than 250 MHz; or

4) scattering delay over 10 mcs; or

c) carrier frequency from 1 GHz and less and, in addition, any of the following characteristics:

1) a product of maximum delay time (in mcs) by frequency bandwidth (in (MHz) more than 100;

2) scattering delay over 10 mcs; or

3) beam lobe frequency supression over 55 dB and the frequency bandwidth over 50 MHz;

3.1.1.3.2. Instruments using volumetric sound waves (i.e. instruments for signal processing using elastic waves in the material) capable of direct signal processing at frequencies over 1 GHz; 854160000

3.1.1.3.3. Acoustooptical signal processing instruments using an interaction of sound waves (volumetric and surface ones) and light waves which permits to process signals or images directly, including spectral analysis, correlation, or convolution 854160000

3.1.1.4. Electronic instruments and circuits containing components made of superconducting materials specially designed for operation at temperatures below the critical one for at least one of the superconducting components, which have at least one of the following features: 854280000

a) electomagnetic amplification:

1) at frequencies equal to or below 31 GHz with the noise level below 0.5 dB; or

2) at frequencies above 31 GHz;

b) current switchers for digital circuits using supercondicting gates which have a product of delay time per gate (in seconds) by power scattering per gate (in W) below 10(-14) J; or

c) frequency selection at all frequencies using resonance circuits with the quality factor over 10,000

3.1.1.5. Listed below power accumulators:

3.1.1.5.1. Batteries and photoelectric cells, such as: 850619900

a) primary cells and batteries with the power density over 480 W.h/kg and fit, according to specification, for operation in the temperature range from 243 K (-30°C) and below to 343 K (70°C) and higher

Technical note:

Power density is determined by multiplying the average power in W (a product of average voltage in V by average current in A) by discharge cycle length in hours during which the voltage at disconnected terminals drops to 75% of the nominal value, and dividing the obtained product by the total cell (or battery) weight in kg;

b) rechargeable cells and batteries with the power density over 150 W.h/kg after 75 charge-discharge cycles with discharge current equal to C/5 h (C - nominal capacitance in ampere-hours) while operating in the temperature range from 253 K (-20°C) and below to 333 K (60°C) and higer;

c) batteries fit, according to specification, for use in the outer space and radiation resistant batteries using photoelectric cells with specific power higher than 160 W/m3 at the working temperature of 301 K (28°C) and a tungsten source heated up to 2,800 K (2,527°C) and creating irradiance of 1 kW/m3

Note:

In Item 3.1.1.5.1, control shall not apply to batteries with the volume of 27 cm3 and less (e.g. standard carbon cells or batteries of R14 type);

3.1.1.5.2. High-energy accumulators, such as: 850619900;

a) accumulators with repetition rate less than 10 Hz (disposable accumulators) which have all of the following characteristics: 850780900

1) nominal voltage 5 kW or more;

2) power density 250 J/kg or more; and

3) total power 25 kJ or more;

b) accumulators with 10 Hz and more repetition rate (rechargeable accumulators) which have all of the following characteristics:

1) nominal voltage no less than 5 kW;

2) power density no less than 50 J/kg;

3) total power no less than 100 J; and

4) number of charge-discharge cycles no less than 10,000;

3.1.1.5.3. Superconducting electric magnets and solenoids specially designed for a full charging or discharging within less than one second which have all of the characteristics listed below: 850519900

a) power released in a discharge more than 10 kJ within the first second;

b) inner diameter of the current conducting winding more than 250 mm; and

c) nominal induction over 8 T or the total current density in the winding over 300 A/mm2

Note:

In Item 3.1.1.5.3, control shall not apply to superconducting electric magnets or solenoids specially designed for medical equipment of magnetoresonance tomography

3.1.1.6. Rotating shaft absolute angular position to code converters which have any of the following characteristics: 903180310

a) resolution better than 1/265,000 of the full range (18-bit); or

b) accuracy better than +-2.5 angular seconds

3.1.2. Listed below general-purpose electronic equipment:

3.1.2.1. Recording equipment and specially designed measirng tape for it, such as:

3.1.2.1.1. Magnetic-tape memory for analogue equipment including equipment permitting recording of digital signals (e.g. using high-density digital recording unit) which have any of the following characteristics: 852039900

a) frequency bandwidth over 4 MHz per electronic channel or track;

b) frequency bandwidth over 2 MHz per electonic channel or track, if the number of tracks is more than 42; or

c) time scale (main) error measured using the methods of respective reference materials of the Interagency Radio Industry Group (IRIG) or Electronic Industries Association (EIA) less than +-0.1 cs

Note:

Analogue video tape recorders specially developed for civil use are not regarded as recording equipment;

3.1.2.1.2. Digital video tape recorders with the maximum throughput of the digital interface over 360 Mbit/s;

Note.

Under Item 3.1.2.1.2 the following shall not be subject to control: digital video recorders specifically designed for television recording operating in a signal format that can include the signal format compression standardized or recommended for use in the civil television by the International Telecommunication Union, the International Electric Commission, the Organizations of Engineers for Developing Cinema and Television, the European Broadcasting Union or the Institutions of Electric and Radioelectronic Engineers;

3.1.2.1.3. Memory on magentic tape for digital equipment using spiral scanning or fixed head principle which have any of the following characteristics: 852110

a) maximum throughput of the digital interface over 175 Mbit/s; or

b) fit for use in the outer space

Note:

In Item 3.1.2.1.3, control shall not apply to analogue magnetic tape memory outfitted with electronic units for conversion to digital highdensity record and desinged to record only digital data;

3.1.2.1.4. Equipment with the maximum throughtput of the digital interface over 175 Mbit/s designed to retrofit digital video tape recorders to use them as digital equipment data recording devices;	852190000
3.1.2.1.5. Instruments used to convert signals to digital form and record transient processes which have all of the following characteristics: a) rate of conversion to digital form no less than 200 million samples per second and 10 or more samples per second resolution; and b) throughput no less than 2 Gbit/s	854380900

Technical note:

The throughput for such instruments with a parallel bus architechture is a product of maximum word volume by the number of bits in the word.

Throughput - the highest data transmission rate for the equipment from which information is transmitted to memory without losses while maintaining the rate of reading and analogue-to-digital conversion

3.1.2.2. Electronic assemblies of frequency synthesizers with the switching time from one preset frequency to another less than 1 ms;	854380900
3.1.2.3. Signal analyzers: a) capable of analysing frequencies over 31 GHz; b) dynamic signal analyzers with the real-time transmission bandwidth over 500 kHz	854380900

Note:

In Subitem (b) of Item 3.1.2.3, control shall not apply to dynamic signal analyzers using only fixed bandwidth portion filters (known also as octave filters or octave-fraction filters)

3.1.2.4. Synthesized frequency generators forming output frequencies permitting accuracy, short-term or long-term stability control on the basis of, or by means of, internal reference frequency which have any of the following characteristics: a) maximum synthesized frequency over 31 GHz; b) switching time from one preset frequency to another less than 1 ms; or c) phase noise of one side band better than (126+20lgF-20lgf) in dBxs/Hz units, where F - working frequency drift in Hz, and f - working frequency in MHz	854320000

Note:

In Item 3.1.2.4, control shall not apply to equipment in which output frequency is produced either by frequency summation or deduction from two or more quartz generators, or by summation or deduction followed by subsequent multiplication of the resulting frequency;

3.1.2.5. Network analyzers with the maximum working frequency over 40 GHz;	854380900
3.1.2.6. Microwave testing receivers which have all of the	852790990

following characteristics:
a) maximum working frequency over 40 GHz; and
b) capable of measuring simultaneously the amplitude and phase;

3.1.2.7. Atomic frequency standards which have any of the following characteristics: 854320000
a) long-term stability (ageing) less (better) than 10(-11) per month; or
b) fit for use in the outer space

Note:
In Subitem (a) of Item 3.1.2.7, control shall not apply to rubidium standards not intended for use in the outer space

3.2. Testing, checking, and production equipment

3.2.1. Listed below equipment used to produce semiconductor instruments or materials and specially designed components and auxiliaries for them:

3.2.1.1. Plants operated by an in-built program designed for epitaxial growth, such as:

3.2.1.1.1. Plants capable of maintaining a layer thickness with a deviation of not more than +-2.5% within 75 mm or more; 841989900

3.2.1.1.2. Chemical vapor depostion plants for metal-organic compounds specially designed to grow crystals of complex semiconductors by chemical reactions between materials controlled under Item 3.3.3 or 3.3.4; 841989900

3.2.1.1.3. Molecular beam plants for epitaxial growth using gas or solid sources 841780100

3.2.1.2. Plants operated by an in-built program specially designed for ion implantation which have any of the following characteristics: 845610000
a) radiation energy (accelerating voltage) of over 1 MeV;
b) specially designed and optimized for operation with radiation energy (accelerating voltage) below 2 keV;
c) capable of direct recording; or
d) fit for high-energy oxygen implantation to a heated sublayer of a semiconductor material;

3.2.1.3. Plants for dry, anisotropic plasma etching operated by an in-built program: 845690000
a) with a batch plate processing and loading through loading gates which have any of the following characteristics:
1) developed according to maker technical specifications or optimised for making structures with size critical deviation of 0.3 mcm or less with the root-mean-square error of 3б=+5%; or
2) developed to ensure surface defective factor less than 0.04

particles per cm2 for particles greater than 0.1 mcm in diameter;
b) specially designed for equipment controlled under Item 3.2.1.5, which have any of the following characteristics:
1) magnetic protection; or
2) electornic cyclotron reasonance;

3.2.1.4. Chemical vapor deposition and plasma stimulation plants operated by an in-built program: 845690000
a) with batch plate processing and loading through loading gates which have any of the following characteristics:
1) developed according to maker technical specifications or optimised for making structures with size critical deviation of 0.3 mcm or less with the root-mean-square error of 3б=+5%; or
2) developed to ensure surface defective factor less than 0.04 particles per cm2 for particles greater than 0.1 mcm in diameter;
b) specially designed for equipment controlled under Item 3.2.1.5 which have any of the following characteristics:
1) magnetic protection; or
2) electronic cyclotron resonance;

3.2.1.5. Operated by an in-built program automatic-loading multi-chamber systems with central plate loading which have any of the following components: 845610000; 845690000
a) interfaces for plate loading and unloading connected to more than two pieces of equipment for semiconductor processing; and
b) designed for integrated system of successive batch plate procesing in a vacuum medium

Note:
In Item 3.2.1.5, control shall not apply to automatic plate-loading robot systems not intended for operatioon in vacuum

3.2.1.6. Lithography plants operated by an in-built program, such as:

3.2.1.6.1. Multiple-match plants and exposure for (direct sequential step-by-step exposure) or step-by-step scanning for plate treatement by photooptical or X-ray lithogrpahy which have any of the following components: 900922900
a) source of light with the wavelength shorter than 350 nm; or
b) capability to reproduce an image with the minumim resolution from 0.5 mcm and less

Note:
The minimum resolution (MR) is estiamted using the following formula:

$$MR = \frac{(\text{exposure of light source with wavelength in mcm}) \times (\text{K factor})}{\text{digital aperture}},$$

where K factor = 0.7;

3.2.1.6.2. Plants specially designed to make templates or process semiconductor instruments using deflected, focused electronic beams, ion or laser beam which have any of the following characteristics: 845610000

a) spot size less than 0.2 mcm;

b) capability to make images with the minimum permitted design norms less than 1 mcm; or

c) matching accuracy better than +-0.20 mcm (3 sigma)

3.2.1.7. Templates or intermediate phototemplates desinged for integrated circuits controlled under Irtem 3.1.1;

3.2.1.8. Multi-layer templates with a phase-shifting layer 901090000

3.2.2. Testing equipment operated by an in-built program specially designed to test finished semiconductor instruments or those at various production stages and specially designed components and auxiliaries for it:

3.2.2.1. To measure S-paramters of transistor instruments at frequencies over 31 GHz; 903180390

3.2.2.2. To test intergrated circuits capable of fulfilling functional testing (according to truth tables) with the string testing frequency more than 60 MHz 903180390

Note:

In Item 3.2.2.2, control shall not apply to testing equipment specially designed to test:

a) electronic assemblies or a class of electronic assemblies for domestic or games electronic equipment;

b) uncontrolled electronic components, electronic assemblies or integrated circuits; c) of memory devices;

3.2.2.3. To test microwave integrated circuits at frequencies over 3 GHz 903180390

Note:

In Item 3.2.2.3, control shall not apply to testing equipment specially designed to test microwave integrated circuits for equipment designed or fit, according to technical specification, for operation in the frequency range set by the International Telecommunication Union with the frequencies not exceeding 31 GHz;

3.2.2.4. Electronic-beam designed for operation at 3 keV or less, or laser-beam systems for non-contact probing of powered semiconductor instruments which have all of the following components: 903180390

a) stroboscopic regime either with beam shading or detector strobing; and

b) electronic spectrometer to measure voltages less

than 0.5 v

Note:
In Item 3.2.2.4, control shall not apply to scanning electronic microscopes, except for those specially designed and outfitted for noncontact probing of powered semiconductor instrumets

3.3. Materials

3.3.1. Heteroepitaxial materials consisting of a sublayer with several successively built epitaxial layers which have any of the following components:

3.3.1.1. Silicon; 381800900

3.3.1.2. Germanium, or 381800900

3.3.1.3. Silicon carbide; or 3818009000

3.3.1.4. III/V compounds made on the basis of gallium or indium 381800900

3. III/V compounds made on the basis of gallium or 381800900 indium

Technical note:
III/V compounds - polycrystalline, or two-element, or complex monocrystalline products consisting of group IIIA and VA elements of Mendeleyev periodical system (according to domestic classification, this is groups A3 and B5) (gallium arsenide, gallium alumoarsenide, indium phosphide, etc.)

3.3.2. Resist and sublayer materials coated with controlled resists, such as:

3.3.2.1. Positive resists designed for semiconductor lythography, specially adjusted (optimized) for use for spectral response less than 350 nm; 854140990

3.3.2.2. All resists designed for exposure to electronic or ion beams with 0.01 mcC/mm2 or better sensitivity; 854140990

3.3.2.3. All resists designed for X-ray exposure with 2.5 mJ/mm2 or better sensitivity; 854140990

3.3.2.4. All resists optimized for image forming technologies including siliconized resists 854140990

Technical note:
Siliconizing methods - the processes including resist surface oxidizing to improve the quality of wet and dry development

3.3.3. Organo-nonorganic compounds, such as:

3.3.3.1. Organometallic compounds based on aluminium, gallium, or indium with the metal basis purity higher than 99.999%; 293100900

3.3.3.2. Organoarsenic, organoantimonide, and 293100900

organophosphoric compounds with the purity of the organic element base higher than 99.999%

Note:
In Item 3.3.3, control shall only apply to compounds with metallic, partly metallic, or non-metallic element directly bound to carbon in the organic part of the molecule

3.3.4. Phosphorus, arsenic, or antimony hybrides with the purity higher than 99.999%, even after dissolving in inert gases or hydrogene — 284890000; 285000100

Note:
In Item 3.3.4, controll shall not apply to hydrides containing 20% of moles and more of inert gases or hydrogen

3.4. Software

3.4.1. Software specially designed to develop or produce equipment controlled under Items 3.1.1.2-3.1.2.7, or under Item 3.2

3.4.2. Software specially designed for use in equipment operated by an in-built program and controlled under Item 3.2

3.4.3. Software of automatic design systems featuring all of the following components:

3.4.3.1. Designed for development of semiconductor instruments or integrated circuits; and
3.4.3.2. Designed for fulfilling or use of any of the following components:
a) rules of designing or rules of checking the circuits;
b) circuit simulation according to their physical layout; or
c) lithographic process imitators for design purposes;

Technical note:
Lythography process simulator - software package used at the design stage to determine the sequence of lythography, etching, and deposition operations to implement the masking templates in particular topological conductor, dielectric, or semiconductor material patterns

Note:
In Item 3.4.3, control shall not apply to software specially designed to describe principal diagrams, logical modelling, arrangement and routing (tracing), topology check, or template duplication

Special note:
Libraries, design attributes, or accompanying data used to design semiconductor instruments or integrated circuits are regarded as a technology

3.5. Technology

3.5.1. Technologies designed, according to the General Technological Note, to develop and produce equipment or materials controlled under Items 3.1, 3.2, or 3.5

Note:

In Item 3.5.1, control shall not apply to technologies used to develop or produce:

a) microwave transistors operating at frequencies below 31 GHz;

b) integrated circuits controlled under Items 3.1.1.1.3-3.1.1.1.12 which have both of the listed below features:

1) which use design norms of 0.7 mcm or higher; and

2) not containing multilayer structures

Special note:

The term "multilayer structures" in Subitem 2 of Item (b) of the Note shall not include instruments containing a maximum of two metallic layers and two polysilicons

3.5.2. Technologies complying with the General Technological Note other than those controlled under Item 3.5.1 for development or production of microprocessor integrated circuits, microcomputer integrated circuits and microcontroller integrated circuits with the total theoretical productivity of 530 Mtops or greater and an arithmetic logical device with the word length of 32 bits or greater;

3.5.3. Other technologies for development or production of:

a) vacuum microelectronic instruments;

b) semiconductor instruments on heterostructures, such as high electron mobility transistors, bipolar transistors on heterostructures, quantum well instruments or superlattice instruments;

c) superconducting electronic instruments;

d) diamond film sublayers for electronic components;

e) sublayers of silicon-on-dielectric structures (SOD structures) for integrated circuits with dielectric of silicon dioxide;

f) sublayers of silicon carbide for electronic components;

Category 4. Computational Equipment

Notes:

1. Computers, auxiliary equipment or software used in telecommunication or local computer networks also ought to be checked for correspondence to characteristics mentioned in Part 1 of Category 5 (Telecommunication)

Special notes:

a) control devices connecting directly buses or channels of central processors, random-access memory, or magnetic disk drive controllers are not included in the telecommunication equipment covered in Part 1 of Category 5 (Telecommunication);

b) to determine the control status of software specially designed for packet switching, one should use Item 5.4.1

2. Computers, auxiliary equipment or software fulfilling cryptographic, cryptoanalysis, certified multilevel data protection functions, or certified functions of user isolation, or restricting electromagnetic compatibility (EMC) also ought to be checked for correspondence to characteristics mentioned in Part 2 of Category 5 (Data Protection)

4.1. Systems, equipment, and components

4.1.1. Listed below computers and auxiliary equipment, as well as electronic assemblies and specially designed components for them:

4.1.1.1. Specially designed to obtain any of the following characteristics: — 847110; 847120

a) according to technical specification, fit for use for operation at the ambient temperature below 228 K (-45°C) or higher than 358 K (85°C)

Note:
In subitem (a) if Item 4.1.1.1, control shall not apply to computers specially designed for civil automobiles or railroad trains;

b) radiation-proof, exceeding any of the below requirements:
1) absorbed dose 5 x 10 (3) Gr (silicon) [5 x 10 (5) rad (silicon)];
2) fault dose value 5 x 10 (6) Gr/sec (silicon) [5 x 10 (6) rad (silicon)]/ sec; or
3) fault due to high-energy particle 10 (-7) error/bit/day;

4.1.1.2. Having characteristics or functional particulars surpassing the limits mentioned in Part 2 of Category 5 (Data Protection) — 847110; 847120

Note.
Under Item 4.1.1.2 the following shall not be subject to control: digital personal computers and equipment relating thereto when they are taken out of this country by the user for the user's personal use;

4.1.2. Hybrid computers, electronic assemblies and specially designed components for them: — 847110

a) containing digital computers controlled under Item 4.1.3;
b) containing analogue-to-digital converters which have all of the following characteristics:
1) 32 channels or more; and
2) 14 bit resolution (plus the sign digit) or higher with the rate of 200,000 conversions/s or higher

4.1.3. Digital computers, electronic assemblies, and auxiliary equipment, as well as specially designed components for them, such as:

Notes:
1. Item 4.1.3 includes:
a) vector processors;
b) matrix processors;
c) digital central processors;
d) logical processors;
e) image quality improvement equipment;
f) signal processing equipment

2. Control status of digital computers or auxiliary equipment described in Item 4.1.3 is determined by the control status of the other equipment or other systems in cases when:

a) digital computers or auxiliary equipment are necessary for operation of other equipment or other systems;

b) digital computers or auxiliary equipment are not the main element of other equipment or other systems; and

c) technology used in digital computers and auxiliary equipment is covered by Item 4.5

Special notes:

1. Control status of signal processing or image quality improvement equipment specially designed for other equipment with the functions restricted to functional destination of other equipment shall be determined by the control status of other equipment, even if the former one matches the criterion of the main element

2. To determine the control status of digital computers or auxiliary equipment used in telecommunication equipment, see Part 1 of Category 5 (Telecommunication)

4.1.3.1. Designed or modified to ensure failure-free operation	8471 (except 847110)

Note:

Conformably to Item 4.1.3.1, digital computers and auxiliary equipment are not considered as designed or modified to ensure failurefree operation, if any of the following is used in them:

a) error detection or correction algorithms stored in the randomaccess memory;

b) interrelation of the two digital computers being such that when the active central processor fails, the waiting and tracking central processor can continue the functioning of the system;

c) interconnection between central processors through data transfer channels or using common memory providing an opportunity for one central processor to fulfil other job till the failure of the second processor, when the first central processor assumes its job to continue the functioning of the system; or

d) synchronization of two central processors connected by software so as to permit one central processor to detect the failure of the other central processor and restore the function of the failing device;

4.1.3.2. Digital computers which have the total theoretic productivity (TP) higher than 28000 mtops;	8471 (except 847110)
4.1.3.3. Electronic assemblies specially designed or modified to raise productivity by uniting computing elements so that the total theoretical productivity of the joined assemblies would surpass the limits indicated in Item 4.1.3.2	8471 (except 847110)

Notes:

1. Item 4.1.3.3 shall apply only to electronic assemblies and programmable interrelations below the limits indicated in Item 4.1.3.2 when supplied as separate electronic assemblies. It does not apply to electronic assemblies whose design is fit for use only as an auxiliary equipment controlled under Items 4.1.3.4, 4.1.3.5;

2. In Item 4.1.3.3, control shall not apply to electronic assemblies specially designed for items, or a whole family of items, whose maximum configuration does not surpass the limits mentioned in Item 4.1.3.2;

4.1.3.4. Graphic accelerators or graphic coprocessors surpassing the calculation rate for three-dimensional	854380900

vectors equal to 200,000,000;

4.1.3.5. Equipment fulfilling analogue-to-digital conversions surpassing the limits mentioned in Item 3.1.1.1.5; 852520900

4.1.3.6. Excluded

Note:
Conformably to Item 4.1.3.6, terminal interface equipment shall include local computer network interfaces and other communication interfaces. Interfaces of local computer networks shall be qualified as network access controllers;

4.1.3.7. Equipment specially designed to ensure digital computers exterior interconnection or auxiliary equipment which have data transmission rate in communication over 1,25 Gbyte/s 847199900

Note:
In Item 4.1.3.7, control shall not apply to external interconnecting equipment (e.g. visible plane, buses) or passive interconnecting equipment

4.1.4. Listed below computers, specially designed auxiliary equipment, electronic assemblies and components for them: 8471

4.1.4.1. Computers with a systolic matrix;

4.1.4.2. Neuron computers;

4.1.4.3. Optical computers

4.2. Testing, checking, and production equipment - no data

4.3. Materials - no data

4.4. Software

Note:
Control status of the software used to develop, produce, or use equipment mentioned in other categories is determined from description of respective categories. The given category provides control status of the software for equipment of this category

4.4.1. Software specially designed or modified to develop, produce, or use equipment or software controlled under Item 4.1 or 4.4

4.4.2. Software specially designed or modified to support technology controlled under Item 4.5

4.4.3. Special software, such as:

4.4.3.1. Software of operating systems, tools to develop software, and compilers specially designed for equipment of multiple-flow data processing in initial codes;

4.4.3.2. Expert systems or software for logical inference mechanisms of expert systems which have the following features simultaneously:

a) time-dependent rules; and

b) primitives to work with time characteristics of rules and factors;

4.4.3.3. Software which has characteristics or fulfil functions surpassing the limits given in Part 2 of Category 5 (Data Protection);

Note.

Under Item 4.4.3.3 the following shall not be subject to control: software when taken out of this country by the users for the users' individual use;

4.4.3.4. Operating systems specially designed for real-time data processing quaranteeing full interrupt request processing time less than 20 mcs

4.5. Technology

4.5.1. Technologies designed, according to the General Technological Note, for development, production, or use of equipment or software controlled under Item 4.1 or 4.4

Technical note (to calculating the total theoretical productivity).

Used abbreviations:
CE - computing element (usually, an arithmetic, logical unit);
FIP - floating point;
FxP - fixed point;
t - solution time;
XOR - exclusive OR;
CP - central processor;
TP - theoretical productivity (of one computing element);
TTP - total theoretical productivity (of all computing elements);
R - effective computing rate;
WL - wordlength (number of bits);
L - wordlength (bit) adjustment;
ALU - arithmetic and logical unit;
x - multiplication sign.

Solution time t is expressed in microseconds, TP or TTP is expressed in millions of theoretical operations per second, WL is expressed in bits

Main method of TTP calculation

TTP - measure of computational productivity in millions of theoretical operations per second. To calculate the total theoretical productivity of a configuration of computing elements (CE), it is necessary to fulfil the following three stages:

1. To determine the effective computational rate for each computing element (CE);

2. To make wordlength adjustment (L) for this rate (R) which produces, as a result, the theoretical productivity (TP) for each computing element (CE);

3. Combine TP and obtain the TTP for the given configuration, if there are more than one computing element.

Detailed description of these procedures is given below

Notes:

1. For computing elements joined in subsystems which have both a common memory and a memory for each subsystem, computation of TTP is done in two stages: first, CEs with a common memory are united into groups, and then the group TTP is calculated for all CEs which do have a common memory using the suggested technique

2. Computing elements whose operating rate is limited by the rate of data input-output devices and peripheral functional units (e.g. drive, data transfer and display controllers) are not united when calculating the TTP

The table given below demonstrates the method of calculating the effective computational rate R for each computing element:

Stage 1: Effective computational rate (R)

For computing elements implementing	Effective computational rate
Only FxP (Rfxp)	1/[3x(FxP addition time)] if there is no an addition operation, it is done through multiplication: 1/(FxP multiplication time) if there are no either an addition or multiplication operations, the Rfp is calculated through the quickest of available arithmetic operations: 1/[3x(FxP operation time)] See Notes X and Z
only FlP (Rflp)	MAX {1/(FlP addition time), 1/(FlP multiplication time)} See Note X and Y
both FxP and FlP (R)	calculated as both Rfxp and Rflp
For simple logical processors unable to fulfill the mentioned arithmetic operations	1/[3x(logical operation time)] the logical operation time here is the time of fulfilling the "exclusive OR" operation, and if it is not available, then the quickest simple logical operation is taken See Notes X and Z
For specialized logical processors unable to fulfill the mentioned arithmetic and logical operations	R=R'xWL/64, where R' - number of results per second WL - number of bits included in the logical operation 64 - normalizing coefficient for a 64-digit operation

Note:
Each CE ought to be evaluated independently

Note W:
After a full pipeline data processing in each machine cycle, one can determine the processing rate for computing elements capable of fulfilling one arithmetic or logical operation. The effective computational speed (R) for such CEs in a pipeline data processing is higher than without using it

Note X:
For computing elements fulfilling multiple arithmetic operations within one cycle (e.g. two additions per cycle), the solution time t is calculated as:

$$t = \frac{\text{cycle time}}{\text{number of arithmetic operations per cycle}}$$

Computing element fulfilling different types of arithmetic or logical operations within one machine cycle ought to be regarded as a multitude of separate CEs working simultaneously (e.g. CE fulfilling addition and multiplication operations within one cycle ought to be regarded as two CEs, one of which is fulfilling addition within one cycle and the other, multiplication within one cycle). If the same CE implements both the scalar and the vector functions, then the shortest execution time is taken

Note Y:
If neither a FIP addition, nor a FIP multiplication, but a FIP division is implemented in the CE, then

$$Rflp = 1/(FlP\ division\ time)$$

If a FIP inverse value is implemented in the CE, rather than FIP addition, multiplication or division, then

$$Rflp = 1/(FlP\ inverse\ value\ time)$$

If division is not available either, then an equivalent operation is used. If neither of the mentioned commands are used, then Rflp=0

Note Z:
Simple logical operation - operation in which one logical action is being fulfilled in one command over not more than two operands of the given length. Complex logical operation - operation in which multiple logical actions are fulfilled in one command over two or more operands producing one or several results. Calculation rates are calculated for all hardware-supported operand lengths, regarding both series operations (if available) and non-series operations using the shortest operations for each operand length while taking into account the following:

1. Series operations or register-to-register operations. Extremely short operations generated for operations over an earlier determined operand or operands (e.g. multiplication by 0 or 1) are excluded. If there no operations of the register-to-register type, one should be guided by Item 2;
2. The quickest register-to-memory or memory-to-register operation. If there no even such operations, one should be guided by Item 3;
3. Memory-to-memory.

In any of the above cases, use the shortest operations provided by the maker in the specification

Stage 2: TP for each supported operand length WL

Recalculate the effective calculation rate R (or R') taking into account the wordlength adjustment L:

$$TP = R \times L,$$
$$\text{where } L = (1/3 + WL/96)$$

Note:

Wordlength WL used in these estimates is the operand length in bits. (If operands of various lengths are used in the operation, use the maximum WL).

A combination of ALU mantissa and ALU exponent in a process with the floating point or in a functional device is considered to be one computing element with the wordlength (WL) equivalent to the number of bits in the data representation (32 or 64 digits) when calculating the TTP

The given recalculation shall not apply to specialized logical processors which do not uyse the "exclusive OR" operation. In this case, TP=R.

Choice of the maximum resulting TP value for:

Each CE using only FxP (Rfxp);

Each CE using only FlP (RflP);

Each CE using a combination of CE FlP and FxP (R);

Each simple logical processor using neither of the mentioned arithmetic operations; and

Each specialized logical processor using neither of the mentioned arithmetic or logical operations

Stage 3: Calculation of TTP for CE configurations including CP

For CP with one CE
TTP = TP
(for CE fulfilling both FxP and FlP operations
TP = max(TPfxp, TPflp)

For configurations with all CE working simultaneously, TTP is calculated as follows:

Notes:

1. For configurations in which all CEs are not working simultaneously, one should choose the configuration with the greatest TTP out of possible CE configurations. The TP value for each CE of the possible configuration used to calculate the TTP is chosen as the maximum possible theoretical value

Special note:

Possible configurations in which CEs are working simultaneously are determined from the results of operation of all CE beginning with the slowest CE (it needs the greatest number of cycles to complete the operation) and ending with the quickest CE. The possible configuration is the configuration of computing elements determined during the machine cycle.

When determining the result, one ought to take into account all technical means and/or the constraints diagram of overlapping operations

2. One crystal of an integrated circuit or one printed circuit may contain numerous CEs

3. It is considered that simultaneous operation of CEs is present if the maker of the computer system has declared the availability of combined, parallel, or simultaneous operations or actions in the instructions or operational guide for this system

4. TTP values are not added together for CE configurations interconnected in local computer networks, computer networks joined by input-output devices, input-output controllers, and any other interconnected transfer systems implemented through software

5. TTP value must be summed up for numerous CEs specially designed to improve their characteristics through joining the CEs, their simultaneous operation with a common or collective memory, in cases of

joining the CEs in a single configuration by using specially designed technical means. This does not apply to electronic assemblies mentioned in Item 4.1.3.3

$$TTP = TP1 + C2 \times TP2 + \ldots + Cn \times TPn,$$

where TPs are sequenced according to their value beginning with TP1 which has the greatest value, then TP2, and, finally, TPn with the lowest value. Ci - coefficient determined by the power of interrelations between CEs in the following way:

For the case of numerous CEs operating simultaneously with a common memory:

$$C2 = C3 = C4 = \ldots = Cn = 0.75$$

Notes:

1. When the TTP is calculated using the above technique, and its value is not greater than 194 mtops, Ci may be defined as a fraction with the numerator equal to 0.75, and denominator, to square root of m, where m is the number of common access CEs or CE groups if:

a) TPi of each CE or CE group is not greater than 30 mtops;

b) common access of CE or CE group to the main memory (except for the cache memory) is arranged through a common channel; and

c) only one CE or CE group can use the channel at any given time

Special note:

The above does not apply to items controlled under Category 3

2. CEs are considered to have a common memory if they address a common block of solid-state memory. This memory may include cache memory, random-access memory, or any other internal memory. External memory of disk drive, tape drive, or random-access drive types is not included here

For the case of numerous CEs or CE groups without a common memory interconnected by one or more data transfer channels:

$$\begin{aligned} Ci &= 0.75 \times ki \quad (i=2,\ldots,32) \quad \text{(see Note below)} \\ &= 0.60 \times ki \quad (i=33,\ldots,64) \\ &= 0.45 \times ki \quad (i=65,\ldots,256) \\ &= 0.30 \times ki \quad (i>256) \end{aligned}$$

Ci valuer is based on CE number, however, not on the unit number,

where jki = min(Si/Kr, 1); and

Kr - normalizing factor equal to 20 Mbyte/s;

Si - sum of maximum data transfer rates (in Mbyte/s) for all data channels connecting the i-th CE to CE group with a common memory

When Ci is calculated for a CE group, the number of the first CE in the group determines the own Ci limit. For example, in a configuration of groups consisting of three CEs each, group 22 will contain CE64, CE65, and CE66. Own Ci limit for these groups is 0.60.

Configuration of CEs or CE groups may be determined from the quickest to the slowest one, i.e.:

$$TP1 >= TP2 >= \ldots >= TPn, \text{ and}$$

when TPi = TPi+1, from the biggest to the smallest, i.e.:

$$Ci >= Ci+1$$

Note:

Ki - factor does not apply to CEs from 2 to 12, if the TP1 for CE or CE group is greater than 50 mtops, i.e. Ci for CEs from 2 to 12 equals 0.75

Item No.	Description	Item code in the foreign-trade classification

Category 5

Part 1. Telecommunication

Notes:

1. Part 1 of Category 5 defines the control status of components, laser, testing, and production equipment, materials and software specially designed for telecommunication equipment or systems

2. In cases when the functioning or support of telecommunication equipment mentioned in this category is dependent on digital computers, equipment or software pertaining to them, which are regarded as specially designed components, under the condition that they are standard models usually supplied by the maker. Implied here is the functioning, administration, operation, designing, or legal issues of computer networks

5.1.1. Systems, equipment, and components

5.1.1.1. Telecommunication equipment which has any of the following characteristics, features, or properties:	
a) specially designed to provide protection against electronic transistor effects or electromagnetic impulse effects produced by a nuclear explosion;	8517; 852520900; 852790990; 854380900
b) specially improved resistance to gamma-, neutron, or ion radiation; or	8517; 852520900; 852790990; 854380900
c) specially designed for operation outside the temperature range from 218 K (-55°C) to 397 K (124°C)	8471; 852520900; 852790990; 854380900

Notes:

1. Under Item 5.1.1.1 Subitem "c" shall be applicable only to electronic equipment

2. Per Subitems "b" and "c" of Item 5.1.1.1 no control shall extend to the equipment intended or modified on board satellites;

5.1.1.2. Telecommunication broadcasting systems and equipment and specially designed components and auxiliaries which have any of the following characteristics, features, or properties:	

5.1.1.2.1. Availability of underwater communication systems which have any of the following characteristics: 901580910

a) acoustic carrier frequency outside the rage from 20 to 60 kHz;

b) using electromagnetic carrier frequency less than 30 kHz; or

c) using electronic beam scanning methods

5.1.1.2.2. Availability of radio equipment operating in the frequency range of 1.5-87.5 MHz which has any of the following characteristics: 852520900

a) including adaptive methods providing for a more than 15 dB suppression of the noise signal; or

b) which has all of the following components:

1) automatically forecasted or selectable frequency values and total digital transmission rate for its optimization; and

2) in-built linear power amplifier capable of maintaining simultaneously multiple signals with the output power rating of 1 kWt or more in the frequency range of 1.5-30 MHz or 250 W or more in the frequency range of 30-87.5 MHz above the maximum bandpass of one octave or more and with the output harmonics-to-distortion ratio better than -80 dB;

5.1.1.2.3. Availability of radio equipment using spectrum expansion or methods of frequency readjustment (jumping frequency change) which has any of the following characteristics: 852520900

a) user-programmable expansion codes; or

b) total transmission frequency bandwidth exceeding 100 times or more the bandwidth of any single data channel and amounting to more than 50 kHz

Notes:

1. In Subitem (b) of Item 5.1.1.2.8, control shall not apply to equipment used in cellular communication systems for operation at civil frequencies

2. In Item 5.1.1.2.8, control shall not apply to equipment designed to operate with the output power rating of 1.0 W or less;

5.1.1.2.4. Availability of digital-control radio receivers which have all of the following characteristics: 852520900

a) more than 1,000 channels;

b) frequency switching time less than 1 ms;

c) automatic search or scanning in the electromagnetic part of the spectrum; and

d) ability to identify the received signal or transmitter type

Note:

In Item 5.1.1.2.9, control shall not apply to cellular communication equipment operating at civil frequencies;

5.1.1.2.5. Using digital signal processing functions to ensure speech encoding with the rate less than 2,400 bit/s | 852520900

5.1.1.3. *Excluded*

5.1.1.3. Optical fiber communication cables, optical fiber and auxiliaries, such as: | 900110900; 854470000

a) optical fiber and cables with the length over 500 m capable of withstanding the stress of 2 x 109 N/sq m or more when tested;

Technical note:

Control test - checking at production stage or after manufacture which includes application of a given stress to the fiber with the length of more than 0.5 to 3 m at the feeding rate of 2 to 5 m/s when passed between guide shafts approximately 150 mm in diameter. The surrounding medium has nominal temperature and relative humidity values of 293 K and 40%

Special note:

To fulfill a control test, one may use respective national standards;

b) optical fiber cables and auxiliaries designed for underwater application

Note:

In Subitem (b) of Item 5.1.1.3, control shall not apply to standard telecommunication cables and auxiliaries for civil use

Special Notes:

1. For underwater cable couplings and joints see Item 8.1.2.1.3;
2. For fiber-optical body couplings and joints see Item 8.1.2.3;

5.1.1.4. Phased antenna arrays with electronic beam scanning operating at frequencies over 31 GHz

Note:

In Item 5.1.1.5, control shall not apply to phased antenna arrays for landing systems with equipment meeting the standards of International Civil Aviation Organization (ICAO) surpassing microwave landing systems (MLS)

5.2.1. Testing, checking, and production equipment

5.2.1.1. Equipment and specially designed components or auxiliaries for it specially designed for development, production, or use of equipment, functions, or properties controlled under Part 1 of Category 5

Note:

In Item 5.2.1.1, control shall not apply to optical fiber and optical fiber intermediate products for equipment which does not use semiconductor lasers

5.2.1.2. Equipment and specifically designed components or accessories for it specifically intended to develop any of the following telecommunication equipment for data transmission or controlled by builtin switching equipment program:

5.2.1.2.1. Digital equipment featuring asynchronous transmission mode intended to perform operations with total digital transmission rate exceeding 1.5 Gbit/sec;

5.2.1.2.2. Laser equipment featuring one of the following elements:

a) a data transmission wavelength exceeding 1,750 nm;

b) optical amplification;

c) coherent optical transmission or coherent optical detection (known also as optical heterodyne

or homodyne oscillator technique); or

d) analog technology and a bandwidth of over 2.5 GHz.

Note.

Under Subitem "d" Item 5.2.1.2.2 equipment specifically intended for developing commercial television systems shall not be subject to control;

5.2.1.2.3. Optical switching equipment;

5.2.1.2.4. Radio equipment using quadrature-amplitude modulation methods with a level of over 128;

5.2.1.2.5. Equipment featuring common channel signal transmission either in non-connected or quasi-connected operating mode;

5.3.1. Materials - no

5.3.1.1. *Excluded*

5.4.1. Software

5.4.1.1. Software specially designed or modified for development, production or use of equipment, operations, or devices controlled under Part 1 of Category 5

5.4.1.2. Software specially designed or modified to support technologies controlled under Item 5.5.1

5.4.1.3. Specialized software, such as:
5.4.1.3.2. Omitted

5.4.1.4. Software specifically designed or modified to develop any of the following data transmission telecommunication equipment or builtin program-controlled switching equipment:

5.4.1.4.1. Digital equipment featuring asynchronous transmission mode intended to perform operations with a total digital transmission rate of over 1.5 Gbit/sec;

5.4.1.4.2. Laser equipment featuring one of the following elements:

a) data transmission wavelength exceeding 1,750 nm;

b) analog technology and bandwidth of over 2.5 GHz.

Note.

Under Subitem (b) Item 5.4.1.4.2 software specifically designed or modified to develop commercial television systems shall not be subject to control;

5.4.1.4.3. Optical switching equipment;

5.4.1.4.4. Radio equipment using quadrature-amplitude modulation methods with a level of over 128;

5.4.1.3.1. Software specially designed or modified to ensure characteristics, functions, or properties of equipment controlled under Item 5.1.1 or 5.2.1;

5.4.1.3.2. Software permitting to restore the initial text of telecommunication software controlled under Part 1 of Category 5;

5.4.1.3.3. Software in the form other than machine-executable one specially designed for dynamic adaptive routing

5.5.1. Technology

5.5.1.1. Technologies designed, according to the General Technological Note, for development, production, or use (including operation) of equipment, operations, or properties or software controlled under Part 1 of Category 5;

5.5.1.2. Individual types of technologies, such as:

5.5.1.2.1. Technology necessary for development of production of telecommunication equipment specially designed for use aboard satellites;

5.5.1.2.2. Technology of development or use of laser communication methods permitting automatic signal acquisition and tracking and communication maintenance through external atmosphere or liquid layer (water);

5.5.1.2.3. Development technology for digital cellular radio systems;

5.5.1.2.4. Development technology for equipment using band spread methods including step-by-step frequency retuning methods;

5.5.1.3. Technologies intended under the general technological note for the purpose of developing or manufacturing any of the below telecommunication equipment for transmitting data via communication lines or controlled by built-in switching equipment program:

5.5.1.3.1. Digital equipment featuring asynchronous transmission mode intended to perform operations with total digital transmission rate exceeding 1.5 Gbit/sec;

5.5.1.3.2. Laser equipment having one of the following elements:

a) a data transmission wavelength exceeding 1,750 nm;

b) optical amplification by fluoride fiber amplifiers with praseodymium;

c) coherent optical transmission or coherent optical detection (known also as optical heterodyne oscillator technique);

d) wavelength distribution multiplexing technology featuring over 8 optical groups for optical window transfer; or

e) analog technology and a bandwidth of over 2.5 GHz.

Note.

Under Subitem "e" Item 5.5.1.3.2 equipment specifically intended for developing commercial television systems shall not be subject to control;

5.5.1.3.3. Optical switching equipment;

5.5.1.3.4. Radio equipment featuring one of the following elements:

a) quadrature amplitude modulation technology with a level exceeding 128; or

b) operating on input or output frequencies exceeding 31 GHz.

Note.

Under Subitem "b" of Item 5.5.1.3.4 the following is not subject to control: equipment specifically intended to develop equipment designed or modified to operate in any frequency band set by the International Telecommunication Union;

5.5.1.3.5. Equipment featuring common channel signal transmission either in non-connected or quasi-connected operating mode;

Part 2. Data Protection

5.1.2. Systems, Equipment, and Components
5.2.2. Testing, Checking, and Production Equipment
5.4.2. Software

Notes:

1. The control status "information safety" of equipment, software, systems, special-application electronic assemblies, modules, integral circuits, components or functions used for information protection shall be determined per Part 2 Category 5 even if they are components or electronic assemblies of other equipment.

2. Export control shall not extend to the products listed in Part 2 Category 5 when they are taken out of this country by the users for the users' own use.

3. Under Items 5.1.2 and 5.4.2 things meeting the below requirements shall not be subject to control:

a) being generally accessible for sale to the public as stock available at retailers through one of the following ways:

1) retail sale deals;

2) mail order deals (mail retailing);

3) electronic deals; or

4) phone order deals;

b) the cryptographic capabilities thereof not being easily modified by the user;

c) having been designed for user's installation without a significant supplier's backup; and

d) omitted

Technical Note.

In Part 2 Category 5 the parity bits shall not be included in the key length;

5.1.2. Systems, equipment, and components

5.1.2.1. Systems, equipment, special assemblies, modules, and integrated circuits used for data protection and other components specially designed for it:

Special note:

See Item 7.1.5 for control of global satellite navigation systems containing reception equipment or using decoding ((of the Global Positioning System (GPS) or Global Navigation Satellite System (GLONASS))

5.1.2.1.1 Designed or modified for use in cryptography with the use of enciphering technologies, performing any cryptographic functions different from assessing the authenticity of electronic signature, having any of the following components: 854389900;

a) symmetrical algorithm using a key length exceeding 56 bits; or

b) asymmetrical algorithm where the algorithm protection is based on any of the following:

1. Factoring into components integers exceeding 512 bits; or

2. Computing discrete logarithms in the multiplicative end field group of a size exceeding 512 bits; or

3. Discrete logarithm in a group different from the groups mentioned under Subitem "b" Item 5.1.2.1.1 and size exceeding 112 bits.

Technical Notes:

1. The functions of assessing the authenticity of electronic signature includes key control function relating thereto.

2. The assessment of authenticity includes all the aspects of access control where there is no file or text enciphering except an enciphering directly concerning password protection, personal

identification numbers or similar data for unauthorized access protection.

3. Cryptography does not include technologies for continuos data compression or enciphering.

Note. Item 5.1.2.1.1 includes equipment designed or modified for cryptography applications operating on analog principle supported by enciphering technologies.

5.1.2.1.2. Designed or modified for cryptoanalytical functions;	854380900
5.1.2.1.3. *Excluded*	
5.1.2.1.4 Specifically designed or modified to reduce unwanted leak of data carrier signals apart from what is necessary for health protection or compliance to established electromagnetic jamming standards.	854389900;

Note:

In Item 5.1.2.1.4, control shall not apply to equipment specially designed to suppress the leakage of signals hazardous for the health or safety of the surrounding population;

5.1.2.1.5. Designed or modified to use cryptographic methods of expansion code generation to expand spectrum or jumping code expansion for frequency switching systems;	854380900
5.1.2.1.6. Designed or modified to ensure a certified or intended for certification multilevel protection or user isolation at the level higher than class B2 or equivalent of computer system reliability criteria;	854380900
5.1.2.1.7. Cable communication systems designed or modified using mechanical, electric, or electronic means of detection of unauthorized access	854380900

Note.

Under Item 5.1.2 the following shall not be subject to control:

1. Built-in microchip personal credit cards where cryptographic capabilities are limited by the use in the equipment or systems exempt from control by Subitems 2 - 6 of the present note.

If a built-in microchip personal credit card has several functions the control status of each of them shall be determined individually.

2. Radio broadcast, commercial television or other commercial type of message transmission for a limited group without the enciphering of digit signal, except the case of its being used exclusively for dispatching bills or returning information connected with program to suppliers.

3. Equipment of which cryptographic capabilities are out of reach of the user that has been specifically designed or restricted for use by any of the following:

a) the software is copy-protected;

b) access to any of the following:

protected against copying contents stored on read-only medium; or

information stored in enciphered form in the media (for instance, in connection with copyright) where such media is offered to the public for sale in identical sets; or

c) one-off copying of audio or video information protected by copyright.

4. Cryptographic equipment specifically designed and limited to banking and financial transaction applications.

Technical Note.

The financial transactions specified under Item 4 of the note to Item 5.1.2 include transportation

or crediting fees and charges.

5. Civil-purpose portable or mobile radio telephone sets (for instance, intended for use in commercial civil cellular radio communication systems) not containing a through enciphering function.

6. Wireless battery-powered telephone equipment not capable of throughout enciphering featuring the maximum wireless battery-powered amplification-free operation range (singular, with no relay, connection between a terminal and home base station) of less than 400 m according to the manufacturer's specifications;

5.2.2. Testing, checking, and production equipment

5.2.2.1. Equipment specially designed for: a) development of equipment or functions controlled under Part 2 of Category 5, including equipment for measuring and testing; b) production of equipment or functions controlled under Part 2 of Category 5, including equipment for measuring, testing, repair, or production	854380900
5.2.2.2. Measuring equipment specially developed for assessment and confirmation of data protection functions controlled under Item 5.1.2 or 5.4.2	854380900

5.3.2. Materials - no data

5.4.2. Software

5.4.2.1. Software specially made or modified for development, production, or use of equipment or software controlled under Part 2 of Category 5;

5.4.2.2. software specially made or modified to support technologies controlled under Item 5.5.2;

5.4.2.3. Special types of software, such as:

5.4.2.3.1. Software which has characteristics or implements the functions of equipment controlled under Items 5.1.2 or 5.2.2;

5.4.2.3.2. Software for certification of software controlled under Item 5.4.2.3.1

Note:
In Item 5.4.2, control shall not apply to::
a) software necessary for use in equipment not controlled under the Note to Item 5.1.2;
b) software implementing any function of equipment not controlled under the Note to Item 5.1.2

5.5.2. Technology

5.5.2.1. Technologies designed, according to the General Technological Note, for development, production, or use of equipment or software controlled under Part 2 of Category 5

Category 6. Sensors and Lasers

6.1. Systems, equipment, and components

6.1.1. Acoustics

6.1.1.1. Naval acoustic systems, equipment, and specially designed components for them, such as:

6.1.1.1.1. Listed below active (transmitting and transceiving) systems, equipment, and specially developed components for it:

Note:
In Item 6.1.1.1.1, control shall not apply to:
a) vertical-action depth sonars with less than +-20° beam scanning function and with use limited to measuring water depth, distance to submerged objects, or fish shoals;
b) following sound buoys:
1) emergency sound buoys;
2) ultrasound pulse emitters specially developed to be moved or returned to underwater position

6.1.1.1.1.1. Depth-measuring wide-angle systems designed for sea bottom mapping which have all of the following characteristics: 901580910
a) designed to take measurements at vertical deviation angles more than 20°;
b) designed for depth measuring to more than 600 m from water surface; and
c) designed to implement any of the following characteristics:
1) combining several beams any of which is narrower then 1.9°; or
2) measuring accuracy better than 0.3% of the water depth obtained by averaging individual measurements within the strip;

6.1.1.1.1.2. Location detection or determination systems which have any of the following characteristics: 901580910
a) transmission frequency below 10 kHz;
b) sound pressure level higher than 224 dB (1 cPa per 1 m) for equipment with the working frequency ranging from 10 kHz to 24 kHz inclusive;
c) sound pressure level higher than 235 dB (1 cPa per 1 m) for equipment with the working frequency ranging between 24 kHz and 30 kHz;
d) beam forming narrow than 1° along any axis and the working frequency below 100 kHz;
e) designed for operation with the target resolution range more than 5,120 m; or

f) designed for normal functioning at depths over 1,000 m which have sensors with any of the following characteristics:

1) dynamically adjusted to pressure; or

2) containing other conversion elements besides those made of lead titanate zirconate;

6.1.1.1.1.3. Sound guns including converters combining piezoelectric, magnetostrictive, electrostrictive, electrodynamic, or hydraulic elements operating separately or in a definite combination which have any of the following characteristics: 901580910

a) density of instantaneously emitted sound power over 0.01 mW/mm2/Hz for instruments operating at frequencies below 10 kHz;

b) density of permanently emitted sound power over 0.001 mW/mm2/Hz for instruments operating at frequencies below 10 kHz, or;

Technical note:

Sound power density is obtained by dividing the output sound power by a product of the square of the emitting surface multiplied by the working frequency;

c) side lobe suppression over 22 dB

Notes:

1. Control status of sound guns with converters specially designed for other equipment shall be determined by the control status of that other equipment

2. In Item 6.1.1.1.1.3, control shall not apply to electronic sources capable of only vertical sounding, mechanical (e.g. air or steam guns) or chemical (e.g. explosive) sources;

6.1.1.1.1.4. Acoustic systems, equipment and specifically designed components intended for determining the position of surface vessels and underwater vessels intended to operate at a distance of over 1,000 km as featuring a positioning accuracy of less than 10 m (mean quadratic deviation) when measured at distances below 1,000 m 9015801100;

Note.

Item 6.1.1.1.1.4 includes:

a) equipment using coherent signal processing between two or more buoys and a hydrophone device of surface vessels and underwater vessels;

b) equipment capable of automatically correcting sound propagation velocity error for the purpose of computing location

6.1.1.1.2. Passive (receiving in the standard mode regardless of connection to active equipment) systems, equipment, and specially developed components for them, such as:

6.1.1.1.2.1. Hydrophones featuring any of the following characteristics:

a) including flexible, continuous-operation sensors or sensor assemblies of discrete action with the diameter or 901580110; 901580930

length less than 20 mm and spacing between elements less than 20 mm;

b) which have any of the following sensor elements: 901580930

1) optical fiber one;

2) polymer piezoelectric one; or

3) flexible piezoelectric made of ceramics materials;

c) which have hydrophone sensitivity better than -180 dB at any depth without acceleration compensation; 901580930

d) designed for operation at depths exceeding 35 m as featuring acceleration compensation; or 9015809300

e) developed for operation at depths over 1,000 m 901580930

Technical note:

Hydrophone sensitivity is defined as a twenty-fold decimal logarithm of the root-mean-square output voltage ratio to reference voltage of 1 V when the hydrophone sensor without a preamplifier is placed in an acoustic field of a plane wave with the root-mean-square pressure of 1 mcPa. For example, a hydrophone with -160 dB (reference voltage 1 V per mcPa) will produce an output voltage of 10(-8) V in such field, while another one with the sensitivity of -180 dB will produce only 10(-9) V output voltage. Thus, -160 dB is better than -180 dB;

Note.

The control status of hydrophones specifically designed for another equipment shall be determined by the control status of that equipment;

6.1.1.1.2.2. Towable acoustic hydrophone arrays which have any of the following characteristic: 901580930; 901580990

a) hydrophone groups located with a 12.5 m spacing and less;

b) designed or capable of being modified to operate at depths exceeding 35 m

Technical note.

The ability to be modified mentioned under Subitem "b" Item 6.1.1.1.2.2 means that there is a possibility of modifying the winding or internal connections to change the arrangement of the hydrophone group or working depth range. Such possibilities are the availability of spare winding loops making up over 10% of the number of working loops, hydrophone group configuration control units or diving depth limitation devices providing adjustment or control of more than one hydrophone group;

c) which have controllable sensors controlled under Item 6.1.1.1.2.4;

d) which have longitudinal, fixed connecting array cables;

e) which have assembled arrays less than 40 mm in diameter;

f) multiplexed hydrophone group signals developed for operation at depths over 35 m or which have an adjustable or interchangeable depth sensor device developed for operation at depths over 35 m; or

g) hydrophone characteristics given in Item 6.1.1.1.2.1;

6.1.1.1.2.3. Data processing equipment specially developed for application in towable acoustic hydrophone arrays featuring user-programmable capabilities, time and frequency processing, and correlation including spectral analysis, digital filtration, and beam forming using Fourier fast transform or other conversions or processes; 901580930; 901580990

6.1.1.1.2.4. Controllable sensors which have all of the following characteristics: 901580110; 901580930

a) accuracy better than 0.5°; and

b) designed to operate at depths exceeding 35 m or featuring a variable or changeable depth-sensitive device intended for operating at depths exceeding 35 m;

6.1.1.1.2.5. Sea-bed or submerged cable systems having any of the below elements: 901580930; 901580990

a) connecting the hydrophones specified under Item 6.1.1.1.2.1; or

b) signal modules united by a multiplexed hydrophone group as featuring all the below characteristics:

1) designed for operation at depths exceeding 35 m or featuring a variable or changeable depth-sensitive device designed for operation at depths exceeding 35 m; and

2) capable of operative interaction with a towed acoustic hydrophone array module;

6.1.1.1.2.6. Data processing equipment specially designed for seabed or submerged cable systems, user-programmable and featuring in time or frequency processing and correlation including spectrum analysis, digital filtering and beam formation through the use of quick Fourier transform or other transforms or processes

6.1.1.2. Log-mounted equipment for correlation measurement of horizontal component of equipment carrier against the sea bottom with the distances between the carrier and sea bottom over 500 m 901580930; 901580990

6.1.2. Optical sensors

6.1.2.1. Optical detectors, such as:

Note.

In Item 6.1.2.1, control shall not apply to germanium or silicon photo-devices

6.1.2.1.1. Listed below solid-state sensors fit for use in the outer space:

6.1.2.1.1.1. Solid-state sensors fit for use in the outer space which have all of the following characteristics: 854140990

a) maximum sensitivity in the wavelength range from 10 nm to 300 nm; and

b) sensitivity at the wavelength over 400 nm less than 0.1% as compared to the maximum sensitivity;

6.1.2.1.1.2. Solid-state sensors fit for use in the outer space which have all of the following characteristics: 854140990

a) maximum sensitivity in the wavelength range from 900 nm to 1,200 nm; and

b) response time constant of 95 ns or less;

6.1.2.1.1.3. Solid-state sensors fit for use in the outer 854140990

space which have maximum sensitivity in the wavelength range from 1,200 nm to 30,000 nm

6.1.2.1.2. Optoelectronic image intensifiers and specially designed components for them, such as:

6.1.2.1.2.1. Optoelectronic image intensifiers which have all of the listed below: 854140990; 901380000

a) maximum sensitivity in the wavelength range from 400 nm to 1,050 nm;

b) micro-channel anode for electronic image intensification with the hole spacing (distance between centers) of 15 Цm or less; and

c) following photocathodes:

1) S-20, S-25 photocathodes or multi-alkali photocathodes with light sensitivity over 240 mcA/lm;

2) GaAs or GaInAs photocathodes;

3) other semiconductor photocathodes on group III-V compounds

Note:

In the last Subitem of Item 6.1.2.1.2.1, control shall not apply to photocathodes on semiconductor compounds with the maximum integral sensitivity to irradiation flux 10 mA/W or less;

6.1.2.1.2.2. Specially designed components:

a) micro-channel circuits with the hole spacing (distance between centers) of 15 mcm or less; 854140990

b) GaAs or GaInAs photocathodes; 854140990

c) other semiconductor photocathodes on group III-V compounds 854140990

Note:

In Subitem (c) of Item 6.1.2.1.2.2, control shall not apply to photocathodes on semiconductor connectors with the maximum integral sensitivity to irradiation flux of 10 mA/W or less

6.1.2.1.3. Focal-plane arrays unfit for use in the outer space, such as:

Technical note:

Linear or two-dimensional multi-element sensor arrays shall refer to focal-plane arrays

Notes:

1. Item 6.1.2.1.3 shall include photoconducting and photogalvanic arrays

2. In Item 6.1.2.1.3, control shall not apply to silicon focal-plane arrays, multi-element (not more than 16 elements) air-tight phtoconducting elements or pyroelectric sensors made on the basis of any of the following materials:

a) plumbum sulphide;

b) triglycinesulphate and its derivatives;

c) plumbum-lanthanum-zirconium titanate and its derivatives;

d) lithium tantalate;

e) polyvinylidene fluoride and its derivatives; or

f) barium-strontium niobate and its derivatives, or

g) plumbum selenide

6.1.2.1.3.1. Focal-plane arrays unfit for use in the outer space which have any of the following components: a) individual elements with the maximum sensitivity in the wavelength range from 900 nm to 1,050 nm; and b) response time constant less than 0.5 ns;	854140910; 854140990
6.1.2.1.3.2. Focal-plane arrays unfit for use in the outer space which have all of the following characteristics: a) individual elements with the maximum sensitivity in the wavelength range from 1,050 nm to 1,200 nm; and b) response time constant 95 ns or less;	854140910; 854140990
6.1.2.1.3.3. Focal-plane arrays unfit for use in the outer space which have individual elements with the maximum sensitivity in the wavelength range from 1,200 nm to 30,000 nm	854140910; 854140990
6.1.2.2. Monospectral image sensors and multispectral image sensors designed for use in remote sounding which have any of the following characteristics: a) instantaneous field of vision (IFV) less than 200 mcrad; or b) designed for operating in the wavelength range from 400 nm to 30,000 nm which have all of the following components: 1) producing output image data in digital format; and 2) fit for use in the outer space or developed for operation aboard a flying vehicle using non-silicon sensors with IFV less than 2.5 mrad;	854089900
6.1.2.3. Equipment for direct image viewing operating in the visible or infrared ranges and containing any of the following components:	
6.1.2.3.1. Optoelectronic converters which have characteristics mentioned in Item 6.1.2.1.2.1; or	854020300; 854099000
6.1.2.3.2. Focal-plane arrays which have characteristics mentioned in Item 6.1.2.1.3	854099000

Technical note:

Direct viewing refers to image-acquiring equipment operating in the visible or infrared ranges which permits to present a visual image to a human observer without converting the image to electronic signal for TV display and which cannot register or save the image photographically, as well as electronically or in other way

Note:

In Item 6.1.2.3, control shall not apply to the following equipment containing photocathodes made on materials other than GaAs or GaInAs:

a) industrial or civil signal devices, traffic control or industrial conveyer systems, or counting systems;

b) medical equipment;

c) process equipment used for inspection, sorting, or analysis of material properties;

d) fire warning devices for industrial furnaces;

e) equipment specially designed for laboratory use

6.1.2.4. Specialized support components for optical sensors, such as:	
6.1.2.4.1. Cryocoolers fit for use in the outer space;	901380000; 901390000
6.1.2.4.2. Listed below cryocoolers unfit for use in the outer space with the source cooling temperature below 218 K (-55°C):	
6.1.2.4.2.1. Closed-cycle ones with a definite average time to failure or average time between failures over 2,500 h;	901380000; 901390000
6.1.2.4.2.2. Self-adjusting Joule-Thompson mini-coolers with the channel outer diameters less than 8 mm;	901380000; 901390000
6.1.2.4.3. Optical sensitive fiber specially designed of composite materials or structurally, or modified with a coating to become acoustically, thermally, inertially, electromagnetically sensitive or sensitive to nuclear radiation;	900190900; 901380000
6.1.2.5. Focal-plane arrays fit for use in the outer space which have more than 2.048 elements per array and maximum sensitivity in the wavelength range from 300 nm to 900 nm	901380000
6.1.3. Chambers	

Special note:
See Items 8.1.2.4 and 8.1.2.5 for chambers specially developed or modified for underwater use

6.1.3.1. Cameras of control and measuring instruments, such as:	
6.1.3.1.1. High-speed recording motion-picture cameras using any film format from 8 to 16 mm in which the film moves forward continuously during the whole of the recording period, and which are capable of recording at the framing rate over 13,150 fps	900711000; 900719000

Note:
In Item 6.1.3.1.1, control shall not apply to recording motionpicture cinecameras developed for ordinary civil purposes;

6.1.3.1.2. Mechanical high-speed cameras without the moving film, and which are capable of recording at the rate of more than 1,000,000 fps for a full 35-mm film framing height or proportionally higher speed for smaller frames, or for a proportionally slower speed for larger frames;	900719000
6.1.3.1.3. Mechanical or electronic photochronographs which have recording speed more than 10 mm/mcs;	900719000

6.1.3.1.4. Electronic transmission cameras with frame synchronization which have the rate over 1,000,000 fps; 900719000

6.1.3.1.5. Electronic transmission cameras which have all of the following characteristics: 900719000

a) electronic shutter speed (strobing capability) less than 1 mcs for a full frame; and

b) reading time permitting the framing rate of more than 125 full frames per second

Note.

Module structure metering chambers controlled under Items 6.1.3.1.3 - 6.1.3.1.5 shall be assessed by their maximum capability to employ suitable electronic modules under manufacturer's specifications;

6.1.3.1.6. Exchangeable cards featuring all of the following characteristics: 9007190000";

a) specially developed for cameras of control and measuring instruments with modular structure and controlled under Item 6.1.3.1; and

b) enabling cameras to meet characteristics specified in Items 6.1.3.1.3, 6.1.3.1.4 or 6.1.3.1.5 according to maker technical requirements

6.1.3.2. Image-forming cameras, such as:

Note:

In Item 6.1.3.2, control shall not apply to TV or video-cameras specially designed for TV broadcasting

6.1.3.2.1. Video-cameras including solid-state sensors which have any of the following characteristics:: 852190000

a) more than 4x10(6) active pixels per solid-state grating for monochrome (black-and-white cameras;

b) more than 4x10(6) active pixels per solid-state grating for color cameras including three solid-state gratings; or

c) more than 12x10(6) active pixels for color cameras made on one solid-state grating;

Technical Note:

For the purposes of the present Item, digital video cameras must be assessed using the maximum number of active pixels used to register moving objects;

6.1.3.2.2. Scanning cameras and systems based on scanning cameras which have all of the following characteristics: 852190000

a) linear detector arrays with over 8,192 elements per grating; and

b) mechanical scanning in one direction;

6.1.3.2.3. Image-forming cameras containing electronic optical brightness amplifiers which have characteristics mentioned in Item 6.1.2.1.2.1; 852190000

6.1.3.2.4. Image-forming cameras containing focal-plane arrays which have characteristics mentioned in Item 6.1.2.1.3 — 852190000

Note.

Under Item 6.1.3.2.4 the following shall not be subject to control: imaging cameras featuring linear focal plane reticules with 12 or less elements not using delay and integration time in the element that has been designed for any of the following:

a) industrial or civil security alarm systems intended for vehicle movement control or industrial process counting;

b) industrial equipment intended for monitoring high-temperature processes in construction, machinery or production facilities;

b) industrial equipment used for monitoring, grading or analyzing the properties of materials;

c) equipment specifically designed for laboratory applications;

d) medical equipment;

6.1.4. Optics

6.1.4.1. Optical mirrors (reflectors), such as:

6.1.4.1.1. Deformable mirrors which have continuous or multielement surfaces and specially developed components for them capable of regrouping dynamically the position of the mirror surface portions at the rate of over 100 Hz; — 900190900

6.1.4.1.2. Light monolithic mirrors with the average equivalent density less than 30 kg/m2 and total weight over 10 kg; — 900190900

6.1.4.1.3. Mirrors of light composite or foam materials which have average equivalent density less than 30 kg/m2 and total weight over 2 kg; — 900190900

6.1.4.1.4. Mirrors for beam control with the diameter or main axis length over 100 m which have plainness of 1/2 of the wavelength or better (wavelength is equal to 633 nm) and control bandwidth more than 100 Hz — 900190900

6.1.4.2. Optical components made of zinc selenide (ZnSe) or zinc sulphide (ZnS) with transmission spectrum from 3,000 nm to 25,000 nm which have any of the following characteristics:

a) volume over 100 cm3; or

b) diameter or main axis length over 80 mm and thickness (depth) over 20 mm; — 900190900

6.1.4.3. Components for optical system fit for use in the outer space, such as:

6.1.4.3.1. Light-weight optical elements with equivalent density less than 20% as compared to solid-state plates with the same aperture and thickness; — 900190900

6.1.4.3.2. Non-processed substrate, processed substrates with — 900190900

surface coating (single-layer or multi-layer, metal or dielectric, conducting, semi-conducting or insulating) or having protective films;

6.1.4.3.3. Segments or mirror units designed for assembly in the outer space into an optical system with a receiving aperture equal to or more than one optical meter in diameter; 900290990

6.1.4.3.4. Made of composite material which have linear thermal expansion coefficient equal to or less than 5x10(-6) along any coordinate axis 900390000

6.1.4.4. Optical-control equipment, such as:

6.1.4.4.1. Specially designed to maintain the surface profile or orient optical components fit for use in the outer space and controlled under Items 6.1.4.3.1 or 6.1.4.3.3; 903140000; 903289900

6.1.4.4.2. Which has resonator control, tracking, stabilization, or adjustment in the frequency band equal to or more than 100 Hz and a 10 mcrad or less error; 903140000; 903289900

6.1.4.4.3. Cardan suspensions which have all of the following characteristics: 903289900

a) maximum angle of rotation more than 5°;

b) bandwidth equal to or more than 100 Hz;

c) angular aiming error equal to or less than 200 mcrad; and

d) which have any of the following characteristics:

1) diameter or main axis length more than 0.15 m, however, not more than 1 m, and angular acceleration more than 2 rad/s2; or

2) diameter or main axis length more than 1 m and angular acceleration more than 0.5 rad/s2;

6.1.4.4.4. Specially designed to maintain the adjustment of phased array or mirror systems with phased segments, containing mirrors with the segment diameter or main axis length of 1 m or more 903289900

Lasers

6.1.4.5. Aspherical optical elements having all the below characteristics: 9001909000;

a) the largest optical aperture diameter exceeding 400 mm;

b) less than 1 nm (root-mean-square value) for selective investigation of the length values equal to or greater than 1 mm

c) the absolute value of linear thermal expansion coefficient less than 3x10-6/K

Technical notes;

1. The "aspherical optical element" is any element used in the optical system where imaginary plane or planes differ from the contours of an ideal sphere

2. The manufacturers need not measure the surface roughness specified under Subitem "b" Item 6.1.4.5, except in cases when the optical element has been designed or manufactured to match or surpass the controlled parameter

Note.

Item 6.1.4.5 does not require control of aspherical optical elements having any of the below characteristics:

a) the largest optical aperture of less than 1 m and relative aperture equal or more than 4.5 : 1;

b) the largest optical aperture equal or exceeding 1 m and relative aperture equal or exceeding 7 : 1;

c) stripes, prisms or diffraction optical elements designed as a Fresnel floating videosensor;

d) made from borosilicate glass with a linear thermal expansion coefficient exceeding 2.5 x 10 (-6)/K at 25 degrees C; or

e) being optical elements for x-rays as featuring internal mirror properties (for instance tubular mirrors)

Special note.

For aspherical optical elements specifically designed for lithographic equipment see Item 3.2.1

6.1.5. Lasers, components, and optical equipment:

Note:

1. Pulsing lasers include lasers operating in the quasicontinuous regime with pulse overlapping

2. Lasers with pulse pumping include lasers operating in continuous regime with pule pumping

3. Control status of Raman lasers is determined by parameters of the laser pumping source. A laser pumping source may be any laser examined below

6.1.5.1. Gas lasers, such as:

6.1.5.1.1. Eximer lasers which have any of the following characteristics: 901320000

a) output wavelength not more than 150 nm and which have any of the following characteristics:

1) output impulse power more than 50 mJ; or

2) average or output power in continuous regime more than 1 W;

b) output wavelength in the range from 150 nm to 190 nm which have any of the following characteristics:

1) pulse output power more than 1.5 J; or

2) average or output power

c) output wavelength in the range from 190 nm to 360 nm which have any of the following characteristics:

1) pulse output power more than 10 J; or

2) average or output power in continuous regime more than 500 W; or

d) output wavelength more than 360 nm which have any of the following characteristics:

1) output pulse power more than 1.5 J; or

2) average or output power in continuous regime more than 30 W;

Special Note.
For excimer lasers specifically designed for lithographic equipment see Item 3.2.1;

6.1.5.1.2. Metal-vapor lasers, such as:

6.1.5.1.2.1. Copper (Cu) lasers which have average or output power more than 20 W; 901320000

6.1.5.1.2.2. Gold (Au) lasers which have average or output power more than 5 W; 901320000

6.1.5.1.2.3. Sodium (Na) lasers which have output power more than 5W; 901320000

6.1.5.1.2.4. Barium (Ba) lasers which have average or output power more than 2 W 901320000

6.1.5.1.3. Carbon oxide (CO) lasers which have any of the following characteristics: 901320000
a) output pulse power more than 2 J and peak power more than 5 kW; or
b) average or output power more than 5 kW;

6.1.5.1.4. Carbon dioxide (CO2) lasers which have any of the following characteristics: 901320000
a) output power more than 15 kW;
b) pulse length in the pulsing regime more than 10 mcs and which have any of the following characteristics:
1) average output power more than 10 kW; or
2) peak power more than 100 kW; or
c) pulse length in the pulsing regime equal to or less than 10 mcs which have any of the following characteristics:
1) pulse power more than 5 J; or
2) average output power more than 2,5 kW;

6.1.5.1.5. Chemical lasers, such as:

6.1.5.1.5.1. Hydrogen-fluoride (HF) lasers; 901320000

6.1.5.1.5.2. Deuterium-fluoride (DF) lasers; 901320000

6.1.5.1.5.3. Junction lasers, such as: 901320000
a) oxygen-iodine (02-I) lasers;
b) deuterium-fluoride-carbon-dioxide (DF-CO2) lasers 901320000

6.1.5.1.6. Argon ion (Ar) or krypton ion (Kr) lasers having any of the following characteristics: 901320000
a) output energy in the pulse over 1.5 J and peak power over 50 W; or
b) mean or output in continuous mode over 50 W;

6.1.5.1.7. Other gas lasers which have any of the following characteristics: 901320000
a) output wave length not more than 150 which have any

of the following characteristics:
1) output pulse power more than 50 mJ and peak power more than 1 W; or
2) average or output power more than 1 W; or
b) output wavelength in the range between 150 nm to 900 nm which have any of the following characteristics:
1) output pulse power more than 1.5 J and peak power more than 30 W; or
2) average or output power in continuous regime more the 30 W;
c) output wavelength from 800 nm to 1,400 nm which have any of the following characteristics
1) pulse output power more than 0.25 J and peak power more than 10 W; or
2) average or output power in continuous regime more than 10 W; or
d) output wavelength more than 1,400 nm and average or output power in continuous operation more than 1 W

Note:
In Item 6.1.5.1.7, control shall not apply to nitrogen lasers

6.1.5.2. Semiconductor lasers, such as: 8541401100
a) separate with the single transverse mode 9013200000 semiconductor lasers featuring all of the following characteristics:
1) wave length less than 950 nm or greater than 2,000 nm; and
2) average or output power in continuous regime greater than 100 mW;
b) separate with multiple transverse mode semiconductor lasers featuring all of the following characteristics:
1) wave length less than 950 nm or greater than 2,000 nm; and
2) average or output power in continuous regime greater than 10 W;
c) separate lattices of separate semiconductor lasers featuring any of the following characteristics:
1) wave length less than 950 nm and average or output power in continuous regime greater than 60 W; or
2) wave length equal to or greater than 2,000 nm and average or output power in continuous regime greater than 10 W
Technical Note:
Semiconductor lasers are usually called laser diodes
Notes:
1. Item 6.1.5.2 includes semiconductor lasers with optical output connectors (for example, flexible optical fibre conductors)
2. Control status of semiconductor lasers specially intended for other equipment shall be determined by the control status of other equipment;

6.1.5.3. Solid-state lasers, such as:

6.1.5.3.1. Tunable lasers which have any of the following characteristics: 901320000

Note:

Item 6.1.5.3.1 includes titanium-sapphire (Ti:Al203) lasers, Thulium-YAG (Tm:YAG), Thulium YSGG (Tm:YSGG) lasers, alexandrite lasers (Cr:BeAl204), and dyed-center lasers

a) output wavelength less than 600 nm which have any of the following characteristics:

1) pulse output power more than 50 J and peak pulse power more than 1 W; or

2) average or output power in continuous regime more than 1 W;

b) output wavelength 600 nm or more, however, not more than 1,400 nm which have any of the following characteristics:

1) pulse output power more than 1 J and peak pulse power more than 20 W; or

2) average or output power in continuous regime more than 20 W; or

c) output wavelength more than 1,400 nm which have any of the following characteristics:

1) pulse output power more than 50 J and peak pulse power more than 1 W; or

2) average or output power in continuous regime more than 1 W

6.1.5.3.2. Non-tunable lasers, such as:

Note:

Item 6.1.5.3.2 includes solid-state nuclear transition lasers

6.1.5.3.2.1. Neodymium glass lasers, such as: 901320000

a) Q-switching lasers which have any of the following characteristics:

1) pulse output power more than 20 J, however, not more than 560 J and average output power more than 10 W; or

2) pulse output power more than 50 J;

b) Lasers without Q-switching which have any of the following characteristics:

1) pulse output power more than 50 J, however, not more than 100 J and average output power more than 20 W; or

2) pulse output power more than 100 J;

6.1.5.3.2.2. Dissolved-neodymium lasers (other than glass ones) which have output wavelength more than 1,000 nm, however, not more than 1,100 nm: 901320000

Special note:

See Item 6.1.5.3.2.3, for dissolved-neodymium lasers (other than glass ones) which have output wavelength less than 1,000 nm or more than 1,100 nm

a) Q-switching, pulse-activated, and mode-synchronization lasers with pulse duration less than 1 ns which have any of the following characteristics:

1) peak power more than 5 GW;

2) average output power more than 10 W; or

3) pulse power more than 0.1 J;

b) Q-switching and pulse-pumped lasers with pulse duration equal to or more than 1 ns which have any of the following characteristics:

1) single-mode transverse-mode emission which has:

peak power more than 100 MW;
average output power more than 20 W; or
pulse power more than 2 J; or
2) multi-mode transverse-mode emission which has:
peak power more than 400 MW;
average output power more than 2 kW; or
pulse power more than 2 J;
c) pulse-pumped lasers without Q-switching which have:
1) single-mode transverse-mode emission which has:
peak power more than 500 kW; or
average or output power in continuous regime more than 150 W; or
2) multi-mode transverse-mode emission which has:
peak power more than 1 MW; or
average or output power in continuous regime more than 2 kW;
d) continuously-pumped lasers which have:
1) single-mode transverse-mode emission which has:
peak power more than 500 kW; or
average or output power in continuous regime more than 150 W; or
2) multi-mode transverse-mode emission which has:
peak power more than 1 MW;
or average or output power in continuous regime more than 2 kW

6.1.5.3.2.3. Other non-tunable lasers which have any of the following characteristics: 901320000

a) wavelength less than 150 nm and:
1) pulse output power more than 50 J and peak pulse power more than 1 W; or
2) average or output power in continuous regime more than 1 W;
b) wavelength no less than 150 nm, however, not more than 800 nm and:
1) pulse output power more than 1.5 J and peak power more than 30 W; or
2) average or output power in continuous operation more than 30 W;
c) wavelength more than 800 nm, however, not more then 1,400 nm, such as:
1) Q-switching lasers which have:
pulse output power more than 0.5 J and pulse peak power more than 50 W; or
average output power over:
10 W for lasers with one latitudinal mode;
30 W for lasers with several latitudinal modes;
2) lasers without Q-switching which have:
pulse output power more than 2 J and peak pulse power more than 50 W; or
average or output power in continuous regime more than 50 W; or
d) wavelength more than 1,400 nm and:
1) pulse output power more than 100 mJ and peak pulse power more than 1 W; or
2) average or output power in continuous regime more than 1 W

6.1.5.4. Dye or other liquid lasers which have any of the following characteristics: 901320000

a) wavelength less than 150 nm which have any of the following characteristics:

1) pulse output power more than 50 mJ and peak pulse power more than 1 W; or

2) average or output power in continuous regime more than 1 W

b) wavelength 150 nm or more, however, not more than 800 which have any of the following characteristics:

1) pulse output power more than 1.5 J and peak pulse power more than 20 W;

2) average or output power in continuous regime more than 20 W or;

3) pulse generator operating on one transverse mode with the average output power more than 1 W and pulse repetition rate more than 1 kHz if the pulse duration is less than 100 ns

c) wavelength more than 800 nm, however, not more than 1,400 nm, which have any of the following characteristics:

1) pulse output power more than 0.5 J and peak pulse power more than 10 W; or

2) average or output power in continuous regime not more than 10 W; or

d) wavelength more than 1,400 nm which have any of the following characteristics:

1) pulse output power more than 100 mJ and peak pulse power more than 1 W; or

2) average or output power in continuous regime more than 1 W

6.1.5.5. Components, such as:

6.1.5.5.1. Mirrors cooled actively or by a pipe cooling system 900290990; 901390000

Technical note:

Active cooling is a method of cooling of optical components which uses the flow of liquid over the subsurface (usually located less than 1 mm below the optical surface) of the optical component to remove heat from optical elements;

6.1.5.5.2. Optical mirrors or transparent or partly transparent optical or electrooptical components specially developed for use with controlled lasers 900290990

6.1.5.6. Optical equipment, such as:

6.1.5.6.1. Equipment measuring the dynamic wave front (phase) using at least 50 positions on the beam wave front which have any of the below characteristics: 901390000; 903140000

a) framing frequency equal to or more than 100 Hz and phase discrimination of at least 5% of the beam wavelength; or

b) framing frequency equal to or more than 1,000 Hz and phase discrimination of at least 20% of the beam wavelength

6.1.5.6.2. Laser diagnosing equipment capable of measuring the beam angular positioning error of a super-high-power laser equal to or less than 10 mcrad; 901390000; 903140000

6.1.5.6.3. Optical equipment and components specially designed for use with a super-high power laser with phased arrays for coherent beam summation with the accuracy of 1/10 of the wavelength or 0.1 mcm depending on which of the values is lower; 901390000; 903140000

6.1.5.6.4. Protected lenses specially designed for use with super-high-power laser systems 901390000; 903140000

Magnetometers

6.1.6. Magnetometers, magnetic gradient meters, internal magnetic gradient meters, and compensation systems and specially developed components for them, such as:

Note:
In Item 6.1.6, control shall not apply to instruments specially developed for biomagnetic measurements in medical diagnostics

6.1.6.1. Magnetometers using technology based on superconductivity effect with optical pumping or nuclear precession (proton/Overhouser) which has noise root-mean-square value (sensitivity) less (better) than 0.05 nT divided by square root of frequency in hertz units; 901580930

6.1.6.2. Magnetometers with an induction coil which have noise root-mean-square value (sensitivity) less (better) than any of the following values: 901580930
a) 0.05 nT divided by square root of frequency in hertz units at the frequency less than 1 Hz;
b) 1x10(-3) nT divided by square root of frequency in hertz units at frequencies more than 10 Hz; or
c) 1x10(-4) nT divided by square root of frequency in hertz units at frequencies more than 10 Hz

6.1.6.3. Optical fiber magnetometers with the noise root-mean-square level (sensitivity) less (better) than 1 nT divided by square root of frequency in hertz units; 901580930

6.1.6.4. Magnetic gradient meters using magnetometer sets controlled under Items 6.1.6.1, 6.1.6.2, or 6.1.6.3; 901580930

6.1.6.5. Optical fiber internal magnetic gradient meters with the noise root-mean-square level (sensitivity) of magnetic field gradient less (better) then 0.3 nT/m divided by square root of frequency in hertz units; 901580930

6.1.6.6. Internal magnetic gradiometers using technology other than optical fiber one with the noise root-mean-square level (sensitivity) of magnetic fields gradient less (better) then 0.015 nT.m divided by square root of frequency in hertz units; 901580930

6.1.6.7. Magnetocompensation systems for magnetic sensors designed for operation on mobile platforms; 901580930

6.1.6.8. Superconductor electromagnetic sensors containing components manufactured from superconductor materials and having all below elements: 901580930

a) being specifically developed to operate in temperature below the critical temperature of at least one of the superconductor components (including Josephson effect devices or quantum interference superconductor devices);

b) being specifically developed to measure electromagnetic field variations at frequencies of 1 kHz or below; and

c) having any of the below characteristics:

1) including thin-film quantum interference superconductor devices with the minimum element dimensions of 2 mcm and respective input and output connection circuits;

2) being developed to operate at the maximum magnetic field buildup rate of 10 (6) quantum of magnetic flux per second;

3) being developed to operate non-magnetic shield in the ambient earth magnetic field; or

4) having the temperature coefficient of less than 0.1 quantum of magnetic flux divided by kelvin

Gravimeters

6.1.7. Gravimeters and gravitation gradientometeres:

6.1.7.1. Gravimeters developed or modified for ground use with statistical accuracy less (better) than 10 microgals 901580930

Note:
In Item 6.1.7.1, control shall not apply to ground gravimeters of quartz (Worden) element type

6.1.7.2. Gravimeters developed for mobile platforms for ground, sea, submerged, air, and outer-space applications which have all of the following characteristics: 901580930

a) statistical accuracy less (better) then 0.7 milligals; and

b) operational accuracy less (better) than 0.7 milligals with recording time in the ready state less than 2 min with any combination of correcting compensations and movement impact;

6.1.7.3. Gravitation gradientometers

Radars

6.1.8. Radar systems, equipment, and units which have any of the following characteristics and components specially designed for them:

Note:
In Item 6.1.8, control shall not apply to:
a) active-response radars;
b) automobile radars designed for accident prevention;
c) displays and monitors used for air traffic control which have resolution not more than 12 elements per 1 mm;
d) meteorology (weather) radars

6.1.8.1. Operating at frequencies from 40 GHz to 230 GHz and which have average output power over 100 mW; 852610900

6.1.8.2. Radars with readjustable working frequency within +-6.25% of the central working frequency 852610900

Technical note:
The central working frequency is equal to half of the sum of the highest and lowest carrier frequencies;

6.1.8.3. Capable of operation at two or more carrier frequencies simultaneously; 852610900

6.1.8.4. Capable of operation in radar synthesized or reverse synthesized aperture regimes or in air-borne sideview radar regime; 852610900

6.1.8.5. Including phased antenna arrays with electronic beam scanning; 852610900

6.1.8.6. Capable of finding single high-altitude targets 852610900

Note:
In Item 6.1.8.6, control shall not apply to precision radar equipment for landing control meeting ICAO standards;

6.1.8.7. Specially designed for air-born operation (installed on an aerostat or body of a flying vehicle) which have Doppler signal processing to detect moving targets; 852610900

6.1.8.8. Radars which have radar signal processing using any of the following components: 852610900
a) radar spectrum expansion methods; or
b) radar methods with frequency agility

6.1.8.9. Radars permitting ground operation with a maximum instrumental operational range over 185 km 852610900

Note:
In Item 6.1.8.9, control shall not apply to:
a) ground radars for fish shoal watching;

b) ground radars specially developed for air traffic control in cases when they meet all of the following requirements:

1) have maximum instrumental operational range of 500 km or less;

2) designed so as to transmit the target data form the radar in only one way from the place of location of the radar to one or several civil air traffic control centers on the route;

3) do not contain any means of remote control of radar scanning rate from an air traffic control center on the route;

4) must be installed for a long period of time;

c) radars for meteorological observation from an aerostat;

6.1.8.10. Which are laser radar stations or laser range meters (LIDARs) with any of the following characteristics: 901380000

a) fit for use in the outer space; or

b) using coherent heterodyne or homodyne detection methods which have angular resolution less (better) than 20 mcrad

Note:

In Item 6.1.8.10, control shall not apply to LIDARs specially designed for surveys or meteorological observation;

6.1.8.1.11. Which have signal processing subsystems in the form of pulse compression with any of the following characteristics: 852110900

a) pulse compression coefficient over 150; or

b) pulse width less than 200 ns, or

6.1.8.12. Which have data processing subsystems with any of the following characteristics: 852110900

a) automatic target tracking ensuring, during any antenna rotation, determination of the suggested target position before the subsequent antenna beam passage;

b) calculation of target speed from the active radar which has aperiodic (interchangeable) scanning;

c) processing for automatic image recognition (feature isolation) and comparison of target characteristics (signals or images) with data bases to identify or classify the targets; or

d) superimposing or correlating or merging of the target data from two or more spatially separated and interconnected measuring radars to enhance and recognize the targets

Notes:

1. In Subitem (a) of Item 6.1.8.12, control shall not apply to signalling devices to prevent accidents in air traffic control systems, sea, or coastal radars

2. In Subitem (d) of Item 6.1.8.12, control shall not apply to systems, equipment, and units used to control naval traffic

6.2. Testing, checking, and production equipment

6.2.1. Acoustics - no data

6.2.2. Optical sensors - no data

6.2.3. Cameras - no data

Optics

6.2.4. The following optical equipment:

6.2.4.1. Equipment used to measure the absolute reflectivity value with the error +-0.1% of the reflectivity value; 903140000

6.2.4.2. Equipment other than that used to measure optical surface scattering which has an unblocked aperture with over 10 cm diameter specially designed for contact-free optical measuring of a non-plane figure (profile) of the optical surface with accuracy 2 nm or less (better) of the required profile 903140000

Note:
In Item 6.2.4, control shall not apply to microscopes

6.2.5. Lasers - no data

6.2.6. Magnetometers - no data

Gravimeters

6.2.7. Equipment for production, adjustment, and calibration of ground gravimeters with the static accuracy better then 0.1 milligals 903180390

Radars

6.2.8. Pulsing radar systems for cross-section measuring with the length of transmitted pulses of 100 ns or less and specially designed components for them 852610900

6.3. Material

6.3.1. Acoustics - no data

Optical sensors

6.3.2. Materials for optical sensors, such as:

6.3.2.1. Chemically pure elemental tellurium (Te) with the purity levels of 99.9995% or more; 280450900

6.3.2.2. Monocrystals (including epytaxial plates) of any of the following: 3818009000 8107900000

a) cadmium zinc telluride with the zinc content less than 6% in molar portions;
b) cadmium telluride (CdTe) of any level of purity; or
c) cadmium mercury telluride (HgCdTe) of any level of purity

Technical Note:

The molar portion is determined using the ZnTe moles ratio to the sum of CdTe and ZnTe moles available in the crystal

6.3.3. Cameras - no data

Optics

6.3.4. Optical materials, such as:

6.3.4.1. Blanks of zinc selenide (ZnSe) and zinc sulphide (ZnS) obtained by chemical vapor deposition which have any of the following characteristics: a) volume more than 100 cm3; or b) diameter more than 80 mm and thickness 20 mm or more;	284290100; 283020000
6.3.4.2. Ingots of the following electrooptical materials:	
6.3.4.2.1. Potassium titanante arsenate;	284290900
6.3.4.2.2. Silver gallium selenide (AgGaSe2);	284290100
6.3.4.2.3. Thallium arsenic selenide (Tl3AsSe3, also known as TAS);	284290100
6.3.4.3. Non-linear optical material which have all of the following characteristics: a) third-order susceptibility (chi 3) of 10(-6) m2/V2 or more; and b) response time less than 1 ms;	702000900
6.3.4.4. Blanks of silica carbide or beryllium-beryllium (Be/Be) deposited materials with the diameter or main axis length more than 300 mm;	284920000; 811219000
6.3.4.5. Glass containing silicon melt, phosphate glass, phosphate fluoride glass, zirconium fluoride (ZrF4), and Hafnium fluoride (HfF4) which have all of the following characteristics: a) hydroxilic ion concentration (OH-) less than 5 ppm; b) integral levels of metal purity less than 1 ppm; and c) high uniformity (refraction coefficient variation) less than 5x10(-6)	700100900; 702000900
6.3.4.6. Synthetic diamond material with absorption less then 10(-5) cm-1 at the wavelength from 200 nm to 14,000 nm	710490000; 710510000

Lasers

6.3.5. Synthetic laser crystal materials (base) in untreated form, such as:

6.3.5.1. Corundum with titanium;	710310000

6.3.5.2. Alexandrite 710310000

6.3.6. Magnetometers - no data

6.3.7. Gravimeters - no data

6.3.8. Radars - no data

6.4. Software

6.4.1. Software specially designed for development or production of equipment controlled under Items 6.1.4, 6.1.5, 6.1.8, or 6.2.8

6.4.2. Software specially developed for use of equipment controlled under Items 6.1.2.2, 6.1.8, or 6.2.8

6.4.3. Other software, such as:

Acoustics

6.4.3.1. Following software:
a) software specially developed to form acoustic beam for real-time processing of acoustic data for passive reception using towable hydrophone arrays;
b) text of the program for real-time processing of acoustic data for passive reception using towable hydrophone arrays;
c) software specially elaborated for the formation of acoustic beam for real time acoustic data processing in when passive reception is performed by sea-bed or submerged cable systems;
d) the text of the software program for real time processing of acoustic data for passive reception by sea-bed or submerged cable systems

6.4.3.2. Optical sensors - no data

6.4.3.3. Cameras - no data

6.4.3.4. Optics - no data

6.4.3.5. Lasers - no data

Magnetometers

6.4.3.6. Software, such as:

6.4.3.6.1. Software specially developed for magnetic compensation systems for magnetic sensors designed for operation on mobile platforms;

6.4.3.6.2. Software specially developed to detect magnetic anomalies on mobile platforms

Gravimeters

6.4.3.7. Software specially developed to correct the influence of gravimeter or gravitation gradiometers movement;

Radars

6.4.3.8. Software, such as:

6.4.3.8.1. Programs used to apply air traffic control software on general-purpose computers available in air traffic control centers which have any of the following capabilities:

a) simultaneous processing and representing more than 150 system trajectories; or

b) reception of information on radar targets from more than four primary radars

6.4.3.8.2. Software for development or production of radar antenna caps which:

a) are specially developed to protect phased antenna arrays with electronic beam scanning controlled under Item 6.1.8.5; and

b) have the resulting average side lobe level more than 40 dB lower than the maximum principal ray level

Technical note:

The average side lobe level mentioned in Subitem (b) of Item 6.4.3.8.2 is measured for the whole of the array except for the angle range including the principal ray and the first two side lobes on the either side of the principal ray

6.5. Technology

6.5.1. Technologies designed, according to the General Technological Note, for development of equipment, materials, or software controlled under Items 6.1, 6.2, 6.3, or 6.4

6.5.2. Technologies designed, according to the General Technological Note, for production of equipment or materials controlled under Items 6.1, 6.2, or 6.3

6.5.3. Other technologies:

6.5.3.1. Acoustics - no data

6.5.3.2. Optical sensors - no data

6.5.3.3. Cameras - no data

Optics

6.5.3.4. Technologies, such as:

6.5.3.4.1. Technology of processing and coating application for optical surfaces necessary to obtain a 99.5% or better

homogeneity for optical coatings with the diameter or main axis length more than 500 mm and total losses (absorption and scattering) less than 5x10(3)

Special Note.
See also Item 2.5.3.6;

6.5.3.4.2. Optical production technologies using the methods of single-point diamond rotation and obtaining the final root-mean-square surface processing accuracies better then square root of 10 nm for non-plain surfaces with the area over 0.5 m2

Lasers

6.5.3.5. Technology necessary for development, production, or use of specialized diagnostics tools or targets in testing units for testing super-high power lasers, or testing or evaluation of resistance of materials exposed to super-high-power laser beams;

Magnetometers

6.5.3.6. Technology necessary for development or production of Gulf magnetometer or Gulf magnetometer systems which have any of the following characteristics:
a) noise level less than 0.05 nT divided by square root of frequency in Hz units at frequencies less than 1 Hz (root-mean-square value); or
b) noise level of 1x10(-3) nT divided by square root of frequency in Hz units at frequencies of 1 Hz or more (root-mean-square value)

6.5.3.7. Gravimeters - no data

6.5.3.8. Radars - no data

Category 7. Navigation and Aviation Electronics

7.1. Systems, equipment, and components

Note:
See Category 8 for autopilots of underwater equipment, and Category 6 for radars

7.1.1. Linear Accelerometers designed for use in inertia navigation or guidance systems which have any of the following characteristics and components specially developed for them: a) shift stability less (better) than 130 mcg against a fixed calibrated value during a one-year period;	901420900 903289	

b) stability of the scale factor less (better) than 130 ppm against a fixed calibrated value during a one year period; or

c) specified for operation at linear acceleration levels over 100 g

Special Note:
See Item 7.1.2 for angular or rotating accelerometers

7.1.2. Gyroscopes and angular or rotating accelerometers which have any of the following characteristics and components specially developed for them:	901420900; 903289
a) drift rate stability measured under 1 g exposure during a 3 months period against a fixed calibrated value:	
1) less (better) than 0.1° per hour when the technical specification (nominal) data are provided for operation at linear acceleration levels below 10 g; or	
2) less (better) than 0.5° per hour when the technical specification (nominal) data are provided for operation at linear acceleration levels from 10 to 100 g inclusive; or	
b) specified for operation at linear acceleration level over 100 g	
7.1.3. Inertia navigation systems (platform, gimbal and non-platform, non-gimbal type) and inertia equipment developed for flying vehicles, ground means of transportation, or outer-space units used for location determination, guiding, or control, which have any of the following characteristics and components specially developed for them:	901410900; 901420900
a) navigation error (purely inertial one) after a normal adjustment from 0.8 nautical mile per hour (50% circular probability error) or less (better); or	
b) specified for operation at linear acceleration levels over 10 g	

Notes:

1. Parameters mentioned in Subitem (a) of Item 7.1.3 are applicable to any of the following medium conditions:

a) input random vibration at the maximum level amounting to square root of 7.7 g in the first half-hour and general one hour and a half testing along each axis of three perpendicular directions when the following random vibration may occur:

1) permanent spectral power density from 0.04 g2/Hz in the frequency range from 15 to 1,000 Hz; and

2) spectral power density drops depending on frequency from 0.04 g2/Hz to 0.01 g2/Hz in the frequency interval from 1,000 to 2,000 Hz; or

b) rotation and yawing are equal to or more than +-2.62 rad/s (150 degrees/s); or

c) conditions mentioned in the national standards with provisions equivalent to Items (a) and (b) of the present Note

2. In Item 7.1.3, control shall not apply to inertia navigation systems certified for use on civil flying vehicles by civil administration of the member-country to agreements

7.1.4. Gyroastrocompasses and other devices providing location determination or orientation by means of automatic	901420900; 901480000

tracking of celestial bodies or satellites with the azimuth accuracy equal to or less (better) than 5 arc seconds

7.1.5. Reception equipment of global navigation satellite systems (GPS or GLONASS) which has one of the following characteristics and components specially designed for it: 901420900; 901480000

a) using decoding; or

b) using antennas with controlled radiation pattern ("gap" in the radiation pattern)

7.1.6. On-board altimeters operating at frequencies other than those from 4.2 to 4.4. GHz inclusive, which have one of the following characteristics: 852610110; 852691900

a) controllable power; or

b) using variable-phase amplitude modulation

7.1.7. Radio direction finding equipment operating at frequencies over 30 MHz which has all of the following characteristics and components specially designed for it: 852691900

a) instant bandpass value of 1 MHz or more;

b) parallel operation at more than 100 frequency channels; and

b) productivity more than 1,000 bearings per second per frequency channel

7.2. Testing, checking, and production equipment

7.2.1. Equipment for testing, calibration, adjustment specially developed for equipment controlled under Item 7.1 903110000; 903120000; 903180

Note:

In Item 7.2.1, control shall not apply to testing, calibration, adjustment for level one and level two maintenance equipment

Technical notes:

1. Level one maintenance

Failure of inertia navigation device in the flying vehicle is detected from the readings of the monitoring and data display devices or from the report of the warning system of the respective subsystem. Eventually, the damage may be eliminated by the maker company by replacing the inoperable device. The operator removes this device and replaces it with a spare one

2. Level two maintenance

Inoperable device is sent for repair to production shop of the company or to operator responsible for level two technical maintenance. In the production shop, the inoperable device is tested by various respective means to check and localize the inoperable device module to be replaced in the shop. This damaged device module is removed and replaced with an operable spare one. The damaged device module (or device, if possible) is then returned to the maker

Special note:

Level two technical maintenance shall not include removal of accelerometers and gyroscope sensors subject to export control from the factory-replaced device module

7.2.2. Equipment specially developed to evaluate characteristics of mirrors of ring-laser gyroscopes, such as:

7.2.2.1. Reflectometers with the measuring accuracy of 10 ppm or less (better)	903180
7.2.2.2. Profilometers with the measuring accuracy of 0.5 nm (5 П) or less (better)	903180
7.2.3. Equipment specially developed to make equipment controlled under Item 7.1	8413; 842119910; 842119990; 903110000; 903120000; 903180

Note:
Item 7.2.3 shall include:
a) testing units for gyroscope adjustment;
b) units for dynamic gyroscope balancing;
c) units for gyromotor testing;

d) units for filling and removing of gyroscope working medium;
e) centrifuges for gyrobearings;
f) units for accelerometer axis aligning

7.3. Materials - no data

7.4. Software

7.4.1. Software specially created or modified for development or production of equipment controlled under Item 7.1 or 7.2

7.4.2. Text of the program for use in any inertia navigation equipment including the inertial equipment not controlled per Item 7.1.3 or 7.1.4 or in the systems intended for defining route direction in the air

Note:
In Item 7.4.2, control shall not apply to texts of the programs made for use in platform-type position determination systems in the air

Technical note:
A system of flying vehicle position (course direction) determination in the air, as a rule, is different from inertia navigation system (INS) in that the system of flying vehicle angular (course) position determination in the air provides information on the airplane position in the air and direction, and usually does not provide information on acceleration, speed, and position (coordinate) taken from INS

7.4.3. Other software, such as:

7.4.3.1. Software specially developed or modified to improve available characteristics or reduce system navigation error to levels indicated in Items 7.1.3 or 7.1.4;

7.4.3.2. Text of the program for hybrid integrated systems

improving available characteristics or reducing system navigation error to levels specified in Item 7.1.3 whenever inertia data are integrated with any navigation data obtained from:

a) Doppler speedometer;

b) global navigation satellite system (GPS or GLONASS); or

c) data bases on terrain relief;

7.4.3.3. Text of the program for integrated aviation or outer-space systems which combine the data from measuring sensors and use expert systems;

7.4.3.4. Text of the program for development of any of the following types of equipment:

7.4.3.4.1. Digital flight control systems for general flight control;

7.4.3.4.2. Integrated flight control systems and engines;

7.4.3.4.3. Wire or signal-lights control systems;

7.4.3.4.4. Failure-free and self-adjustable active flight control systems;

7.4.3.4.5. On-board automatic equipment controlling the orientation;

7.4.3.4.6. Air data systems based on surface jamming information; or

7.4.3.4.7. Projection displays with raster-type heads or three-dimensional displays

7.4.3.5. Software for automatic design systems specially developed to create active flight control systems, helicopter multi-coordinate control systems using wire or signal lights, or helicopter direction or counterrotation control with controlled circulation systems whose technologies are controlled under Items 7.5.4.2, 7.5.4.3.1, or 7.5.4.3.2

7.5. Technology

7.5.1. Technologies designed, according to the General Technological Note, for development of equipment or software controlled under Items 7.1, 7.2, or 7.4

7.5.2. Technologies designed, according to the General Technological Note, to produce equipment controlled under Item 7.1 or 7.2

7.5.3. Technologies designed, according to the General

Technological Note, for repair, overhauls, and restoration of equipment controlled under Items 7.1.1-7.1.4

Note:

In Item 7.5.3, control shall not apply to technical maintenance technologies pertaining directly to calibration, demounting, or replacement of inoperable or unfit for operation typical replaceable elements and to location of specialized repair of civil flying vehicles described in maintenance manuals for Level 1 and Level 2

Special note:

For the purposes of Item 7.5.3, see technical note to Item 7.2.1

7.5.4. Other technologies, such as:

7.5.4.1. Technologies for development and production:

7.5.4.1.1. On board, automatically controlled equipment operating at frequencies over 5 mHz;

7.5.4.1.2. Air data systems based only on surface statistical data, i.e. systems which do not need standard air sampling;

7.5.4.1.3. Projection displays with raster-type heads or three-dimensional displays for flying vehicles;

7.5.4.1.4. Inertia navigation systems or gyroastrocompasses containing accelerometers or gyroscopes controlled under Item 7.1.1 or 7.1.2;

7.5.4.1.5. Electric actuating mechanisms (i.e. electromechanical, electrohydrostatic, and integrated actuating units) specially developed for direct flight control;

7.5.4.1.6. Groups of optical sensors of the flight control systems specially developed for use in active flight control systems

7.5.4.2. Development technologies for active flight control systems (including wire or signal-lights control), including:

7.5.4.2.1. Configuration developed to connect numerous microelectronic computing elements (on-board computers) permitting to implement real-time control laws;

7.5.4.2.2. Compensation of control dependence on the location of the measuring sensor or dynamic loads on the frame of the flying vehicle, e.g. compensation of the sensor vibration background or variation of sensor location against the center of gravity;

7.5.4.2.3. Electronic control of excessive data or reservation systems for determination of error, permitted

error deviation, error localization, or its reconfiguration

Note:

In Item 7.5.4.2.3, control shall not apply to physical redundancy design technology;

7.5.4.2.4. Flying vehicle control permitting a real-time, independent change of the structure of forces and momentums during the flight;

7.5.4.2.5. Integration of the digital flight control system, navigation system, and engine-control system data into a general digital flight control system

Note:

In Item 7.5.4.2.5., control shall not apply to:

a) design technologies for integrated digital flight, navigation, and engine-data control systems joined into a digital flight control system used to optimize the flight trajectory;

b) design technologies for air navigation means intended exclusively for an omnidirectional microwave localizer beacon, long-range measuring equipment, blind landing system, microwave landing system, or final approach system;

7.5.4.2.6. Fully independent digital system of flight control or multisensor system of control systems using expert systems

Special note:

See Item 9.5.3.1.9 for technologies of a fully autonomous, digitalelectronic engine control system (FADEC)

7.5.4.3. Development technology for the following helicopter systems:

7.5.4.3.1. Multicoordinate means of wire or signal-lights control combining at least two of the following functions in one control element:

a) main rotor control;
b) rotation control;
c) yawing control

7.5.4.3.2. Torque control systems during rotation;

7.5.4.3.3. Rotating blades with a variable-geometry aerodynamic profile for systems with controllable blades

Category 8. Sea-Going

8.1. Systems, equipment, and components

8.1.1. Underwater units and surface vessels, such as:

Special note:

To determine the control status of equipment of underwater units, see: for encoded data transmission equipment - Part 2, Category 5 (Data Protection); inasmuch as it pertains to sensors - Category 6; for navigation equipment - Category 7 and 8; for equipment transmitting encoded data to underwater equipment - Item 8.1

8.1.1.1. Manned, wire-control underwater units designed for operation at depths over 1,000 m;	890600910; 890600990
8.1.1.2. Manned, wireless-control underwater units which have any of the following characteristics:	
8.1.1.2.1. Designed for autonomous navigation, featuring all below lifting capacity characteristics: a) 10% or more of their own weight (weight in the air); and b) 15 kN or more	890600910; 890600990
8.1.1.2.2. Designed for navigation at depths over 1,000 m; or	890600910; 890600990
8.1.1.2.3. Featuring all of the following characteristics: a) designed for a crew of four persons or more; b) designed for autonomous navigation within 10 hours or more; c) featuring an operating range of 25 nautical miles or more; and d) featuring the length of 21 m or less	890600910; 890600990

Technical note:

1. For the purposes of Item 8.1.1.2, "autonomous navigation" means that the units are fully submerged without a snorkel, all their systems are functioning and providing navigation at the minimum speed permitting a safe diving control (taking into account the necessary depth dynamics) using only elevators without participation of the surface support vessel or base (coastal one or mother-ship); the units have engine systems to move in a submerged or surface condition;

2. For the purposes of Item 8.1.1.2, the operating range makes half of the maximum distance which can be covered by the underwater unit

8.1.1.3. Unmanned, wire-control underwater units designed for navigation at depths over 1,000 m which have any of the following components:	890600910; 890600990
8.1.1.3.1. Designed for self-propelled maneuvering, using engines or propulsion units controlled under Item 8.1.2.1.2; or	
8.1.1.3.2. Which have optical-fiber data transmission lines	
8.1.1.4. Unmanned, wireless-control underwater units which have any of the following components:	890600910; 890600990
8.1.1.4.1. Designed to solve the tasks of reaching any geographical reference point (course laying) in real-time environment without human attendance;	

8.1.1.4.2. Which have acoustic data or command transmission channel; or

8.1.1.4.3. Which have an optical-fiber data transmission line or command transmission line longer than 1,000 m

8.1.1.5. Ocean rescue systems with the lifting capacity over 5 MN to rescue objects from depths over 250 m, featuring one of the following characteristics:

8.1.1.5.1. Dynamic position-control systems capable of stabilization within 20 m of the given point as registered by navigation system; or — 890590100; 890600910

8.1.1.5.2. Bottom navigation systems and navigation integration for depths over 1,000 m with positioning accuracy within 10 m of the given point — 890590100; 890600910

8.1.1.6. Amphibian hovercraft vessels (with a completely changeable surface configuration) featuring all of the following characteristics: — 890600910; 890600990

a) maximum full-load design speed over 30 knots at 1.25 m or more wave height (Naval Article 3);

b) damping pressure more than 3,830 Pa; and

c) unloaded-to-fully-loaded vessel water displacement factor less than 0.70;

8.1.1.7. Amphibian hovercraft vessels (with unchangeable surface configuration) with the maximum full-load design speed over 40 knots at 3.25 m or more wave height (Naval Article 5); — 890600910; 890600990

8.1.1.8. Hydrofoil vessels with active automatic hydrofoil-control system and maximum full-load design speed of 40 knots or more at 3.25 m or more wave height (Naval Article 5); — 890600910; 890600990

8.1.1.9. Vessels with a low waterline area featuring any of the following characteristics: — 890600910; 890600990

a) full-load displacement over 500 t with a maximum full-load design speed over 35 knots at 3.25 m or more waveheight (Naval Article 5); or

b) full-load displacement over 1,500 t with maximum full-load design speed over 25 knots at 4 m or more wave height (Naval Article 6)

Technical note:

Vessel qualification as the one belonging to vessels with a low water-line area is determined using the following formula: waterline area with a known water displacement value at operational design draught of less than 2x(displacement at operating design draught)2/3

8.1.2. Systems or equipment, such as:

Note:

See Part 1 of Category 5 (Telecommunication) for underwater communication systems

8.1.2.1. Systems and equipment specially designed or modified for underwater units designed for navigation at depths over 1,000 m, such as:	
8.1.2.1.1. Pressurized space or bodies with the maximum inner chamber diameter over 1.5 m;	890590100; 890600900
8.1.2.1.2. Direct current electric motors or propulsion plants;	850133910; 850134500; 850134990
8.1.2.1.3. Cable sockets and connectors for them using optical fiber which have power-supply elements made of synthetic materials	853690110; 853690190; 901390000
8.1.2.2. Systems specially designed or modified for automatic underwater unit control controlled under Item 8.1.1 which use navigation data and have closed-circuit servocontrol devices: a) capable of unit movement control within 10 m of the given water column; b) maintaining the unit position within 10 m of the given point of the water column; or c) maintaining the unit position within 10 m in tow by a rope (cable) behind or under the mother-ship	901480000
8.1.2.3. Optical fiber sockets or connectors;	901390000
8.1.2.4. Underwater surveillance systems, including:	
8.1.2.4.1. TV systems and TV cameras, such as:	
8.1.2.4.1.1. TV systems (including the camera, monitoring and signal transmission equipment) with the maximum resolution over 800 lines, if measured in an atmospheric environment, and TV systems specially designed or modified for remote control of the underwater vessel; or	852510900
8.1.2.4.1.2. Underwater TV cameras with the maximum resolution over 1,100 lines, if measured in an atmospheric environment;	852530900
8.1.2.4.1.3. TV cameras for low-illuminance shooting specially designed or modified for underwater use containing all of the following components: a) image intensifier tubes controlled under Item 6.1.2.1.2.1; and b) more than 150,000 active pixels on the area of the solid-state receiver	852530990

Technical note:

Maximum resolution in television is measured by the horizontal (linear) resolution usually expressed as the maximum number of lines for the image (screen) height legible on the test chart using IEEE standard 208/1960 or any equivalent of this standard

8.1.2.4.2. Systems specially designed or modified for remote control of an underwater craft using backwater scattering minimization methods, including radiation sources transmitting the signal in a definite distance spectrum or laser systems	852692000
8.1.2.5. Slide cameras specially designed or modified for underwater application at the depths over 150 m using 35-mm or more film format which have any of the following components: a) film annotation with data defining the particulars of external camera source; b) automatic backward focal length correction; or c) control with automatic compensation specially designed for underwater shooting boxes capable of withstanding the depth over 1,000 m	900653000; 900659000
8.1.2.6. Electronic observation systems specially designed of modified for underwater use capable of storing in digital form more than 50 shot frames;	903081900
8.1.2.7. Lighting systems specially designed or modified for underwater use:	
8.1.2.7.1. Stroboscopic lighting systems with the output power more than 300 J per flash and flashing frequency over 5 per second;	902920900; 940540100; 940540390
8.1.2.7.2. Argon arch lighting systems specially designed for use at depths over 1,000 m	940540100; 940540390
8.1.2.8. Robots specially designed for underwater use operated by a specialized computer operated by an in-built program which have any of the following components: a) systems operating a robot using data from sensors measuring the effort or torque applied to an external object, distance to the external object or contact (tactile) interaction between the robot and external object; or b) capable of producing an effort of 250 N or more or a torque of 250 Nm or more and using titanium-based alloys or fibrous or filamentous composite materials in the robot design elements	847989500; 847990980
8.1.2.9. Remote-control hinged manipulators specially designed or modified for use with underwater crafts which have any of the following components: a) manipulator control systems using data from sensors measuring the effort or torque applied to an external object, distance to the external object or contact (tactile) interaction between the manipulator and external object; or b) master-slave proportional control or a control using a specialized computer operated by an in-built program with five or more degrees of freedom	847989500; 847990980

Note:

To determine the number of degrees of freedom, one should take into account only those functions which have proportional control using positioning feedback or using a specialized computer operated by an in-built program provided in the program library;

8.1.2.10. Isolated form atmosphere power systems specially designed for underwater use, such as:

8.1.2.10.1. Isolated from atmosphere power systems with Brighton or Renkin cycle engines which have any of the following components: 840810; 840999000

a) chemical scrubbers or absorbers specially designed for removal of carbon dioxide, carbon oxide, and particles from recycled engine exhaust;

b) systems specially designed to use monoatomic gas;

c) instruments or silencers specially designed to reduce noise under the water at frequencies below 10 kHz, or specially installed instruments to cushion exhaust popping; or

d) systems specially designed for:

1) reaction products pressing or fuel recycling;

2) storage of reaction products; and

3) reaction products exhaust in the presence of 100 kPa or more backpressure;

8.1.2.10.2. Diesel engines for isolated from atmosphere power systems which have any of the following characteristics: 840810; 840999000

a) chemical scrubbers or absorbers specially designed to remove carbon dioxide, carbon oxide, and particles from recyclable engine exhaust;

b) systems specially designed to use monoatomic gas;

c) instruments or silencers specially designed to reduce noise under the water at frequencies below 10 kHz, or specially installed instruments to cushion exhaust popping; and

d) specially designed exhaust systems delaying the exhaust of combustion products;

8.1.2.10.3. Air-independent power plants on fuel elements with the output power over 2 kW which have any of the following components: 840999000

a) instruments or silencers specially designed to reduce noise under the water at frequencies below 10 kHz, or specially installed instruments to cushion exhaust popping; or

b) systems specially designed for:

1) reaction products pressing or fuel recycling;

2) storing reaction products; and

3) reaction products exhaust at 100 kPa or more backpressure;

8.1.2.10.4. Air-independent power systems with Stirling 840810;

cycle engines which have all of the following components: a) instruments or silencers specially designed to reduce noise under the water at frequencies below 10 kHz, or specially installed instruments to cushion exhaust popping; and b) specially designed exhaust systems with combustion products exhaust at 100 kPa or more backpressure	840999000
8.1.2.11. Body edges, seals, and extendable elements which have any of the following components: a) designed for pressures in the air cushion of 3,830 Pa or more operating at the wave height of 1.25 m or more (Naval Article 3) and specially designed for amphibian hovercraft vessels (with a fully changeable surface configuration) controlled under Item 8.1.1.6; or b) designed for pressures of 6,224 Pa or more, operating at the wave height of 3.25 m or more (Naval Article 5) and specially designed for amphibian hovercraft vessels (with unchangeable surface configuration) controlled under Item 8.1.1.7;	847990980; 890600910; 890600990
8.1.2.12. Lifting fans with the power rating over 400 kW specially designed for amphibian hovercraft vessels controlled under Items 8.1.1.6 or 8.1.1.7;	841239900; 841280990; 848510900
8.1.2.13. Fully submerged subcavitation or supercavitation hydrofoils specially developed for vessels controlled under Item 8.1.1.8;	847990980; 890600910; 890600990
8.1.2.14. Active systems specially designed or modified for automatic control of underwater vessels or vessels controlled under Items 8.1.1.6, 8.1.1.7, 8.1.1.8, or 8.1.1.9;	847990980; 890600910; 890600990
8.1.2.15. Propellers, power transfer systems, power generating systems, and noise-reduction systems, such as:	
8.1.2.15.1. Engine systems with a water propeller or power transfer systems specially designed for amphibian hovercraft vessels (with a fully changeable or non-changeable surface configuration), for hydrofoil vessels, and low waterline-area vessels controlled under Items 8.1.1.6, 8.1.1.7, 8.1.1.8, or 8.1.1.9, such as:	
8.1.2.15.1.1. Supercavitating, superventilated, partially submerged or descendible (penetrating through the surface) propulsive devices with the power rating over 7.5 MW;	840810
8.1.2.15.1.2. Counter-rotating propulsive systems with the power rating over 15 MW;	841229500; 848510900
8.1.2.15.1.3. Systems flattening the flow encountered by the propulsive device using vortex-elimination techniques before and after their forming;	841229500

8.1.2.15.1.4. Light-weight, high-power reduction gear (K-factor over 300);	848340930
8.1.2.15.1.5. Power transfer systems with a transmission shaft including components made of composite material capable of transmitting the power over 1 MW	848310900
8.1.2.15.2. Propulsive devices with a water propeller, power generation and transfer systems developed for use on vessels, such as:	
8.1.2.15.2.1. Variable-pitch propellers and hub assemblies with the power rating over 30 MW;	848510900
8.1.2.15.2.2. Electric motors with internal water cooling and output power capacity over 2.5 MW;	850134990
8.1.2.15.2.3. Propulsive device using superconductivity or prolonged-operation magnetoelectrical engines with the output power rating over 0.1 MW;	850120900
8.1.2.15.2.4. Power transfer systems using transmission shaft, including components made of composite materials, and capable of transmitting the power over 2 MW;	848310900
8.1.2.15.2.5. Systems using or based on ventilated propellers with the power rating over 2.5 MW	848510900
8.1.2.15.3. Noise-reduction systems developed for use on vessels with 1,000 t or more displacement, including:	
8.1.2.15.3.1. Under-water noise-reduction systems at frequencies below 500 Hz consisting of compound acoustic assemblies for acoustic insulation of diesel engine, diesel generator plants, gas turbines, gas-turbine generator plants, engine plants or reduction gears specially designed for sound or vibration insulation which have an average weight more than 30% of the weight of installed equipment;	840999000; 841229500
8.1.2.15.3.2. Active noise-reduction or noise-extinction systems, or magnetic-levitation bearings specially designed for powerful transmission systems including electronic control systems capable of actively reducing equipment vibration by generating anti-noise or anti-vibration signals in direct vicinity of the noise source	841229500
8.1.2.16. Jet-propulsion systems with the output power rating over 2.5 MW using deflecting nozzles and blade flow regulation to improve propulsion efficiency or reduce the noise generated by the propulsion unit and disseminated under the water;	841229500

Note.

Item 8.1.2.17 does not control individual devices accompanied by the user for his/her personal

use;

8.1.2.17. Units dipped or navigating under the water, autonomous, closed- or semiclosed-type (with own air-supply systems)

Note.
Item 8.1.2.17 does not control individual devices accompanied by the user for his/her personal use;

8.2. Testing, checking, and production equipment

8.2.1. Water channels with the background noise less then 100 dB (reference signal: 1 mcPa, 1 Hz) in the frequency range from 0 to 500 Hz, designed to measure acoustic fields generated by the water flow in the vicinity of propulsion system models 903120000

8.3. Materials

8.3.1. Sintact material developed for under-wager use which has all of the following characteristics: 392190900
a) designed for sea depths over 1,000 m; and
b) density less than 561 kg/m3

Technical note:
Sintact material consists of hollow spheres of plastic or glass encapsulated in rubber matrix

8.4. Software

8.4.1. Software specially designed or modified for development, production, or use of equipment or material controlled under Items 8.1, 8.2, or 8.3

8.4.2. Specific software specially designed or modified for development, production, maintenance, overhauls, or restoration of surface purity (re-machining) of propellers specially designed to reduce their noise under the water

8.5. Technology

8.5.1. Technologies designed, according to the General Technological Note, for development or production of equipment or material controlled under Items 8.1, 8.2, or 8.3

8.5.2. Other technologies, such as:

8.5.2.1. Technologies used for development, production, maintenance, overhauls, restoration (re-machining) of propellers specially designed to reduce noise under the water;

8.5.2.2. Technologies for overhauls or restoration of surface purity of equipment controlled under Items 8.1.1,

8.1.2.2, 8.1.2.10, 8.1.2.15, or 8.1.2.16

Category 9. Engines

9.1. Systems, equipment, and components

9.1.1. Gas-turbine aircraft engines using, during their production, any of the technologies controlled under Item 9.5.3.1: a) without a certificate for particular civil flying vehicles for which they are designed;	841111900; 841181-841182

Note:

For certification purposes to qualify the flying vehicles as civil, it is permitted to certify 16 engines, assemblies, or their components, including spare ones

b) without a certificate for civil use issued by acknowledged experts of the member-countries to the agreements;

c) developed for the flying speed over 1.2 M for more than 30 min

9.1.2. Naval gas-turbine engines with ISO standard operational power rating of 24,245 kW or more and specific fuel consumption not more than 0.219 kg/kWh in the power range between 35% and 100%, and specially developed units and components for such engines	841182910-841182990

Note:

The term "naval gas-turbine engines" shall include industrial or aircraft gas-turbine engines adjusted for use in ship electric-generator or engine plants

9.1.3. Specially developed units and components using, for their production, technologies for the following gas-turbine engines controlled under Item 9.5.3.1: a) controlled under Item 9.1.1; b) their development or production is not known to the maker, or they are developed and produced in the states that are not members to the agreements	841199900
9.1.4. Carrier rockets and outer space vessels	880250000; 930690

Note.

Payloads are not controlled under Item 9.1.4

Special note.

As it concerns the control status of equipment incorporated in a spacecraft payload see respective categories;

9.1.5. Liquid-propellant rocket engines containing any of the systems or components controlled under Item 9.1.6	
9.1.6. Systems and components specially developed for	

liquid-propellant rocket engines, such as:	
9.1.6.1. Cryogenic refrigerators, on-board Dewar flasks, cryogenic heat-removal pipes, or cryogenic systems specially developed for use in space vessels which have cryogenic medium (coolant) losses less than 30% per year;	841290900
9.1.6.2. Closed-cycle cryogenic containers or refrigeration systems capable of producing temperatures of 100 K (-173°C) or lower for airplanes capable of maintaining the flying speed over 3 M, carrier rockets, or space vessels;	841290900
9.1.6.3. Storage containers for liquid hydrogen or its pumping systems;	731100; 841319960; 841960000
9.1.6.4. High-pressure turbo-pumps (over 17.5 MPa), pump components or gas generators integrated with them, or systems controlling the gas feeding to the turbine;	841319
9.1.6.5. High-pressure combustion chambers (over 10.6 MPa) and nozzles for them;	841290300
9.1.6.6. Fuel storage systems using capillary restriction or fine-feeding principles (i.e. with flexible displacement bubbles);	841229990; 847989800
9.1.6.7. Liquid propellant nozzles with single calibrated holes 0.381 mm or less in diameter (with the section area of 1.4x10(-3) cm2 or less for non-circular holes) specially designed for liquid-propellant rocket engines;	841290900; 930690900
9.1.6.8. Monolithic combustion chambers or monolithic exhaust conical nozzle headpieces made of carbon-carbon material with the density over 1.4 g/cm3 and breaking strength more than 48 MPa	3801; 841290; 930660
9.1.7. Solid-propellant rocket engines featuring any of the following characteristics: a) total impulse over 1.1 MNs; b) specific impulse 2.4 kN/kg or more with the nozzle flow discharge conditions corresponding to sea level conditions, and the pressure in the combustion chamber is 7 MPa; c) portion in the stage weight is more than 88% and the solid-propellant charge weighs more than 86% of the stage; d) contains any of the components controlled under Item 9.1.8; e) insulation systems or fuel mounting systems made as a single piece together with the engine to ensure a greater mechanical strength or as an obstacle to prevent interpenetration of chemical products (components) of the solid propellant into the insulation material	841210900

Technical note:

For the purposes of Subitem (e) of Item 9.1.7, the greater mechanical strength means the applied strength equal to or exceeding the propellant strength

9.1.8. Components specially developed for solid-propellant rocket engines, such as:	
9.1.8.1. Insulation systems and propellant-mounting systems, inserts used to ensure a greater mechanical strength or as an obstacle to prevent interpenetration of the solid propellant into the insulation material	841290300; 880390990

Technical note:

For the purposes of Item 9.1.8.1, a greater mechanical strength means the applied strength equal to or exceeding the strength of the propellant;

9.1.8.2. Engine compartments made of composite, weaving fiber materials more than 0.61 m in diameter or with specific strength over 25 km	930690

Technical note:

Specific strength (PV/W) is the breaking stress (P) multiplied by the compartment volume (V) and divided by the total high-pressure compartment weight (W);

9.1.8.3. Engine nozzles with the trust level over 45 kN or mass discharge speed at the nozzle throat less than 0.075 mm/s;	930690
9.1.8.4. Thrust vector control systems relying on tiltable nozzle or secondary liquid injection which have any of the following characteristics: a) capable of azimuth and tilt-angle travel (two degrees of freedom) in the range over +-5 degrees; b) thrust vector rotation speed of 20 degrees/s or more; or c) thrust vector rotation acceleration of 40 degrees/s2 or more;	841290300; 930690
9.1.9. Hybrid rocket engines with: a) total impulse over 1.1 MNs; or b) output pushing force in vacuum over 220 kN	841210900; 841290300
9.1.10. The following specially designed components, systems, or structures for carrier rockets, propulsion plants of carrier rockets and outer space vessels, including:	
9.1.10.1. Components and structures weighing over 10 kg each specially developed for carrier rockets, made using metallic matrices, composite materials, organic composite materials, ceramics matrices, or reinforced intermetallic materials controlled under Items 1.3.7 or 1.3.10	280450100; 281820000; 284920000; 3801; 392690100; 681599100; 690310000; 701910; 701920;

	810192000; 810292000; 810890300- 810890700; 841290; 880390990; 930690

Note:
Weight restriction do not apply to the head (combat) component of the charge;

9.1.10.2. Components and structures specially developed for propulsion plants of carrier rockets controlled under Items 9.1.5-9.1.9 made using metallic matrices, composite materials, organic composite materials, ceramics matrices, or reinforcement intermetallic materials controlled under Item 1.3.7 or 1.3.10;	280450100; 281820000; 284920000; 3801; 392690100; 681599100; 690310000; 701910; 701920; 810192000; 810292000; 810890300- 810890700; 841290; 880390990; 930690
9.1.10.3. Structural components and insulation systems specially designed for active control of dynamic sensitivity or structural deformations of the space vessel;	880390990; 930690
9.1.10.4. Liquid-propellant restartable rocket engines with the thrust-to-weight ratio equal to or more than 1 kN/kg and actuation time (time necessary to reach 90% of the full nominal thrust from starting) less than 0.03 s	841210900
9.1.11. Ramjet, pulsejet rocket engines, or combined-cycle engines and specially developed components for them	841210900

9.2. Testing, checking, and production equipment

9.2.1. Listed below equipment, tools, or auxiliaries specially developed to produce or measure parameters of gas turbine blades, one-piece-cast blades, or housing edges:	
9.2.1.1. Equipment for oriented crystallization or monocrystal growing;	841199900
9.2.1.2. Ceramics rods (pellets, cores) or cartridges (enclosures);	690390900
9.2.2. Control systems operated by the main equipment in real-time environment, control and measuring instruments (including sensors) or automatic equipment for data collection and processing specially designed for development	903180910

of gas-turbine engines, units and components including technologies controlled under Item 9.5.3.1	
9.2.3. Equipment specially developed for production or testing (checking) of the mounting of gas-turbine brushes developed for operation at speeds at blade ends over 335 m/s and temperature over 773 K (500°C) and components or auxiliaries specially developed for it	845961; 845969; 902410
9.2.4. Tools, dies, or gripping devices used to connect superalloys, titanium alloys, or interceramics blade-disk combinations described in Items 9.5.3.1.3 or 9.5.3.1.6 for gas turbines	851580100; 851590000
9.2.5. Control systems operated from the main equipment in real-time environment, checking and measuring instruments (including sensors) or automatic equipment used for data collection and processing specially designed for use with any of the following wind tunnels or devices:	
9.2.5.1. Wind tunnels developed for speeds 1.2 M or higher, except for those specially developed for research purposes which have the size of the testing chamber (measures longitudinally) less than 250 mm	903120000

Technical note:

The size of the testing chamber is determined using the circumference diameter, square side, or greatest side of the rectangle measured in the place of their greatest section;

9.2.5.2. Devises for simulation of flow-around conditions at speeds over 5 M including thermal, plasma-arc, pulse, and impact-type wind tunnels, as well as gas wind installations and light-gas guns;	903120000
9.2.5.3. Wind tunnels or devices, other than two-dimensional ones, capable of flow imitation with the Reynolds number over 25x10(6)	903120000
9.2.6. Equipment specially developed for vibroacoustic testing featuring the level of sound pressure of 160 dB or more (as compared to 20 mcPa), estimated power rating of 4 kW or more, working temperature in the chamber over 1,273 K (1,000°C) with specially developed for it quartz heaters	903120000
9.2.7. Equipment specially developed to check the integrity of rocket engines using a non-destructive testing technique other than plane x-ray radiation, or which requires to take the main physical and chemical samples	902290000; 9031
9.2.8. Sensors specially developed for direct measuring of wall surface friction in the flow with the stagnation temperature over 833 K (560°C)	902519990; 902780990
9.2.9. Auxiliaries specially developed for making the elements of engine turbine rotors by powder metallurgy	846299100

capable of operation in the presence of a stress of about 60% of the maximum tensile strength or more and metal temperature 873 K (600°C) or more

9.3. Materials - no data

9.4. Software

9.4.1. Software specially elaborated or modified for development of equipment or technology controlled under Items 9.1, 9.2, or 9.5.3

9.4.2. Software specially elaborated or modified for production of equipment, controlled under Item 9.1 or 9.2

9.4.3. Software specially elaborated or modified to activate fully autonomous, digital, electronic engine-control systems (FADEC) controlled under Item 9.2, such as:

9.4.3.1. Software in the digital electronic controllers for engine systems, aerospace testing installations, or blower installations for aircraft engine testing;

9.4.3.2. Software permitting emergency turning-off used in FADEC and integrated in test-bed equipment

9.4.4. Other software, such as:

9.4.4.1. Software used to simulate double- or triple-viscose intra-engine flow in wind tunnels or to process the data of

flight tests permitting to simulate in detail the intra-engine flow;

9.4.4.2. Software for testing aviation gas-turbine engines, assemblies, or components specially developed for real-time data summing up, conversion, and analysis and capable of providing a feedback control including dynamic fine-tuning of the tested items or testing conditions during the experiment;

9.4.4.3. Software specially developed to control oriented crystallization or forming of the single crystal;

9.4.4.4. Software in the form of the program text, object or machine code necessary for application of active compensation systems for rotor blading gap control

Note:

In Item 9.4.4.4, control shall not apply to software making part of uncontrolled equipment or necessary for maintenance pertaining to calibration, repair, or modernization of control systems with active clearance compensation

9.5. Technology

9.5.1. Technologies designed, according to the General Technological Note, for development of equipment or software controlled under Subitem (c) of Item 9.1.1 and Items 9.1.4-9.1.11, 9.2, or 9.4

9.5.2. Technologies designed, according to the General Technological Note, for production of equipment controlled under Subitem (c) of Item 9.1.1 and Items 9.1.4-9.1.11, or 9.2

Special note.
As it concerns the technology for repairing the controlled structures, laminates or materials see Item 1.5.2.6

Note.
The technology for developing or manufacturing gas-turbine engines controlled under Item 9.5 remains under control when used as applied technology of repair, restoration or rebuilding. Not subject to control are technical data, drawings or documentation intended for operation activities directly related to calibration, removal or movement of damaged units or units which cannot be maintained without being moved, including without limitation, movement of engines as a whole or movement of engine modules;

9.5.3. Other technologies, such as:

9.5.3.1. Technologies necessary for development or production of any of the following components or systems of gas-turbine engines:

9.5.3.1.1. Gas-turbine blades, blades or upper parts of crowns made from alloys by oriented crystallization or from a single crystal (Miller directivity index 001) which have breaking resistance time more than 400 h at 1,273 K (1,000°C) and 200 MPa pressure based on average figures for material properties;

9.5.3.1.2. Multi-cupola combustion chambers operating at average temperatures at chamber outlet over 1,813 K (1,540°C) or combustion chambers containing thermally separated heat-protection elements, non-metallic heat-protection elements. or non-metallic bodies;

9.5.3.1.3. Components made of organic composite materials for use at temperature over 588 K (315°C) or of metallic matrix, composite, ceramics matrix, intermetallic, or reinforced intermetallic material controlled under Items 1.1.2 or 1.3.7;

9.5.3.1.4. Uncooled turbine blades, upper parts of crowns, or other components designed for operation in a gas flow with the temperature of 1,323 K (1,050°C) or more;

9.5.3.1.5. Cooled turbine blades, upper parts of crowns other than those described in Item 9.5.3.1.1 operating

without thermal protection at gas temperature of 1,643 K (1,370°C) or more;

9.5.3.1.6. Combinations of the wing-shaped blade-turbine disk type connected rigidly;

9.5.3.1.7. Components of a gas-turbine engine using diffusion welding technique controlled under Item 2.5.3.2;

9.5.3.1.8. Long-life rotating components of gas-turbine engines using materials made by powder-metallurgy technique controlled under Item 1.3.2.2;

9.5.3.1.9. FADEC systems for gas-turbine engines and combined-cycle engines and pertaining to them diagnostics components, sensors, and specially designed components for them;

9.5.3.1.10. Gas-flow geometry control systems and control systems in general for:

a) gas turbines;
b) fan-type or powerful turbines;
c) movable nozzles

Notes:

1. Gas-flow geometry control systems and control systems in general in Item 9.5.3.1.10 shall not include outlet rotating blades, variablespacing fans, rotating starters or vent valves for compressors

2. In Items 9.5.3.1.10, control shall not apply to development or production technologies for gas-flow geometry control systems for thrust reversal;

9.5.3.1.11. Hollow blades with a wide chord and without interspan bonding

9.5.3.2. Technologies necessary for development or production of any of the following equipment:

9.5.3.2.1. Aerodynamic models for wind tunnel testing outfitted with removable sensors capable of data transfer from primary sensors to data collection system;

9.5.3.2.2. Blades made of composite materials or their fixtures capable of withstanding more than 2,000 kW at flight speeds over 0.55 M

9.5.3.3. Technologies necessary for development or production of gas-turbine engine components using lasers, water jet, electrochemical treatment (ECT), or electric spark machine-tools (EST) to obtain holes featuring any of the following characteristics:

9.5.3.3.1. All of the following parameters:

a) depth more than 4 times greater than their diameter;
b) diameter less than 0.76 mm; and
c) slope angles equal to or less than 25 degrees; or

9.5.3.3.2. All of the following parameters:

a) depth 5 times greater than their diameter;

b) diameter less than 0.4 mm; and

c) slope angles more than 25 degrees

Technical note:

For the purposes of Item 9.5.3.3, the slope angle is measured from the surface exposed to the flow as a tangent for the point where the hole axis crosses this surface

9.5.3.4. Technologies necessary for development or production of helicopter power transmission or rotor tilting systems or power transmission systems of the rotating wing of the flying vehicle

9.5.3.5 Development or production technologies for the piston diesel engine of the ground systems of the station with the power plant featuring all of the following characteristics:

a) box volume of 1.2 m3 or less;

b) full output power over 750 kW based on 80/1269/EEC, ISO 2534 standards or their national equivalents; and

c) power density over 700 kW/m3 of the box volume

Technical note:

Box volume: a product of three perpendicular values measures as follows:

length - the length of the crankshaft from the front flange to the front plane of the flywheel;

width - maximum value of the following measurements:

1) outer distance between one extreme valve bonnet to the other;

2) distance between cylinder head ends; or

3) diameter of the flywheel casing;

height - the greatest of the following measurements:

1) distance from the crankshaft axis to the upper plane of the valve bonnet (or cylinder head) plus double the length of the piston stroke; or

2) diameter of the flywheel casing;

9.5.3.6. Technologies necessary for production of specially designed components for diesel engines with a high output power, such as:

9.5.3.6.1. Technologies necessary for production of engine systems featuring all of the below components using ceramics materials, controlled under Item 1.3.7:

a) cylinder sleeves;

b) pistons;

c) cylinder heads; and

d) one or more of other components (including exhaust holes, turbo-supercharging elements, valve guides, valve assemblies, or insulated fuel injectors)

9.5.3.6.2. Technologies necessary for production of turbo-supercharging systems with single-stage compressors featuring all of the following properties:

a) pressure ratio (compression ratio) 4:1 or higher;

b) consumption ranging between 30 and 130 kg/min; and

c) ability to change the flow cross-section inside the compressor or turbine section

9.5.3.6.3. Technologies necessary for production of fuel injection systems with a specially designed multi-fuel (e.g. diesel or ordinary fuel) ability to change the fuel viscosity ranging from diesel fuel (2.5 centistokes at 310.8 K (37.8°C)) to gasoline (0.5 centistokes at 310.8 K (37.8°C)) featuring both of the following components:

a) injected amount more than 230 mm3 per one injection per cylinder;

b) parts of a specially designed electronic control for switching adjuster and automatic fuel parameter changing to ensure a particular torque value using respective sensors

9.5.3.7. Technologies necessary for development or production of diesel engines with a high output power and a solid, gas-phase, or liquid-film (or their combinations) lubrication of cylinder walls permitting to withstand temperatures over 723 K (450°C) measured on the cylinder wall in the upper tangency point of the piston ring

Technical note:

Diesel engines with a high output power - engines with the nominal effective stagnation pressure value of 1.8 MPa or higher at the rotation speed of 2,300 rpm ensuring the rotation speed of 2,300 rpm or more

Section 2

"Sensitive" Commodities and Technologies

Item No.	Description	Item code in the foreign-trade classification

Category 1. Perspective Materials

1.1. Systems, equipment, and components

1.1.2. Composite structures or lamellar structures

(laminates) featuring any of the following components:

1.1.2.1. Organic matrix and made of materials controlled under Items 1.3.10.3, 1.3.10.4, or 1.3.10.5 of Section 1 — 392690100

Note:

In Item 1.1.2.1, control shall not apply to finished or semifinished items specially designed for the following, purely civilian use:

a) in sports applications;

b) in automotive industry;

c) in machine-tool building;

e) in medical applications;

1.1.2.2. Metallic or carbon matrix and made of:

1.1.2.2.1. Carbonic fibrous or filamentous materials: — 3801;

a) with specific modulus of elasticity over 10.15x10(6) m; and — 392690100; 690310000

b) with specific breaking strength over 17.7x10(4) m; or

1.1.2.2.2. Materials controlled under Item 1.3.10.3

Note (to Item 1.1.2.2):

In Item 1.1.2.2, control shall not apply to finished or semifinished items specially designed for the following, purely civilian use:

a) for sports applications;

b) in automotive industry;

c) in machine-tool building;

c) in medical applications

Note (to Item 1.1.2):

In Item 1.1.2, control shall not apply to composite structures or laminates made of epoxy resin impregnated with carbon, fibrous or filamentous materials used to repair structures of flying vehicles or laminates sizing not more than 1 m2

1.3. Materials

1.3.1. Materials specially designed to absorb electromagnetic waves, or current-conducting polymers, such as:

1.3.1.1. Materials for wave absorption at frequencies over 2x10(8) Hz, however, less than 3x10(12) Hz — 381519000; 391000000

Note 1:

Per Item 1.3.1.1 no control shall extend to the following:

a) hair-type absorbers manufactured from natural or synthetic fibers, with non-magnetic absorption filler;

b) absorbers not featuring magnetic losses the working surface of which is not flat including pyramids, cones, edges and spiral surfaces;

c) flat absorbers having all below characteristics:

1) manufactured from any of the following materials: plastic foam materials (flexible or

non-flexible) with carbon filler or organic materials including binding additives providing a reflection coefficient of over 5 per cent in comparison with metal within a frequency range differing from the central frequency of falling energy by more than -+ 15 per cent and not capable to withstand temperature exceeding 450 K (177 degrees C);

or

ceramic materials providing reflection of over 20 per cent in comparison with metal within a frequency range differing from the central frequency of falling energy by more than -+ 15 per cent and not capable to withstand temperature exceeding 800 K (527 degrees C)

Technical note.

The specimens for conducting tests for absorption as per the last subitem of the note to Item 1.3.1.1 must have the shape of a square with the side of at least five times the wavelength of the central frequency located in the remote zone of the radiating element

2) tensile strength of less than 7 x 10 (6) N/sq.m; and

3) compression strength of less than 14 x 10 (6) N/sq.m

d) flat absorbers manufactured from baked ferrite and having:

1) specific weight of over 4.4; and

2) the maximum operating temperature of 548 K (275 degrees C)

Note 2.

The wave absorption magnetic materials specified in Note 1 to Item 1.3.1.1 are not exempt from control if contained in paints;

1.3.1.2. Material for wave absorption at frequencies over 1.5x10(14) Hz, however, less than 3,7x10(14) Hz, not transparent for visible light;	381519000; 391000000
1.3.1.3. Current-conducting polymer materials with the bulk electric conductivity over 10,000 S/m or surface resistivity less than 100 ъ/m2 made on the basis of any of the following polymers:	
1.3.1.3.1. Polyaniline;	390930000
1.3.1.3.2. Polypyrol;	391190900
1.3.1.3.3. Polythiophene;	391190900
1.3.1.3.4. Polyphenylene-vinylene; or	391190900
1.3.1.3.5. Polythienylene-vinylene	391990900
1.3.7. Ceramics-based materials, non-composite ceramics material, composite materials with ceramics matrix, as well as their precursor materials, such as:	
1.3.7.3. Composite materials of ceramics-ceramics type with a glass or oxide matrix reinforced with fiber featuring specific tensile strength of 12.7x10(3) m of any of the below systems: a) Si-N; b) Si-C; c) Si-Al-O-N; or d) Si-O-N;	2849; 285000; 880390990; 930690
1.3.7.4. Composite materials of ceramics-ceramics type with a permanent metal phase, or without it, including particles, filamentous crystals or fiber in which the matrix is formed	880390990; 930690

from silicon, zirconium, or boron carbides or nitrides;

1.3.10. Filamentous or fiber materials which can be used in organic, metallic, or carbon matrix composite materials or lamellar structures, such as:

1.3.10.3. Non-organic fibrous or filamentous materials which have all of the following characteristics: a) specific modulus of elasticity over 2.54x10(6) m; and b) melting, softening, decomposition or sublimation point in inert medium over 1,922 K (1,649°C)	392690100; 810192000; 810890300-810890700

Note:

In Item 1.3.10.3, control shall not apply to:

a) discrete, multi-phase, polycrystalline alumina fibers containing 3% or more (by weight) of silica which have specific modulus of elasticity less than 10x10(6) m;

b) molybdenum fibers and fibers of molybdenum alloys;

c) boron-based fibers;

d) discrete ceramics fibers with the melting, softening, decomposition, or sublimation temperature in inert medium less than 2,043 K (1,770°C);

1.3.10.4. Fibrous or filamentous materials:	
1.3.10.4.1. Made of any of the following materials:	
1.3.10.4.1.1. Polyetherimides controlled under Item 1.3.8.1.1 - 1.3.8.1.4 of Section 1 or	540249990; 550190000; 550390900
1.3.10.4.1.2. Materials controlled under Items 1.3.8.2, 1.3.8.3, 1.3.8.4, 1.3.8.5, or 1.3.8.6 of Section 1; or	540224990; 550190900; 550390900
1.3.10.4.2. Made of materials controlled under Items 1.3.10.4.1.1 or 1.3.10.4.1.2 of this Section and bound with other types of fibers controlled under Items 1.3.10.1, 1.3.10.2, or 1.3.10.3 of Section 1	
1.3.12. The following materials:	

Technical note.

The materials specified under Item 1.3.12 are normally used for nuclear thermal sources;

1.3.12.1. Plutonium in any form containing more than 50% (by weight) of Plutonium-238 isotope	284420910; 284420990

Note:

In Item 1.3.12.1, control shall not apply to:

a) supplies containing one gram of plutonium of less;

b) supplies containing three "effective grams" of plutonium or less when used as a sensing element in interments;

1.3.12.2. Pre-purified Neptunium-237 in any form	284440000

Note:
In Item 1.3.12.2, control shall not apply to supplies containing one gram of Neptunium-237 or less

1.4. Software

1.4.2. Software designed to develop organic matrices, metal matrices, or carbon matrix laminates or composite materials mentioned in the given Section of the List

1.5. Technology

1.5.1. Technologies designed, according to the General Technological Note, to develop or produce equipment or materials controlled under Items 1.1.2 or 1.3 of the present Section of the List

1.5.2. Other technologies, such as:

1.5.2.5. Technologies used to assemble, operate, or restore material controlled under Item 1.3.1;

1.5.2.6. Technologies used to restore composite materials, lamellar structures, or materials controlled under Items 1.1.2, 1.3.7, or 1.3.7.4 of this Section

Note:
In Item 1.5.2.6, control shall not apply to technologies used to repair structures of civil flying vehicles applying carbonic fibrous or filamentous materials and epoxy resins contained in aviation items

Category 2. Material Treatment

2.2. Testing, checking, and production equipment

2.2.1. Machine-tools mentioned below and any of their combinations used to machine or cut metal, ceramics, and composite materials which, according to maker technical specification, can be outfitted with electronic numerical-control devices:

2.2.1.1. Lathes which have all of the following characteristics: 8458; 846490900; 846599100

a) positioning accuracy with all available compensation equal to or below (better than) 3.6 mcm under the international standard ISO 230/2 (1997) or a national equivalent thereof; along any linear axis;
and

b) two or more axes capable of simultaneous coordination for contour control

Note:
In Item 2.2.1.1, control shall not apply to lathes specially designed to make contact lenses;

2.2.1.2. Milling machine-tools which have any of the following characteristics: a) featuring all of the following characteristics: 1) positioning accuracy with all available compensation equal to or less (better) than 3.6 mcm according to the international standard ISO 230/2 (1997) or its national equivalent along any linear axis; and 2) three linear axes plus one axis of rotation that may be coordinated simultaneously for contour control; b) five or more axes which can be simultaneously coordinated for contour control and have positioning accuracy with all available compensation equal to or below (better than) 3.6 mcm under the international standard ISO 230/2 (1997) or a national equivalent thereof along any linear axis (general positioning); c) the precision of positioning for coordinate boring machine tools with the whole available compensation is equal to or below (better than) 3 mcm under the international standard ISO 230/2 (1997) or a national equivalent thereof along any of the linear axes;	845931000; 845939000;
2.2.1.4. Wireless electrospark-treatment machine-tools (ETM) which have two or more axes of rotation which may be simultaneously coordinated for contour control;	845630000
2.2.1.6. Machine-tools for deep drilling or lathes modified for deep drilling providing for a maximum hole drilling depth of 5,000 mm or more and components specially designed for them	845899900
2.2.3. Numerical-control and manual-control machine-tools and components specially designed for them, control equipment, and auxiliaries specially designed for shaving, finish treatment, grinding or honing of hardened (Rc=40 or more), single- and double-cut spur pinions with the pitch over 1,250 mm and front width equal to 15 % of the pitch or more and quality after finish treatment corresponding to the international ISO standard 1328 as Class 3	846140710; 846140790

2.4. Software

2.4.1. Software different from the software subject to control under Item 2.4.2, specially designed to develop or produce equipment controlled under Item 2.2 of the present Section of the List	

2.5. Technology

2.5.1. Technologies designed, according to the General Technological Note, to develop equipment or software controlled under Item 2.2, or 2.4 of the present Section of	

the List

2.5.2. Technologies designed, according to the General Technological Note, to produce equipment controlled under Items 2.2 of the given Section of the List

Category 3. Electronics

3.1. Systems, equipment, and components

3.1.2. Listed below general-purpose electronic equipment:

3.1.2.7. Atomic frequency standards which have any of the following characteristics: 854320000
b) fit for use in the outer space

3.2. Testing, checking, and production equipment

3.2.1. Listed below equipment used to produce semiconductor instruments or materials and specially designed components and auxiliaries for them:

3.2.1.1.2. Chemical vapor-deposition plants for metalorganic compounds specially designed to grow crystals of complex 841989900

semiconductors by chemical reactions between materials controlled under Item 3.3.3 or 3.3.4 of Section 1 of the List

3.4. Software

3.4.1. Software specially designed to develop and produce equipment controlled under Items 3.1.2.7 or 3.2 of the given Section of the List

3.5. Technology

3.5.1. Technologies designed, according to the General Technological Note, to develop and produce equipment and materials controlled under Items 3.1, or 3.2 of the given Section of the List

Category 4. Computational Equipment

4.1. Systems, equipment, and components

4.1.1. Listed below computers and auxiliary equipment, as well as electronic assemblies and specially designed components for them:

4.1.1.1.
b) radiation-proof, exceeding any of the below requirements: 847110;
1) absorbed dose 5 x 10 (3) Gr (silicon) [5 x 10 (5) rad (silicon)]; 847120
2) fault dose value 5 x 10 (6) Gr/sec (silicon) [5 x

10 (6) rad (silicon)]/ sec; or
3) fault due to high-energy particle 10 (-7) error/bit/day;

4.1.3. Digital computers, electronic assemblies, and auxiliary equipment, as well as specially designed components for them, such as:	
4.1.3.2. Digital computers which have the total theoretical productivity (TTP) higher than 75,000 mtops;	8471 (except 847110)
4.1.3.3. Electronic assemblies specially designed or modified to raise productivity by uniting computing elements so that the total theoretical productivity of the joined assemblies would surpass the limits indicated in Item 4.1.3.2 of the given Section of the List	8471 (except 847110)

Notes:

1. Item 4.1.3.3 shall apply only to electronic assemblies and programmable interrelations below the limits indicated in Item 4.1.3.2 of the given Section of the List when supplied as separate electronic assemblies.

2. In Item 4.1.3.3, control shall not apply to electronic assemblies specially designed for items, or a whole family of items, whose maximum configuration does not surpass the limits mentioned in Item 4.1.3.2 of the given Section of the List

4.4. Software

4.4.1. Software specially designed to develop or produce equipment or software controlled under Item 4.1 or 4.4 of the given Section of the List

4.5. Technology

4.5.1. Technologies designed, according to the General Technological Note, for development, production, or use of equipment or software controlled under Item 4.1 or 4.4 of the given Section of the List

Category 5

Part 1. Telecommunication

5.1.1. Systems, equipment, and components

5.1.1.2. Telecommunication broadcasting systems and equipment and specially designed components and auxiliaries which have any of the following characteristics, features, or properties:	
5.1.1.2.3. Availability of radio equipment using spectrum expansion or methods of frequency readjustment (jumping frequency change) which has any of the following characteristics: a) user-programmable expansion codes; or b) total transmission frequency bandwidth exceeding 100	852520900

time or more the bandwidth of any single data channel and constituting more than 50 kHz

Notes:

1. In Subitem (b) of Item 5.1.1.2.8, control shall not apply to equipment used in cellular communication systems for operation at civil frequencies

2. In Item 5.1.1.2.8, control shall not apply to equipment designed to operate with the output power rating of 1.0 W or less;

5.1.1.2.4. Availability of digital-control radio receivers which have all of the following characteristics: 852520900

a) more than 1,000 channels;

b) frequency switching time less than 1 ms;

c) automatic search or scanning in the electromagnetic part of the spectrum; and

d) ability to identify the received signal or transmitter type

Note:

In Item 5.1.1.2.9, control shall not apply to cellular communication equipment operating at civil frequencies;

5.2.1. Testing, checking, and production equipment

5.2.1.1. Equipment and specially designed components or auxiliaries for it specially designed for development, production, or use of equipment, functions, or properties controlled under Part 1 of Category 5 of the given Section of the List

5.4.1. Software

5.4.1.1. Software specially designed for development or production of equipment, operations, or devices controlled under Part 1 of Category 5 of the given Section of the List

5.4.1.2. Software specially designed or modified to support technologies controlled under Item 5.5.1 of the given Section of the List

5.5.1. Technology

5.5.1.1. Technologies designed, according to the General Technological Note, for development or production of equipment, operations, devices, or software controlled under Part 1 of Category 5 of the given Section of the List

Category 6. Sensors and Lasers

6.1. Systems, equipment, and components

6.1.1. Acoustics

6.1.1.1. Marine acoustic systems, equipment, and specially designed components for them, such as:

6.1.1.1.1.2. Location detection or determination systems which have any of the following characteristics: 901580910

a) transmission frequency below 5 kHz;

b) sound pressure level higher than 224 dB (1 mcPa per 1 m) for equipment with the working frequency ranging from 10 kHz to 24 kHz inclusive;

c) sound pressure level higher than 235 dB (1 mcPa per 1 m) for equipment with the working frequency ranging between 24 kHz and 30 kHz;

d) beam forming narrow than 1° along any axis and the working frequency below 100 kHz;

e) designed for operation with the target resolution range more than 5,120 m; or

f) designed for normal functioning at depths over 1,000 m which have sensors with any of the following characteristics:

1) dynamically adjusted to pressure; or

2) containing other conversion elements besides those made of lead titanate zirconate;

6.1.1.1.2. Passive (receiving in the standard mode regardless of connection with active equipment) systems, equipment, and specially developed components for them, such as:

6.1.1.1.2.1. Hydrophones (converters) with any of the following characteristics:

a) including flexible continuous operation sensors or discrete-action sensor assemblies with the diameter or length less than 20 mm and distance between elements less than 20 mm; 901580110; 901580930

b) which have any of the following sensor elements: 901580930

1) optical fiber one;

2) polymer piezoelectric one; or

3) flexible piezoelectric made of ceramics materials;

g) developed for operation at depths over 1,000 m 901580930

6.1.1.1.2.2. Towable acoustic hydrophone arrays which have any of the following characteristic: 901580930; 901580990

a) hydrophone groups located with a 12.5 m spacing and less;

b) hydrophone groups located with a 12.5 m to 25 m spacing and developed for or capable of being modified for operation at depths over 35 m;

c) hydrophone groups in an array located with a 25 m spacing and more and developed for operation at depths over 100 m;

d) which have controllable sensors controlled under Item 6.1.1.1.2.4; of this Section

e) which have longitudinal, fixed connecting array cables;

f) which have assembled arrays less than 40 mm in

diameter;

g) multiplexed hydrophone group signals developed for operation at depths over 35 m or which have an adjustable or interchangeable depth sensor device developed for operation at depths over 35 m; or

h) hydrophone characteristics given in Item 6.1.1.1.2.1 of this Section;

6.1.1.1.2.3. Equipment for real-time data processing specially developed for application in towable acoustic hydrophone arrays featuring user-programmable capabilities, time and frequency processing, and correlation, including spectral analysis, digital filtration, and beam forming using Fourier fast transform, or other conversions or processes; — 901580930; 901580990

6.1.1.1.2.4. Controllable sensors which have all of the following characteristics: — 901580110; 901580930

a) accuracy better than +-0.5°; and

b) any of the following characteristics:

1) developed to be joined in the array connecting cable and operating at depths over 35 m or which have an adjustable or interchangeable depth sensor device designed for operation at depths over 35 m; or

2) developed for external mounting to tyhe array connecting cable and which have a sensor device capable of operation with a 360° rotation at depths over 35 m;

6.1.1.1.2.5. Sea-bed or submerged cable systems having any of the below elements: — 901580930; 901580990

a) connecting the hydrophones specified under Item 6.1.1.1.2.1; or

b) signal modules united by a multiplexed hydrophone group as featuring all the below characteristics:

1) designed for operation at depths exceeding 35 m or featuring a variable or changeable depth-sensitive device designed for operation at depths exceeding 35 m; and

2) capable of operative interaction with a towed acoustic hydrophone array module;

6.1.1.1.2.6. Data processing equipment specially designed for seabed or submerged cable systems, user-programmable and featuring in time or frequency processing and correlation including spectrum analysis, digital filtering and beam formation through the use of quick Fourier transform or other transforms or processes

6.1.2. Optical sensors

6.1.2.1. Optical sensors, such as:

Note:

In Item 6.1.2.1, control shall not apply to germanium or silicon photo-devices

6.1.2.1.1. Listed below solid-state sensors fit for use in the outer space:

6.1.2.1.1.1. Solid-state sensors fit for use in the outer space which have all of the following characteristics: 854140990

a) maximum sensitivity in the wave-length range from 10 nm to 300 nm; and

b) sensitivity at the wave-length over 400 nm less than 0.1% as compared to the maximum sensitivity;

6.1.2.1.1.2. Solid-state sensors fit for use in the outer space which have all of the following characteristics: 854140990

a) maximum sensitivity in the wave-length range from 900 nm to 1,200 nm; and

b) response time constant of 95 ns or less;

6.1.2.1.1.3. Solid-state sensors fit for use in the outer space which have maximum sensitivity in the wave-length range from 1,200 nm to 30,000 nm 854140990

6.1.2.1.2. Opto-electronic converters and specially designed components for them, such as:

6.1.2.1.2.1. Opto-electronic converters which have all of the listed below: 8540203000;

a) maximum sensitivity in the wave-length range from 400 nm to 1,050 nm;

b) microchannel anode for electronic image intensification with the hole spacing (distance between centers) of 15 mcm or less; and

c) following photocathodes:

1) S-20, S-25 photocathodes or multi-alkali photocathodes with light sensitivity over 550 mcA/lm;

2) GaAs or GaInAs photocathodes;

3) other semiconductor photocathodes on group III-V compounds

Note:

In the last Subitem of Item 6.1.2.1.2.1, control shall not apply to photocathodes on semiconductor compounds with the maximum integral sensitivity to irradiation flux 10 mA/W or less;

6.1.2.1.3. Focal-plane arrays unfit for use in the outer space, such as:

6.1.2.1.3.1. Focal-plane arrays unfit for use in the outer space which have any of the following components: 854140910; 854140990

a) individual elements with the maximum sensitivity in the wave-length range from 900 nm to 1,050 nm; and

b) response time constant less than 0.5 ns;

6.1.2.1.3.2. Focal-plane arrays unfit for use in the outer space which have all of the following characteristics: 854140910; 854140990

a) individual elements with the maximum sensitivity in the wave-length range from 1,050 nm to 1,200 nm; and

b) response time constant 95 ns or less;

6.1.2.1.3.3. Focal-plane arrays unfit for use in the outer space which have individual elements with the maximum 854140910; 854140990

sensitivity in the wave-length range from 1,200 nm to 30,000 nm

Technical note:

Linear or two-dimensional multi-element detector arrays shall be included in the focal-plane arrays

Notes:

1. Item 6.1.2.1.3 shall include photoconducting and photogalvanic arrays

2. The following is not subject to control under Item 6.1.2.1.3:

a) focal plane silicon reticle;

b) multi-element (up to 16 elements) airtight photoconducting elements using either sulfides or lead selenide;

c) pyroelectric detectors based on any of the below materials:

1) triglycine sulfate and derivatives thereof;

2) lead-lanthanum-zirconium titanate and derivatives thereof;

3) lithium tantalate;

4) polyvinylidene fluoride and derivatives thereof; or

5) barium-strontium niobate and derivatives thereof;

3. In Item 6.1.2.1.3, the following focal-plane arrays are not included in the given Section of the List:

a) focal-plane arrays on platinum silicide (PtSi) which have less than 10,000 elements; or

b) focal-plane arrays on iridium silicide ((IrSi)

4. In Item 6.1.2.1.3, the following focal-plane arrays are not included in the given Section of the List:

a) focal-plane arrays on indium antimonide (InSb) or plumbum selenide (PbSe) which have less than 256 elements;

b) focal-plane arrays on indium arsenide (InAs);

c) focal-plane arrays on plumbum sulphide (PbS); or

d) focal-plane arrays on indium-gallium-arsenide compounds (InGaAs)

5. In Item 6.1.2.1.3, the following focal-plane arrays made on the basis of mercury-cadmium-tellurium (HgCdTe) are not included in the given Section of the List:

a) scanning arrays which have:

1) 30 elements or less; or

2) implementing element-by-element delay-time switching and integration which have two or less elements; or

b) wide-angle arrays which have less than 256 elements

Technical notes:

1. Scanning arrays are defined as focal-plane arrays developed for use in scanning optical systems forming the total picture by consecutive forming of individual images

2. Wide-angle arrays are defined as focal-plane arrays developed for use with a non-scanning optical system forming the total picture

6. In Item 6.1.2.1.3, the following focal-plane arrays are not included in the given Section of the List:

a) focal-plane arrays with a potential well made on the basis of gallium arsenide (GaAs) or gallium-aluminium-arsenic (GaAlAs) which have less than 256 elements;

b) pyroelectric or ferroelectric focal-plane arrays (containing barium-strontium titanate, plumbum zirconate titanate, or scandiumplumbum titanate) which have less than 8,000 elements;

c) nitride vanadium, oxide silicone, microbolometric focal-plane arrays which have less than 8,000 elements

6.1.2.2. Monospectral image sensors and multispectral image 854089900

sensors designed for use in remote sounding which have any of the following characteristics:

a) instantaneous field of vision (IFV) less than 200 mcrad; or

b) designed for operation in the wavelength range from 400 nm to 30,000 nm which have all of the following components:

1) providing output image data in a digital format; and

2) fit for use in the outer space or developed for operation aboard a flying vehicle, using non-silicon sensors, with IFV less than 2.5 mrad;

6.1.2.3. Equipment for direct image viewing operating in the visible or infrared ranges and containing any of the following components:

6.1.2.3.1. Opto-electronic converters which have characteristics mentioned in Item 6.1.2.1.2.1; or	854020300; 854099000
6.1.2.3.2. Focal-plane arrays which have characteristics mentioned in Item 6.1.2.1.3	854099000

Note:

In Item 6.1.2.3, control shall not apply to the following equipment containing photocathodes made on materials other than GaAs or GaInAs:

a) industrial or civil warning devices, traffic control systems, or industrial conveyers, or counting systems;

b) medical equipment;

c) technological equipment used for inspection, sorting, or analysis of material properties;

d) fire warning devices for industrial furnaces;

e) equipment specially designed for laboratory use

6.1.2.5. Focal-plane arrays fit for use in the outer space which have more than 2.048 elements per array and the maximum sensitivity in the wave-length range from 300 nm to 900 nm	901380000

6.1.3. Cameras

6.1.3.2. Image-forming cameras, such as:

Note:

In Item 6.1.3.2, control shall not apply to TV or video cameras specially designed for TV broadcasting

6.1.3.2.3. Image-forming cameras containing electronic optical brightness amplifiers which have characteristics mentioned in Item 6.1.2.1.2.1 of the given Section of the List; or	852190000
6.1.3.2.4. Image-forming cameras containing focal-plane arrays which have characteristics mentioned in Item 6.1.2.1.3 of the given Section of the List	852190000

6.1.4. Optics

6.1.4.3. Components for optical systems fit for use in the outer space, such as:	
6.1.4.3.1. Light-weight optical elements with equivalent density less than 20% as compared to solid-state plates with the same aperture and thickness;	900190900
6.1.4.3.2. Non-processed substrate, processed substrates with surface coating (single-layer or multi-layer, metal or dielectric, conducting, semi-conducting or insulating) or having protective films;	900190900
6.1.4.3.3. Segments or mirror units designed for assembly in the outer space into an optical system with a receiving aperture equal to or more than one optical meter in diameter;	900290990
6.1.4.3.4. Made of composite material which have linear thermal expansion coefficient equal to or less than 5x10(-6) along any coordinate axis	900390000
6.1.4.4. Optical-control equipment, such as:	
6.1.4.4.1. Specially designed to maintain the surface profile or orient optical components fit for use in the outer space and controlled under Items 6.1.4.3.1 or 6.1.4.3.3;	903140000; 903289900
6.1.4.4.2. Which have resonator control, tracking, stabilization, or adjustment in the frequency band equal to or more than 100 Hz and a 10 mcrad or less error;	903140000; 903289900
6.1.4.4.3. Cardan suspensions which have any of the following characteristics: a) maximum angle of rotation more than 524°; b) bandwidth equal to or more than 100 Hz; c) angular aiming error equal to or less than 200 mcrad; and d) which have any of the following characteristics: 1) diameter or main axis length more than 0.15 m, however, not more than 1 m and angular acceleration more than 2 rad/s2; or 2) diameter or main axis length more than 1 m and angular acceleration more than 0.5 rad/s2;	903289900
6.1.4.4.4. Specially designed to maintain the adjustment of the phased array or mirror systems with phased segments containing mirrors with the segment diameter or main axis length of 1 m or more	903289900
Magnetometers	
6.1.6. Magnetometers, magnetic gradient meters, internal	

magnetic gradient meters, and compensation systems and specially developed components for them, such as:

Note:
In Item 6.1.6, control shall not apply to instruments specially developed for medical-diagnostics biomagnetic measurements

6.1.6.7. Magnetocompensation systems for magnetic sensors designed for operation on mobile platforms; 901580930

Note:
In Item 6.1.6.7, compensators capable of ensuring only absolute output geomagnetic field values, i.e. output signal bandwidth from 0 to at least 0.8 Hz, are not included in the given Section of the List;

6.1.6.8. Superconductor electromagnetic sensors containing components manufactured from superconductor materials and having all below elements: 901580930

a) being specifically developed to operate in temperature below the critical temperature of at least one of the superconductor components (including Josephson effect devices or quantum interference superconductor devices);

b) being specifically developed to measure electromagnetic field variations at frequencies of 1 kHz or below; and

c) having any of the below characteristics:

1) including thin-film quantum interference superconductor devices with the minimum element dimensions of 2 mcm and respective input and output connection circuits;

2) being developed to operate at the maximum magnetic field buildup rate of 10 (6) quantum of magnetic flux per second;

3) being developed to operate non-magnetic shield in the ambient earth magnetic field; or

4) having the temperature coefficient of less than 0.1 quantum of magnetic flux divided by kelvin

6.1.8. Radars

6.1.8. Radar systems, equipment, and units which have any of the following characteristics and components specially designed for them:

Note:
In Item 6.1.8, control shall not apply to:
a) active response radars;
b) automobile radars designed for accident prevention;
c) displays and monitors used for air traffic control with resolution not more than 12 elements per 1 mm;
d) meteorology (weather) radars

6.1.8.4. Capable of operation in radar synthesized or 852610900

reverse synthesized aperture regimes or in air-borne, side-view radar regime;

6.1.8.8. Using radar signal processing with any of the following components: 852610900
a) radar spectrum expansion methods; or
b) radar methods with frequency agility

6.1.8.11. Which have signal processing subsystems in the form of pulse compression with any of the following characteristics: 852110900
a) pulse compression coefficient more than 150; or
b) pulse width less than 200 ns, or

6.1.8.12. Which have data processing subsystems with any of the following characteristics: 852110900
c) processing for automatic image recognition (feature isolation) and comparison of target characteristics (signals or images) with data bases to identify or classify the targets; or

6.2. Testing, checking, and production equipment

Radars

6.2.8. Pulsing radar systems for cross-section measuring with the length of transmitted pulses 100 ns or less and specially designed components for them 852610900

6.4. Software

6.4.1. Software specially designed for development or production of equipment controlled under Items 6.1.4, 6.1.8, or 6.2.8 of the given Section of the List

6.4.3. Other software, such as:

Acoustics

6.4.3.1. Following software:
a) software specially developed to form acoustic beam for real-time processing of acoustic data for passive reception using cable hydrophone arrays;
b) text of the program for real-time processing of acoustic data for passive reception using cable hydrophone arrays;
c) software specially elaborated for the formation of acoustic beam for real time acoustic data processing in when passive reception is performed by sea-bed or submerged cable systems;
d) the text of the software program for real time processing of acoustic data for passive reception by sea-bed or submerged cable systems

6.5. Technology

6.5.1. Technologies designed, according to the General Technological Note, for development of equipment, materials, or software controlled under Items 6.1, 6.2, 6.3, or 6.4 of Section 1

6.5.2. Technologies designed, according to the General Technological Note, for production of equipment or materials controlled under Items 6.1 or 6.2 of the given Section of the List

Category 7. Navigation and Aviation Electronics

7.4. Software

7.4.2. Text of the program for use in any inertia navigation equipment including inertial equipment not controlled per Item 7.1.3 or 7.1.4 of Section 1 or in the systems intended to define route direction in the air

Note:
In Item 7.4.2, control shall not apply to texts of programs for use in platform-type position determination systems in the air

Technical note:
An ordinary system of flying vehicle position (course direction) determination in the air is different from inertia navigation system (INS) in that the system of flying vehicle angular (course) position determination in the air provides information on the airplane position in the air and direction and usually does not provide information on acceleration, speed, and position (coordinate) taken from INS

7.4.3. Other software, such as:

7.4.3.1. Software specially developed or modified to improve available characteristics or reduce system navigation error to levels indicated in Items 7.1.3 or 7.1.4; of Section 1

7.4.3.2. Text of the program for hybrid integrated systems improving available characteristics or reducing system navigation error to levels specified in Item 7.1.3 of Section 1 , whenever inertia data are integrated with any navigation data obtained from:

a) Doppler speedometer (radar);

b) global navigation satellite system (i.e. GPS or GLONASS); or

c) data bases on terrain relief;

7.4.3.3. Text of the program for integrated aviation or outer-space systems which combine the data from of the measuring sensors and use expert systems;

7.4.3.4. Text of the program for development of any of the following types of equipment:

7.4.3.4.1. Digital flight control systems for general flight control;

7.4.3.4.2. Integrated flight control systems and engines;

7.4.3.4.3. Wire or signal-lights control systems;

7.4.3.4.4. Failure-free and self-adjustable active flight control systems;

7.4.3.4.7. Projection displays with raster-type heads or three-dimensional displays

7.5. Technology

7.5.1. Technologies designed, according to the General Technological Note, to develop equipment or software controlled under Items 7.1, 7.2, or 7.4 of Section 1

7.5.2. Technologies designed, according to the General Technological Note, to produce equipment controlled under Item 7.1 or 7.2 of Section 1

Category 8. Sea-Going

8.1. Systems, equipment, and components

8.1.1. The following underwater units and surface vessels, such as:

Special note:
To determine the control status of equipment of underwater units, see: for encoded data transmission equipment - Part 2, Category 5 (Data Protection); inasmuch as it pertains to sensors - Category 6; for navigation equipment - Category 7 and 8; for underwater equipment - Item 8.1

8.1.1.2. Manned, wireless-control underwater units which have any of the following characteristics:

8.1.1.2.1. Designed for autonomous navigation and featuring all below lifting capacity characteristics: 890600910; 890600990
a) 10% or more of their own weight (weight in the air); and
b) 15 kN or more;

8.1.1.2.2. Designed for navigation at depths over 1,000 m; or

8.1.1.2.3. Featuring all of the following characteristics: 890600910
a) designed for a crew of four persons or more;
b) designed for autonomous navigation within 10 hours or more;
c) featuring an operating range of 25 nautical miles or more; and
d) featuring the length of 21 m or less

Technical note:

1. For the purposes of Item 8.1.1.2, "autonomous navigation" means that the units are fully submerged without a snorkel, all their systems are functioning and providing navigation at the minimum speed permitting a safe diving (taking into account the necessary depth dynamics) using only elevators without attendance of the surface support vessel or base (coastal one or mother-ship); the units have engine system to move in a submerged or surface condition;

2. For the purposes of Item 8.1.1.2, the operating range makes half of the maximum distance which can be covered by the underwater unit

8.1.1.3. Unmanned, wire-controlled underwater units designed for navigation at depths over 1,000 m which have any of the following components:	890600910
8.1.1.3.1. Designed for self-propelled maneuvering using engines or propulsion units controlled under Item 8.1.2.1.2 of Section 1; or	
8.1.1.3.2. Which have optical fiber data transmission lines	
8.1.1.4. Unmanned, wireless-control underwater units which have any of the following components:	890600910
8.1.1.4.1. Designed to solve the tasks of reaching any geographical reference point (course laying) in real-time environment without human attendance;	
8.1.1.4.2. Which have acoustic data or command transmission channel; or	
8.1.1.4.3. Which have an optical fiber data transmission line or command transmission line longer than 1,000 m	
8.1.2. Systems or equipment, such as:	

Note:

See Part 1 of Category 5 (Telecommunication) for underwater communication systems

8.1.2.2. Systems specially designed or modified for automatic underwater unit control controlled under Item 8.1.1 of the given section of the List using navigation data which have closed-circuit servocontrol devices: a) capable of the unit movement control within 10 m of the given point of the water column; b) maintaining the unit position within 10 m of the given point of the water column; or c) maintaining the unit position within 10 m in tow by a rope (cable) behind or under the mother-ship;	901480000
8.1.2.8. Robots specially designed for underwater use controlled by a specialized computer operated by an in-built program which have any of the following components: a) systems operating a robot using data from sensors measuring the effort or torque applied to an external object, distance to the external object or contact (tactile)	847989500; 847990980

interaction between the robot and the external object; or

b) capable of producing an effort of 250 N or more, or a torque of 250 Nm or more, and using titanium-based alloys, or fibrous or filamentous composite materials in the robot design elements;

8.1.2.10. Isolated form atmosphere power systems specially designed for underwater use:

8.1.2.10.1. Isolated from atmosphere power systems with Brighton- or Renkin-cycle engines which have any of the following components: 840810; 840999000

a) chemical scrubbers or absorbers specially designed for removal of carbon dioxide, carbon oxide, and particles from recycled engine exhaust;

b) systems specially designed to use monoatomic gas;

c) instruments or silencers specially designed to reduce noise under the water at frequencies below 10 kHz, or specially installed instruments to cushion exhaust popping; or

d) systems specially designed for:

1) reaction products pressing or fuel recycling;

2) storage of reaction products; and

3) reaction products exhaust in the presence of a 100 kPa or more backpressure;

8.1.2.10.2. Diesel engines for power systems isolated from atmosphere which have any of the following characteristics: 840810; 840999000

a) chemical scrubbers or absorbers specially designed to remove carbon dioxide, carbon oxide, and particles from recyclable engine exhaust;

b) systems specially designed to use monoatomic gas;

c) instruments or silencers specially designed to reduce noise under the water at frequencies below 10 kHz, or specially installed instruments to cushion exhaust popping; and

d) specially designed exhaust systems delaying the combustion products exhaust;

8.1.2.10.3. Air-independent power plants on fuel elements with the output power over 2 kW which have any of the following components: 840999000

a) instruments or silencers specially designed to reduce noise under the water at frequencies below 10 kHz or specially installed instruments to cushion exhaust popping; or

b) systems specially designed for:

1) reaction products pressing or fuel recycling;

2) storing reaction products; and

3) reaction products exhaust at 100 kPa or more backpressure;

8.1.2.10.4. Independent from atmosphere power systems with Stirling-cycle engines which have all of the following 840810; 840999000

components:

a) instruments or silencers specially designed to reduce noise under the water at frequencies below 10 kHz, or specially installed instruments to cushion exhaust popping; and

b) specially designed exhaust systems with combustion products exhaust at 100 kPa or more backpressure

8.1.2.15. Propellers, power transfer systems, power generation systems, and noise-reduction systems, such as:

8.1.2.15.3. Noise reduction systems developed for use on vessels with 1,000 t or more displacement, including:

8.1.2.15.3.1. Under-water noise-reduction systems at frequencies below 500 Hz containing compound acoustic assemblies for acoustic insulation of diesel engines, diesel generator plants, gas turbines, gas-turbine generator plants, engine plants or reduction gears specially designed for sound or vibration insulation which have an average weight more than 30% of the weight of installed equipment;	841229500; 840999000
8.1.2.15.3.2. Active noise-reduction or noise extinction systems or magnetic levitation bearings specially designed for powerful transmission systems, including electronic control, systems capable of actively reducing equipment vibration by generating anti-noise or anti-vibration signals in direct vicinity of the noise source	841229500
8.1.2.16. Jet propulsor systems with the output power rating over 2.5 MW using deflecting nozzles and blade flow-regulation technique to improve propulsor efficiency or reduce the noise generated by the propulsor and disseminated under the water;	841229500

8.4. Software

8.4.1. Software specially designed or modified for development, production, or use of equipment or materials controlled under Item 8.1 of the given Section of the List

8.4.2. Specific software specially designed or modified for development, production, maintenance, overhauls, or restoration of surface purity (re-machining) of propellers specially designed to reduce noise under the water

8.5. Technology

8.5.1. Technologies designed, according to the General Technological Note, for development or production of equipment or materials controlled under Items 8.1 of the given Section of the List

8.5.2. Other technologies, such as:

8.5.2.1. Technologies used for development, production, maintenance, overhauls, restoration of surface purity (re-machining) of propellers specially designed to reduce noise under the water;

Category 9. Engines

9.1. Systems, equipment, and components

9.1.11. Ramjet, pulsejet, or combined-cycle engines and specially developed components for them 841210900

9.2. Testing, checking, and production equipment

9.2.1. Equipment, tools, or auxiliaries specially developed to produce gas-turbine blades, one-piece-cast blades, or housing edges:

9.2.1.2. Ceramics rods (pellets, cores) or cartridges (enclosures); 690390900

9.4. Software

9.4.1. Software specially elaborated or modified for development of equipment or technologies controlled under Items 9.1, 9.2, or 9.5.3 of the given Section of the List

9.4.2. Software specially elaborated or modified for production of equipment controlled under Item 9.1 or 9.2 of the given Section of the List

9.4.4. Other software, such as:

9.4.4.1. Software used to simulate double- or triple-viscous intra-engine flow in wind tunnels or for processing the data of flight tests permitting to simulate in detail the intra-engine flow;

9.4.4.3. Software specially developed to control oriented crystallization or single-crystal forming;

9.5. Technology

9.5.1. Technologies designed, according to the General Technological Note, for development of equipment or software controlled under Subitem (c) of Item 9.1.1 and Items 9.1.4-9.1.11, 9.2, or 9.4 of Section 1

9.5.2. Technologies designed, according to the General Technological Note, for production of equipment controlled under Subitem (c) of Item 9.1.1 and Items 9.1.4-9.1.11, or 9.2 of Section 1

Notes:

1. See Item 1.5.2.6 for technologies used for repair of controlled structures, laminates, or materials

2. Gas-turbine engine development or production technologies controlled under Item 9.5 shall be also qualified as controlled when they are used as applied repair, restoration, or overhaul technologies. Control shall not apply to technical data, drawings, or operational documentation directly pertaining to calibration, removal or transfer of damaged or unserviceable without removal units, including the transfer of engines as a whole piece or their modules

9.5.3. Other technologies, such as:

9.5.3.1. Technologies necessary for development or production of any of the following components or systems of gas-turbine engines:

9.5.3.1.1. Gas-turbine blades, blades or upper parts of crowns made from alloys by oriented crystallization or from a single crystal (Miller directivity index 001) which have breaking resistance time more than 400 h at 1,273 K (1,000°C) and 200 MPa pressure based on average figures for material properties;

9.5.3.1.2. Multi-cupola combustion chambers operating at average temperatures at chamber outlet over 1,813 K (1,540°C) or combustion chambers containing thermally separated heat-protection elements, non-metallic heat-protection elements or nonmetallic bodies;

9.5.3.1.3. Components manufactured from any of the below:

a) organic composite materials designed for applications at temperatures exceeding 588 K (315 degrees C);

b) the matrix metal composite, ceramic matrix, intermetal or reinforcement intermetal materials subject to control under Item 1.3.7; or

c) the composite materials controlled under Item 1.3.10 and manufactured with the use of polymer substances controlled under Item 1.3.8..

9.5.3.1.4. Uncooled turbine blades, blades, upper parts of crowns or other components designed for operation in a gas flow with the temperature of 1,323 K (1,050°C) or more;

9.5.3.1.5. Cooled turbine blades, blades, upper parts of crowns other than those described in Item 9.5.3.1.1 operating without thermal protection at gas temperature of 1,643 K (1,370°C) or more;

9.5.3.1.8. Long-life rotating components of gas-turbine engines using materials made by powder-metallurgy technique controlled under Item 1.3.2.2 of Section 1;

9.5.3.1.9. FADEC systems for gas-turbine engines and combined-cycle engines and pertaining to them diagnostics components, sensors, and specially designed components for them;

Section 3*3

"Very Sensitive" Commodities and Technologies

Item No.	Description	Item code in the foreign-trade classification

Category 1. Perspective Materials

1.1. Systems, equipment, and components

1.1.2. Composite structures or lamellar structures (laminates) which have one of the following components:

Note.

Under Item 1.1.2 no control shall be extended to composite structures or laminates manufactured from epoxy resin impregnated with carbon, fiber or thread materials intended for making repair to aircraft structures or laminates having dimensions not exceeding 1 square meter

1.1.2.1. Organic matrix and made of materials controlled under Items 1.3.10.3, or 1.3.10.4 of Section 1 — 392690100

Note:

In Item 1.1.2.1, control shall not apply to finished or semifinished items specially designed for the following, strictly civilian, use:

a) for sports purposes;

b) in automotive industry;

c) in machine-tool making;

d) for medical purposes;

1.3. Materials

1.3.1. Materials specially designed to absorb electromagnetic waves, or current-conducting polymers, such as:

1.3.1.1. Materials designed to absorb waves at frequencies over 2x10(8) Hz, however, less than 3x10(12) Hz — 381519000; 391000000

Note 1:

Per Item 1.3.1.1 no control shall extend to the following:

a) hair-type absorbers manufactured from natural or synthetic fibers, with non-magnetic absorption filler;

b) absorbers not featuring magnetic losses the working surface of which is not flat including

pyramids, cones, edges and spiral surfaces;

c) flat absorbers having all below characteristics:

1) manufactured from any of the following materials: plastic foam materials (flexible or non-flexible) with carbon filler or organic materials including binding additives providing a reflection coefficient of over 5 per cent in comparison with metal within a frequency range differing from the central frequency of falling energy by more than -+ 15 per cent and not capable to withstand temperature exceeding 450 K (177 degrees C);

or

ceramic materials providing reflection of over 20 per cent in comparison with metal within a frequency range differing from the central frequency of falling energy by more than -+ 15 per cent and not capable to withstand temperature exceeding 800 K (527 degrees C)

Technical note.

The specimens for conducting tests for absorption as per the last subitem of the note to Item 1.3.1.1 must have the shape of a square with the side of at least five times the wavelength of the central frequency located in the remote zone of the radiating element

2) tensile strength of less than 7 x 10 (6) N/sq.m; and

3) compression strength of less than 14 x 10 (6) N/sq.m

d) flat absorbers manufactured from baked ferrite and having:

1) specific weight of over 4.4; and

2) the maximum operating temperature of 548 K (275 degrees C)

Note 2.

The wave absorption magnetic materials specified in Note 1 to Item 1.3.1.1 are not exempt from control if contained in paints;

1.3.1.2. Materials for wave absorption at frequencies over 1.5x10(14) Hz, however, less than 3.7x10(14) Hz, not transparent for visible light;	381519000; 391000000
1.3.1.3. Current conducting polymer materials with the bulk electric conductivity of more than 10,000 S/m or surface resistivity less than 100 ъ/m2 made on the basis of any of the following polymers:	
1.3.1.3.1. Polyaniline;	390930000
1.3.1.3.2. Polypyrol;	391190900
1.3.1.3.3. Polythiophene;	391190900
1.3.1.3.4. Polyphenylene-vinylene; or	391190900
1.3.1.3.5. Polythienylene-vinylene	391990900
1.3.12. The following materials, such as:	

Technical note.

The materials specified under Item 1.3.12 are normally used for nuclear thermal sources;

1.3.12.1. Plutonium in any form containing more than 50% (by weight) of Plutonium-238 isotope	284420910; 284420990

Note:

In Item 1.3.12.1, control shall not apply to:

a) supplies containing one gram of plutonium of less;

b) supplies containing three "effective grams" of plutonium or less when used as a sensing element in instruments;

1.3.12.2. Pre-purified Neptunium-237 in any form	284440000

Note:
In Item 1.3.12.2, control shall not apply to supplies containing one gram of Neptunium-237 or less

1.5. Technology

1.5.1. Technologies designed, according to the General Technological Note, to develop or produce materials controlled under Item 1.1.2 or 1.3 of the given Section

Category 2. Material Treatment - no data

Category 3. Electronics - no data

Category 4. Computational Equipment

4.1. Systems, equipment, and components

4.1.3. Digital computers, electronic assemblies, and auxiliary equipment, as well as specially designed components for them, such as:

4.1.3.2. Digital computers which have the total theoretic productivity (TTP) higher than 150,000 mtops;	8471 (except 847110)
4.1.3.3. Electronic assemblies specially designed or modified to raise productivity by uniting computing elements so that the total theoretical productivity of the joined assemblies would surpass the limits indicated in Item 4.1.3.2 of the given Section	8471 (except 847110)

Notes:
1. Item 4.1.3.3 shall apply only to electronic assemblies and programmable interrelations below the limits indicated in Item 4.1.3.2 of the given Section, when supplied as separate electronic assemblies
2. In Item 4.1.3.3, control shall not apply to electronic assemblies specially designed for items, or a whole family of items, whose maximum configuration does not surpass the limits mentioned in Item 4.1.3.2 of the given Section

4.4. Software

4.4.1. Software specially designed or modified to develop or produce equipment or software controlled under Items 4.1 of the given Section

4.5. Technology

4.5.1. Technologies designed, according to the General Technological Note, for development, production, or use of equipment or software controlled under Item 4.1 or 4.4 of the given Section

Category 5

Part 1. Telecommunication

5.1.1. Systems, equipment, and components

5.1.1.2. Telecommunication broadcasting systems and equipment and specially designed components and auxiliaries which have any of the following characteristics or properties:

5.1.1.2.4. Availability of digital-control radio receivers which have all of the following characteristics: 852520900

a) more than 1,000 channels;

b) frequency switching time less than 1 ms;

c) automatic search or scanning in the electromagnetic part of the spectrum; and

d) ability to identify the received signal or transmitter type

Note:

In Item 5.1.1.2.9, control shall not apply to cellular communication equipment operating at civil frequencies;

5.4.1. Software

5.4.1.1. Software specially designed or modified for development or production of equipment, operations, or devices controlled under items of Pert 1 of Category 5 of the given Section

5.5.1. Technology

5.5.1.1. Technologies designed, according to the General Technological Note, for development or production of equipment, operations, devices, or software controlled under items of Part 1 of Category 5 of the given Section

Part 2. Data Protection - no data

Category 6. Sensors and Lasers

6.1. Systems, equipment, and components

6.1.1. Acoustics

6.1.1.1. Naval acoustic systems, equipment, and specially designed components for them, such as:

6.1.1.1.1.2. Location detection or determination systems which have any of the following characteristics: 901580910

a) transmission frequency below 5 kHz;

b) sound pressure level higher than 224 dB (1 mcPa per 1 m) for equipment with the working frequency ranging from

5 kHz to 24 kHz inclusive;

c) sound pressure level higher than 235 dB (1 mcPa per 1 m) for equipment with the working frequency ranging between 24 kHz and 30 kHz;

d) beam forming narrow than 1° along any axis and the working frequency below 100 kHz;

e) designed for operation with the target resolution range more than 5,120 m; or

f) designed for normal functioning at depths over 1,000 m which have sensors with any of the following characteristics:

1) dynamically adjusted to pressure; or

2) containing other conversion elements other than those made of lead titanate zirconate;

6.1.1.1.2. Passive (receiving in the standard mode regardless of connection with active equipment) systems, equipment, and specially developed components for them, such as:

6.1.1.1.2.1. Hydrophones (converters) with any of the following characteristics:

a) including flexible continuous-operation sensors or sensor assemblies of discrete action with the diameter or length less than 20 mm and distance between elements less than 20 mm; — 901580110; 901580930

b) which have any of the following sensor elements: — 901580930

1) optical fiber one;

2) polymer piezoelectric one; or

3) flexible piezoelectric made of ceramics materials;

g) developed for operation at depths over 1,000 m — 901580930

6.1.1.1.2.2. Towable acoustic hydrophone arrays which have any of the following characteristics: — 901580930; 901580990

a) hydrophone groups located with the 12.5 m spacing and less;

b) hydrophone groups located with the 12.5 m to 25 m spacing and developed for or capable of being modified for operation at depths over 35 m

c) hydrophone groups in the array located with the 25 m spacing and more and developed for operation at depths over 100 m;

d) which have controllable sensors controlled under Item 6.1.1.1.2.4; of Section 1

e) which have longitudinal, fixed connecting array cables;

f) which have assembled arrays less than 40 mm in diameter;

g) multiplexed signals of hydrophone groups developed for operation at depths over 35 m or which have an adjustable or interchangeable depth sensor device developed for operation at depths over 35 m; or

h) hydrophone characteristics given in Item 6.1.1.1.2.1; of this Section

6.1.1.1.2.3. Real-time data processing equipment specially developed for application in towable acoustic hydrophone arrays featuring user-programmable capabilities, time and frequency processing, and correlation including spectral analysis, digital filtration, and beam forming using Fourier fast transform, or other conversions or processes;	901580930; 901580990
6.1.1.1.2.5. Sea-bed or submerged cable systems having any of the below elements: a) connecting the hydrophones specified under Item 6.1.1.1.2.1; or b) signal modules united by a multiplexed hydrophone group as featuring all the below characteristics: 1) designed for operation at depths exceeding 35 m or featuring a variable or changeable depth-sensitive device designed for operation at depths exceeding 35 m; and 2) capable of operative interaction with a towed acoustic hydrophone array module;	901580930; 901580990
6.1.1.1.2.6. Data processing equipment specially designed for seabed or submerged cable systems, user-programmable and featuring in time or frequency processing and correlation including spectrum analysis, digital filtering and beam formation through the use of quick Fourier transform or other transforms or processes	
6.1.2. Optical sensors	
6.1.2.1. Optical detectors, such as:	
6.1.2.1.1. Listed below solid-state sensors fit for use in the outer space:	
6.1.2.1.1.3. Solid-state sensors fit for use in the outer space which have maximum sensitivity in the wave-length range from 1,200 nm to 30,000 nm	854140990
Radars	
6.1.8. Radar systems, equipment and units which have any of the following characteristics and components specially designed for them: **Note:** In Item 6.1.8, control shall not apply to: a) active response radars; b) automobile radars designed for accident prevention; c) displays and monitors used for air traffic control which have resolution not more than 12 elements per 1 mm; d) meteorology (weather) radars	
6.1.8.12. Which have data processing subsystems with any of the following characteristics: c) processing for automatic image recognition (feature isolation) and comparison of target characteristics (signals or images) with data bases to identify or classify the targets	852110900

6.2. Testing, checking, and production equipment

6.2.8. Radars

6.2.8. Pulsing radar systems for cross-section measuring with the length of transmitted pulses 100 ns or less and specially designed components for them 852610900

6.4. Software

6.4.1. Software specially designed for development or production of equipment controlled under Items 6.1.8 or 6.2.8 of the given Section

6.4.3. Other software, such as:

Acoustics

6.4.3.1. Following software:

a) software specially developed to form acoustic beam for real-time processing of acoustic data for passive reception using towable hydrophone arrays;

b) text of the program for real-time processing of acoustic data for passive reception using towable hydrophone arrays;

c) software specially elaborated for the formation of acoustic beam for real time acoustic data processing in when passive reception is performed by sea-bed or submerged cable systems;

d) the text of the software program for real time processing of acoustic data for passive reception by sea-bed or submerged cable systems

6.5. Technology

6.5.1. Technologies designed, according to the General Technological Note, for development of equipment or software controlled under Items 6.1, 6.2, or 6.4 of the given Section

6.5.2. Technologies designed, according to the General Technological Note, for production or equipment controlled under Items 6.1 or 6.2 of the given Section

Category 7. Navigation and Aviation Electronics

7.4. Software

7.4.3. Other software, such as:

7.4.3.1. Software specially developed or modified to improve available characteristics or reduce systems navigation error to levels indicated in Items 7.1.3 or 7.1.4; of Section 1

7.4.3.2. Text of the program for hybrid integrated systems improving available characteristics or reducing system navigation error to levels specified in Item 7.1.3 of Section 1, whenever inertia data are integrated with any navigation data obtained from:

a) Doppler speedometer;

b) global navigation satellite system (GPS or GLONASS); or

c) data bases on terrain relief

Category 8. Sea-Going

8.1. Systems, equipment, and components

8.1.1. Underwater units and surface vessels, such as:

Special note:

To determine the control status of equipment of underwater units, see: for encoded information transmission equipment - Part 2, Category 5 (Data Protection); inasmuch as it pertains to sensors - Category 6; for navigation equipment - Category 7 and 8; for underwater equipment - Item 8.1

8.1.1.2. Manned, wireless-control underwater units which have any of the following characteristics:

8.1.1.2.1. Designed for autonomous navigation and featuring all below lifting capacity characteristics: 890600910; 890600990

a) 10% or more of their own weight (weight in the air); and

b) 15 kN or more;

8.1.1.2.2. Designed for navigation at depths over 1,000 m; or 890600910; 890600990

8.1.1.2.3. Featuring all of the following characteristics: 890600910; 890600990

a) designed for a crew of four persons or more;

b) designed for independent navigation within 10 hours or more;

c) featuring an operating range of 25 nautical miles or more; and

d) featuring the length of 21 m or less

Technical note:

1. For the purposes of Item 8.1.1.2, "autonomous navigation" means that the units are submerged completely without a snorkel, all their systems are functioning and providing navigation at the minimum speed permitting a safe diving (taking into account the necessary depth dynamics) using only elevators without attendance of the surface support vessel or base (coastal one or mother-ship); the units have engine system to move in a submerged or surface condition;

2. For the purposes of Item 8.1.1.2, the operating range makes half of the maximum distance which can be covered by the underwater unit

8.1.1.4. Unmanned, wireless-control underwater units which have any of the following components: 890600910; 890600990

8.1.1.4.1. Designed to solve the task of reaching any geographical reference point (course laying) in real-time

environment without human attendance;

8.1.1.4.2. Which have acoustic data or command transmission channel; or

8.1.1.4.3. Which have an optical-fiber data transmission line or command transmission line longer than 1,000 m

8.1.2. Systems or equipment, such as:

Special note:
See Part 1 of Category 5 (Telecommunication) for underwater communication systems

8.1.2.15. Propellers, power transfer systems, power generation systems, and noise-reduction systems, such as:

8.1.2.15.3. Noise-reduction systems developed for use on vessels with 1,000 t or more displacement, including:

8.1.2.15.3.2. Active noise-reduction or noise-extinction systems or magnetic-levitation bearings specially designed for powerful transmission systems, including electronic control systems, capable of actively reducing equipment vibration by generating anti-noise or anti-vibration signals in direct vicinity of the noise source	841229500

8.4. Software

8.4.1. Software specially designed or modified for development, production, or use of equipment controlled under Item 8.1 of the given Section

8.5. Technology

8.5.1. Technologies designed, according to the General Technological Note, for development or production of equipment controlled under Item 8.1 of the given Section

Category 9. Engines

9.1. Systems, equipment, and components

9.1.11. Ramjet, pulsejet rocket engines or combined-cycle engines and specially developed components for them	841210900

9.4. Software

9.4.1. Software specially elaborated or modified for development or production of equipment or technologies controlled under Item 9.1 or 9.5.3 of the given Section

9.4.2. Software specially elaborated or modified for production of equipment, controlled under Item 9.1 of the given Section

9.5. Technology

9.5.1. Technologies designed, according to the General Technological Note, for development of equipment or software controlled under Item 9.1.11 or 9.4 of the given Section

9.5.2. Technologies designed, according to the General Technological Note, for production of equipment controlled under Item 9.1.11 of the given Section

9.5.3. Other technologies, such as:

9.5.3.1. Technologies necessary for development or production of any of the following components or systems of gas-turbine engines:

9.5.3.1.1. Gas-turbine blades, blades, or upper parts of crowns made from alloys by oriented crystallization or from a single crystal (Miller directivity index 001) which have breaking resistance time more than 400 h at 1,273 K (1,000°C) and 200 MPa pressure based on average figures for material properties;

9.5.3.1.3. Components manufactured from organic composite materials designed for applications at temperatures exceeding 588 K (315 degrees C).

Notes to the List

1. General Technological Note

Export of technology necessary for development, production or use of items mentioned in the List shall be controlled according to the conditions given in each Category. This technology will still be subject to control even when it is used to create any uncontrolled item.

Control shall not apply to a technology required as a minimum prerequisite for assembly, operation, maintenance (checking), and repair (restoration) of those items that are not controlled or cleared for export.

Special note:

This does not apply to technologies controlled under Items 1.5.2.5, 1.5.2.6, 8.5.2.1, and 8.5.2.2.

Control shall not apply to technologies available in the "public sphere", used for "fundamental scientific research", or as a minimum necessary information for patent application.

2. General Note for Software

The list does not control the following software:

1. Generally available:

a) sold from funds to retail-trade outlets without restrictions and designed for:

1) retail-trade deals;

2) mail-order deals; or
3) telephone-order deals; and
b) developed for user installation without further real support from the supplier (seller) or

Special Note:

In Item 1 of the General Software Note, control exemption does not apply to software of Part 2 of Category 5.

2. Available in the "public sphere".

3. Definitions of Terms Used in the List

Automatic target tracking - processing method which determines automatically and provides as an output signal the extrapolated value of the most probable target location in real-time environment (Category 6)*4.

Adaptive control - control system adjusting characteristics according to measured parameters of operational conditions (source - ISO 2806-1980) (Category 2).

Active flight control systems - function of preventing undesirable movements or structural stress of the flying vehicle and a missile by autonomous processing of output signals from several measuring sensors and issue of necessary warning commands to implement automatic control (Category 7).

Active pixel - smallest (single) element of a solid-state grating possessing a photoelectric transfer functions when exposed to light (electromagnetic) radiation (Category 6, 8).

"Signal analyzers" is equipment capable of metering and displaying the basic characteristics of single-frequency component of a multifrequency signal (Category 3).

"Asymmetrical algorithm" is a cryptographic algorithm used different enciphering and deciphering keys mathematically interconnected (Category 5).

Technical Note.

Normally asymmetrical algorithm is applied to distribute keys.

Asynchronous transmission regime - transmission regime in which the data is grouped in units; it is called asynchronous meaning that the unit repetition rate depends on the required or instantaneous data transmission rate (Category 5).

ATR - asynchronous transmission regime (Category 5).

Variable-geometry aerofoil profiles - use of flaps, or trimmers, or slats, or hinged control of the nose part angle whose position can be controlled during the flight (Category 7).

Wobble - radial shift per one revolution of the main spindle measured in the plane perpendicular to spindle axis in the measuring point on the outer or inner surface of rotation (source - ISO 230/1-1986, _ 5.61) (Category 2).

Quick hardening - process consisting of material melt hardening at the cooling rates over 1,000 K/s.

Available in the public sphere - definition of a technology or software with no restrictions as to their further dissemination (General Technological Note).

Special note:

Copyright restrictions cannot render a technology or software outside the generally available status.

Vacuum spraying - process of melt jet vaporization into drops 500 mcm or less in diameter by quick release of liquified gas in vacuum (Category 1).

Interconnected measuring radars - two or more measuring radars are considered to be interconnected in case of a real-time exchange of data (Category 6).

Internal magnetic gradiometer - separate element measuring magnetic field and electronic unit connected to it whose output signal is taken as a measure of magnetic field gradient (Category 6).

Fibrous or filamentous materials - materials including:

a) continuous threads;
b) continuous yarn and roving;
c) tapes, fabric, irregular nets of free structure, and braid;
d) cotton and flax fiber;
e) reinforcement fiber, mono- and polycrystalline of any length;
f) aromatic and polyamide cellulose (Category 1).

Main logic element delay time is the value of delay time of the signal's passing via the main logic element used in a monolithic integral circuit. For a family of monolithic integral circuits it can be determined as a signal passage delay time on a typical main element in the given family or as a typical signal passage delay time in the main element of the given family (Category 3).

Special note.

The definition of the main logic element delay time is provided so as to avoid confusion between it and the input-output delay time of a composite monolithic integral circuit.

Technical note.

The family is composed of all kinds of integral circuits having the following common characteristics concerning both manufacture techniques and specifications apart from the functions corresponding to the circuit design:
a) the general architecture of data processing and software;
b) the general know-how of development and processing;
c) the general basic characteristics.

Global interrupt latent time - time within which a computer system recognizes an interrupt request from an event, serves the request, and executes a context transfer to process another task resident in the memory and waiting for interrupt request (Category 4).

Frequency switching time - maximum time (e.g. delay time) necessary for the output signal to switch over from one frequency to another to obtain any of the following characteristics:
a) frequency within 100 Hz of its final value; or
b) level within 1 dB of its final value (Category 3, 5).

Relative frequency bandwidth - instantaneous frequency bandwidth divided by the average carrier frequency expressed in percent (Category 3).

Settling time - time necessary for the output signal to reach the half bite level of its final value when switching between any two converter levels (Category 3).

CE - computing element (Category 4).

Gas spraying - process of vaporization of a jet of melted metallic alloy into drops 500 mcm or less in diameter in a high-pressure gas jet (Category 1).

Hybrid integrated circuit - free combination of integrated circuits or an integrated circuit with circuit elements or discrete components connected together to fulfill particular functions which has all of the following characteristics:
a) includes at least one unpackaged device;
b) components are connected to each other using typical methods of making integrated circuits;
c) replaced as a integral part; and
d) may not be disassembled in normal condition (Category 4).

Hybrid computer - equipment capable of fulfilling all of the following functions:
a) receive data;
b) process data in both analogue and digital representation; and
c) provide for data output (Category 4).

For for use in the outer space - equipment designed, made, and tested to correspond to special electric, mechanical requirements, or operational requirements to be used when launching and deploying satellites or high-altitude flying vehicles operating at altitudes of 100 km or more (Category 3, 6).

Hot isostatic modification - process of moulding of cast forms at temperatures over 375 K

(102°C) in a hermetically-sealed chamber by means of various media (gaseous, liquid, solid particles, etc.) to create equal forces in all directions to reduce or remove internal cavities in the moulded forms (Category 2).

Civil flying vehicles - flying vehicles listed in compliance with those indicated in the published certification airworthiness lists for flights on commercial civil internal and foreign air lines or legal private civil use, or for business purposes (Category 1, 7, 9).

Group of optical sensors of a flight control system - network of deployed optical sensors using laser beams to provide flight control data in real-time environment for on-board processing (Category 7).

Deformable mirrors - mirrors which have:

a) one continuous optical reflecting surface dynamically deformed by applying individual forces or torques to compensate for the distortion of the optical signal falling on the mirror; or

b) multi-element optical reflectors whose position can be changed separately and independently by applying individual forces or torques to compensate for the distortion of the optical signal falling on the mirror.

Deformable mirrors are also known as adaptive-optics mirrors (Category 6).

Dynamic adaptive routing - automatic alteration of the message transmission route on the basis of measurement and analysis of the current operational conditions of the network (Category 5).

Special note:

Not included here are cases when a decision to change the message transmission route is taken on the basis of information available in advance.

Dynamic signal analyzers - signal analyzers which rely on digital signal sampling and its conversion methods to obtain the Fourier-spectrum pattern for the given signal including the data on its amplitude and phase (Category 3).

Discrete component - circuit element in a separate package with own external leads.

Diffusion welding - solid-state molecular combination of at least two metals into a single whole with the common force equivalent to the binding force of the weakest material (Category 1, 2, 9).

Pulse duration - duration of a laser emission pulse measured as half of the full pulse duration (Category 6).

"Symmetrical algorithm" is a cryptographic algorithm using one and the same key for enciphering and deciphering (Category 5).

Technical Note.

Normally symmetrical algorithm is used to ensure information confidentiality.

Blanks - monolithic bodies whose dimensions are fit for making optical elements, such as mirrors or optical spectral windows (Category 6).

Data protection - all means and functions providing for accessibility, confidentiality, or integrity of information or communications, except for the means and functions preventing from failure. It includes cryptography, cryptoanalysis, protection against own radiation and computer protection (Category 5).

Technical note:

Cryptoanalysis - analysis of a cryptographic system or its input or output signals to obtain confidential parameters or sensitive information including an open test (ISO 7498-2-1988 (E), _ 3.3.18).

Comminution - process of comminuting of the material by grinding or sieving (Category 1).

Isostatic presses - equipment capable of pressing in a hermeticallysealed chamber in various media (gaseous, liquid, solid particles, etc.) to create an equal pressure on the blank or material in all directions inside this hermetically-sealed chamber (Category 2).

Instrumental range - operational range of a radar determined by target resolution on the display (Category 6).

Intensity of two-dimensional vectors - number of vectors generated per second rated as

10-pixel polyvectors checked for limitations with a random orientation and coordinate values expressed in integer or floating-point variables (whichever of them corresponding to the maximum intensity) (Category 4).

SDTH - synchronous digital transmission hierarchy (Category 5).

Composite material (composite structure) - matrix and an additional phase or phases comprising reinforcement filler particles, fiber, or any combination of them designed for a definite task or tasks (Categories 1, 2, 6, 8, 9).

Network access controller - physical interface of a distributed, switched network. It uses a common media operating at uniform digital transmission rate with transmission control (e.g. carrier control or detection). Independent of any other, it chooses data packets or groups (e.g. IEEE 802) sent to it. This is the unit which can be integrated in a computer or telecommunication equipment to provide accesss to the system (Category 4, 5).

Communication channel controller - physical interface controlling the flow of synchronous or asynchronous digital data. This is the unit which may be integrated in a computer or telecommunication equipment to provide access to communication (Category 5).

Contour control - travel along two or more axes with a numerical control carried out according to instructions defining the subsequent required position and required feeding speeds to this position. These feeding speeds may vary as compared to each other, thus forming the sought after contour (Category 2).

Outer space vessels - active and passive satellites and probes (Category 7, 9).

Cryptography - branch of science including principles, means, and methods of converting data for the purposes of concealing its contents, prevention of transformation, or unauthorized use. Cryptography is limited to data conversions using one or more secret parameters (e.g. encoding variables) or to a respective key control (Category 5).

Technical note:

Secrete parameter - constant or key concealed from the knowledge of others or known to a definite number of persons. Critical temperature (sometimes called the transition temperature) of a certain superconducting material - temperature at which the material loses completely resistance to conduction of electric current (Categories 1, 3, 6).

Cam effect (eccentricity) - axial shift during one revolution of the main spindle measured in the plane perpendicular to the spindle faceplate in the point neighboring the spindle faceplate circumference (source: ISO 230/1-1986, _ 5.63) (Category 2).

Laser - set of components creating a coherent light emission - both in space and time - amplified by a stimulated radiation emission (Categories 2, 3, 5, 6, 9).

Q-switching laser - laser in which the energy is accumulated in the population inversion or optical resonator and then emitted in a pulsing regime (Category 6).

Super-high-power laser - laser capable of emitting energy (total or partly) over 1 kJ within 50 ms or having a continuous power over 20 kJ (Category 6).

Flying vehicle - vehicle for air flight with a rigid or variable wing geometry, rotating wing (helicopter), tiltable rotor, or carrying wing (Category 1, 7, 9).

Linearity (usually measured through nonlinearity parameters) - maximum deviation of the actual characteristic (average against the upper and lower scale readings), positive or negative, from the straight line located so as to equalize and minimize the maximum deviations (Category 2).

Local network - system of data transmission featuring all of the following characteristics:

a) permitting an unrestricted number of independent data devices to connect directly to each other; and

b) limited to a geographical zone of measured dimensions (e.g. boundaries of an office building, factory, group of buildings, or warehouse buildings) (Category 4).

Special note:

Information device means equipment capable of transmitting or receiving sequences of digital

data.

SHPL - super-high-power laser (Category 6).

Magnetic gradientometers - devices deigned to measure spatial changes in magnetic fields of sources external to the given instrument. They consist of one element measuring the magnetic field and an electronic unit connected to it, output signals of which represent the measure of the gradient of the magnetic field (Category 6).

Magnetometers - devices designed to measure the magnetic field of sources external to the instrument. They consist of a separate measuring element of the magnetic field and an electronic unit connected to it, the output signal of which represents the measure of the magnetic field (Category 6).

Scale factor (of a gyroscope or accelerator) - ratio of the change of the output signal to the change of the measured input signal. The scale factor is usually measured as a slope of a straight line which can be built using the least-square technique according to the data obtained from the change of the input signal within the given range (Category 7).

Matrix - strong solid substance filled with particles, filamentous crystals, or fiber (Categories 1, 2, 8, 9).

Instantaneous frequency bandwidth - frequency bandwidth in which the output signal power level remains stable within 3 dB without adjustment of the main working parameters (Category 3, 5, 7).

Mechanical alloying - process of alloying resulting from pressing, crushing, and new composition of powders and an alloying substance by mechanical impact (Category 1).

Microprogram - sequence of elementary commands stored in a special memory whose execution is initiated by a starting command entered in the command register.

Microprocessor integrated circuit - monolithic integrated circuit or multi-crystal integrated circuit containing an arithmetic logical device capable of executing a sequence of general-purpose commands from external memory (Category 3).

Technical notes:

1. Microprocessor integrated circuit usually does not contain a user-accessible random-access memory, though the memory of the integrated circuit may be used when fulfilling a logical function.

2. The given definition includes sets of integrated circuits designed for joint fulfilling of the function of the microprocessor integrated circuit.

Microcomputer integrated circuit - monolithic integrated circuit or a multi-crystal integrated circuit containing an arithmetic logical device (ALU) capable of fulfilling general-purpose commands of an internal memory applicable to the data stored in the internal memory (Category 3).

Technical note:

Internal memory may be expanded by using an external memory.

Multi-crystal integrated circuit - two or more monolithic integrated circuits united by a common substrate (Category 3).

Multi-flow processing - microprogram or equipment architecture methods permitting to process simultaneously two or more data sequences controlled by one or more command sequences using such methods as:

a) single-instruction multiple-data architecture (SIMD);

b) multiple-single instruction multiple-data architecture (MSIMD);

c) multiple-instruction multiple data architecture (MIDM) including tightly connected, closely connected, and weakly connected data; or

d) structurizing of the processing element array, including systolic arrays (Category 4).

Multilevel protection - class of systems containing information of various degrees of sensitivity, access to which is open for users with various rights of access to information and resources, but not granted for those user groups which do not enjoy these rights (Category 5).

Technical note:

Multi-level protection is the protection of a computer and not its reliability pertaining to equipment failure or operator error prevention.

Monolithic integrated circuit - combination of passive and/or active circuit elements which:

a) produced using diffusion processes, implantation processes, or deposition inside, or on the surface, of a separate piece of a semiconductor material, the so-called "chip";

b) may be considered unbreakable connected; and

c) may fulfill the functions of a circuit (Category 3).

Monospectrum image sensors - sensors capable of obtaining image information from one discrete spectral range (Category 6).

Multispectrum image sensors - sensors capable of carrying out simultaneously or consecutively image data collection from two or more discrete spectrum ranges. Image signal generators which have more than twenty spectrum ranges are known as hyperspectrum ones (Category 6).

Tiltable spindle - spindle holding the tool which changes the angular position of its central axis as compared to other axes in the process of machining (Category 2).

Neuron computer - computational device designed or modified to imitate the conduct of a neuron or set of neurons, for example, a computational device capable of modulating the weight and number of interconnections of a multitude of computing elements on the basis of previous information (Category 4).

Direct hydraulic pressing - deforming process relying on the use of a liquid-filled flexible chamber being in a direct contact with the blank (Category 2).

Terminal interface equipment - equipment through which the information is supplied to the telecommunication system, for example, telephone, computer information device, facsimile unit, or goes out of it (Category 4).

Real time processing - computer data processing providing for a necessary level of service as a function of available resources within a guaranteed system response time regardless of the load level in the presence of system excitation by external events (Categories 4, 6, 7).

Signal processing - processing of received external signals carrying information using algorithms, such as, compression in time, filtering, parameter evaluation, selection, correlation, convolution, or conversion from one representation area to another (e.g. Fourier fast transform or Walsh transform) (Categories 3, 4, 5, 6).

Total digital transmission speed - number of bites, including channel encoding, redundancy, etc., per unit of time transmitted between respective equipment in a digital transmission system (Category 5).

Overall flight control - automated control of the variable parameters of a flying vehicle and its flight trajectory to fulfill the given task in compliance with the changing task data, data on damages or other flying vehicles in real-time environment (Category 7).

Object code - executable form of a suitable representation of one or more processes (program text or language) converted by the programming system (Category 9).

Random-access memory - main place of storage of data and instructions for quick access from the central processor. It consists of the internal memory of the digital computer and any means of its hierarchical expansion, such as cache memory or parallel-access expanded memory (Category 4).

Flight trajectory optimization - procedure minimizing deviations from the four-dimensional (in space and time) required trajectory on the basis of maximization of characteristics or task execution efficiency (Category 7).

Optical integrated circuit - monolithic integrated circuit or hybrid integrated circuit containing one or more parts designed for operation as a photo-receiver or photocathode or to perform optical or electrooptical functions (Category 3).

Optical switching - signal routing or switching in the optical form without conversion to electrical signals (Category 5).

Optical computer - equipment deigned or modified to use light for data representation whose computational logic elements are based on directly connected optical devices (Category 4).

Optical amplification (in optical communication) - method of amplification of optical signals united by a separate optical source without conversion to electrical signals, for example, using semiconductor optical amplifiers, optical-fiber luminescent amplifiers (Category 5).

Main element - element considered to be the main one whenever the cost of its replacement amounts to 35% of the total price of the system where the element belongs to. The price of the element is considered to be the price paid out for it by system maker or assembler. The total price is the normal international price at the place of production or full-set assembly of supplied items (Category 4).

Failure-free operation - ability of a computer system to continue its operation without human attendance, ensure continuity of operation, data integrity, and renewal of work within the specified time interval after a failure in its hardware or software components (Category 4).

Deviation of angular position - maximum difference between the angular position and the actual angular position measured with a very high accuracy after the workpiece fixed after treatment has been rotated against its initial position (Category 2).

"Common channel signal transmission" is a method of signal transmission whereby a single channel between exchange terminals is used to transmit marked messages whereby information is passed as relating to the variety of circuits and signals as well as other information of the same kind which is used to control the network.

Tunable laser - laser capable of generating radiation at all wavelengths within several laser junctions. Laser capable of selecting a certain line emits discrete wavelengths within one laser junction and is not considered to be a tunable one (Category 6).

Junction laser - laser in which generation medium is activated by energy transfer when unexcited atom or molecule collides with excited atoms or molecules (Category 6).

"Built-in chip personal credit card" is a built-in chip card programmed for a specific application, this program not being userchangeable to fit other applications (Category 5).

Peak power - pulse energy in J divided by pulse duration in seconds (Category 5).

Film integrated circuits - set of circuit elements and metallic connections formed by placing a thick or thin film on an insulation sublayer (Category 3).

Measuring error - characteristic determining the range around the measured value within which lies the true value of the measured variable with a 95% probability. It includes uncompensated for systematic errors, uncompensated for play, and random deviations (source: ISO 10360-2 or VDI/VDE 2617) (Category 2).

Sublayer - plate of the main material with connections structure, or without it, on which, or inside which, may be located discrete components or integrated circuits, or both of them together (Category 3).

Real-time frequency bandwidth (for dynamic signal analyzers) - the widest signal frequency bandwidth which the analyzer can produce on the displaying device or memory without breaking the continuity of input information analysis. To assess the real-time frequency bandwidth of multichannel analyzers, one should use the channel configuration with the greatest value of the given parameter (Category 3).

Time constant - time necessary for a light stimulus to reach the level (1-1/e) of the final value at current increase (e.g. 63% of the final value) (Category 6).

Permanent - means that the encoding or compression algorithm cannot change parameters set externally (e.g. cryptographic or key parameters) and cannot be changed by the user (Category 5).

Preliminary separation - use of any process to increase the concentration of a controlled isotope (Category 1).

Use - operation, erection works (including on-site installation) maintenance, repair, overhauls, restoration (General Technological Note, Categories 1, 2, 4-9).

Fit for military use - having undergone any changes or selection to match definite properties (e.g. amount of impurities, shelf life, virulence, transfer of properties, resistance to ultraviolet radiation) to increase the efficiency of impact on human beings or animals or deteriorate

characteristics of equipment, soil fertility, or environment (Category 1).

Program - sequence of commands for execution or conversion into a form executable by a computer (Categories 2, 6).

User programmability - availability of equipment permitting the user to insert, modify, or replace the programs by means other than:

a) physical change of connections or wiring;

b) introduction of functions control including control of entered parameters (Category 6).

Software - set of one or more programs or microprograms recorded on any type of medium (the whole List).

Production - includes all stages: designing, manufacture, assembly (installation), checking, testing, quality control (General Technological Note, Category 7).

Spatially distributed - measuring sensors are considered to be spatially distributed when each sensor is located more than 1.5 m away from any other in any direction. Mobile sensors are always considered to be spatially distributed (Category 6).

Direct flight control - stabilization of a flying vehicle or maneuvering with the sources of power (impulse), for example, with aerodynamically controlled planes or by changing the trust vector (Category 7).

Tools - grips, active tool units, and any other tools mounted on the support grating at the end of the robot manual manipulator (Category 2).

Technical note:

Active tool units are implied to be devices used to apply moving or processing energy to measuring sensors to a blank (workpiece).

Development - all stages of works up to serial production, such as: designing, design research, analysis of design options, working out design concepts, assembly and testing of prototypes (pilot samples), working out experimental production patterns and technical documentation, process of transfer of technical documentation to production facilities, defining project design and component layout, modelling (whole List).

Resolution - minimum increments of the readings of the measuring instrument; in digital instruments - the smallest significant bit (source: ANSI B-89.1.12) (Category 2).

Allocated by the International Telecommunication Union - distribution of frequency bands in compliance with the Radio Regulations of the International Telecommunication Union (published in 1998) for primary, authorized and secondary services (Categories 3, 5).

Special Note:

Additional and alternative distribution is not included.

Spectrum expansion - method used to expand the energy in a relatively narrow-band communication channel to a significantly wider energy spectrum (Category 5).

Radar spectrum expansion - any modulation technique used to distribute the signal energy concentrated in a relatively narrow frequency bandwidth in a wider frequency bandwidth by applying random or pseudo-random encoding techniques (Category 6).

Quick cooling - process of quick hardening of a melted metallic flow on a cooling disk to form flakes (Category 1).

Special note:

Quick hardening - hardening of material melt at the rates over 1,000 K/s.

Focal-plane array - linear or two dimensional planar array or combination of planar layers, individual detector elements with reading electronics or without it which operates in a focal plane (Category 6).

Note:

This definition does not include the set of separate detectors or any two-, three-, or four-element detectors in the absence of time-delay and integration operations in these elements.

Expanded-spectrum radar - spectrum expansion of a radar (Category 5).

Robot - manipulator capable of moving continuously or between definite points, possessing measuring sensors which have all of the following characteristics:

a) multifunctionality;

b) ability to put in a definite position or orient material, workpieces, tools, or special devices by using readjustable threedimensional movements;

c) capable of controlling three or more closed- or open-circuit servodrives, including step motors; and

d) programming ability available to the user by way of learning with subsequent memorizing or through the use of a computer which can be a programmable logical controller, i.e. without intermediary mechanical operations (Categories 2, 8).

Note:

Above definition does not include the following instruments:

a) manipulators controlled only manually or by a teleoperator;

b) manipulators with a fixed sequence of operations which include automatic mobile devices operating according to mechanically fixed programmable types of movements. The program is mechanically restricted by stopping devices, such as rods, or cams. The sequence of movements and choice of trajectories or angles cannot be changed or replaced by mechanical, electronic, or electrical means;

c) mechanically controlled manipulators with a variable sequence of operations which include automated mobile devices operating in accordance with mechanically fixed, programmable types of movements. The program is mechanically restricted by fixed by readjustable devices, such as rods, or cams. The sequence of movements and choice of trajectories or angles are changeable within the given program structure. Any changes or modification of the program structure (e.g. rod or cam change) pertaining to the travel along one or several coordinates is being done only through mechanical operations;

d) non-servocontrolled manipulators with a variable sequence of actions referred to automated mobile devices operating in accordance with mechanically fixed, programmable types of movements. The program can be changed, but the sequence of operations is changed only through a digital signal from mechanically fixed, electrical instruments or readjustable stopping devices;

e) lifting devices with a punch card receptacle rated as Cartesian coordinate manipulators made as an integral part of data storage bins and designed to provide access to the contents of these bins for loading and unloading.

Superplastic forming - deformation process relying on metal heating featuring low elongation factors (less than 20%) in the maximum strength point under ordinary modulus of elasticity testing at room temperature to obtain elongation in the presence of forces at least two times less than the modulus of elasticity (Categories 1, 2).

Superconducting (based on superconductivity effect) - the term refers to materials, e.g. metals, alloys, or compounds which may lose completely resistance to electric current, e.g. have an infinitely high electric conductivity and carry large electric currents without Joule heating (Categories 1, 3, 6, 8).

Technical note:

Material superconducting condition is characterized individually by the critical temperature, critical magnetic field which is a function of temperature, and the critical current density which is a function of both magnetic field and temperature.

Bound - having a contingency of thermoplastic fiber winding and a fiber reinforcement to obtain a combination of a matrix reinforced with fiber in a common fiber form (Category 1).

Pulse compression - encoding and processing of a long-duration radar signal which convert it into a low-duration signal while preserving the advantages of the high energy of the pulse (Category

6).

Frequency synthesizer - any type of signal generator or frequency source producing, regardless of the used generation method, a set of one or several signals generated simultaneously or alternately which are isolates or synchronized purposefully using a fewer number of frequency standards (Category 3).

Direction or counter-rotation control systems with a controlled circulation - control systems relying on air flows along aerodynamic surfaces to strengthen or control the forces generated by the surfaces (Category 7).

Step-by-step frequency retuning is a kind of band spread in which one communication channel frequency band is varied in step-like manner (Category 5).

Drift rate (of a gyroscope) - rate obtained as a time derivative of the deviation of the required output signal. It consists of the random and the systematic component and is expressed as an input angular shift equivalent against inertial space per unit of time (Category 7).

Data transmission rate - rate which, when determined, implies, according to the Recommendation 53-36 of the International Telecommunication Union (ITU), that the Baud rate and the rate in bits per second are not equal in cases of non-digital modulation. Encoding, check, and synchronization bites should also be taken into account (Category 5).

Special notes:

1. When data transmission rates are determined, the service and administrative channels ought to be excluded.

2. This is the maximum transmission rate in one direction, e.g. the maximum rate of reception or transmission.

Digital transmission rate - total rate of data transmission in bits transmitted directly through any type of media (see also "Total digital transmission rate") (Category 56).

Shift (of accelerometer) - accelerometer output signal in the absence of applied acceleration (Category 7).

Total theoretical productivity - measure of computational productivity expressed in millions of theoretical operations per second (mtops) obtained as a result of integration of computing elements (Categories 3, 4).

Special note:

See technical notes to Category 4.

SON - synchronous optical network (Category 5).

Compound rotating table - table permitting to rotate and tilt the workpiece around two unparalleled axes whose control can be coordinated to obtain contours (contour control) (Category 2).

Spectral efficiency - parameter characterizing the efficiency of a system relying on the use of complex modulation methods, such as SAM, array encoding, QFM, and so on. It is determined using the formula:

$$\text{spectral efficiency} = \frac{\text{digital transmission rate (bit/s)}}{\text{level spectrum width less 6 dB (Hz)}}$$

(Category 5).

Melt spinning - process of quick hardening of the flow of the melted metal falling on a rotating cooled disc forming the product in the form of wire, tape, or flake or scale particles (Category 1).

Stability - standard deviation (1 sigma) of the variation of a certain parameter against its calibrated value measured under stable temperature conditions. It is expressed as a function of time (Category 7).

TTP - Total theoretical productivity (Category 4).

Total current density - total number of ampere-turns in a solenoid (i.e. sum of the number of turns multiplied by the maximum current of each turn) divided by the total area of the cross-section of the solenoid (including superconducting turns, metallic matrix containing the superconducting turns, material of the shell, the cooling channel, and so on) (Category 3).

Superalloys - alloys made on the basis of nickel, cobalt, or iron whose strength surpasses the strength of any of alloys of the series AISI 300 at temperature over 922 K (649°C) under stressful operational conditions and environment (Categories 2, 9).

Program text (or source language) - respective representation of one or more processes which can be converted by a programming system in the form executed by the equipment ((object code or object language) (Categories 4-7, 9).

Technology - special information necessary for development, production, or use of equipment. The information can be in the form of technical data or technical aid. A controlled technology is defined in the General Technological Note and the present List.

Special notes:

1. Technical data may be of such forms as photocopies, charts, diagrams, prototypes, formulas, tables, technical projects, and specification, user guides and instructions in written form or recorded on other media, such as a disk, tape, ROM.

2. Technical aid may be of such forms as briefing, getting skills, teaching, process knowledge, consulting services. Technical aid may include transfer of technical data.

Accuracy - maximum deviation, positive or negative, of the mentioned value from an accepted standard of true value usually measured through an error (Categories 2, 6).

System trajectories - processed, correlated (a synthesis of radar data of the target together with the flight task position), and renewed information (reports) on the position of the airplane during the flight submitted to air traffic controllers (Category 6).

Necessary - as applied to technology, means only the portion of the technology which permits to obtain or surpass the controlled levels of characteristics or functions. Such necessary technology may form part of a production technology of various equipment (Categories 6, 9, General Technological Note).

Carbon fiber preforms is either non-coated or coated fibers arranged in an order used for the purpose of making up a matrix frame for forming up a composite material.

Quality improvement - algorithmic image processing to isolate information contained in them by using such algorithms as time compression, filtering, parameter assessment, selection, correlation, convolution or conversion between different representation sphere (e.g. Fourier fast transform or Walsh transform). It does not include algorithms using only linear conversion or individual image rotation, such as shift, feature isolation, registration or false painting (Category 4).

Power control - measuring of the power of the signal transmitted by an altimeter so that the power of the signal received at the altitude of the flying vehicle is always maintained at the lowest level necessary for altitude determination (Category 7).

Operated by an in-built program - control method relying on commands built into the electronic memory which the processor can execute to control any of the given functions (Categories 2, 3, 5).

Technical note:

The equipment may be operated by an in-built program regardless of whether the electronic memory is located outside or inside the given equipment.

Noise level - electric signal expressed through parameters of spectral noise density. The ratio of noise level to peak level is expressed using the formula S2pp=8No(f2-f1), where Spp - peak signal level (e.g. in nanoteslas), No - spectral power density (e.g. (nanotesla)2/Hz), and (f2-f1) - frequency band (Category 6).

FADEC (fully autonomous digital electronic engine controller) - electronic control system of a turbine engine or combined-cycle engine using a digital computer to control the variable parameters

which adjusts the level of engine trust or output power taken from the shaft within the engine operation range from the beginning of fuel consumption control to the end of its feeding (Categories 7, 9).

Phased antenna array with electronic beam scanning is an antenna shaping up the beam by means of selecting phase ratios (i.e. beam pattern is controlled by means of selecting complex emitting element excitation coefficients and it is variable (both in reception and transmission) by bearing and inclination or in both directions by means of applying an electric signal) (Categories 5, 6).

Fundamental scientific research - experimental or theoretical works carried out mainly to obtain new knowledge of the fundamental principles or observed facts not aimed first and foremost to obtain a particular practical goal or solving a particular task (General Technological Note).

Chemical laser - laser in which the excited medium if formed at the expence of energy of the chemical reaction (Category 6).

Centrifugal spraying - process of transforming a flow or melted metal in a bath by centrifugal force into drops 500 mcm or less in diameter (Category 1).

Digital computer - equipment capable of fulfilling the following functions in the form of one or more discrete variables:

a) receive entered data;

b) store data or commands in permanent or changeable (re-recorded) storage devices;

c) process data by using a recorded sequence of instructions which may change; and

d) provide for data output (Categories 4, 5).

Technical note:

Transformation of the recorded sequence of commands includes a replacement of ROM devices but not a physical change of available wiring or internal connections.

DISN - digital integral service network (Category 5).

Frequency agility (frequency readjustment) - form of spectrum expansion when the transmission frequency of an individual communication channel is readjusted discretely (Category 5).

Digital software control - automated control of a process provided by a device using digital data usually entered as soon as the process proceeds (source: ISO 2382) (Category 2).

Gateways - function implemented by any combination of equipment and software to convert representation, processing, or data transmission standards used in one system into respective other standards used in another system (Category 5).

Systolic matrix computer - computer in which the data flow and their conversion can be controlled dynamically at the level of user logical pattern (Category 4).

Equivalent density is a ratio of optical mass to the optical area unit projected on the optical surface (Category 6).

Expert systems - systems providing results by applying rules to information stored independently of the program and featuring any of the following properties:

a) automatic modification of the program text entered by the user;

b) providing knowledge pertaining to a certain class of problems in a quasinatural language; or

c) obtaining knowledge necessary for their development (symbolic training) (Categories 4, 7).

Melt extraction - process of product extraction and quick hardening in the form of a tape or alloy threads by introduction of a short segment of a cooled rotating disk into the bath with the melted metallic alloy (Category 1).

Electronic assembly - a certain number of electronic components (e.g. circuit elements, discrete components, integrated circuits, and so on) connected to fulfill a certain function(s) which can be replaced or disassembled (Categories 3-5).

Circuit element - separate active or passive part of an electronic circuit, such as a diode, transistor, resistor, capacitor, etc.

Effective gram - for plutonium isotope is defined as isotope weight in grams (Category 1).

***1** Referring a particular commodity or technology to commodities or technologies subject to export control is determined by correspondence of technical characteristics of this commodity or technology to technical description given in the column "Description".

***2** See Notes Item to the given Table matching the one indicated in parenthesis.

***3** In official Wassenaarh documents on export control, dual-purpose conventional armaments, commodities, and technologies, Section 3 of the List is referred to as a subsection of Section 2.

***4** Here and below the parentheses are used to provide the List categories where the given terms are used.