DECREE
OF THE PRESIDENT OF THE RUSSIAN FEDERATION
NO. 228 OF FEBRUARY 21, 1996
ON THE CONTROL OF EXPORTS FROM THE RUSSIAN FEDERATION OF THE EQUIPMENT AND MATERIALS OF DUAL USE AND CORRESPONDING TECHNOLOGIES USED IN THE ATOMIC FIELD, THE EXPORT OF WHICH IS CONTROLLED
(with the Amendments and Addenda of January 21, 1997, May 5, 2000)

Decree of the President of the Russian Federation No. 36 of January 14, 2003 abolished this Decree three months after the day of the official publication of the mentioned Decree

In accordance with Article 16 of the Federal Law on State Control of Foreign Economic Activity (Collection of the Legislation of the Russian Federation No. 42, Item 3923, 1995), and with the purpose of abiding by the international obligations of the Russian Federation on the non-proliferation of nuclear arms, I decree:

1. To approve the List of Equipment and Materials of Dual Use and Corresponding Technologies Used in the Atomic Field, the Export of Which Is Controlled (attached), submitted by the Government of the Russian Federation.

Decree of the President of the Russian Federation No. 32 of January 21, 1997 supplemented the present Decree with the following Paragraph

Decree of the President of the Russian Federation No. 798 of May 5, 2000 amended paragaraph 2 of Item 1 of this Decree
The amendments shall come into force as of April 1, 2000
See the previous text of the paragraph

To establish that the codes of commodity classification of the foreign economic activity mentioned in a List of Equipment and Materials of Double Purpose and Respective Technologies Used for Nuclear Purposes, the Export of Which is under Control may, if the necessity arises, be updated by the State Customs Committee of the Russian Federation with the aim of bringing these in accordance with the international base of the Commodity Classification of the foreign economic activity of the Commonwealth of Independent States and with the Commodity Classification of Foreign Economic Activity of the Russian Federation.

2. The Government of the Russian Federation shall approve the Regulations on the manner of export control from the Russian Federation of equipment and materials of dual use and of corresponding technologies used in the atomic field, the export of which is controlled, and ensure their coming into force concurrently with the entry into force of this Decree.

See the Regulations on the Implementation of Control of Foreign Trade Activities Involving the Dual Use Equipment and Materials and Also Relevant Technology Used for Nuclear Purposes were approved by Decision of the Government of the Russian Federation No. 462 of June 14, 2001

3. To void the Order of the President of the Russian Federation No. 827-rp of December 28, 1992 (Collection of the Acts of the President and the Government of the Russian Federation, No. 1, Item 3, 1993).

4. This Decree (except for Item 2) shall come into force three months after the day of its official publication.

President of the Russian Federation — Boris Yeltsin
Moscow, the Kremlin

LIST
OF DUAL-PURPOSE EQUIPMENT AND MATERIALS AND RESPECTIVE TECHNOLOGIES USED FOR NUCLEAR PURPOSES, THE EXPORT OF WHICH IS CONTROLLED
(Endorsed by the Decree of the President of the Russian Federation No. 228 of February 21, 1996)

See the List of Dual-Use Equipment and Materials and Appropriate Technologies Used for Nuclear Purposes Subject to Export Control endorsed by Decree of the President of the Russian Federation No. 36 of January 14, 2003

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

Section 1.
Industrial Equipment and Respective Technologies

1.1. Rolling and bending machine-tools capable of rolling function, mandrels and specially designed software for them

1.1.1. Rolling and bending machine-tools: 846229100; 846390100; 846390900
a) which have three or more rolls (active and guide ones); and
b) which, according to maker specification, may be outfitted with numerical control or computer control units

Note:
Item 1.1.1 shall also include machine-tools which have only one roll designed to form the metal and two auxiliary rolls which support the mandrel but are not involved directly in the deformation process

1.1.2. Rotary- and-rolling-type mandrels for cylindrical forms with the inner diameter of 75 to 400 mm 846610100

1.1.3. Specially designed software for machine-tools mentioned in Item 1.1.1

1.1.4. Technologies of development, production, or use of equipment indicated in Items 1.1.1 and 1.1.2

Definitions:

(conformably to this list):

1. **"Technology"** - special information necessary for development, production, and use of an item. This information may be transferred as "technical aid" or "technical data"

2. **"Technical aid"** may assume such forms as:

- instructions;
- professional development measures;
- practical training of specialists;
- practical mastering of operational techniques;
- consulting services;

3. **"Technical data"** may be presented in such formats as:

- drawings and their copies;
- charts;
- diagrams;
- prototypes;
- formulas;
- technical designs and specifications;
- reference materials;
- guides and instructions in the form of descriptions or records on disks, tapes, and ROM modules

Notes:

1) Permission to export (transfer, exchange) any of the items (materials or equipment) from the given List envisages simultaneously the handing over of the minimum technology necessary to install, operate, service and repair this item to the end user

2) The present definition of technology shall not apply to "generally available technology" or "fundamental scientific research"

4. **"Generally available technology"** means a technology with no restriction as to its further dissemination. (Copyright restrictions cannot bring the technology outside the "generally available" category)

5. **"Fundamental scientific research"** means experimental or theoretical works carried out mostly with the aim of obtaining new knowledge of the fundamental principles of phenomena and observed facts not pertaining, first and foremost, to achieving a particular practical goal or solving a specific task

6. **"Use"** means operation, installation (including on-site mounting), technical servicing (checks), current maintenance, overhauls, and modernization

7. **"Development"** includes all stages of production, such as:

- design;
- design research;
- analysis of design options;
- working out design concepts;
- assembly and testing of prototypes (experimental specimen);
- patterns of experimental production;
- technical documentation;
- the process of transfer of technical documentation for production purposes;
- structural design works;
- complex design works;
- layout diagram

8. **"Factory"** means all stages of production, such as:

- erection;
- production technology;
- manufacture;
- integration;
- installation (assembly);
- supervision;
- testing;
- quality control measures

9. **"Specially designed software"** shall include the minimum volume of "operation systems", "troubleshooting systems", "technical servicing systems", and "application programs" necessary to furnish the particular equipment so that it can fulfil its assigned function. To execute the same function on some other, incompatible, equipment, one needs to:

a) modify this "software"; or

b) add "programs"

1.2. Numerical control units, machine-tools outfitted with numerical control units, and specially designed software. (Equipment specification is provided in Section 9 of the present List.)	
1.3. Dimension control mechanisms, systems, or devices and specially developed software for them	
1.3.1. Computer or numerical control means of dimension inspection which feature all of the following characteristics: a) two or more coordinate axes; and b) length measurement error equal to or less (better) than (1.25 + _/1000) mkm checked with an instrument with the measurement accuracy of less (better) than 0.2 mkm (_ - measured length in mm)	903180310
1.3.2. Linear measurement instruments featuring the following characteristics: a) contact-free measuring systems with resolution equal to or less (better) than 0.2 mkm in the measuring range of up to 0.2 mm; b) linear variable hybrid systems with linearity equal to or less (better) than 0.1% in the measuring range of up to 5 mm and deviation equal to or less (better) than 0.1% per day in the presence of a standard ambient temperature + 1K; or c) measuring systems with a laser which can preserve the measuring accuracy of + 0.1 mkm or higher and the measuring error equal to or less (better) than (0.2 + _/2000) mkm for at least 12 hours in the presence of a standard temperature +1K and a standard pressure (_ - measures length in mm)	903140000

Note:

In Item 1.3.2, export control shall not apply to measuring interferometer systems without feedback which have a laser used to measure the error attributable to the displacement of movable parts of machine-tools, means of dimension inspection, or similar equipment

1.3.3. Angular measuring instruments with the measuring accuracy equal to or less (better) than 0.00025° of the arc	903140000; 903180310; 903180910

Note:

In Item 1.3.3, export control shall not apply to optical instruments, such as autocollimators, which rely on collimated light in the detection of angular displacement of the mirror

1.3.4. Systems for simultaneous checking of linear and angular parameters of hemispheres, featuring all of the following characteristics: a) measuring error along any linear axis equal to or less (better) than 3.5 mkm per 5 mm; and b) angular measuring error equal to or less than 0.02° of the arc	903140000
1.3.5. Specially designed software for dimension inspection mechanisms, systems, and devices mentioned in Items 1.3.1-1.3.4	

Note:

Specially designed software for systems indicated in Item 1.3.4 shall include software permitting to measure simultaneously the shell thickness and the wall contour

1.3.6. Technology of development, production, or use of equipment indicated in Items 1.3.1 and 1.3.4	

Technical notes:

1) Machine-tools which may be used as measuring devices shall be subject to export control if their parameters correspond to or surpass characteristics fixed for machine-tools or measuring instruments

2) Systems described in Item 1.3 shall be subject to export control if they surpass prototypes subject to export control anywhere in their working range

3) Instruments used to check the accuracy of the readings of dimension inspection systems ought to meet the requirements set forth in VDI/VDE 2617, parts 2, 3, and 4

4) All permissible deviations in the measured parameters in this Item are provided in their absolute value

Definitions:

"Measuring error" - a characteristic parameter indicating the range, as compared to the output value, in which lies the correct value of the measured variable with the 95% confidence level. It includes uncorrected systematic errors, uncorrected clearance, and random deviations

"Resolution" - the lowest increments in the readings of the measuring device; in digital instruments, the least significant digit

"Linearity" (usually measured as non-linearity) - is the maximum deviation of a real characteristic (averaged values of readings up and down the scale) - positive or negative - from the straight line positioned so as to straighten and minimize the maximum deviations

"Deviation of angular position" - maximum difference between angular position and the actual, measured accurately enough, turning angular position of the item mounted on the table as compared to its initial position

1.4. Vacuum induction furnaces, or those with controlled atmosphere (inert gas), specially designed to operate with the working temperature of more than 850°C and having	8504; 851420100

induction coils 600 mm and less in diameter and designed for input power rating of 5 kW or more, as well as power supply equipment with the nominal output power rating of 5 kW or more especially designed for them

Note:
In Item 1.4, export control shall not apply to furnaces designed to process semiconductor wafers

1.5. Isostatic presses capable of reaching a maximum working pressure of 69 MPa and more which have inner diameter of the working chamber more than 152 mm and specially designed punches and matrices, as well as a control system with specially designed software	846299100; 846299500

Technical notes:
1) **"Inner diameter of the chamber"** - is the dimension of the part of the chamber where both the working temperature and the working pressure is obtained and which does not include the internal fixtures. This dimension is determined as the lowest of the two diameters: that of the press chamber or the isolated furnace chamber, depending on which of the chambers is placed inside the other
2) **"Isostatic presses"** - is the equipment capable of producing a surplus pressure in the closed chamber by various means (gas, liquid, hard particles, etc.) while providing an equilibrium pressure on the treated material inside the chamber in all directions

1.6. Technology of development, production, and use of equipment indicated in Items 1.4 and 1.5	
1.7. Robots or working parts featuring one of the following characteristics, as well as specially designed software or specially designed controllers for them	
1.7.1. Robots or working parts specially designed to national safety standards for operation in explosive atmosphere (for example, those meeting restrictions applied to electrical equipment designed to operate in explosive atmosphere)	847989500
1.7.2. Robots or working parts specially designed or rated as radiation-proof which can withstand more than 5x104 Gy (silicon) 5x106 rad (silicon) without affecting operational characteristics	847989500
1.7.3. Specially designed controllers for robots indicated in Item 1.7	853710100; 853710910; 853710990
1.7.4. Specially designed software for robots indicated in Item 1.7	
1.7.5. Technology of development, production, or use of equipment indicated in Items 1.7.1 -1.7.3	

Definitions:
(conformably to Item 1.7):
1) "Robot" - manipulator which can travel continuously or with intervals, which can use sensors,

and features the following characteristics:

a) is a multifunctional device;

b) is capable of mounting or orienting material, parts, tools, or special devices by means of various three-dimensional movements;

c) includes three or more closed- or open-contour servodevices which may include a stepping motor; and

d) has a programming capability affordable to the user through learning/repetition or by means of a computer which may have a logical software control, i.e. the one without mechanical interference

Note:

The robot category indicated in Item 1.7 shall not include the following devices:

a) manipulators operated only manually or by a teleoperator;

b) manipulators with a fixed sequence of actions which are automatic mobile devices operating in accordance with mechanically-restricted preprogrammed movements. The program is mechanically restricted by rigid stoppers, such as pins or cams. The sequence of movements, choice of directions and angles cannot be changed by mechanical, electronic, or electric means;

c) mechanically controlled manipulators with a variable sequence of movements, which are automatically driven devices operating in accordance with mechanically-restricted pre-programmed movements. The program is mechanically restricted by rigid but adjustable stoppers, such as pins or cams.

The sequence of movements and choice of directions and angles can be changed within the preset program model. Variations or modification of the program model (for example, change of (pins or cams) in one or several of coordinate axes are done only through mechanical operations;

d) non-servocontrolled manipulators with a variable sequence of actions, which are automatic mobile devices operating in accordance with mechanically-restricted pre-programmed movements. The program may be changed, but the sequence of commands can be renewed only by means of a binary signal from mechanically-restricted electrical binary devices or adjustable stoppers;

e) piler cranes defined as systems/manipulators operating in Cartesian coordinates, installed as a part of a vertical system of warehouse bunkers and designed to provide storage and unloading of the contents of these bunkers

2) The working parts shall include grips, active means of mechanical treatment, and other tools mounted on the execution mechanism of the manipulator

3) Export control shall not apply to robots specially designed for non-nuclear industrial uses, such as, for example, in automobile paint chambers

1.8. Systems for vibration tests, equipment, their parts and software for them	
1.8.1. Electrodynamic systems for vibration tests relying on feedback or closed-circuit control methods, which include a digital controller capable of producing vibration loads of 10 g or more (root-mean-square value) in the frequency range between 20 Hz and 2,000 Hz with the pushing force of 50 kN or more measured under "clean table" conditions	903120000
1.8.2. Digital controllers which have a real-time frequency bandwidth of more than 50 kHz, designed for use in systems indicated in Item 1.8.1 in combination with specially designed software for vibration tests	853710100; 853710910; 853710990
1.8.3. Vibration pushers (vibrators) outfitted with respective amplifiers, or without them, capable of transmitting an effort of 50 kN and more measured under "clean table" conditions and fit for use in systems	903190900

indicated in Item 1.8.1	
1.8.4. Separate auxiliary and electronic units forming in aggregate a complete vibration testing machine, capable of producing an effort of 50 kN and more measured under "clean table" conditions and fit for use in systems indicated in Item 1.8.1	903120000; 903190900
1.8.5. Specially designed software for use with systems indicated in Item 1.8.1 or with electronic units indicated in Item 1.8.4	
1.8.6. Technology of development, production, or use of equipment indicated in Items 1.8.1-1.8.4	
1.9. Vacuum and with controlled atmosphere metal-making foundry and melting furnaces which have a special computer-control and monitoring structure and specially designed software for them	
1.9.1. Electric arc melting furnaces which use electrodes 1,000 to 20,000 cm3 in volume ensuring the process at melting temperatures of more than 1,700°C	851430900
1.9.2. Electron-beam and plasma-arc melting furnaces featuring a 50 kW power rating or more, ensuring the process at melting temperatures of more than 1,200°C	851430900
1.9.3. Special software for furnaces indicated in Items 1.9.1 and 1.9.2	
1.9.4. Technology of development, production, and use of equipment indicated in Items 1.9.1 and 1.9.2	

Section 2
Materials And Respective Technologies

2.1. Aluminium alloys with the tensile strength threshold of 460 MPa (0.46x109 N/m2) and more at 293°K (20°C) used as pipe or cylindrical rod items (including forgings) with the outer diameter of more than 75 mm	760429100; 760820910; 760820990

Technical note:

In Item 2.1, export control shall apply to both aluminium alloys with the above value of tensile strength obtained after thermal treatment and those which can attain this strength as a result of thermal treatment

2.2. Beryllium of the following types: metal, alloys containing more than 50% of beryllium by weight, beryllium compounds and items of them. Export control shall also apply to waist and scrap containing beryllium in the above mentioned forms	282590200; 282619000; 282739000; 283329900; 283429100; 283699190; 285000900; 811211000;

	811219000

Note:

In Item 2.2 , export control shall not apply to:

a) metallic windows for X-ray units or for well logging instruments;

b) shapes of beryllium oxides, ready-made or semi-finished, specially designed for electronic units or as backings for electronic circuits;

c) beryls (beryllium and aluminium silicates) in the form of emeralds and aquamarines

2.3. High-purity bismuth (99.99% and more) with a very low content of silver (less than 10 ppm)	810600
2.4. Boron and its compounds, mixtures, and materials saturated with it in which boron-10 isotope comprises more than 20% by weight of the whole boron content	284590900
2.5. Calcium (high-purity) containing simultaneously less than 10 parts of boron and 1,000 parts of any metallic impurities per million parts of calcium by weight, except for magnesium	280521000
2.6. Chlorine trifluoride (Cl_3)	281290000
2.7. Crucibles of materials resistant to liquid actinide metals	
2.7.1. Crucibles with 150 ml to 8 l capacity made of the following materials with 98% or more purity or coated with them: a) calcium fluoride (Ca_2); b) calcium zirconate (metazirconate) (Ca2ZrO3); c) cerium sulphide (Ce2S3); d) erbium oxide (Er2O3); e) hafnium oxide (HfO2); f) magnesium oxide (MgO); g) niobium, titanium, and tungsten alloy nitride (approximately 50% Nb, 30% Ti, 20% W); h) Yttrium oxide (Y2O3); i) Zirconium oxide (ZrO2)	690390900
2.7.2. Crucibles with 50 ml to 2 l capacity made of, or protected with tantalum with 99.9% and higher purity	6903; 810390900
2.7.3. Crucibles with 50 ml to 2 l capacity made of, or protected with tantalum with 98% and higher purity, coated with tantalum carbide, nitride, or boride (or any combination of them)	6903; 810390900
2.8. Fiber- or thread-like materials, prepregs, and composite structures with the following characteristics	
2.8.1. Carbon or aramid fibrous or thread-like materials with specific modulus of elasticity equal to 12.7x106 m or more, or a specific tensile strength of 23.5x104 m or more, except for aramid fibrous or thread-like materials with	380190900; 540210100; 540490900; 681510000

0.25% by weight or more of ether-based fiber surface modifier	
2.8.2. Glass fibrous or thread-like materials with specific modulus of elasticity equal to 3.218x106 m or more and specific tensile strength of 7.62x104 m or more	701910; 701920
2.8.3. Impregnated with a thermosetting resin continuous yarns, rovings, oakums, or tapes with the width of no more than 15 mm (prepregs) made of carbonic or glass fibrous or thread-like materials indicated in Items 2.8.1 and 2.8.2	380119900; 392690100; 681510000; 681599900; 701910; 701920

Note:
The resin forms the composite matrix

2.8.4. Composite structures in the form of pipes with the inner diameter of 75 to 400 mm made of fibrous or thread-like materials controlled under Item 2.8.1, or of carbonic impregnated materials controlled under Item 2.8.3	380190000; 392690100; 681510000; 681599900

Technical notes:
1) The term **"fibrous or thread-like materials"** includes continuous monofilament threads, yarn, roving, oakum, or tapes

Definitions:
a) **"Thread"** or **"monothread"** - the smallest constituent part of a fibre, usually several цm in diameter;
b) **"Strand"** - bundle of threads (usually more than 200) positioned approximately in parallel;
c) **"Roving"** - bundle (usually 12-120) of approximately parallel strands;
d) **"Yarn"** - bundle of twisted strands;
e) **"Oakum"** - bundle of threads, usually approximately parallel;
f) **"Tape"** - material composed of interlaced or oriented in a single direction threads, strands, roving, oakum, or yarn, etc. usually preimpregnated with a resin
2) **"Specific modulus of elasticity"** - is the Young's modulus in N/m2 divided by specific weight in N/m3 measured at 23 + 2°C and relative humidity 50 + 5%
3) **"Specific tensile strength"** - is a maximum tensile strength in N/m2 divided by specific weight in N/m3 measured at 23 + 2°C ambient temperature and relative humidity 50 + 5%

2.9. Hafnium in the following forms: metal, alloys, and compounds containing more than 60% of hafnium by weight and items of them	282590900; 282619000; 282690900; 282739000; 282749900; 282760000; 283329900; 283429900; 284190900; 285000100; 285000300; 811291100
2.10. Lithium enriched with isotope 6 (6_и) more than 7.5	284590900

atomic percent; alloys, compounds, or mixtures containing lithium enriched with isotope 6 and items or devices containing any of the above, except for thermofluorescent dosimeters	

Note:
Natural content of isotope 6 in lithium equals 7.5 atomic per cent

2.11. Magnesium (high-purity) containing simultaneously less than 200 parts of metallic impurities by weight, except for calcium, and less than 10 parts of boron per million parts of magnesium	810411000
2.12. Maraging steel with the maximum tensile strength of no less than 2,050 MPa (2.050x109 N/m2) at 293°K (20°C), except for items no single linear dimension of which exceeds 75 mm	7218-7229; 730441900; 730449100

Technical note:
In Item 2.12, export control shall apply to maraging steel which either has this value of the maximum tensile strength after thermal treatment and the one which can attain such value after thermal treatment

2.13. Radium-226, compounds of radium-226 or mixtures containing radium-226, as well as items or devices containing them, except for medical applicators	284440000
2.14. Titanium alloys with the maximum tensile strength of no less than 900 MPa (0.9x109 N/m2) at 293°K (20°C) in the form of pipes or cylindrical rods (including forgings) with the outer diameter of more than 75 mm	810890300; 810890700

Technical note:
In Item 2.14, export control shall apply to titanium alloys which both have the mentioned value of the maximum tensile strength after thermal treatment and the ones which can attain such value after thermal treatment

2.15. Tungsten in the following form: parts of tungsten, tungsten carbide or alloys containing more than 90% of tungsten weighing more than 20 kg and having the form of a hollow symmetrical cylinder (including the cylinder segments) with the inner diameter of more than 100 mm, however, not more than 300 mm, except for the parts specially designed for use as weights or gamma-radiation collimators	284990300; 810199000
2.16. Zirconium with hafnium content of less than 1 part of hafnium per 500 parts of zirconium by weight in the form of metal, alloys containing more than 50% of zirconium by weight and compounds, as well as items made of the mentioned metal alloys and compounds. Export control shall also apply to waste and scrap containing zirconium in the above mentioned form	282560900; 282590900; 282619000; 282690100; 282739000; 282749900; 282760000; 282990100; 283329900; 283429900;

	283529000; 283699190; 283990900; 284190900; 284990900; 285000100; 285000300; 285000900; 291529000; 382320000; 8109

Notes:

1. Item 2.16 shall not apply to pipes or pipe assemblies of metallic zirconium or its alloys specially designed or prepared for use in nuclear reactors which have a weight hafnium to zirconium ratio less than 1:500.

Control over the export of such pipes or their assemblies shall be carried out in compliance with procedure set forth in the federal legislation for export and import of nuclear materials, technology, equipment, installations and special non-nuclear materials

2. In Item 2.16, export control shall not apply to items of zirconium in the form of a foil or tape with the thickness not more than 0.10 mm

2.17. Nickel powder and porous metallic nickel with the following characteristics	
2.17.1. Nickel powder with the nickel purity of 99.0% or higher and average particle size less than 10 μm measured in compliance with ASTM B 330 or equivalent standard, except for the fibrous nickle powders	750400000

Note:

Item 2.17.1 shall not apply to nickel powders specially prepared for making gas diffusion barriers. Control over the export of such nickel powders shall be carried out in compliance with procedure set forth in the federal legislation for export and import of nuclear materials technology, equipment, installations, and special non-nuclear materials

2.17.2. Porous metallic nickel produced by pressing or caking of materials indicated in Item 2.17.1 to make metallic material with fine pores connected internally along the whole structure, except for the sheets of porous metallic nickel sizing less than 1,000 cm2 per sheet	750800900
2.18. Technology of development, production, or use of materials or items of them indicated in Section 2	

Section 3
Equipment, Its Parts, and Respective Technologies for Uranium Isotope Separation
(Except for equipment, its parts and technologies subject to a special procedure of export and import of nuclear materials, technologies, equipment, installations, and special non-nuclear materials under the federal legislation)

3.1. Electrolytic cells used to make fluoride with the	854330000

output capacity of more than 250 g of fluoride per hour

3.2. Equipment used to make and assemble rotors, as well as mandrels and shaping dies for bellows

3.2.1. Installation equipment to assemble pipe sections of the rotor of the gas centrifuge, diaphragms, and covers 847989800

Note:
Equipment indicated in Item 3.2.1 shall include precision mandrels, grips, and shrink fit devices

3.2.2. Adjustment equipment to center pipe sections of the gas centrifuge rotor along the common axis 903180310

Note:
Equipment indicated in Item 3.2.2 consists, as a rule, of precision measuring sensors connected to a computer which controls then, for example, the operation of pneumatic power cylinders used to center pipe sections of the rotor

3.2.3. Mandrels and dies used to make corrugated bellows (bellows made of high-strength alloys or aluminium, maraging steel, and high-strength thread-like materials). The bellows have the following dimensions: 846694000
a) inner diameter of 75 to 400 mm;
b) length of 12.7 mm and more; and
c) depth of the corrugation more than 2 mm

3.3. Centrifugal multiplane balancing machines - stationary or mobile, horizontal or vertical

3.3.1. Centrifugal balancing machines to balance flexible rotors having the length of 600 mm or more and all of the following characteristics: 903110000
a) hinge or shaft, 75 mm or more in diameter;
b) capability to balance the mass of 0.9 to 23 kg; and
c) capability to make the balancing with rotational speed of more than 5,000 rpm

3.3.2. Centrifugal balancing machines designed to balance the parts of a cylindrical rotor which have the following characteristics: 903110000
a) shaft 75 mm or more in diameter;
b) capability to balance the mass of 0.9 to 23 kg;
c) capability to make the balancing with residual disbalance of 0.010 kg per mm/kg and less (better); and
d) belt-type drive

3.3.3. Specially designed software for the balancing machines indicated in Items 3.3.1 and 3.3.2

3.4. Winding machines in which fibre positioning, wrapping, and winding motions are coordinated and programmed along two or more axes, specially designed to make composite or lamellar structures of fibrous or thread-like materials permitting the winding of cylindrical rotors 75 to 400 mm in 844590000

diameter with the length no less than 600 mm; coordinating and programming control devices for them, precision mandrels, as well as specially designed software for them

3.5. Frequency converters (also called inverters) or generators which have the following characteristics: 850230990; 850240900

a) polyphase output with the power rating of 40 W or more;

b) developing its power capabilities in the frequency range from 600 to 2,000 Hz;

c) total non-linear distortions below 10%;

d) frequency adjustment with accuracy less (better) than 0.1%

Note:

In Item 3.5, export control shall not apply to frequency converters specially developed or prepared to provide power supply to electric motor stators (definition is provided below) and which have characteristics mentioned in Subitems (b) and (e) of Item 3.5, as well as the total nonlinear distortion of less than 2% and efficiency higher than 80%

Definition:

"Electric motor stators" - specially developed or prepared circularform stators for high-speed, polyphase, hysteresis (or reaction-type) alternating current electric motors designed for synchronous operation in vacuum in the 600-2,000 Hz frequency range and with the power rating from 500 to 1,000 W. Stators consist of polyphase windings made on a ferrous, low-loss core consisting of thin pressed sheets with the thickness of 2.0 mm or less

3.6. Lasers, laser amplifiers and generators, including:

3.6.1. Copper vapor lasers with an average output power rating of 40 W or more operating in the 500-600 nm wave length range 901320000

3.6.2. Argon ion lasers with an average output power rating of more than 40 W operating in the 400-515 nm wave length range 901320000

3.6.3. Neodymium ion lasers (except for glass ones) including: 901320000

1) pulsing, Q-switching ones with the wave length of 1,000-1,100 nm and pulse duration of 1 ns and more which have:

a) output signal with a one transverse mode and average output power rating exceeding 40 W;

b) output signal with several transverse modes and an average output power rating exceeding 50 W

2) operating in the wave-length range of 1,000 to 1,100 nm and capable of frequency doubling and producing the wave length of the output emission from 500 to 550 nm with the average output capacity at the doubled frequency of more than 40 W (with a new wave length)

3.6.4. Adjustable unimodal pulsing dye lasers capable of producing an average output capacity of more than 1 W with 901320000

the pulsing frequency of more than 1 kHz, pulse duration less than 100 ns, and the wave length from 300 to 800 nm

3.6.5. Adjustable pulsing laser amplifiers and dye generators, except for the unimodal generators, with an average output capacity of more than 30 W, pulsing frequency more than 1 kHz, pulse duration less than 100 ns, and the wave length from 300 to 800 nm 901320000

3.6.6. Alexandrite lasers with the band width of no more than 0.005 nm, pulsing frequency more than 125 Hz, average output capacity more than 30 W, and the wave length from 720 to 800 nm 901320000

3.6.7. Pulsing lasers operating on carbon dioxide with the pulsing frequency of more than 250 Hz, average output capacity more than 500 W, and pulse duration more than 200 ns operating on wave lengths from 9,000 to 11,000 nm 901320000

Note:

In Item 3.6.7, export control shall not apply to more powerful (with the power rating of 1-5 kW) industrial lasers operating on CO2 used for cutting and welding, because these lasers operate either in a continuous mode or in a pulsing mode with the pulse duration of more than 200 ns

3.6.8. Pulsing eximer lasers (be_, beCl, Kr_) with the pulsing frequency of more than 250 Hz and average output capacity higher than 500 W operating in the wave length range of 240 to 360 nm 901320000

3.6.9. Hydrogen vapor Raman phase shifters designed for operation with the wave length of 16 cm and repetition frequency of more than 250 Hz 901380000

Technical note:

Machine-tools, measuring devices and technologies pertaining to them, which can be used potentially in the nuclear industry, shall be controlled in compliance with Items 1.2 and 1.3

3.7. Mass spectrometers capable of measuring mass nucleon numbers equal to 230 and more with the resolution better than 2x230 and sources of ions for them, including:

3.7.1. Mas spectrometers with induction confined plasma (PMS/IS) 902780990

3.7.2. Glow-discharge mass spectrometers (MSTR) 902780990

3.7.3. Thermo-ionizing mass spectrometers (TIMS) 902780990

3.7.4. Electronic impact mass spectrometers with an ionization chamber designed of materials resistant to uranium hexafluoride or protected with such materials 902780990

3.7.5. Molecular beam mass spectrometers, such as: 902780990

1) which have an ionization chamber designed of

stainless steel or molybdenum, or protected with them, and a cooling chamber providing for the cooling to 193°K (-80°C) and below; or 2) which have an ionization chamber designed of materials, or protected with materials resistant to uranium hexafluoride	
3.7.6. Mass spectrometers outfitted with a microfluoride source of ions designed for use with actinides or actinide fluorides	902780990

Note:

In Item 3.7, export control shall not apply to specially designed or prepared magnetic or quadrupole mass spectrometers capable of a real-time sampling of input flows, finished products, or tails of gas flows of uranium hexafluoride which have all of the following characteristics:

a) mass resolution over 320;

b) sources of ions designed of Ni-Cr or Monel alloys, or protected with these materials, or those with a nickel coating;

c) electronic-impact sources of ions;

d) having a collector system fit for isotope analysis

3.8. Pressure gauges capable of measuring the absolute pressure in the range between 0 and 13 kPa with the sensitive elements made of or protected with nickel, nickel alloys containing more than 60% of nickel by weight, or aluminium or aluminium alloys	
3.8.1. Pressure gauges with the full scale of 13 kPa and accuracy better than + 1% of the full scale	902620300
3.8.2. Pressure gauges with the full scale of 13 kPa or more and accuracy better than + 130 Pa	902620300

Technical notes:

1) **"Pressure gauges"** - instruments converting the measured pressure into an electrical signal

2) For purposes indicated in Items 3.8.1 and 3.8.2, the **accuracy** shall include non-linearity, hysteresis, and reproduction ability at various ambient temperatures

3.9. Valves with at least 5 mm nominal bore with a bellows packer completely made of aluminium, aluminium alloy, nickel or an alloy containing no less than 60% of nickel, or coated with them, operated either manually or automatically	848110900; 848130990; 848140900

Note:

For valves with different input and output diameters, the nominal bore parameter refers to the lower diameter

3.10. Superconducting solenoid electrical magnets which have simultaneously the following characteristics: a) ability to induce magnetic fields of more than 2 T (20 kgf); b) length to inner diameter ratio, _/D, more than 2; c) inner diameter more than 300 mm; and d) uniformity of the magnetic field better than 1%	850590100

within the 50% of the inner volume in the center

Note:

In Item 3.10, export control shall not apply to magnets specially designed for medical nuclear magnetic resonance display systems and exported as integral parts. The words "integral parts" may not necessarily imply a physical part of the same equipment. It is permitted to make individual shipments from different sources under the condition that respective export documents clearly indicate the linkage of component parts

3.11. Vacuum pumps with the input diameter no less than 38 cm, pumping-out rate of 15,000 liters per second or more, and ability to produce a limiting vacuum with the rarefaction value less than 1.33x10-4 millibar (10-4 torr)	841410300; 841410500; 841410900

Technical notes:

1) Limiting vacuum - the value of vacuum determined at pump inlet at closing

2) Pumping-out rate is determined when measured with nitrogen or air

3.12. Powerful rectifiers capable of continuous operation for more than 8 hours at more than 100 v, output current of 500 A or more, current or voltage stability better than 0.1%	850440990
3.13. High-voltage sources of direct current capable of producing 20,000 v or more for 8 hours with the output current of 1 A or more and current or voltage stability better than 0.1%	8501
3.14. Electromagnetic isotope separators outfitted with one or several sources of ions, capable of producing a total current of an ion beam of 50 mA or more	840120000

Technical notes:

1) The requirement of Item 3.14 applies to separators capable of enrichment with stable isotopes, including uranium ones. Separator which can separate lead isotopes with a one mass unit distinction is capable of uranium isotope enrichment with a three mass unit distinction

2) The requirement of Item 3.14 includes both separators with sources of ions and collectors in the magnetic field and configurations which have them outside the field

3) A single source of ions with a 50 mA current permits to separate less than 3 g of highly enriched uranium per year from natural raw uranium

3.15. Technology of development, production, or use of equipment indicated in Items 3.1-3.14	

Section 4
Equipment and Respective Technologies Pertaining to Installations Producing Heavy Water
(Except for equipment and technologies subject to a special procedure of export and import of nuclear materials, technologies, equipment, installations, and special non-nuclear materials under the federal legislation)

4.1. Specialized assemblies designed to isolate heavy water	840120000;

from an ordinary one, made of phosphor bronze (chemically treated to improve wettability) and designed for application in vacuum distilling towers

4.2. Pumps used to transfer catalyst solutions from diluted or concentrated potassium amide in liquid ammonia (KNH2/NH3) with the following characteristics:
a) air-tight (hermetically sealed);
b) for concentrated solutions of potassium amide (more than 1%) with the working pressure of 1.5-60 MPa (15-600 at) and for diluted solutions of potassium amide (less than 1%) with the working pressure of 20-60 MPA (200-600 at); and
c) output capacity more than 8.5 m3/h — 8413

4.3. Plate-type exchange columns for water-to-hydrogen sulphide exchange made of high-quality carbon steel, 1.8 m in diameter and more, capable of operation under nominal pressure of 2 MPa or more, and internal contactors for them — 840120000

Notes:

1. Item 4.3 shall not apply to columns specially designed or fit for production of heavy water.

Control over the export of such columns is carried out in compliance with procedure set forth in the federal legislation for the export and import of nuclear materials, technologies, equipment, installations, and special non-nuclear materials

2. Internal contactors of columns indicated in Item 4.3 are segmented plates with an effective diameter of 1.8 m or more when assembled, designed to provide a counterflow contact and made of materials resistant to corrosion produced by hydrogen sulphide/water mixtures. These may be sieve trays, perforated trays, bubble-cup trays, and spiral extension pieces

3. High-quality carbon steel indicated in Item 4.3 is defined as a steel with the size of austenitic grain N 5 or more according to ASTM (or equivalent) standard

4. Materials resistant to corrosion produced by hydrogen sulphide/water mixtures indicated in Item 4.3 are defined as stainless steels with 0.03% or less carbon content

4.4. Hydrogen cryogenic distilling columns which have all of the following uses and characteristics:
a) for operation at internal temperature from -238°C (35°K) and below;
b) for operation at internal pressure from 0.5 to 5 MPa (from 5 to 50 at);
c) made of fine-grain stainless steel series 300 with a low content of sulphur or of other equivalent cryogenic materials compatible with hydrogen; and
d) having an inner diameter of less than 1 m and effective length no less than 5 m — 841940000

Technical note:

Fine-grain stainless steels indicated in Item 4.4 are defined as fine-grain austenitic stainless steels with the size of the grain # 5 or more according to ASTM (or equivalent) standard

4.5. Ammonia synthesizing converters or ammonia synthesizing sections in which the synthesis gas (nitrogen and hydrogen) is introduced from an ammonia-hydrogen exchange high-pressure column and the synthesized ammonia is returned to — 840120000

the same column	
4.6. Turbo-expanders or turbo-expander-compressor units designed for operation at temperatures below 35°K and through-put capacity for gaseous hydrogen of 1,000 kg/h or more	841430910
4.7. Technology of development, production, or use of equipment indicated in Items 4.1-4.6	

Section 5
Equipment Used to Develop Demolition Systems and Respective Technologies

5.1. Pulse X-ray generators or pulse electronic accelerators:	
a) which have a peak accelerator electron energy of 500 keV or more, however, less than 25 MeV with a 0.25 or more quality (Q), where Q is determined using the formula:	854310000; 902219000
Q=1.7x103V2.65Y	
where, V - peak electron energy in megaelectonvolts, and Y - total accelerated discharge in coulombs, if the accelerator beam pulse duration is equal or less than 1 mks. If the accelerator beam duration is more than 1 mks, then Y -is the maximum accelerated discharge per 1 mks, Y, equal to the integral and, taken over t, to the interval representing the least value of 1 цs or beam pulse duration (Y = udt), where u - beam current in amperes, and t - time in seconds; or	
b) which have a peak electron energy of 25 MeV or more and a peak power rating of 50 MW (peak power is equal to the peak potential in volts multiplied by the peak beam current in amperes)	854310000; 902219000

Note:

In Item 5.1, export control shall not apply to accelerators which make an integral part of devices designed for purposes other than obtaining electronic beams or X-ray radiation (for example, electronic microscopy) and devices designed for medical uses

Technical note:

Duration of the beam pulse - in devices based on microwave acceleration chambers, is the least of the two values: 1 цs or duration of a grouped beam pulse packet determined by the microwave modulator pulse length

Peak beam current - in devices based on microwave acceleration chambers, is the average current value during the grouped pulse packet beam

5.2. Multi-stage light-gas mass accelerators or other high-speed means of throwing (coil-type, electromagnetic, electrothermal, or other promising systems) capable of providing a travel velocity for the item of 2 km/s or more	8501
5.3. Rotating mechanical mirror cameras and specially designed parts for them	

5.3.1. Frame cameras with registration speeds of more than 225,000 frames per second	900711000; 900719000
5.3.2. Tracking cameras with recording speeds of more than 0.5 mm/μs	900711000; 900719000
5.3.3. Parts for cameras indicated in Items 5.3.1 and 5.3.2, including electronic synchronization blocks and rotor units consisting of turbines, mirrors, and bearings	900791900
5.4. Electronic frame and tracking cameras and tubes	
5.4.1. Electronic tracking cameras with the time resolution of 50 ns or more and tracking tubes for them	852810610; 852820200
5.4.2. Electronic frame cameras (or those outfitted with electronic shutters) with exposure time of 50 ns or less	852810610; 852820200
5.4.3. Frame tubes and semiconductor display devices for use in cameras indicated in Item 5.4.1, including: 1) close-focusing image intensifier tubes which have a photocathode settled on a transparent current-conducting coating to reduce photocathode dark resistance; 2) supersilicon cones with a control electrode in which a high-speed system permits to strobe photoelectrons from the cathode before they reach the anode of the supersilicon cone; 3) electronic Kerr- and Pockels-cell shutters; or 4) other frame tubes and semiconductor display devices which have a high-speed shutter with the operation time of less than 50 ns specially designed for cameras controlled under Item 5.4.2	852810610; 852820200; 854020300; 854020900; 854030
5.5. Special instruments for hydrodynamic experiments	
5.5.1. Interferometers to measure pressure change speeds of more than 1 km/s with the time intervals less than 10 μs	902620300;
5.5.2. Manganin gauges for more than 100 kbar pressure	902620300
5.5.3. Quartz converters for more than 100 kbar pressure	902620300
5.6. Technology of development, production, or use of equipment indicated in Items 5.1-5.5.3	

Section 6
Explosives, Equipment and Respective Technologies Pertaining to Them

6.1. Detonators and multipoint initiation systems (with a blasting strap jumper, impact-type, and other)	
6.1.1. Electrodetonators: 1) spark-type; 2) electric;	360300

3) impact-type; and
4) initiators with the blasting foil

6.1.2. Devices which use one or several detonators designed for nearly simultaneous initiation of the explosive on the surface (more than 5,000 km2) from a single signal (with the time difference along the whole area less than 2.5 s) 854380900

Description:

All detonators mentioned in Item 6.1 use a small electric conductor (bridge blasting wire or foil) which evaporates with the explosion when a powerful electric pulse passes through it. In non-impact fuses, the blasting wire initiates a chemical detonation in the sensitive explosive contacting it, such as pentaerythritoltetranitrate. In impact detonators, the blasting evaporation of the wire actuates a striker or a plate in a clearance, and the plate's impact on the explosive initiates the chemical detonation.

In some designs, the striker is accelerated by a magnetic field. The term "blasting foil detonator" may refer to both detonators with a blasting conductor and impact-type detonators. Besides, sometimes the term "initiator" is used instead of the term "detonator".

Note:

In Items 6.1.1-6.1.2, export control does not apply to detonators which use only a primary explosive, such as lead azide

6.2. Electronic parts for initializing (ignition) devices (switching devices and capacitors for impulse discharge)

6.2.1. Switching devices

6.2.1.1. Tubes with a cold cathode (including gas dischargers and vacuum spark relays), regardless of whether they are filled with gas or not, acting as a spark gap, containing three and more electrodes and which have all of the following characteristics: 854089900
a) peak anode voltage 2,500 v or more;
b) peak anode current 100 A or more;
c) anode delay 10 цs or less

6.2.1.2. Controlled spark dischargers which have anode delay not more than 15 mks and designed for a peak current of 500 A or more 853690800

6.2.1.3. Modules or assemblies for quick switching which have all of the following characteristics: 8535
a) peak anode voltage of 2,000 v or more;
b) peak anode current of 500 A or more; and
c) switching time of 1 mks or less

6.2.2. Capacitors with the following characteristics: 853210000;
a) voltage more than 1.4 kV, energy reserve more than 10 J, capacity more than 0.5 mkF, series inductance less than 50 nH; or 853229000
b) voltage more than 750 V, capacity more than 0.25 mkF, series inductance less than 10 nH

6.3. Initializing devices and equivalent strong-current pulse generators (for controlled detonators)

6.3.1. Initializing devices of detonators of explosive devices designed to initiate parallel-control detonators mentioned in Item 6.1	854380900
6.3.2. Modular electric pulse generators designed for portable, mobile, or heavy-duty application (including xenon drivers with a flash-bulb) which have all of the following characteristics: a) capable of releasing all stored energy within less than 15 mks; b) producing an output current of more than 100 A; c) with the pulse rise time less than 10 mks at load impedance less than 40 Om (Pulse rise time is defined as the time interval between 10% and 90% of the current amplitude passing through a respective load.); d) made in a dust-proof package; e) not one of the dimensions exceeding 25.4 cm; f) weight less than 25 kg; and g) fit for use in the temperature range from -50°C to +100°C or specified as fit for use in the outer space	854320000; 854380900
6.4. Powerful explosives or mixtures containing more than 2% of any of the following substances: a) cyclotetramethylene tetranitramine (octogen); b) cyclotrimethylene trinitramine (hexogen); c) triaminotrinitrobenzole; d) any explosive with the crystal density more than 1.8 g/cm3 which have detonation rate more than 8,000 m/s; or e) hexanitrostilbene	360200000
6.5. Technology of development, production, or use of explosives and equipment pertaining to them mentioned in Items 6.1-6.4	

Section 7.
Equipment and Its Parts Used for Nuclear Tests and Respective Technologies

7.1. Oscillographs and recorders of transient processes and specially designed parts for them, including: interchangeable units, external amplifiers, preamplifiers, signal reading devices and cathode-ray tubes for analogue oscillographs	
7.1.1. Non-modular analogue oscillographs with the band width of 1 GHz or more	903020900
7.1.2. Modular analogue oscillograph systems which have any of the following characteristics: a) main device with the band width of 1 GHz or more; or b) interchangeable modules with individual band width of 4 GHz or more	903020900
7.1.3. Analogue stroboscopic oscillographs used to	903020900

investigate periodic processes with effective band width of more than 4 GHz	
7.1.4. Digital oscillographs and recorders of transient processes using analogue-to-digital conversion methods, capable of storing transient processes by consecutive strobing of single input signals with consecutive intervals of less than 1 ns (more than 1 million operations per second) which have 8-bit or more digital conversion and 256-bit or more memory	903020900

Definition:

"Band width" is defined as the frequency band within which CRT cathode defection does not drop below the 70.7% level of the maximum deflection measured at constant input voltage supplied to the oscillograph

7.2. Photomultiplier tubes with the photocathode area more than 20 cm2 which have anode pulse rise time less than 1 ns	854020900
7.3. Superhigh-speed pulse generators with the output voltage of more than 6 V at resistive load less than 55 Om and pulse rise time (front length) less than 500 ps (defined as the time interval between 10% and 90% of the voltage amplitude)	854320000
7.4. Technology of development, production, or use of equipment and its parts for nuclear tests mentioned in Items 7.1-7.3	

Section 8.
Other Equipment, Materials, And Respective Technologies

8.1. Neutron generator systems including tubes designed for operation without an external vacuum system and using electrostatic acceleration to induce the tritium-deuterium nuclear reaction	854310000
8.2. Equipment pertaining to nuclear reactors, as well as the one pertaining to the handling of nuclear materials and their processing	
8.2.1. Remote-control manipulators which can be used to provide remote-control actions in radio-chemical separation and in hot chambers, in particular: a) capable of transmitting operator actions through the wall of a hot chamber with the thickness of 0.6 m or more ("through-the-wall" operation); or b) capable of transmitting operator actions through the cover of a hot chamber with the wall thickness of 0.6 m or more ("through-the-cover" operation)	842890990

Note:

Remote-control manipulators mentioned in Item 8.2.1 can transmit the actions of the human operator to a remote-control arm and the terminal grip. They may be of a "master/slave" type (manipulators repeating operator movements) or controlled with a joystick or keyboard

8.2.2. High-density (made of lead glass or other materials) radiation protection windows with the area of more than 0.09 m2 of the cold surface, density higher than 3 g/cm3, and thickness 100 mm or more, and specially designed frames for them	902290900
8.2.3. Radiation-proof TV cameras or lenses for them, specially designed or specified as radiation-proof, and withstanding more than 5x104 Gy (silicon) 5x106 rad (silicon) without affecting the working characteristics	852530990; 900219000
8.3. Tritium, tritium compounds, and mixtures containing tritium, in which its portion in the total number of hydrogen atoms is more than 1 per 1,000, and items or devices containing them	284440000
8.4. Factories, units, and equipment for tritium production	
8.4.1. Factories or units for tritium production, regeneration, isolation, concentration, and handling it	8401
8.4.2. Equipment for factories and units producing tritium	
8.4.2.1. Hydrogen or helium cooling devices capable of cooling them to -250°C (23°K) or lower with the heat remover power capacity of more than 150 W	8418; 840120000; 841950900; 841989900
8.4.2.2. Systems for storing and purification of hydrogen isotopes which use metal hydrides as a means of storage or purification	840120000
8.5. Platinum-coated catalysts specially designed or prepared to accelerate the hydrogene isotope exchange reaction between hydrogen and water for tritium reduction from heavy water or for making heavy water	381512000
8.6. Helium-3 or helium enriched with helium-3 isotope, mixtures containing helium-3 and products or devices containing them	284590900
8.7. Alpha-radiating radionuclides with the alpha half-decay period of no less than 10 days, however, not more than 200 years, compounds or mixtures containing any of these radionuclides with the total alpha-activity of 1 curie per 1 kg (37 GBq/kg) or more and products or devices containing them	2844
8.8. Factories, units, and equipment used to separate lithium isotopes	
8.8.1. Factories or units used to separate lithium isotopes	840120000
8.8.2. Equipment used to separate lithium isotopes	840120000

8.8.2.1. Columns for liquid-to-liquid exchange with extension pieces specially designed for lithium amalgams	840120000; 847989800
8.8.2.2. Pumps for mercury and/or lithium amalgams	841381900
8.8.2.3. Cells for lithium amalgam electrolysis	854330000
8.8.2.4. Evaporators for concentrated solution of lithium hydroxide	840120000; 841989900
8.9. Technology of development, production, or use of equipment and materials mentioned in Items 8.1-8.8.2.4	

Section 9.
Supplement to Item 1.2 of Section 1 of the List

9.1. Numerical-control units, machine-tools outfitted with numerical-control units and specially designed software for them	
9.1.1. Numerical-control units or any combination of electronic devices or systems capable of operation as a numerical-control unit, fit for controlling five or more interpolated axes which may be managed simultaneously in coordination to provide contour control, specially designed or modified for machine-tools subject to export control under Items 9.1.2-9.1.2.4	853710100
9.1.2. Machine-tools for cutting metals, ceramics, or composite materials which, according to maker specification, may be outfitted with electronic devices for simultaneous contour control along two or more axes	
9.1.2.1. Turning lathes which have positioning accuracy with all compensatory capabilities less (better) than 0.006 mm along any linear axis (general positioning) for machine-tools fit for machining the parts more than 35 mm in diameter	8458; 846490900; 846599100

Note:

In Item 9.1.2.1, export control shall not apply to rod-working machine-tools restricted to only feed-trough rods, if the maximum diameter of the rod is equal to or less than 42 mm, and there is no opportunity to install chucks. The machine-tools may have the drilling and/or milling functions to work the pieces less than 42 mm in diameter

9.1.2.2. Milling machine-tools which have any of the following characteristics: a) positioning accuracy with all compensatory capabilities less (better) than 0.006 mm along any linear axis (general positioning); or b) two or more horizontal axes of rotation	845931000; 845939000; 845951000; 845961; 845969; 846490900; 846592000

Note:

In Item 9.1.2.2, export control shall not apply to milling machinetools which have the following characteristics:

a) X-axis movement more than 2 m, and

b) total X-axis positioning accuracy more (worse) than 0.030 mm

9.1.2.3. Grinding machine-tools which have any of the following characteristics:	846011000; 846019000;
a) positioning accuracy with all compensatory capabilities less (better) than 0.004 mm along any linear axis (general positioning); or	846021; 846029; 846420900;
b) which have two or more horizontal axes of rotation	846593000

Note:

In Item 9.1.2.3, export control shall not apply to the following grinding machine-tools:

1) machine-tools for external, internal, and external-and-internal grinding which have all of the following characteristics:

a) designed only for cylindrical grinding;

b) maximum outer diameter or length of the worked piece 150 mm;

c) which have no more than two coordinate axes which can be managed simultaneously in coordination to provide contour control; and

d) horizontal C-axis is not available;

2) jig-grinding machine-tools with axes restricted to X, Y, C, and A, where the C-axis is used for perpendicular mounting of the grinding wheels with respect to the worked surface, and the A-axis, for grinding the cylindrical cams;

3) software-controlled machine-tools for sharpening the cutters and cutting tools specially designed to make cutters or cutting tools; or

4) grinding machine-tools for crankshafts and camshafts

9.1.2.4. Wireless-type machine-tools for electro-spark machining which have two or more circular contour-machining coordinates which can be controlled simultaneously in coordination to provide contour control	845630000

Note.

(conformably to Items 9.1.2-9.1.2.4):

Instead of individual test protocols, one may use the guaranteed levels of positioning accuracy for each machine-tool model subject to ICO-approved testing procedure

Technical notes:

(conformably to Items 9.1.2-9.1.2.4)

1. Axes classification ought to be in line with the international ICO 841 standard "Numerical-control machine-tools. Classification of axes and types of movements"

2. Not counted in the total horizontal axes of rotation are secondary ones, parallel to horizontal axes of rotation, whose central line is parallel to the primary axis of rotation

3. Axes of rotation may not necessarily provide a more than 360° rotation. The axis of rotation may be controlled by a linear movement device, for example, a screw or a rack with a gear

9.1.3. Software

9.1.3.1. Software specially designed or modified for development, production, or use of equipment mentioned in Items 9.1.1-9.1.2.4

9.1.3.2. Software for any combination of electronic devices

or systems which enable this device(s) to operate as a numerical control unit capable of controlling five or more interpolated axes which can be controlled simultaneously in coordination to provide contour control

Notes:

1. In Items 9.1.3.1-9.1.3.2, export control shall apply to software if it is supplied separately, or if it is placed in the numerical-control unit or any electronic device or system

2. In Items 9.1.3.1-9.1.3.2, export control shall not apply to software specially designed or modified by the maker of the control unit, or machine-tool, to control machine-tools not subject to export control

Definitions:

(conformably to Section 9)

"Accuracy" - usually measured through inaccuracy, defined as a maximum permitted positive or negative deviation of the indicated value from the accepted standard or true value

"Contour control" - two or more numerically controlled movements carried out in compliance with commands assigning the next required position and required speeds of feeding to this position. These speeds may vary with respect to each other so as to make a necessary contour (see ICO/IC 2806-1980)

"Laser" - device consisting of parts which generate a coherent light emission amplified with an induced emission

"Microprogram" - sequence of elementary commands stored in a special memory module whose execution is initiated by entering an indicator command to command register

"Numerical control" - automatic control of the process carried out by a device using digital data usually entered in the course of execution of an operation (see ICO 2382)

"Positioning accuracy" - accuracy of selecting the position in numerical-control machine-tools, ought to be determined and represented in compliance with paragraph 2.13 ICO/IC 230/2 in combination with the requirements presented below:

1) testing conditions (ICO/IC 230/2, Item 3):

a) 12 hours before and during the measuring, the machine-tools and equipment for accuracy testing ought to be maintained in the same ambient temperature. During preparation, the guide rails of the machine-tool ought to be maintained in the operative cycle mode to be used during accuracy testing;

b) the machine-tool ought to be outfitted with any mechanical, electronic, or embedded in the software compensation system to be exported together with it;

c) the accuracy of the measuring equipment must be at least four times as high as the expected accuracy of the machine-tool;

d) the source of electric power supply for the guide drives ought to meet the following requirements;

- fluctuations of the mains supply voltage must not be more than +10% of the nominal voltage level;
- frequency fluctuations must not be more than +2 Hz of the nominal value;
- power supply failures or discontinuation are not allowed

2) testing program (Item 4):

a) the feed speed (speed at the guide rails) during the measurements ought to be such as to provide for a quick transverse feeding;

Note:

For machine-tools producing optical quality surfaces, the feed speed ought to be no more than 50 mm per minute

b) the measurements ought to be arranged in ascending order from one extreme coordinate-change value to another without returning to the initial position for each movement to the

final position;

c) axes not scheduled for testing ought to be in the medium position

3) presentation of test results (Item 2):

- results of the measurements ought to include:

a) "positioning accuracy" (A) and

b) average positioning error measured after reverse movement (B);

"Program" - sequence of commands used to execute the process presented in such a form as to be executed by an electronic computer or may be converted in such a form

"Sensors" - detectors of physical phenomena whose output signal (after being converted into a signal which can be interpreted by a controller) is capable of creating "programs" or modify the programmed commands or digital data of the programs. These include "sensors" using the principles of machine vision, infra-red vision, acoustic visualization, tactile perception, inertial position measurement, optical or acoustic measuring of distances, or efforts, or torques

"Software" - set of one or more "programs" or "microprograms" stored in any tangible media

"User-affordable programming capability" - user ability to add, modify, or replace the programs by means other than:

a) physical changes to the wiring and scheme of connections; or

b) imposing a functional control including entry of parameters