IAEA
Атом для мира

Информационный циркуляр

INFCIRC/832
12 декабря 2011 года

Общее распространение

Русский
Язык оригинала: английский

Сообщение Постоянного представительства Пакистана при Агентстве от 17 октября 2011 года о политике экспортного контроля правительства Пакистан и имеющем силу закона постановлении

Генеральный директор получил сообщение Постоянного представительства Пакистана при Агентстве от 17 октября 2011 года, в приложении к которому содержится нота, где излагается политика экспортного контроля правительства Пакистана и имеющее силу закона постановление (SRO 699 (I)/2011) о внесении поправок в Контрольные списки товаров, технологий, материалов и оборудования, связанных с ядерным и биологическим оружием и системами его доставки, которые приведены в постановлении SRO 1078 (1)/2005.

В соответствии с выраженной в сообщении просьбой нота и имеющее силу закона постановление[1] распространяются для сведения всех государств-членов.

[1] Имеющее силу закона постановление приводится на английском языке в онлайновой версии настоящего документа.

Стратегические меры экспортного контроля и пересмотренные Контрольные списки Пакистана

- Правительство Пакистана, как ответственного государства, обладающего ядерным оружием, полностью уважает свои национальные и международные обязательства.

- Пакистан, принимая стратегические меры экспортного контроля, стремится внести дальнейший вклад в международные усилия, направленные на нераспространение оружия массового уничтожения и средств его доставки.

- В 2004 году в Пакистане был принят закон о контроле за экспортом товаров, технологий, материалов и оборудования, связанных с ядерным и биологическим оружием и системами его доставки (распространен Агентством в качестве документа INFCIRC/636 26 ноября 2004 года). Аспекты, касающиеся химического оружия, рассматриваются в отдельном законе, принятом в 2000 году.

- В этом законе об экспортном контроле совершенствуются меры контроля за экспортом, реэкспортом и другими формами передачи, перегрузки и транзита товаров, технологий, материалов и оборудования, в том числе запрещается переключение контролируемых товаров и технологий, он охватывает нематериальную передачу технологий и включает всеобъемлющие положения.

- Во исполнение закона в 2005 году правительство Пакистана определило национальный Контрольный список товаров, технологий, материалов и оборудования, связанных с ядерным и биологическим оружием и системами его доставки (распространен Агентством в качестве документа INFCIRC/669 от 27 февраля 2006 года).

- В Контрольных списках приводятся перечни предметов и устанавливается сфера действия экспортного контроля, которые определяются Группой ядерных поставщиков (ГЯП), Австралийской группой (АГ) и в рамках Режима контроля за ракетными технологиями (РКРТ). Система классификации основана на комплексном списке Европейского союза.

- В 2007 году в составе министерства иностранных дел был образован отдел стратегического экспортного контроля (СЕКДИВ), как это требовалось в статье 3 закона о контроле за экспортом. СЕКДИВ разрабатывает и обеспечивает соблюдение правил и норм экспортного контроля и выступает в качестве лицензирующего органа.

- Кроме того, для надзора за осуществлением закона о контроле за экспортом и работой СЕКДИВ был также учрежден Совет по надзору.

- В 2009 году были введены в действие Правила экспортного контроля (лицензирования и обеспечения соблюдения), где излагается соответствующий подробный порядок (доступ к ним можно получить на сайте http://www.mofa.gov.pk/documents/secdiv/document1.pdf). Любой экспорт товаров и технологий, перечисленных в законе о контроле за экспортом и Контрольном списке, полежит регистрации и лицензированию в СЕКДИВ.

- На различных уровнях была начата также реализация разных инициатив по дальнейшему укреплению механизма обеспечения соблюдения. Они предусматривают меры по установке аппаратуры обнаружения, подготовке кадров, информированию и межведомственной координации.

- В результате регулярного всеобъемлющего межведомственного анализа в июле 2011 года был пересмотрен национальный Контрольный список. Пересмотренный список был введен в действие в соответствии с имеющим силу закона постановлением. В пересмотренном Контрольном списке учтены соответствующие поправки и изменения, внесенные в рамках ГЯП, РКРТ и Австралийской группы. Основные изменения касаются категорий ракет и ядерных предметов двойного использования.

- В приложении к настоящей ноте содержится копия имеющего силу закона постановления, в котором приводится Контрольный список.

- Успешное завершение процесса анализа и другие меры и инициативы, предпринятые в интересах совершенствования экспортного контроля, свидетельствуют о непреклонной решимости Пакистана продолжать политику, направленную на достижение общих целей нераспространения и эффективного экспортного контроля.

- Пакистан верит в справедливый, недискриминационный и основанный на соответствующих критериях подход к достижению общемировых целей нераспространения и мирного использования ядерной энергии.

- В плане обеспечения энергетической безопасности Пакистана 2005 года предусматривается, что к 2030 году мощность АЭС должна достигнуть 8800 МВт. Все находящиеся в эксплуатации и в стадии строительства АЭС Пакистана поставлены под гарантии МАГАТЭ. Эффективный и надежный экспортный контроль должен содействовать международному сотрудничеству в области находящихся под гарантиями МАГАТЭ гражданских ядерных технологий.

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PART II

Statutory Notifications (S. R. O.)

GOVERNMENT OF PAKISTAN

MINISTRY OF FOREIGN AFFAIRS

NOTIFICATION

Islamabad, the 6th July, 2011

S. R. O. 699(I)/2011.—In exercise of the powers conferred by section 4 (2) of the Export Control on Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems Act 2004 (Act No. V of 2004), the Federal Government is pleased to notify the amended Control lists of Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems. The Control Lists notified earlier *vide* S.R.O. 1078 (1)/2005, Islamabad dated 19th October, 2005 ceases to exist.

GENERAL NOTES

1. These lists are in pursuance of the Export Control on Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapon and their delivery Systems Act, 2004, article 4(1).

2. The object of the controls contained in this Annex should not be defeated by the export of any non-controlled goods (including plant) containing one or more controlled components when the controlled component or components are the principal element of the goods and can feasibly be removed or used for other purposes.

[628(11)/Ex. Gaz.] *Price : Rs. 83.50*

N.B:—*In judging whether the controlled component or components are to be considered the principal element, it is necessary to weigh the factors of quantity, value and technological know-how involved and other special circumstances, which might establish the controlled component or components as the principal element of the goods being procured.*

3. Goods specified in this Annex include both new and used goods.

NUCLEAR TECHNOLOGY NOTE (NTN)

(To be read in conjunction with section E of Category 0)

4. The "technology" directly associated with any goods controlled in Category 0 is controlled according to the provisions of Category 0. *"Technology"* for the *"development"*, *"production"* or *"use"* of goods under control remains under control even when applicable to non-controlled goods. The approval of goods for export also authorizes the export to the same end-user of the minimum *"technology"* required for the installation, operation, maintenance and repair of the goods. Controls on *"technology"* transfer do not apply to information *"in the public domain"* or to *"basic scientific research"*.

GENERAL TECHNOLOGY NOTE (GTN)

(To be read in conjunction with section E of Categories 1 to 9)

5. The export of *"technology"*, which is *"required"* for the *"development"*, "production", or "use" of goods controlled in Categories 1 to 9, is controlled according to the provisions of Categories 1 to 9.

6. "Technology" "required" for the "development", "production" or "use" of goods under control remains under control even when applicable to non-controlled goods. Controls do not apply to that "technology" which is the minimum necessary for the installation, operation, maintenance (checking) and repair of those goods which are not controlled or whose export has been authorized.

7. Controls on "technology" transfer do not apply to information "in the public domain", to "basic scientific research" or to the minimum necessary information for patent applications.

GENERAL SOFTWARE NOTE (GSN)

(This note overrides any control within section D of Categories 0 to 9)

8. Categories 0 to 9 of this list do not control "software" which is either:

a. Generally available to the public by being:

(1) Sold from stock at retail selling points, without restriction, by means of:

a. Over-the-counter transactions;

b. Mail order transactions;

c. Electronic transactions; or

d. Telephone order transactions; and

(2) Designed for installation by the user without further substantial support by the supplier; or

N.B.: *Entry a. of the General Software Note does not release "software" specified in Category 5 — Part 2 ("Information Security").*

b. "In the public domain".

EDITORIAL NOTE

In this document following Editorial Practice is followed:-

a. A comma is used to separate the whole number from the decimals,

b. Whole numbers are presented in series of three, each series being separated by a thin space.

DEFINITIONS OF TERMS USED IN THIS ANNEX

Definitions of terms between 'single quotation marks' are given in a Technical Note to the relevant item.

Definitions of terms between "double quotation marks" are as follows:

N.B.: *Category references are given in brackets after the defined term.*
"Accuracy" usually measured in terms of inaccuracy, means the maximum deviation, positive or negative, of an indicated value from an accepted standard or true value.
"Active flight control systems" are systems that function to prevent undesirable "aircraft" and missile motions or structural loads by autonomously processing outputs from multiple sensors and then providing necessary preventive commands to effect automatic control.

"Active pixel" is a minimum (single) element of the solid state array which has a photoelectric transfer function when exposed to light (electromagnetic) radiation.
"Adapted for use in war" means any modification or selection (such as altering purity, shelf life, virulence, dissemination characteristics, or resistance to UV radiation) designed to increase the effectiveness in producing casualties in humans or animals, degrading equipment or damaging crops or the environment.

"Aircraft" means a fixed wing, swivel wing, rotary wing (helicopter), tilt rotor or tilt-wing airborne vehicle.

N.B.: *See also "civil aircraft".*

"All compensations available" means after all feasible measures available to the manufacturer to minimize all systematic positioning errors for the particular machine-tool models are considered.

"Allocated by the ITU" means the allocation of frequency bands according to the ITU Radio Regulations (Edition 1998) for primary, permitted and secondary services.

N.B.: *Additional and alternative allocations are not included.*

"Angular position deviation" means the maximum difference between angular position and the actual, very accurately measured angular position after the work piece mount of the table has been turned out of its initial position (ref. VDI/VDE 2617, Draft: 'Rotary tables on coordinate measuring machines').

"Asymmetric algorithm" means a cryptographic algorithm using different, mathematically related keys for encryption and decryption.

N.B.: *A common use of "asymmetric algorithms" is key management.*

"Automatic target tracking" means a processing technique that automatically determines and provides as output an extrapolated value of the most probable position of the target in real time.

"Basic gate propagation delay time" means the propagation delay time value corresponding to the basic gate used in a "monolithic integrated circuit". For a 'family' of "monolithic integrated circuits", this may be specified either as the propagation delay time per typical gate within the given 'family' or as the typical propagation delay time per gate within the given 'family'.

N.B. 1: "Basic gate propagation delay time" is not to be confused with the input/output delay time of a complex "monolithic integrated circuit.

N.B. 2: 'Family' consists of all integrated circuits to which all of the following are applied as their manufacturing methodology and specifications except their respective functions:

a. *The common hardware and software architecture;*

b. *The common design and process technology; and*

c. *The common basic characteristics.*

"Bias" (accelerometer) means an accelerometer output when no acceleration is applied.

"Camming" means axial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle faceplate, at a point next to the circumference of the spindle faceplate (Reference: ISO 230/1 1986, paragraph 5.63).

"Carbon fibre performs" means an ordered arrangement of uncoated or coated fibres intended to constitute a framework of a part before the "matrix" is introduced to form a "composite".

"CE" is equivalent to "computing element".

"CEP" (circle of equal probability) is a measure of accuracy; the radius of the circle centred at the target, at a specific range, in which 50 % of the payloads impact.

"Chemical laser" means a "laser" in which the excited species is produced by the output energy from a chemical reaction.

"Chemical mixture" means a solid, liquid or gaseous product made up of two or more components which do not react together under the conditions under which the mixture is stored.

"Circulation-controlled anti-torque or circulation controlled direction control systems" are systems that use air blown over aerodynamic surfaces to increase or control the forces generated by the surfaces.

"Civil aircraft" means those "aircraft" listed by designation in published airworthiness certification lists by the civil aviation authorities to fly commercial civil internal and external routes or for legitimate civil, private or business use.

N.B.: *See also "aircraft".*

"Commingled" means filament to filament blending of thermoplastic fibres and reinforcement fibres in order to produce a fibre reinforcement "matrix" mix in total fibre form.

"Comminution" means a process to reduce a material to particles by crushing or grinding.

"Common channel signalling" is a signalling method in which a single channel between exchanges conveys, by means of labelled messages, signalling information relating to a multiplicity of circuits or calls and other information such as that used for network management.

"Communications channel controller" means the physical interface which controls the flow of synchronous or asynchronous digital information. It is an assembly that can be integrated into computer or telecommunications equipment to provide communications access.

"Composite" means a "matrix" and an additional phase or additional phases consisting of particles, whiskers, fibres or any combination thereof, present for a specific purpose or purposes.

"Composite theoretical performance" ("CTP") is a measure of computational performance given in millions of theoretical operations per second (Mtops), calculated using the aggregation of "computing elements" ("CE").

N.B.: *See Category 4, Technical Note.*

"Compound rotary table" means a table allowing the work piece to rotate and tilt about two non-parallel axes, which can be coordinated simultaneously for "contouring control".

"Computing element" ("CE") means the smallest computational unit that produces an arithmetic or logic result.

"Contouring control" means two or more "numerically controlled" motions operating in accordance with instructions that specify the next required position and the required feed rates to that position. These feed rates are varied in relation to each other so that a desired contour is generated (ref. ISO/DIS 2806 - 1980).

"Critical temperature" (sometimes referred to as the transition temperature) of a specific "super conductive" material means the temperature at which the material loses all resistance to the flow of direct electrical current.

"Cryptography" means the discipline which embodies principles, means and methods for the transformation of data in order to hide its information content, prevent its undetected modification or prevent its unauthorized use. "Cryptography" is limited to the transformation of information using one or more 'secret parameters' (*e.g.*, crypto variables) or associated key management.

N.B.: *'Secret parameter': a constant or key kept from the knowledge of others or shared only within a group.*

"CTP" is equivalent to "composite theoretical performance".

"Data-Based Referenced Navigation" ("DBRN") Systems means systems which use various sources of previously measured geo-mapping data integrated to provide accurate navigation information under dynamic conditions. Data sources include bathymetric maps, stellar maps, gravity maps, magnetic maps or 3-D digital terrain maps.

"Deformable mirrors" (also known as adaptive optic mirrors) means mirrors having:

a. A single continuous optical reflecting surface, which is dynamically deformed by the application of individual torques or forces to compensate for distortions in the optical waveform incident upon the mirror; or

b. Multiple optical reflecting elements that can be individually and dynamically repositioned by the application of torques or forces to compensate for distortions in the optical waveform incident upon the mirror.

"Depleted uranium" means uranium depleted in the isotope 235 below that occurring in nature.

"Development" (GTN NTN All) is related to all phases prior to serial production, such as: design, design research, design analyses, design concepts, assembly and testing of prototypes, pilot production schemes, design data, process of transforming design data into a product, configuration design, integration design, layouts.

"Diffusion bonding" means a solid state molecular joining of at least two separate metals into a single piece with a joint strength equivalent to that of the weakest material.

"Digital computer" means equipment, which can, in the form of one or more discrete variables, perform all of the following:

a. Accept data;

b. Store data or instructions in fixed or alterable (writable) storage devices;

c. Process data by means of a stored sequence of instructions which is modifiable; and

d. Provide output of data.

N.B.: *Modifications of a stored sequence of instructions include replacement of fixed storage devices, but not a physical change in wiring or interconnections.*

"Digital transfer rate" means the total bit rate of the information that is directly transferred on any type of medium.

N.B.: *See also "total digital transfer rate".*

"Direct-acting hydraulic pressing" means a deformation process, which uses a fluid-filled flexible bladder in direct contact with the work piece.

"Drift rate" (gyro) means the time rate of output deviation from the desired output. It consists of random and systematic components and is expressed as an equivalent input angular displacement per unit time with respect to inertial space.

"Dynamic adaptive routing" means automatic rerouting of traffic based on sensing and analysis of current actual network conditions.

N.B.: *This does not include cases of routing decisions taken on predefined information.*

"Dynamic signal analysers" means "signal analysers" which use digital sampling and transformation techniques to form a Fourier spectrum display of the given waveform including amplitude and phase information.

N.B.: *See also "signal analysers".*

"Effective gramme" of "special fissile material" means:

a. For plutonium isotopes and uranium-233, the isotope weight in grammes;

b. For uranium enriched 1 per cent or greater in the isotope uranium-235, the element weight in grammes multiplied by the square of its enrichment expressed as a decimal weight fraction;

c. For uranium enriched below 1 per cent in the isotope uranium-235, the element weight in grammes multiplied by 0,0001;

"Electronic assembly" means a number of electronic components (*i.e.*, 'circuit elements', 'discrete components', integrated circuits, etc.) connected together to perform (a) specific function(s), replaceable as an entity and normally capable of being disassembled.

N.B. 1: *'Circuit element': a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.*

N.B. 2: *'Discrete component': a separately packaged 'circuit element' with its own external connections.*

"Electronically steerable phased array antenna" means an antenna which forms a beam by means of phase coupling, *i.e.*, the beam direction is controlled by the complex excitation coefficients of the radiating elements and the direction of that beam can be varied in azimuth or in elevation, or both, by application, both in transmission and reception, of an electrical signal.

"End-effectors" means grippers, 'active tooling units' and any other tooling that is attached to the baseplate on the end of a "robot" manipulator arm.

N.B.: *'Active tooling unit' means a device for applying motive power, process energy or sensing to the work piece.*

"Equivalent Density" means the mass of an optic per unit optical area projected onto the optical surface.

"Expert systems" mean systems providing results by application of rules to data, which are stored independently of the "programme" and capable of any of the following:

a. Modifying automatically the "source code" introduced by the user;

b. Providing knowledge linked to a class of problems in quasi-natural language; or

c. Acquiring the knowledge required for their development (symbolic training).

"FADEC" is equivalent to "full authority digital engine control".

"Fault tolerance" is the capability of a computer system, after any malfunction of any of its hardware or "software" components, to continue to operate without human intervention, at a given level of service that provides: continuity of operation, data integrity and recovery of service within a given time.

"Fibrous or filamentary materials" include:

a. Continuous "monofilaments";
b. Continuous "yarns" and "rovings";
c. "Tapes", fabrics, random mats and braids;
d. Chopped fibres, staple fibres and coherent fibre blankets;
e. Whiskers, either monocrystalline or polycrystalline, of any length;
f. Aromatic polyamide pulp.

"Film type integrated circuit" means an array of 'circuit elements' and metallic interconnections formed by deposition of a thick or thin film on an insulating "substrate".

N.B.: *'Circuit element' is a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.*

"Fixed" means that the coding or compression algorithm cannot accept externally supplied parameters (*e.g.*, cryptographic or key variables) and cannot be modified by the user.

"Flight control optical sensor array" is a network of distributed optical sensors, using "laser" beams, to provide real time flight control data for on-board processing. "Flight path optimisation" is a procedure that minimizes deviations from a four-dimensional (space and time) desired trajectory based on maximizing performance or effectiveness for mission tasks.

"Focal plane array" means a linear or two-dimensional planar layer, or combination of planar layers, of individual detector elements, with or without readout electronics, which work in the focal plane.

N.B.: *This is not intended to include a stack of single detector elements or any two, three or four element detectors provided time delay and integration is not performed within the element.*

"Fractional bandwidth" means the "instantaneous bandwidth" divided by the centre frequency, expressed as a percentage.

"Frequency hopping" means a form of "spread spectrum" in which the transmission frequency of a single communication channel is made to change by a random or pseudo-random sequence of discrete steps.

"Frequency switching time" means the maximum time (*i.e.*, delay), taken by a signal, when switched from one selected output frequency to another selected output frequency, to reach:

a. A frequency within 100 Hz of the final frequency; or

b. An output level within 1 dB of the final output level.

"Frequency synthesiser" means any kind of frequency source or signal generator, regardless of the actual technique used, providing a multiplicity of simultaneous or alternative output frequencies, from one or more outputs, controlled by, derived from or disciplined by a lesser number of standard (or master) frequencies.

"Full Authority Digital Engine Control" ("FADEC") means an electronic control system for gas turbine or combined cycle engines utilising a digital computer to control the variables required to regulate engine thrust or shaft power output throughout the engine operating range from the beginning of fuel metering to fuel shutoff.

"Gas Atomisation" means a process to reduce a molten stream of metal alloy to droplets of 500 micrometre diameter or less by a high pressure gas stream. "Geographically dispersed" is where each location is distant from any other more than 1 500 m in any direction. Mobile sensors are always considered "geographically dispersed".

"Guidance set" means systems that integrate the process of measuring and computing a vehicles position and velocity (*i.e.* navigation) with that of computing and sending commands to the vehicles flight control systems to correct the trajectory.

"Hot isostatic densification" means the process of pressurising a casting at temperatures exceeding 375 K (102 °C) in a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal force in all directions to reduce or eliminate internal voids in the casting.

"Hybrid computer" means equipment, which can perform all of the following:

a. Accept data;

b. Process data, in both analogue and digital representations; and

c. Provide output of data.

"Hybrid integrated circuit" means any combination of integrated circuit(s), or integrated circuit with 'circuit elements' or 'discrete components' connected together to perform (a) specific function(s), and having all of the following characteristics:

a. Containing at least one unencapsulated device;
b. Connected together using typical IC production methods;
c. Replaceable as an entity; and
d. Not normally capable of being disassembled.

N.B. 1: *'Circuit element': a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.*

N.B. 2: *'Discrete component': a separately packaged 'circuit element' with its own external connections.*

"Image enhancement" means the processing of externally derived information-bearing images by algorithms such as time compression, filtering, extraction, selection, correlation, convolution or transformations between domains (*e.g.*, fast Fourier transform or Walsh transform). This does not include algorithms using only linear or rotational transformation of a single image, such as translation, feature extraction, registration or false coloration.

"Immunotoxin" is a conjugate of one cell specific monoclonal antibody and a "toxin" or "sub-unit of toxin", that selectively affects diseased cells.

"In the public domain" (GTN NTN GSN), as it applies herein, means "technology" or "software" which has been made available without restrictions upon its further dissemination (copyright restrictions do not remove "technology" or "software" from being "in the public domain").

"Information security" is all the means and functions ensuring the accessibility, confidentiality or integrity of information or communications, excluding the means

and functions intended to safeguard against malfunctions. This includes "cryptography", 'cryptanalysis', protection against compromising emanations and computer security.

N.B.: *'Cryptanalysis': analysis of a cryptographic system or its inputs and outputs to derive confidential variables or sensitive data, including clear text.*

"Instantaneous bandwidth" means the bandwidth over which output power remains constant within 3 dB without adjustment of other operating parameters.

"Instrumented range" means the specified unambiguous display range of a radar.

"Insulation" is applied to the components of a rocket motor, *i.e.* the case, nozzle, inlets, case closures, and includes cured or semi-cured compounded rubber sheet stock containing an insulating or refractory material. It may also be incorporated as stress relief boots or flaps.

"Interconnected radar sensors" means two or more radar sensors are interconnected when they mutually exchange data in real time.

"Interior lining" is suited for the bond interface between the solid propellant and the case or insulating liner. Usually a liquid polymer based dispersion of refractory or insulating materials, *e.g.* carbon filled hydroxyl terminated polybutadiene (HTPB) or other polymer with added curing agents sprayed or screeded over a case interior.

"Intrinsic Magnetic Gradiometer" is a single magnetic field gradient sensing element and associated electronics the output of which is a measure of magnetic field gradient.

N.B.: *See also "magnetic gradiometer".*

"Isolated live cultures" includes live cultures in dormant form and in dried preparations.

"Isostatic presses" mean equipment capable of pressurising a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal pressure in all directions within the cavity upon a workpiece or material.

"Laser" is an assembly of components which produce both spatially and temporally coherent light that is amplified by stimulated emission of radiation.

N.B.: *See also: "Chemical laser";*

"Q-switched laser";
"Super High Power Laser";
"Transfer laser".

"Linearity" (usually measured in terms of non-linearity) means the maximum deviation of the actual characteristic (average of upscale and downscale readings), positive or negative, from a straight line so positioned as to equalise and minimise the maximum deviations.

"Local area network" is a data communication system having all of the following characteristics:

a. Allows an arbitrary number of independent 'data devices' to communicate directly with each other; and

b. Is confined to a geographical area of moderate size (*e.g.*, office building, plant, campus, warehouse).

N.B.: *'Data device' means equipment capable of transmitting or receiving sequences of digital information.*

"Magnetic Gradiometers" are instruments designed to detect the spatial variation of magnetic fields from sources external to the instrument. They consist of multiple "magnetometers" and associated electronics the output of which is a measure of magnetic field gradient.

N.B.: *See also "intrinsic magnetic gradiometer".*

"Magnetometers" are instruments designed to detect magnetic fields from sources external to the instrument. They consist of a single magnetic field sensing element and associated electronics the output of which is a measure of the magnetic field.

"Main storage" means the primary storage for data or instructions for rapid access by a central processing unit. It consists of the internal storage of a "digital computer" and any hierarchical extension thereto, such as cache storage or non-sequentially accessed extended storage.

"Materials resistant to corrosion by UF_6" may be copper, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or alloy containing 60 weight percent or more nickel and UF_6- resistant fluorinated hydrocarbon polymers, as appropriate for the type of separation process.

"Matrix" means a substantially continuous phase that fills the space between particles, whiskers or fibres.

"Measurement uncertainty" is the characteristic parameter which specifies in what range around the output value the correct value of the measurable variable lies with a confidence level of 95 %. It includes the uncorrected systematic deviations, the uncorrected backlash and the random deviations (ref. ISO 10360-2, or VDI/ VDE 2617).

"Mechanical Alloying" means an alloying process resulting from the bonding, fracturing and rebonding of elemental and master alloy powders by mechanical impact. Non-metallic particles may be incorporated in the alloy by addition of the appropriate powders.

"Melt Extraction" means a process to 'solidify rapidly' and extract a ribbon-like alloy product by the insertion of a short segment of a rotating chilled block into a bath of a molten metal alloy.

N.B.: *'Solidify rapidly': solidification of molten material at cooling rates exceeding 1 000 K/s.*

"Melt Spinning" means a process to 'solidify rapidly' a molten metal stream impinging upon a rotating chilled block, forming a flake, ribbon or rod-like product.

N.B.: *'Solidify rapidly': solidification of molten material at cooling rates exceeding 1 000 K/s.*

"Microcomputer microcircuit" means a "monolithic integrated circuit" or "multichip integrated circuit" containing an arithmetic logic unit (ALU) capable of executing general purpose instructions from an internal storage, on data contained in the internal storage.

N.B.: *The internal storage may be augmented by an external storage.*

"Microprocessor microcircuit" means a "monolithic integrated circuit" or "multichip integrated circuit" containing an arithmetic logic unit (ALU) capable of executing a series of general purpose instructions from an external storage.

N.B. 1: *The "microprocessor microcircuit" normally does not contain integral user-accessible storage, although storage present on the-chip may be used in performing its logic function.*

N.B. 2: *This includes chip sets, which are designed to operate together to provide the function of a "microprocessor microcircuit".*

"Microorganisms" means bacteria, viruses, mycoplasms, rickettsiae, chlamydiae or fungi, whether natural, enhanced or modified, either in the form of isolated live cultures or as material including living material which has been deliberately inoculated or contaminated with such cultures.

"Missiles" means complete rocket systems and unmanned air vehicle systems, capable of delivering at least 500 kg payload to a range of at least 300 km. "Monofilament" or filament is the smallest increment of fibre, usually several micrometres in diameter.

"Monolithic integrated circuit" means a combination of passive or active 'circuit elements' or both which:

a. Are formed by means of diffusion processes, implantation processes or deposition processes in or on a single semiconducting piece of material, a so-called 'chip';

b. Can be considered as indivisibly associated; and

c. Perform the function(s) of a circuit.

N.B.: *'Circuit element' is a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.*

"Monospectral imaging sensors" are capable of acquisition of imaging data from one discrete spectral band.

"Multichip integrated circuit" means two or more "monolithic integrated circuits" bonded to a common "substrate".

"Multi-data-stream processing" means the 'microprogramme' or equipment architecture technique which permits simultaneous processing of two or more data sequences under the control of one or more instruction sequences by means such as:

a. Single Instruction Multiple Data (SIMD) architectures such as vector or array processors;

b. Multiple Single Instruction Multiple Data (MSIMD) architectures;

c. Multiple Instruction Multiple Data (MIMD) architectures, including those which are tightly coupled, closely coupled or loosely coupled; or

d. Structured arrays of processing elements, including systolic arrays.

N.B.: *'Microprogramme' means a sequence of elementary instructions, maintained in a special storage, the execution of which is initiated by the introduction of its reference instruction into an instruction register.*

"Multispectral imaging sensors" are capable of simultaneous or serial acquisition of imaging data from two or more discrete spectral bands. Sensors having more than twenty discrete spectral bands are sometimes referred to as hyperspectral imaging sensors.

"Natural uranium" means uranium containing the mixtures of isotopes occurring in nature.

"Network access controller" means a physical interface to a distributed switching network. It uses a common medium which operates throughout at the same "digital transfer rate" using arbitration (*e.g.*, token or carrier sense) for transmission. Independently from any other, it selects data packets or data groups (e.g., IEEE 802) addressed to it. It is an assembly that can be integrated into computer or telecommunications equipment to provide communications access.

"Neural computer" means a computational device designed or modified to mimic the behaviour of a neuron or a collection of neurons, *i.e.*, a computational device which is distinguished by its hardware capability to modulate the weights and numbers of the interconnections of a multiplicity of computational components based on previous data.

"Noise level" means an electrical signal given in terms of power spectral density. The relation between "noise level" expressed in peak-to-peak is given by S2 pp = 8 No (f2–f1), where Spp is the peak-to-peak value of the signal (e.g., nanoteslas), No is the power spectral density (*e.g.*, (nanotesla) 2/Hz) and (f2–f1) defines the bandwidth of interest.

"Nuclear reactor" means the items within or attached directly to the reactor vessel, the equipment, which controls the level of power in the core, and the components, which normally contain, come into direct contact with or control the primary coolant of the reactor core.

"Numerical control" means the automatic control of a process performed by a device that makes use of numeric data usually introduced as the operation is in progress (ref. ISO 2382).

'Object code' means an equipment executable form of a convenient expression of one or more processes ("source code" (source language) which has been converted by programming system.

"Optical amplification" in optical communications, means an amplification technique that introduces a gain of optical signals that have been generated by a separate optical source, without conversion to electrical signals, i.e., using semiconductor optical amplifiers, optical fibre luminescent amplifiers.

"Optical computer" means a computer designed or modified to use light to represent data and whose computational logic elements are based on directly coupled optical devices.

"Optical integrated circuit" means a "monolithic integrated circuit" or a "hybrid integrated circuit", containing one or more parts designed to function as a photosensor or photoemitter or to perform (an) optical or (an) electro-optical function(s).

"Optical switching' means the routing of or switching of signals in optical form without conversion to electrical signals.

"Overall current density" means the total number of ampere-turns in the coil (i.e., the sum of the number of turns multiplied by the maximum current carried by each turn) divided by the total cross-section of the coil (comprising the superconducting filaments, the metallic matrix in which the superconducting filaments are embedded, the encapsulating material, any cooling channels, etc.).

"Payload" means the total mass that can be carried or delivered by the specified rocket system or unmanned aerial vehicle (UAV) system that is not used to maintain flight.

"Peak power" means energy per pulse in joules divided by the pulse duration in seconds.

"Personalized smart card" means a smart card containing a microcircuit which has been programmed for a specific application and cannot be reprogrammed for any other application by the user.

"Power management" means changing the transmitted power of the altimeter signal so that received power at the "aircraft" altitude is always at the minimum necessary to determine the altitude.

"Pressure transducers" are devices that convert pressure measurements into an electrical signal.

"Previously separated" means the application of any process intended to increase the concentration of the controlled isotope.

"Primary flight control" means an "aircraft" stability or manoeuvring control using force/moment generators, i.e., aerodynamic control surfaces or propulsive thrust vectoring.

"Principal element" as it applies in Category 4, is a "principal element" when its replacement value is more than 35 % of the total value of the system of which it is an element. Element value is the price paid for the element by the manufacturer of the system, or by the system integrator. Total value is the normal international selling price to unrelated parties at the point of manufacture or consolidation of shipment.

"Production" means all production phases, such as: construction, production engineering, manufacture, integration, assembly (mounting), inspection, testing, quality assurance.

"Production equipment" means tooling, templates, jigs, mandrels, moulds, dies, fixtures, alignment mechanisms, test equipment, other machinery and components therefor, limited to those specially designed or modified for "development " or for one or more phases of "production'.

"Production facilities' means equipment and specially designed software therefor integrated into installations for "development" or for one or more phases of "production".

"Programme" means a sequence of instructions to carry out a process in, or convertible into, a form executable by an electronic computer.

"Pulse compression" means the coding and processing of a radar signal pulse of long time duration to one of short time duration, while maintaining the benefits of high pulse energy.

"Pulse duration" is the duration of a "laser" pulse measured at Full Width Half Intensity (FWHI) levels.

"Q-switched laser" means a "laser" in which the energy is stored in the population inversion or in the optical resonator and subsequently emitted in a pulse.

"Radar frequency agility" means any technique which changes, in a pseudo-random sequence, the carrier frequency of a pulsed radar transmitter between pulses or between groups of pulses by an amount equal to or larger than the pulse bandwidth.

"Radar spread spectrum" means any modulation technique for spreading energy originating from a signal with a relatively narrow frequency band, over a much wider band of frequencies, by using random or pseudo-random coding.

"Range" means the maximum distance that the specified rocket system or unmanned aerial vehicle (UAV) system is capable of traveling in the mode of stable flight as measured by the projection of its trajectory over the surface of the Earth.

"Real-time bandwidth" for "dynamic signal analysers" is the widest frequency range, which the analyser can output to display or mass storage without causing any discontinuity in the analysis of the input data. For analysers with more than one channel, the channel configuration yielding the widest "real-time bandwidth" shall be used to make the calculation.

"Real time processing" means the processing of data by a computer system providing a required level of service, as a function of available resources, within a guaranteed response time, regardless of the load of the system, when stimulated by an external event.

"Required" as applied to "technology" or "software", refers to only that portion of "technology" or "software" which is peculiarly responsible for achieving or extending the controlled performance levels, characteristics or functions. Different goods may share such "required" "technology" or "software".

"Resolution" means the least increment of a measuring device; on digital instruments, the least significant bit (ref. ANSI B-89.1.12).

"Robot" means a manipulation mechanism, which may be of the continuous path or of the point-to-point variety, may use sensors, and has all the following characteristics:

a. Is multifunctional;

b. Is capable of positioning or orienting material, parts, tools or special devices through variable movements in three dimensional space;

c. Incorporates three or more closed or open loop servo-devices which may include stepping motors; and

d. Has "user accessible programmability" by means of teach/playback method or by means of an electronic computer which may be a programmable logic controller, i.e., without mechanical intervention.

N.B.: *In the above definition 'sensors' means detectors of a physical phenomenon, the output of which (after conversion into a signal that can be interpreted by a control unit) is able to generate "programs" or modify programmed instructions or numerical "program" data. This includes 'sensors'*

with machine vision, infrared imaging, acoustical imaging, tactile feel, inertial position measuring, optical or acoustic ranging or force or torque measuring capabilities.

N.B.1: *In the above definition 'user-accessible programmability' means the facility allowing a user to insert, modify or replace "programs" by means other than:*

(a) a physical change in wiring or interconnections; or

(b) the setting of function controls including entry of parameters.

N.B.2: *The above definition does not include the following devices:*

1. *Manipulation mechanisms, which are only manually/teleoperator controllable;*

2. *Fixed sequence manipulation mechanisms, which are automated moving devices, operating according to mechanically fixed programmed motions. The programme is mechanically limited by fixed stops, such as pins or cams. The sequence of motions and the selection of paths or angles are not variable or changeable by mechanical, electronic or electrical means;*

3. *Mechanically controlled variable sequence manipulation mechanisms, which are automated moving devices, operating according to mechanically fixed programmed motions. The programme is mechanically limited by fixed, but adjustable stops, such as pins or cams. The sequence of motions and the selection of paths or angles are variable within the fixed programme pattern. Variations or modifications of the programme pattern (e.g., changes of pins or exchanges of cams) in one or more motion axes are accomplished only through mechanical operations;*

4. *Non-servo-controlled variable sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The programme is variable but the sequence proceeds only by the binary signal from mechanically fixed electrical binary devices or adjustable stops;*

5. *Stacker cranes defined as Cartesian coordinate manipulator systems manufactured as an integral part of a vertical array of storage bins and designed to access the contents of those bins for storage or retrieval.*

"Rotary atomisation" means a process to reduce a stream or pool of molten metal to droplets to a diameter of 500 micrometre or less by centrifugal force.

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

N.B.: *'Strand' is a bundle of "mono filaments" (typically over 200) arranged approximately parallel.*

"Run-out" (out-of-true running) means radial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle axis at a point on the external or internal revolving surface to be tested (Reference: ISO 230/1 1986, paragraph 5.61).

"Scale factor" (gyro or accelerometer) means the ratio of change in output to a change in the input intended to be measured. Scale factor is generally evaluated as the slope of the straight line that can be fitted by the method of least squares to input-output data obtained by varying the input cyclically over the input range.

"Settling time" means the time required for the output to come within one-half bit of the final value when switching between any two levels of the converter.

"SHPL" is equivalent to 'super high power laser'.

"Signal analysers" means apparatus capable of measuring and displaying basic properties of the single-frequency components of multi-frequency signals.

"Signal processing" means the processing of externally derived information-bearing signals by algorithms such as time compression, filtering, extraction, selection, correlation, convolution or transformations between domains (e.g., fast Fourier transform or Walsh transform).

"Software" means a collection of one or more "programmes" or 'microprogrammes' fixed in any tangible medium of expression.

N.B.: *'Microprogramme' means a sequence of elementary instructions, maintained in a special storage, the execution of which is initiated by the introduction of its reference instruction into an instruction register.*

"Source code" (or source language) is a convenient expression of one or more processes, which may be turned by a programming system into equipment executable form ('object code' (or object language)).

"Spacecraft" means active and passive satellites and space probes.

"Space qualified" refers to products designed, manufactured and tested to meet the special electrical, mechanical or environmental requirements for use in the launch and deployment of satellites or high altitude flight systems operating at altitudes of 100 km or higher.

"Special fissile material" means plutonium-239, uranium-233, 'uranium enriched in the isotopes 235 or 233", and any material containing the foregoing.

"Specific modulus" is Young's modulus in pascals, equivalent to N/m2 divided by specific weight in N/m^3, measured at a temperature of (296 ± 2) K ((23 ± 2) °C) and a relative humidity of (50 ± 5) %.

"Specific tensile strength" is ultimate tensile strength in pascals, equivalent to N/m^2 divided by specific weight in N/m^3, measured at a temperature of (296 ± 2) K ((23 ± 2) °C) and a relative humidity of (50 ± 5) %.

"Splat Quenching" means a process to 'solidify rapidly' a molten metal stream impinging upon a chilled block, forming a flake-like product.

N.B.: *'Solidify rapidly' solidification of molten material at cooling rates exceeding 1 000 K/s.*

"Spread spectrum" means the technique whereby energy in a relatively narrow-band communication channel is spread over a much wider energy spectrum.

"Spread spectrum" radar - see "Radar spread spectrum"

"Stability" means the standard deviation (1 sigma) of the variation of a particular parameter from its calibrated value measured under stable temperature conditions. This can be expressed as a function of time.

"Stored programme controlled" means controlled by using instructions stored in an electronic storage which a processor can execute in order to direct the performance of predetermined functions.

N.B.: *Equipment may be "stored programme controlled" whether the electronic storage is internal or external to the equipment.*

'Substrate" means a sheet of base material with or without an interconnection pattern and on which or within which 'discrete components' or integrated circuits or both can be located.

N.B. 1: *'Discrete component': a separately packaged 'circuit element' with its own external connections.*

N.B. 2: *'Circuit element': a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.*

"Substrate blanks" means monolithic compounds with dimensions suitable for the production of optical elements such as mirrors or optical windows.

"Sub-unit of toxin" is a structurally and functionally discrete component of a whole "toxin".

"Superalloys" means nickel-, cobalt- or iron-base alloys having strengths superior to any alloys in the AISI 300 series at temperatures over 922 K (649 °C) under severe environmental and operating conditions.

"Superconductive" means materials, i.e., metals, alloys or compounds, which can lose all electrical resistance, i.e., which can attain infinite electrical conductivity and carry very large electrical currents without Joule heating.

N.B.: *The "superconductive" state of a material is individually characterised by a "critical temperature", a critical magnetic field, which is a function of temperature, and a critical current density, which is, however, a function of both magnetic field and temperature.*

"Super High Power Laser" ("SHPL") means a "laser" capable of delivering (the total or any portion of) the output energy exceeding 1 kJ within 50 ms or having an average or CW power exceeding 20 kW.

"Superplastic forming" means a deformation process using heat for metals that are normally characterised by low values of elongation (less than 20 %) at the breaking point as determined at room temperature by conventional tensile strength testing, in order to achieve elongations during processing which are at least 2 times those values.

"Symmetric algorithm" means a cryptographic algorithm using an identical key for both encryption and decryption.

N.B.: *A common use of "symmetric algorithms" is confidentiality of data.*

"System tracks" means processed, correlated (fusion of radar target data to flight plan position) and updated aircraft flight position report available to the Air Traffic Control centre controllers.

"Systolic array computer" means a computer where the flow and modification of the data is dynamically controllable at the logic gate level by the user.

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

N.B.: *'Strand' is a bundle of "mono filaments" (typically over 200) arranged approximately parallel.*

"Technology" means specific information necessary for the "development", "production" or "use" of goods. This information takes the form of 'technical data' or 'technical assistance'.

N.B. 1: *'Technical assistance' may take forms such as instructions, skills, training, working knowledge and consulting services and may involve the transfer of "technical data".*

N.B. 2. *'Technical data' may take forms such as blueprints, plans, diagrams, models, formulae, tables, engineering designs and specifications, manuals and instructions written or recorded on other media or devices such as disk, tape, read-only memories.*

"Tilting spindle" means a tool-holding spindle, which alters, during the machining process, the angular position of its centre line with respect to any other axis.

"Time constant" is the time taken from the application of a light stimulus for the current increment to reach a value of 1-1/e times the final value (i.e., 63% of the final value).

"Time-modulated ultra-wideband" means the technique in which very short precisely time-controlled RF pulses are modulated in accordance with communications data by shifting pulse positions (usually called Pulse Position Modulation, PPM) channelised or scrambled in accordance with pseudo-random noise codes by PPM, then transmitted and received in the direct pulse form without using any carrier frequencies, consequently having extremely low power density over ultrawide frequency bands. It is also known as Impulse Radio.

"Total control of flight" means an automated control of "aircraft" state variables and flight path to meet mission objectives responding to real time changes in data regarding objectives, hazards or other "aircraft".

"Total digital transfer rate" means the number of bits, including line coding, overhead and so forth per unit time passing between corresponding equipment in a digital transmission system.

N.B.: *See also "digital transfer rate".*

"Tow" is a bundle of "monofilaments", usually approximately parallel.

"Toxins" means toxins in the form of deliberately isolated preparations or mixtures, no matter how produced, other than toxins present as contaminants of other materials such as pathological specimens, crops, foodstuffs or seed stocks of "microorganisms".

"Transfer laser" means a "laser" in which the lasing species is excited through the transfer of energy by collision of a non-lasing atom or molecule with a lasing atom or molecule species.

"Tunable" means the ability of a "laser" to produce a continuous output at all wavelengths over a range of several "laser" transitions. A line selectable "laser" produces discrete wavelengths within one "laser" transition and is not considered "tunable".

"Uranium enriched in the isotopes 235 or 233" means uranium containing the isotopes 235 or 233, or both, in an amount such that the abundance ratio of the sum of these isotopes to the isotope 238 is more than the ratio of the isotope 235 to the isotope 238 occurring in nature (isotopic ratio 0,72 per cent).

"Use" means operation, installation (including on-site installation), maintenance (checking), repair, overhaul and refurbishing.

"User accessible programmability" means the facility allowing a user to insert, modify or replace "programmes" by means other than:

a. A physical change in wiring or interconnections; or

b. The setting of function controls including entry of parameters.

"Vaccine" is a medicinal product in a pharmaceutical formulation licensed by, or having marketing or clinical trial authorisation from, the regulatory authorities of either the country of manufacture or of use, which is intended to stimulate a protective immunological response in humans or animals in order to prevent disease in those to whom or to which it is administered.

"Vacuum Atomisation" means a process to reduce a molten stream of metal to droplets of a diameter of 500 micrometre or less by the rapid evolution of a dissolved gas upon exposure to a vacuum.

"Variable geometry airfoils" means the use of trailing edge flaps or tabs, or leading edge slats or pivoted nose droop, the position of which can be controlled in flight.

"Yarn" is a bundle of twisted 'strands'.

N.B.: *'Strand' is a bundle of "mono filaments" (typically over 200) arranged approximately parallel.*

ACRONYMS AND ABBREVIATIONS USED IN THIS ANNEX

An acronym or abbreviation, when used as a defined term, will be found in 'Definitions of Terms used in this Annex'.

Acronym or Abbreviation	Meaning
ABEC	Annular Bearing Engineers Committee
AGMA	American Gear Manufacturers' Association
AHRS	Attitude and Heading Reference Systems
AISI	American Iron and Steel Institute
ALU	Arithmetic logic unit
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
ATC	Air traffic control
AVLIS	Atomic vapour laser isotope separation
CAD	Computer-aided-design
CCITT	International Telegraph and Telephone Consultative Committee
CDU	Control and Display Unit
CEP	Circular Error Probable
CNTD	Controlled Nucleation Thermal Deposition
CRIS LA	Chemical Reaction by Isotope Selective Laser Activation
CVD	Chemical Vapour Deposition

Acronym or Abbreviation	Meaning
CW (for lasers)	Continuous wave
DME	Distance Measuring Equipment
DS	Directionally solidified
EB-PVD	Electron beam physical vapour deposition
EBU	European Broadcasting Union
ECM	Electro-chemical machining
ECR	Electron cyclotron resonance
EDM	Electrical discharge machines
EEPROMS	Electrically.Erasable Programmable Read Only Memory
IEA	Electronic Industries Association Electromagnetic compatibility
EMC	Electromagnetic Compatibility
ETSI	European Telecommunications Standards Institute
FFT	Fast Fourier Transform
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System
HBT	Hetero-bipolar Transistors
HDDR	High Density Digital Recording
HEMT	High Electron Mobility Transistors
ICAO	International Civil Aviation Organisation
IEC	International Electro-technical Commission
IEEE	Institute of Electrical and Electronic Engineers
IFOV	Instantaneous-field-of-view
ILS	Instrument landing system
IRIG	Inter-Range Instrumentation Group
ISAR	Inverse Synthetic Aperture Radar
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JIS	Japanese Industrial Standard
JT	Joule-Thomson
LIDAR	Light Detection and Ranging
LRU	Line Replaceable Unit
MAC	Message Authentication Code

Acronym or Abbreviation	Meaning
Mach	Ratio of speed of an object to speed of sound (after Ernst Mach)
MLIS	Molecular laser isotopic separation
MLS	Microwave landing systems
MOCVD	Metal organic chemical vapour deposition
MRI	Magnetic resonance imaging
MTBF	Mean-time-between-failures
Mtops	Million theoretical operations per second
MTTF	Mean-time-to-failure
NBC	Nuclear, Biological and Chemical
NDT	Non-destructive test
PAR	Precision approach radar
PIN	Personal identification number
ppm	Parts per million
PSD	Power spectral density
QAM	Quadrature-amplitude-modulation
RF	Radio frequency
SACMA	Suppliers of Advanced Composite Materials Association
SAR	Synthetic aperture radar
SC	Single crystal
SLAR	Side looking airborne radar
SMPTE	Society of Motion Picture and Television Engineers
SRA	Shop replaceable assembly
SRAM	Static random access memory
SRM	SACMA Recommended Methods
SSB	Single sideband
SSR	Secondary surveillance radar
TCSEC	Trusted computer system evaluation criteria
TIR	Total indicated reading
UV	Ultraviolet
UTS	Ultimate tensile strength
VOR	Very high frequency omni-directional range
YAG	Yttrium/aluminium Garnet

CATEGORY 0

NUCLEAR MATERIALS, FACILITIES, AND EQUIPMENT

0A Systems, Equipment and Components

0A001 "Nuclear reactors" and specially designed or prepared equipment and components therefor, as follows:

a. "Nuclear reactors" capable of operation so as to maintain a controlled self-sustaining fission chain reaction;

b. Metal vessels, or major shop-fabricated parts therefor, specially designed or prepared to contain the core of a "nuclear reactor", including the reactor vessel head for a reactor pressure vessel;

c. Manipulative equipment specially designed or prepared for inserting or removing fuel in a "nuclear reactor";

d. Control rods specially designed or prepared for the control of the fission process in a "nuclear reactor", support or suspension structures therefor, rod drive mechanisms and rod guide tubes;

e. Pressure tubes specially designed or prepared to contain fuel elements and the primary coolant in a "nuclear reactor" at an operating pressure in excess of 5,1 MPa;

f. Zirconium metal and alloys in the form of tubes or assemblies of tubes in which the ratio of hafnium to zirconium is less than 1:500 parts by weight, specially designed or prepared for use in a "nuclear reactor";

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

h. "Nuclear reactor internals" specially designed or prepared for use in a "nuclear reactor", including support columns for the core, fuel channels, thermal shields, baffles, core grid plates, and diffuser plates;

Note: In 0A001.h. "nuclear reactor internals" means any major structure within a reactor vessel which has one or more functions such as supporting the core, maintaining fuel

alignment, directing primary coolant flow, providing radiation shields for the reactor vessel, and guiding in-core instrumentation.

i. Heat exchangers (steam generators) specially designed or prepared for use in the primary coolant circuit of a "nuclear reactor";

j. Neutron detection and measuring instruments specially designed or prepared for determining neutron flux levels within the core of a "nuclear reactor".

0B Test, Inspection and Production Equipment

0B001 Plant for the separation of isotopes of "natural uranium", "depleted uranium" and "special fissile materials", and specially designed or prepared equipment and components therefor, as follows:

a. Plant specially designed for separating isotopes of "natural uranium", "depleted uranium", and "special fissile materials", as follows:

1. Gas centrifuge separation plant;
2. Gaseous diffusion separation plant;
3. Aerodynamic separation plant;
4. Chemical exchange separation plant;
5. Ion-exchange separation plant;
6. Atomic vapour "laser" isotope separation (AVLIS) plant;
7. Molecular "laser" isotope separation (MLIS) plant;
8. Plasma separation plant;
9. Electro magnetic separation plant;

b. Gas centrifuges and assemblies and components, specially designed or prepared for gas centrifuge separation process, as follows:

Note: *In 0B001.b. 'high strength-to-density ratio material' means any of the following:*

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

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

c. *"Fibrous or filamentary materials" with a "specific modulus" of more than 3,18 × 10^6 m and a "specific tensile strength" greater than 76,2 × 10^3 m;*

1. Gas centrifuges;

2. Complete rotor assemblies;

3. Rotor tube cylinders with a wall thickness of 12 mm or less, a diameter of between 75 mm and 400 mm, made from 'high strength-to-density ratio materials';

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

5. Baffles of between 75 mm and 400 mm diameter for mounting inside a rotor tube, made from 'high strength-to-density ratio materials';

6. Top or bottom caps of between 75 mm and 400 mm diameter to fit the ends of a rotor tube, made from 'high strength-to-density ratio materials';

7. Magnetic suspension bearings consisting of an annular magnet suspended within a housing made of or protected by "materials resistant to corrosion by UF_6 " containing a damping medium and having the magnet coupling with a pole piece or second magnet fitted to the top cap of the rotor;

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

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

10. Ring-shaped motor stators for multiphase AC hysteresis (or reluctance) motors for synchronous operation within a vacuum in the frequency range of 600 to 2000 Hz and a power range of 50 to 1000 Volt-Amps;

11. Centrifuge housing/recipients to contain the rotor tube assembly of a gas centrifuge, consisting of a rigid cylinder of wall thickness up to 30 mm with precision machined ends and made of or protected by "materials resistant to corrosion by UF_6";

12. Scoops consisting of tubes of up to 12 mm internal diameter for the extraction of UF_6 gas from within a centrifuge rotor tube by a Pitot tube action, made of or protected by "materials resistant to corrosion by UF_6";

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

    a. Multiphase output of 600 to 2000 Hz;

    b. Frequency control better than 0,1%;

    c. Harmonic distortion of less than 2%; and

    d. An efficiency greater than 80%;

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

    1. Gaseous diffusion barriers made of porous metallic, polymer or ceramic "materials resistant to corrosion by UF_6" with a pore size of 10 to 100 nm, a thickness of 5 mm or less, and, for tubular forms, a diameter of 25 mm or less;

    2. Gaseous diffuser housings made of or protected by "materials resistant to corrosion by UF_6";

    3. Compressors (positive displacement, centrifugal and axial flow types) or gas blowers with a suction volume capacity of 1 m^3/min or more of UF_6, and discharge pressure up to 666,7 kPa, made of or protected by "materials resistant to corrosion by U F_6";

    4. Rotary shaft seals for compressors or blowers specified in 0B001.c.3. and designed for a buffer gas in-leakage rate of less than 1000 cm^3/min.;

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

6. Bellow valves made of or protected by "materials resistant to corrosion by UF", with a diameter of 40 mm to 1500 mm;

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

1. Separation nozzles consisting of slit-shaped, curved channels having a radius of curvature less than 1mm, resistant to corrosion by UF_6, and having a knife-edge contained within the nozzle which separates the gas flowing through the nozzle into two streams;

2. Tangential inlet flow-driven cylindrical or conical tubes, (vortex tubes), made of or protected by "materials resistant to corrosion by UF_6" with a diameter of between 0,5 cm and 4 cm and a length to diameter ratio of 20:1 or less and with one or more tangential inlets:

3. Compressors (positive displacement, centrifugal and axial flow types) or gas blowers with a suction volume capacity of 2 m^3/min or more, made of or protected by "materials resistant to corrosion by UF_6", and rotary shaft seals therefor;

4. Heat exchangers made of or protected by "materials resistant to corrosion by UF_6";

5. Aerodynamic separation element housings, made of or protected by "materials resistant to corrosion by UF_6" to contain vortex tubes or separation nozzles;

6. Bellows valves made of or protected by "materials resistant to corrosion by U F_6", with a diameter of 40 mm to 1500 mm;

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

   a. Cryogenic heat exchangers and cryoseparators capable of temperatures of 153 K (– 120°C) or less;

   b. Cryogenic refrigeration units capable of temperatures of 153 K (– 120°C) or less;

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

   d. UF_6 cold traps capable of temperatures of 253 K (– 20°C) or less;

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

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

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

   3. Electrochemical reduction cells resistant to concentrated hydrochloric acid solutions, for reduction of uranium from one valence state to another;

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

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

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

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

1. Fast reacting ion-exchange resins, pellicular or porous macro-reticulated resins in which the active chemical exchange groups are limited to a coating on the surface of an inactive porous support structure, and other composite structures in any suitable form, including particles or fibres, with diameters of 0,2 mm or less, resistant to concentrated hydrochloric acid and designed to have an exchange rate half-time of less than 10 seconds and capable of operating at temperatures in the range of 373 K (100°C) to 473 K (200°C);

2. Ion exchange columns (cylindrical) with a diameter greater than 1000 mm, made of or protected by materials resistant to concentrated hydrochloric acid (*e.g.* titanium or fluorocarbon plastics) and capable of operating at temperatures in the range of 373 K (100°C) to 473 K (200°C) and pressures above 0,7 MPa;

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

g. Equipment and components, specially designed or prepared for atomic vapour "laser" isotope separation process (AVLIS), as follows:

1. High power strip or scanning electron beam guns with a delivered power of more than 2,5 kW/cm for use in uranium vaporization systems;

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

N.B.: SEE ALSO 2A225.

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

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

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

N.B.: SEE ALSO 6A005 AND 6A205.

h. Equipment and components, specially designed or prepared for molecular "laser" isotope separation process (MLIS) or chemical reaction by isotope selective laser activation (CRISLA), as follows:

1. Supersonic expansion nozzles for cooling mixtures of UF_6 and carrier gas to 150 K (– 123 °C) or less and made from "materials resistant to corrosion by UF6";

2. Uranium pentafluoride (UF_5) product collectors consisting of filter, impact, or cyclone-type collectors or combinations thereof, and made of "materials resistant to corrosion by UF_5/UF_6";

3. Compressors made of or protected by "materials resistant to corrosion by UF_6", and rotary shaft seals therefor;

4. Equipment for fluorinating UF_5 (solid) to UF_6 (gas);

5. Process systems for separating UF_6 from carrier gas (*e.g.* nitrogen or argon) including:

a. Cryogenic heat exchangers and cryoseparators capable of temperatures of 153 K (– 120°C) or less;

b. Cryogenic refrigeration units capable of temperatures of 153 K (– 120°C) or less;

c. UF6 cold traps capable of temperatures of 253 K (– 20°C) or less;

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

N.B.: SEE ALSO 6A005 AND 6A205.

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

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

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

3. Uranium plasma generation systems;

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

N.B.: SEE ALSO 2A225.

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

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

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

1. Ion sources, single or multiple, consisting of a vapour source, ioniser, and beam accelerator made of suitable non-magnetic materials (*e.g.* graphite, stainless steel, or copper)

and capable of providing a total ion beam current of 50 mA or greater;

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

3. Vacuum housings for uranium electromagnetic separators made of non-magnetic materials (*e.g.* stainless steel) and designed to operate at pressures of 0,1 Pa or lower;

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

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

   a. Capable of continuous operation;

   b. Output voltage of 20000 V or greater;

   c. Output current of 1 A or greater; and

   d. Voltage regulation of better than 0,01 % over a period of 8 hours;

   N.B.: SEE ALSO 3A227.

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

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

   b. Current or voltage regulation better than 0,01 % over a period of 8 hours.

   N.B.: SEE ALSO 3A226.

0B002 Specially designed or prepared auxiliary systems, equipment and components, as follows, for isotope separation plant specified in 0B001, made of or protected by "materials resistant to corrosion by UF_6":

a. Feed autoclaves, ovens or systems used for passing UF_6 to the enrichment process;

b. Desublimers or cold traps, used to remove UF_6 from the enrichment process for subsequent transfer upon heating;

c. Product and tails stations for transferring UF_6 into containers;

d. Liquefaction or solidification stations used to remove UF_6 from the enrichment process by compressing, cooling and converting UF_6 to a liquid or solid form;

e. Piping systems and header systems specially designed for handling UF_6 within gaseous diffusion, centrifuge or aerodynamic cascades;

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

2. Vacuum pumps specially designed for use in UF_6 bearing atmospheres;

g. UF_6 mass spectrometers/ion sources specially designed or prepared for taking on-line samples of feed, product or tails from UF_6 gas streams and having all of the following characteristics:

1. Unit resolution for mass of more than 320 amu;

2. Ion sources constructed of or lined with nichrome or monel, or nickel plated;

3. Electron bombardment ionisation sources; and

4. Collector system suitable for isotopic analysis.

0B003 Plant for the conversion of uranium and equipment specially designed or prepared therefor, as follows:

a. Systems for the conversion of uranium ore concentrates to UO_3;
b. Systems for the conversion of UO_3 to UF_6;
c. Systems for the conversion of UO_3 to UO_2;
d. Systems for the conversion of UO_2 to UF_4;

e. Systems for the conversion of UF_4 to UF_6;

f. Systems for the conversion of UF_4 to uranium metal;

g. Systems for the conversion of UF_6 to UO_2;

h. Systems for the conversion of UF_6 to UF_4;

i. Systems for the conversion of UO_2 to UCl_4.

0B004 Plant for the production or concentration of heavy water, deuterium and deuterium compounds and specially designed or prepared equipment and components therefor, as follows:

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

1. Water-hydrogen sulphide exchange plants;

2. Ammonia-hydrogen exchange plants;

b. Equipment and components, as follows:

1. Water-hydrogen sulphide exchange towers fabricated from fine carbon steel (*e.g.* ASTM A516) with diameters of 6 m to 9 m, capable of operating at pressures greater than or equal to 2 MPa and with a corrosion allowance of 6 mm or greater;

2. Single stage, low head (i.e. 0,2 MPa) centrifugal blowers or compressors for hydrogen sulphide gas circulation (*i.e.* gas containing more than 70 % H_2S) with a throughput capacity greater than or equal to 56 m^3/second when operating at pressures greater than or equal to 1,8 MPa suction and having seals designed for wet H_2S service;

3. Ammonia-hydrogen exchange towers greater than or equal to 35 m in height with diameters of 1,5 m to 2,5 m capable of operating at pressures greater than 15 MPa;

4. Tower internals, including stage contactors, and stage pumps, including those which are submersible, for heavy water production utilizing the ammonia-hydrogen exchange process;

5. Ammonia crackers with operating pressures greater than or equal to 3 MPa for heavy water production utilizing the ammonia-hydrogen exchange process;

6. Infrared absorption analysers capable of on-line hydrogen/ deuterium ratio analysis where deuterium concentrations are equal to or greater than 90 %;

7. Catalytic burners for the conversion of enriched deuterium gas into heavy water utilizing the ammonia-hydrogen exchange process;

8. Complete heavy water upgrade systems, or columns therefor, for the upgrade of heavy water to reactor-grade deuterium concentration.

0B005 Plant specially designed for the fabrication of "nuclear reactor" fuel elements and specially designed or prepared equipment therefor.

Note: A plant for the fabrication of "nuclear reactor" fuel elements includes equipment which:

a. Normally comes into direct contact with or directly processes or controls the production flow of nuclear materials;
b. Seals the nuclear materials within the cladding;

c. Checks the integrity of the cladding or the seal; or

d. Checks the finish treatment of the sealed fuel.

0B006 Plant for the reprocessing of irradiated "nuclear reactor" fuel elements, and specially designed or prepared equipment and components therefor.

Note: 0B006 includes:

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

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

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

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

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

Note: Holding or storage vessels may have the following features:

1. Walls or internal structures with a boron equivalent (calculated for all constituent elements as defined in the note to 0C004) of at least two per cent;

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

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

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

0B007 Plant for the conversion of plutonium and equipment specially designed or prepared therefor, as follows:

a. Systems for the conversion of plutonium nitrate to oxide;

b. Systems for plutonium metal production.

0C Materials

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

Note: 0C001 does not control the following:

a. Four grammes or less of "natural uranium" or "depleted uranium" when contained in a sensing component in instruments;

b. "Depleted uranium" specially fabricated for the following civil non-nuclear applications:

1. Shielding;

2. Packaging;

3. Ballasts having a mass not greater than 100 kg;

4. Counter-weights having a mass not greater than 100 kg;

c. Alloys containing less than 5% thorium;

d. Ceramic products containing thorium, which have been manufactured for non-nuclear use.

0C002 "Special fissile materials"

Note: 0C002 does not control four "effective grammes" or less when contained in a sensing component in instruments.

0C003 Deuterium, heavy water (deuterium oxide) and other compounds of deuterium, and mixtures and solutions containing deuterium, in which the isotopic ratio of deuterium to hydrogen exceeds 1:5000.

0C004 Graphite, nuclear grade, having a purity level of less than 5 parts per million 'boron equivalent' and with a density greater than 1,5 g/cm^3.

N.B.: SEE ALSO 1C107.

Note 1: 0C004 does not control the following:

a. Manufactures of graphite having a mass less than 1 kg, other than those specially designed or prepared for use in a nuclear reactor;

b. Graphite powder.

Note 2: In 0C004, 'boron equivalent' (BE) is defined as the sum of BEz for impurities (excluding BEcarbon since carbon is not considered an impurity) including boron, where:

BEz (ppm) = CF × concentration of element Z in ppm;

where CF is the conversion factor = $\sigma_Z \times A_B / \sigma_B \times A_Z$ and σ_B and σ_Z are the thermal neutron capture cross sections (in barns) for naturally occurring boron and element Z respectively; and A_B and A_Z are the atomic masses of naturally occurring boron and element Z respectively.

0C005 Specially prepared compounds or powders for the manufacture of gaseous diffusion barriers, resistant to corrosion by UF_6 (*e.g.* nickel or alloy containing 60 weight per cent or more nickel, aluminium oxide and fully fluorinated hydrocarbon polymers), having a purity of 99,9 weight per cent or more and a mean particle size of less than 10 micrometres measured by American Society for Testing and Materials (ASTM) B330 standard and a high degree of particle size uniformity.

0D Software

0D001 "Software" specially designed or modified for the "development", "production" or "use" of goods specified in this Category.

0E Technology

0E001 "Technology" according to the Nuclear Technology Note for the "development", "production" or "use" of goods specified in this Category

CATEGORY 1

MATERIALS, CHEMICALS, "MICROORGANISMS" & "TOXINS"

1A Systems, Equipment and Components

1A102 Resaturated pyrolized carbon-carbon components designed for sounding rockets specified in 9A104.

1A202 Composite structures in the form of tubes and having both of the following characteristics:

N.B.: SEE ALSO 1C210 & 9A110.

a. An inside diameter of between 75 mm and 400 mm; and

b. Made with any of the "fibrous or filamentary materials" specified in 1C210.a. or with carbon prepreg materials specified in 1C21 0.c.

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

1A226 Specialized packings which may be used in separating heavy water from ordinary water, having both of the following characteristics:

a. Made of phosphor bronze mesh chemically treated to improve wettability; and

b. Designed to be used in vacuum distillation towers.

1A227 High-density (lead glass or other) radiation shielding windows, having all of the following characteristics, and specially designed frames therefor:

a. A 'cold area' greater than 0,09 m^2;

b. A density greater than 3 g/cm^3; and

c. A thickness of 100 mm or greater.

Technical Note:

In 1A227 the term 'cold area' means the viewing area of the window exposed to the lowest level of radiation in the design application.

1B Test, Inspection and Production Equipment

1B101 Equipment for the "production" of structural composites as follows; and specially designed components and accessories therefor:

N.B.: SEE ALSO 1B201.

Note: *Components and accessories specified in 1B 101 include moulds, mandrels, dies, fixtures and tooling for the preform pressing, curing, casting, sintering or bonding of composite structures, laminates and manufactures thereof.*

a. Filament winding machines or fibre placement machines, of which the motions for positioning, wrapping and winding fibres can be

coordinated and programmed in three or more axes, designed to fabricate composite structures or laminates from fibrous or filamentary materials, and coordinating and programming controls;

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

c. Equipment designed or modified for the "production" of "fibrous or filamentary materials" as follows

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

2. Equipment for the vapour deposition of elements or compounds on heated filament substrates;

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

d. Equipment designed or modified for special fibre surface treatment or for producing prepregs and preforms specified in entry 9C110.

Note: 1 B101.d. includes rollers, tension stretchers, coating equipment, cutting equipment and clicker dies.

e. Multi-directional, multi-dimensional weaving machines or interlacing machines, including adapters and modification kits for weaving, interlacing or braiding fibers to manufacture composite structures;

1B102 Metal powder "production equipment" and components as follows:

N.B.: SEE ALSO 1B115.b.

a. Metal powder "production equipment" usable for the "production", in a controlled environment, of spherical or atomised materials specified in 1C111.a.1. 1C111.a.2.

b. Specially designed components for "production equipment" specified in 1B102.a.

Note: 1B102 includes:

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

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

c. Equipment usable for the "production" of spherical aluminium powders by powdering a melt in an inert medium (e.g. nitrogen).

1B115 Equipment, other than that 1B102, for the production of propellant and propellant constituents, as follows, and specially designed components therefor:

a. "Production equipment" for the "production", handling or acceptance testing of liquid propellants or propellant constituents specified in 1C111;

b. "Production equipment" for the "production", handling, mixing, curing, casting, pressing, machining, extruding or acceptance testing of solid propellants or propellant constituents specified in 1C111.

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

Note1: 1B115 does not control equipment for the "production", handling and acceptance testing of boron carbide.

1B116 Specially designed nozzles for producing pyrolitically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1573 K (1 300°C) to 3173 K (2900°C) temperature range at pressures of 130 Pa to 20 kPa.

1B117 Batch mixers with provision for mixing under vacuum in the range of zero to 13,326 kPa and with temperature control capability of the mixing chamber and having all of the following, and specially designed components therefor:

a. A total volumetric capacity of 110 litres or more; and

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

1B118 Continuous mixers with provision for mixing under vacuum in the range of zero to 13,326 kPa and with a temperature control capability of the mixing chamber having any of the following, and specially designed components therefor:

a. Two or more mixing/kneading shafts; or

b. A single rotating shaft which oscillates and having kneading teeth/ pins on the shaft as well as inside the casing of the mixing chamber.

1B119 Fluid energy mills usable for grinding or milling substances specified in 1C111 and specially designed components therefor.

1B201 Filament winding machines, other than those specified 1B101, and related equipment, as follows:

a. Filament winding machines having all of the following characteristics:

1. Having motions for positioning, wrapping, and winding fibres coordinated and programmed in two or more axes;

2. Specially designed to fabricate composite structures or laminates from "fibrous or filamentary materials"; and

3. Capable of winding cylindrical rotors of diameter between 75 and 400 mm and lengths of 600 mm or greater;

b. Coordinating and programming controls for the filament winding machines specified in 1B201.a.;

c. Precision mandrels for the filament winding machines specified in 1B201 .a.

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

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

Note: 1B226 includes separators:

a. Capable of enriching stable isotopes;

Note: 1. Item1B226. includes separators capable of enriching stable isotopes as well as those for uranium.

N.B.: A separator capable of separating the isotopes of lead with a one-mass unit difference is inherently capable of enriching the isotopes of uranium with a three-unit mass difference.

b. With the ion sources and collectors both in the magnetic field and those configurations in which they are external to the field.

Technical Note: A single 50 mA ion source cannot produce more than 3 g of separated highly enriched uranium (HEU) per year from natural abundance feed.

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

1B228 Hydrogen-cryogenic distillation columns having all of the following characteristics:

a. Designed for operation with internal temperatures of 35 K (– 238 °C) or less;

b. Designed for operation at an internal pressure of 0,5 to 5 MPa;

c. Constructed of either:

1. Stainless steel of the 300 series with low sulphur content and with an austenitic ASTM (or equivalent standard) grain size number of 5 or greater; or

2. Equivalent materials which are both cryogenic and H_2-compatible; and

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

1B229 Water-hydrogen sulphide exchange tray columns and 'internal contactors', as follows:

Note: For columns which are specially designed or prepared for the production of heavy water see 0B004.

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

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

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

3. With a diameter of 1,8 m or greater;

b. 'Internal contactors' for the water-hydrogen sulphide exchange tray columns specified in 1B229.a.

Technical Note:

'Internal contactors' of the columns are segmented trays which have an effective assembled diameter of 1,8 m or greater, are designed to facilitate countercurrent contacting and are constructed of stainless steels with a carbon content of 0,03% or less. These may be sieve trays, valve trays, bubble cap trays, or turbo grid trays.

1B230 Pumps capable of circulating solutions of concentrated or dilute potassium amide catalyst in liquid ammonia (KNH_2/NH_3), having all of the following characteristics:

a. Airtight (*i.e.*, hermetically sealed);

b. A capacity greater than 8,5 m^3/h; and

c. Either of the following characteristics:

1. For concentrated potassium amide solutions (1% or greater), an operating pressure of 1,5 to 60 MPa; or

2. For dilute potassium amide solutions (less than 1%), an operating pressure of 20 to 60 MPa.

1B231 Tritium facilities or plants, and equipment therefor, as follows:

a. Facilities or plants for the production, recovery, extraction, concentration, or handling of tritium;

b. Equipment for tritium facilities or plants, as follows:

1. Hydrogen or helium refrigeration units capable of cooling to 23 K (– 250 °C) or less, with heat removal capacity greater than 150 W;

2. Hydrogen isotope storage or purification systems using metal hydrides as the storage or purification medium.

1B232 Turboexpanders or turboexpander-compressor sets having both of the following characteristics:

a. Designed for operation with an outlet temperature of 35 K (– 238 °C) or less; and

b. Designed for a throughput of hydrogen gas of 1000 kg/h or greater.

1B233 Lithium isotope separation facilities or plants, and equipment therefor, as follows:

a. Facilities or plants for the separation of lithium isotopes;

b. Equipment for the separation of lithium isotopes, as follows:

1. Packed liquid-liquid exchange columns specially designed for lithium amalgams;

2. Mercury or lithium amalgam pumps;

3. Lithium amalgam electrolysis cells;

4. Evaporators for concentrated lithium hydroxide solution.

1C Materials

1C101 Materials and devices for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures usable in "missiles" and their subsystems.

Note 1: 1C101 includes:

a. Structural materials and coatings specially designed for reduced radar reflectivity;

b. Coatings, including paints, specially designed for reduced or tailored reflectivity or emissivity in the microwave, infrared or ultraviolet regions of the electromagnetic spectrum.

Note 2: 1C101 does not include coatings when specially used for the thermal control of satellites.

1C102 Resaturated pyrolized carbon-carbon materials designed for sounding rockets specified in 9A104.

1C107 Graphite and ceramic materials as follows:

a. Fine grain recrystallised bulk graphites having a bulk density of 1,72 g/cm^3 or greater, measured at 288 K (15°C), and having a particle size of 100 micrometres or less, usable for "missile" nozzles and re-entry vehicle nose tips, as follows:

1. Cylinders having a diameter of 120 mm or greater and a length of 50 mm or greater;

2. Tubes having an inner diameter of 65 mm or greater and a wall thickness of 25 mm or greater and a length of 50 mm or greater;

3. Blocks having a size of 120 mm × 120 mm × 50 mm or greater;

b. Pyrolytic or fibrous reinforced graphites, usable for "missile" nozzles and re-entry vehicle nose tips;

c. Ceramic composite materials (dielectric constant less than 6 at frequencies from 100 Hz to 10000 MHz) usable for "missile" radomes;

d. Bulk machinable silicon-carbide reinforced unfired ceramic, usable for "missile" nose tips.

1C111 Propellants and constituent chemicals for propellants, as follows:

a. Propulsive substances:

1. Spherical aluminium powder, with particles of uniform diameter of less than 200 μm and an aluminium content of 97 % by weight or more, if at least 10 % of the total weight is made up of particles of less than 63 μm, according to ISO 2591:1988 or national equivalents;

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

2. Metal fuels, in particle sizes of less than 60 μm, whether spherical, atomized, spheroidal, flaked or ground, consisting 97 % by weight or more of any of the following:

a. Zirconium;

b. Beryllium;

c. Magnesium; or

d. Alloys of the metals specified by a. to c. above;

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

3. Liquid oxidiser substances as follows:

a. Dinitrogen trioxide (CAS 10544-73-7);

b. Nitrogen dioxide(CAS 10102-44-0);/dinitrogen tetroxide (CAS 10544-72-6);

c. Dinitrogen pentoxide(CAS 10102-03-1);;

d. Mixed Oxides of Nitrogen (MON);

Technical Note:

Mixed Oxides of Nitrogen (MON) are solutions of Nitric Oxide (NO) in Dinitrogen Tetroxide/Nitrogen Dioxide (N_2O_4/NO_2) that can be used in missile systems. There are a range of compositions that can be denoted as MONi or MONij, where i and j are integers representing the percentage of Nitric Oxide in the mixture (e.g., MON3 contains 3% Nitric Oxide, MON25 25% Nitric Oxide. An upper limit is MON40, 40% by weight).

4. Hydrazine derivatives as follows:.
   a. Trimethylhydrazine (CAS 1741-01-1);
   b. Tetramethylhydrazine (CAS 6415-12-9);
   c. N,N diallylhydrazine;
   d. Allylhydrazine (CAS 7422-78-8);
   e. Ethylene dihydrazine;
   f. Monomethylhydrazine dinitrate;
   g. Unsymmetrical dimethylhydrazine nitrate;
   h. Hydrazinium azide (CAS 14546-44-2);
   i. Dimethylhydrazinium azide;
   j. Hydrazinium dinitrate;
   k. Diimido oxalic acid dihydrazine;
   l. 2-hydroxyethylhydrazine nitrate (HEHN);
   m. Hydrazinium diperchlorate;
   n. Methylhydrazine nitrate (MHN);
   o. Diethylhydrazine nitrate (DEHN);
   p. 3,6-dihydrazino tetrazine nitrate (1,4-dihydrazine nitrate) (DHTN);

b. Polymeric substances:

   1. Carboxy-terminated polybutadiene (CTPB);
   2. Hydroxy-terminated polybutadiene (HTPB);
   3. Polybutadiene-acrylic acid (PBAA);
   4. Polybutadiene-acrylic acid-acrylonitrile (PBAN);

c. Other propellant additives and agents:

1. Triethylene glycol dinitrate (TEG DN)(CAS111-22-8);
2. 2-Nitrodiphenylamine (CAS119-75-5);
3. Trimethylolethane trinitrate (TMETN) (CAS 3032-55-1);
4. Diethylene glycol dinitrate (DEGDN) (CAS 693-21-0);
5. Ferrocene derivatives as follows:
   a. Ethyl ferrocene;
   b. Propyl ferrocene (CAS1273-89-8);
   c. Pentyl ferrocene (CAS1274-00-6);
   d. Dicyclopentyl ferrocene (CAS 20733-28-8);
   e. Dicyclohexyl ferrocene;
   f. Diethyl ferrocene;
   g. Dipropyl ferrocene;
   h. Dibutyl ferrocene (CAS1274-08-4);
   i. Dihexyl ferrocene (CAS 93894-59-8);
   j. Acetyl ferrocenes;
   k. Other ferrocene derivatives usable as rocket propellant burning rate modifiers.
6. 4,5 diazidomethyl-2-methyl-1,2,3-triazole (iso- DAMTR),
7. Nitratoethylnitramine (NENA) based plasticisers, as follows:
   a. Methyl-NENA (CAS 17096-47-8);
   b. Ethyl-NENA (CAS 85068-73-1);
   c. Butyl-NENA (CAS 82486-82-6);
8. Dinitropropyl based plasticisers, as follows:
   a. Bis (2,2-dinitropropyl) acetal (BDNPA) (CAS 5108-69 0);
   b. Bis (2,2-dinitropropyl) formal (BDNPF) (CAS 5917-61-3);

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

N.B.: SEE ALSO 1C216.

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

1C118 Titanium-stabilised duplex stainless steel (Ti-DSS) having all of the following:

a. Having all of the following characteristics:

1. Containing 17,0-23,0 weight percent chromium and 4,5-7,0 weight percent nickel;

2. Having a titanium content of greater than 0,10 weight percent; and

3. A ferritic-austenitic microstructure (also referred to as a two-phase microstructure) of which at least 10 percent is austenite by volume (according to ASTM E-1 181-87 or national equivalents); and

b. Having any of the following forms:

1. Ingots or bars having a size of 100 mm or more in each dimension;

2. Sheets having a width of 600 mm or more and a thickness of 3 mm or less; or

3. Tubes having an outer diameter of 600 mm or more and a wall thickness of 3 mm or less.

1C202 Alloys, as follows:

a. Aluminium alloys having both of the following characteristics:

1. 'Capable of' an ultimate tensile strength of 460 MPa or more at 293 K (20 °C); and

2. In the form of tubes or cylindrical solid forms (including forgings) with an outside diameter of more than 75 mm;

b. Titanium alloys having both of the following characteristics:

1. 'Capable of' an ultimate tensile strength of 900 MPa or more at 293 K (20 °C); and

2. In the form of tubes or cylindrical solid forms (including forgings) with an outside diameter of more than 75 mm.

Technical Note:
The phrase alloys 'capable of' encompasses alloys before or after heat treatment.

1C210 'Fibrous or filamentary materials' or prepregs as follows:

a. Carbon or aramid 'fibrous or filamentary materials' having either of the following characteristics:

1. A "specific modulus" of $12,7 \times 10^6$ m or greater; or

2. A "specific tensile strength" of 235×10^3 m or greater;

Note: 1C210.a. does not control aramid 'fibrous or filamentary materials' having 0,25 percent or more by weight of an ester based fibre surface modifier;

b. Glass 'fibrous or filamentary materials' having both of the following characteristics:

1. A "specific modulus" of $3,18 \times 10^6$ m or greater; and

2. A "specific tensile strength" of $76,2 \times 10^3$ m or greater;

c. Thermoset resin impregnated continuous "yarns", "rovings", "tows" or "tapes" with a width of 15 mm or less (prepregs),

made from carbon or glass 'fibrous or filamentary materials' specified in 1C210.a. or b.

Technical Note:
The resin forms the matrix of the composite.

Note: In 1C210, 'fibrous or filamentary materials' is restricted to continuous "monofilaments", "yarns", "rovings", "tows" or "tapes".

1C216 Maraging steel, other than that specified in 1C116, 'capable of' an ultimate tensile strength of 2 050 Mpa or more, at 293 K (20 °C).

Note: 1C216 does not control forms in which all linear dimensions are 75 mm or less.

Technical Note:
The phrase maraging steel 'capable of' encompasses maraging steel before or after heat treatment.

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

Note: In 1C225 mixtures containing boron include boron loaded materials.

Technical Note:
The natural isotopic abundance of boron-10 is approximately 18,5 weight per cent (20 atom per cent).

1C226 Tungsten, tungsten carbide, and alloys containing more than 90 % tungsten by weight, having both of the following characteristics:

a. In forms with a hollow cylindrical symmetry (including cylinder segments) with an inside diameter between 100 mm and 300 mm; and

b. A mass greater than 20 kg.

Note: 1C226 does not control manufactures specially designed as weights or gamma-ray collimators.

1C227 Calcium having both of the following characteristics:

a. Containing less than 1000 parts per million by weight of metallic impurities otherthan magnesium; and

b. Containing less than 10 parts per million by weight of boron.

1C228 Magnesium having both of the following characteristics:

a. Containing less than 200 parts per million by weight of metallic impurities otherthan calcium; and

b. Containing less than 10 parts per million by weight of boron.

1C229 Bismuth having both of the following characteristics:

a. A purity of 99,99 % or greater by weight; and

b. Containing less than 10 parts per million by weight of silver.

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

Note: 1C230 does not control the following:

a. Metal windows for X-ray machines, or for bore-hole logging devices;

b. Oxide shapes in fabricated or semi-fabricated forms specially designed for electronic component parts or as substrates for electronic circuits;

c. Beryl (silicate of beryllium and aluminium) in the form of emeralds or aquamarines.

1C231 Hafnium metal, alloys containing more than 60% hafnium by weight, hafnium compounds containing more than 60 % hafnium by weight, manufactures thereof, and waste or scrap of any of the foregoing.

1C232 Helium-3 (^{3}He), mixtures containing helium-3, and products or devices containing any of the foregoing.

Note: 1C232 does not control a product or device containing less than 1 g of helium -3.

1C233 Lithium enriched in the lithium-6 (^{6}Li) isotope to greater than its natural isotopic abundance, and products or devices containing enriched lithium, as follows: elemental lithium, alloys, compounds, mixtures containing lithium, manufactures thereof, waste or scrap of any of the foregoing.

Note: 1C233 does not control thermoluminescent dosimeters.

Technical Note:
The natural isotopic abundance of lithium-6 is approximately 6,5 weight per cent (7,5 atom per cent).

1C234 Zirconium with a hafnium content of less than 1 part hafnium to 500 parts zirconium by weight, as follows: metal, alloys containing more than 50 % zirconium by weight, compounds, manufactures thereof, waste or scrap of any of the foregoing.

Note: 1C234 does not control zirconium in the form of foil having a thickness of 0,10 mm or less.

1C235 Tritium, tritium compounds, mixtures containing tritium in which the ratio of tritium to hydrogen atoms exceeds 1 part in 1000, and products or devices containing any of the foregoing.

Note: 1C235 does not control a product or device containing less than 1,48 × 10^3 GBq (40 Ci) of tritium.

1C236 Alpha-emitting radionuclides having an alpha half-life of 10 days or greater but less than 200 years, in the following forms:

a. Elemental;

b. Compounds having a total alpha activity of 37 GBq/kg (1 Ci/kg) or greater;

c. Mixtures having a total alpha activity of 37 GBq/kg (1 Ci/kg) or greater;

d. Products or devices containing any of the foregoing.

Note: 1C236 does not control a product or device containing less than 3,7 GBq (100 millicuries) of alpha activity.

1C237 Radium-226 (^{226}Ra), radium-226 alloys, radium-226 compounds, mixtures containing radium-226, manufactures thereof, and products or devices containing any of the foregoing.

Note: 1C237 does not control the following:

a. Medical applicators;

b. A product or device containing less than 0,37 GBq (10 millicuries) of radium-226.

1C238 Chlorine Trifluoride (ClF_3)

1C239 High explosives, or substances or mixtures containing more than 2 % by weight of any of the following:

a. Cyclotetramethylenetetranitramine (HMX) (CAS 2691-41-0);

b. Cyclotrimethylenetrinitramine (RDX) (CAS 121-82-4);

c. Triaminotrinitrobenzene (TATB) (CAS 3058-38-6);

d. Hexanitrostilbene (HNS) (CAS 20062-22-0); or

e. Any explosive with a crystal density greater than 1,8 g/cm^3 and having a detonation velocity greater than 8000 m/s.

1C240 Nickel powder and porous nickel metal, as follows:

a. Nickel powder having both of the following characteristics:

1. A nickel purity content of 99,0 % or greater by weight; and

2. A mean particle size of less than 10 micrometres measured by American Society for Testing and Materials (ASTM) B330 standard;

b. Porous nickel metal produced from materials specified in 1C240.a.

Note: 1C240 does not control the following:

a. Filamentary nickel powders;

b. Single porous nickel sheets with an area of 1 000 cm^2 per sheet or less.

Technical Note: 1C240.b. refers to porous metal formed by compacting and sintering the materials in 1C240.a. to form a metal material with fine pores interconnected throughout the structure.

1C351 Human pathogens, zoonoses and "toxins", as follows:

a. Viruses, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:

1. Chikungunya virus;
2. Congo-Crimean haemorrhagic fever virus;
3. Dengue fever virus;
4. Eastern equine encephalitis virus;
5. Ebola virus;
6. Hantaan virus;
7. Junin virus;
8. Lassa fever virus;
9. Lymphocytic choriomeningitis virus;
10. Machupo virus;
11. Marburg virus;
12. Monkey pox virus;
13. Rift Valley fever virus;
14. Tick-borne encephalitis virus (Russian Spring-Summer encephalitis virus);
15. Variola virus;
16. Venezuelan equine encephalitis virus;
17. Western equine encephalitis virus;
18. White pox;
19. Yellow fever virus;
20. Japanese encephalitis virus;
21. Kyasanur Forest virus;
22. Louping ill virus;
23. Murray Valley encephalitis virus;
24. Omsk haemorrhagic fever virus;
25. Oropouche virus;
26. Powassan virus;
27. Rocio virus;
28. St Louis encephalitis virus;

29. Hendra virus (Equine morbillivirus);
30. South American haemorrhagic fever (Sabia, Flexal, Guanarito);
31. Pulmonary & renal syndrome-haemorrhagic fever viruses (Seoul, Dobrava, Puumala, Sin Nombre);
32. Nipah virus.

b. Rickettsiae, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:

1. Coxiella burnetii;
2. Bartonella quintana (Rochalimaea quintana, Rickettsia quintana);
3. Rickettsia prowasecki;
4. Rickettsia rickettsii;

c. Bacteria, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:

1. Bacillus anthracis;
2. Brucella abortus;
3. Brucella melitensis;
4. Brucella suis;
5. Chlamydia psittaci;
6. Clostridium botulinum;
7. Francisella tularensis;
8. Burkholderia mallei (Pseudomonas mallei);
9. Burkholderia pseudomallei (Pseudomonas pseudomallei);
10. Salmonella typhi;
11. Shigella dysenteriae;
12. Vibrio cholerae;
13. Yersinia pestis;
14. Clostridium perfringens epsilon toxin producing types;
15. Enterohaemorrhagic Escherichia coli, serotype O157 and other verotoxin producing serotypes.

d. "Toxins ", as follows, and "sub-unit of toxins" thereof:

1. Botulinum toxins;
2. Clostridium perfringens toxins;

3. Conotoxin;
4. Ricin
5. Saxitoxin
6. Shiga toxin;
7. Staphylococcus aureus toxins;
8. Tetrodotoxin;
9. Verotoxin;
10. Microcystin (Cyanginosin);
11. Aflatoxins;
12. Abrin;
13. Cholera toxin;
14. Diacetoxyscirpenol toxin;
15. T-2 toxin;
16. HT-2 toxin;
17. Modeccin;
18. Volkensin;
19. Viscum album Lectin 1 (Viscumin).

Note: 1C351.d. does not control botulinum toxins or conotoxins in product form meeting all of the following criteria:

1. Are pharmaceutical formulations designed for human administration in the treatment of medical conditions;
2. Are pre-packaged for distribution as medical products;
3. Are authorised by a state authority to be marketed as medical products.

e. Fungi, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:

1. Coccidioides immitis;
2. Coccidioides posadasii.

Note: 1C351 does not control "vaccines" or "immunotoxins".

1C352 Animal pathogens, as follows:

a. Viruses, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:

1. African swine fever virus;
2. Avian influenza virus, which are:

   a Uncharacterised; or
   b. Having high pathogenicity, as follows:

      1. Type A viruses with an IVPI (intravenous pathogenicity index) in 6-week-old chickens of greater than 1,2; or
      2. Type A viruses H5 or H7 subtype for which nucletide sequencing has demonstrated multiple basic amino acids at the cleavage site of haemagglutinin;
      3. Bluetongue virus;
      4. Foot and mouth disease virus;
      5. Goat pox virus;
      6. Porcine herpes virus (Aujeszky's disease);
      7. Swine fever virus (Hog cholera virus);
      8. Lyssa virus;
      9. Newcastle disease virus;
      10 Peste des petits ruminants virus;
      11. Porcine enterovirus type 9 (swine vesicular disease virus);
      12. Rinderpest virus;
      13. Sheep pox virus;
      14. Teschen disease virus;
      15. Vesicular stomatitis virus;
      16. Lumpy skin disease virus;
      17. African horse sickness virus.

b. Mycoplasmas, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:

   1. Mycoplasma mycoides subspecies mycoides SC (small colony);

   2. Mycoplasma capricolum subspecies capripneumoniae.

   Note: IC352 does not control "vaccines".

1C353 Genetic elements and genetically modified organisms, as follows:

a. Genetically modified organisms or genetic elements that contain nucleic acid sequences associated with pathogenicity of organisms specified in 1C351 .a. to c. or 1C352 or 1C354;

b. Genetically modified organisms or genetic elements that contain nucleic acid sequences coding for any of the "toxins" specified in 1C351 .d. or "sub-units of toxins" thereof.

Technical Note:
Genetic elements include, inter alia, chromosomes, genomes, plasmids, transposons and vectors whether genetically modified or unmodified.

Note: 1C353 does not apply to nucleic acid sequences associated with the pathogenicity of enterohaemorrhagic Escherichia coli, serotype O157 and other verotoxin producing strains, other than those coding for the verotoxin, or for its sub-units.

1C354 Plant pathogens, as follows:

a. Viruses, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:

1. Potato Andean latent tymovirus;

2. Potato spindle tuber viroid;

b. Bacteria, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material which has been deliberately inoculated or contaminated with such cultures, as follows:

1. Xanthomonas albilineans;

2. Xanthomonas campestris pv. citri including strains referred to as Xanthomonas campestris pv. Citri types A,B,C,D,E or otherwise classified as Xanthomonas citri, Xanthomonas campestris pv. Aurantifolia or Xanthomonas campestris pv. citrumelo;

3. Xanthomonas oryzae pv. Oryzae (Pseudomonas campestris pv. Oryzae);

4. Clavibacter michiganensis subsp. Sepedonicus (Corynebacterium michiganensis subsp. Sepedonicum or Corynebacterium Sepedonicum);

5. Ralstonia solanacearum Races 2 and 3 (Pseudomonas solanacearum Races 2 and 3 or Burkholderia solanacearum Races 2 and 3);

c. Fungi, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material which has been deliberately inoculated or contaminated with such cultures, as follows:

1. Colletotrichum coffeanum var. virulans (Colletotrichum kahawae);

2. Cochliobolus miyabeanus (Helminthosporium oryzae);

3. Microcyclus ulei (syn. Dothidella ulei);

4. Puccinia graminis (syn. Puccinia graminis f. sp. tritici);

5. Puccinia striiformis (syn. Puccinia glumarum);

6. Magnaporthe grisea (pyricularia grisea/pyricularia oryzae).

1D Software

1D101 "Software" specially designed or modified for the "use" of goods specified in 1B101, 1B102, 1B115, 1B117, 1B118 or 1B119.

1D103 "Software" specially designed for analysis of reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures.

1D201 "Software" specially designed for the "use" of goods specified in 1B201.

1E Technology

1E101 "Technology" according to the General Technology Note for the "use" of goods specified in 1A102, 1B101, 1B102, 1B115 to 1B119, 1C101, 1C107, 1C111 to 1C117, 1D101 or 1D103.

1E102 "Technology" according to the General Technology Note for the "development" of "software" specified in 1D101 or 1D103.

1E103 "Technology" for the regulation of temperature, pressure or atmosphere in autoclaves or hydroclaves, when used for the "production" of "composites" or partially processed "composites".

1E104 "Technology" relating to the "production" of pyrolytically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1573 K (1300 °C) to 31 73K (2900 °C) temperature range at pressures of 130 Pa to 20 kPa.

Note: 1E104 includes "technology" for the composition of precursor gases, flow-rates and process control schedules and parameters.

1E201 "Technology" according to the General Technology Note for the "use" of goods specified in 1A202, 1A225 to 1A227, 1B201, 1B225 to 1B233, 1C202, 1C210, 1C216, 1C225 to 1C240 or 1D201.

1E202 "Technology" according to the General Technology Note for the "development" or "production" of goods specified in 1A202 or 1A225 to 1A227.

1E203 "Technology" according to the General Technology Note for the "development" of "software" specified in 1D201.

CATEGORY 2

MATERIALS PROCESSING

2A Systems, Equipment and Components

2A001 Anti-friction bearings and bearing systems, as follows, and components therefore:

Note: 2A001 does not control balls with tolerances specified by the manufacturer in accordance with ISO 3290 as grade 5 or worse.

a. Ball bearings and solid roller bearings, having all tolerances specified by the manufacturer in accordance with ISO 492 Tolerance Class 4 (or ANSI/ABMA Std 20 Tolerance Class ABEC-7 or RBEC-7, or other national equivalents), or better, and having both rings and rolling elements (ISO 5593), made from monelor beryllium;

Note: 2A001.a. does not control tapered roller bearings.

b. Other ball bearings and solid roller bearings, having all tolerances specified by the manufacturer in accordance with ISO 492 Tolerance Class 2 (or ANSI/ABMA Std 20 Tolerance Class ABEC-9 or RBEC-9, or other national equivalents), or better;

Note: 2A001.b. does not control tapered roller bearings.

c. Active magnetic bearing systems using any of the following:

1. Materials with flux densities of 2,0 T or greater and yield strengths greater than 414 MPa;

2. All-electromagnetic 3D homopolar bias designs for actuators; or

3. High temperature (450 K (177 °C) and above) position sensors.

2A225 Crucibles made of materials resistant to liquid actinide metals, as follows:

a. Crucibles having both of the following characteristics:

1. A volume of between 150 cm^3 and 8 000 cm^3; and

2. Made of or coated with any of the following materials, having a purity of 98 % or greater by weight:

a. Calcium fluoride (CaF_2);

b. Calcium zirconate (metazirconate) ($CaZrO_3$);

c. Cerium sulphide (Ce_2S_3);

d. Erbium oxide (erbia) (Er_2O_3);

e. Hafnium oxide (hafnia) (HfO_2);

f. Magnesium oxide (MgO);

g. Nitrided niobium-titanium-tungsten alloy (approximately 50 % Nb, 30 % Ti, 20% W);

h. Yttrium oxide (yttria) (Y_2O_3); or

i. Zirconium oxide (zirconia) (ZrO_2);

b. Crucibles having both of the following characteristics:

1. A volume of between 50 cm^3 and 2 000 cm^3; and

2. Made of or lined with tantalum, having a purity of 99.9 % or greater by weight;

c. Crucibles having all of the following characteristics:

1. A volume of between 50 cm^3 and 2 000 cm^3;

2. Made of or lined with tantalum, having a purity of 98 % or greater by weight; and

3. Coated with tantalum carbide, nitride, boride, or any combination thereof.

2A226 Valves having all of the following characteristics:

a. A 'nominal size' of 5mm or greater;

b. Having a bellows seal; and

c. Wholly made of or lined with aluminium, aluminium alloy, nickel, or nickel alloy containing more than 60 % nickel by weight.

Technical Note:
For valves with different inlet and outlet diameters, the 'nominal size' in 2A226 refers to the smallest diameter.

2B Test, Inspection and Production Equipment

Technical Notes:

1. Secondary parallel contouring axes, (*e.g.*, the w-axis on horizontal boring mills or a secondary rotary axis the centre line of which is parallel to the primary rotary axis) are not counted in the total number of contouring axes. Rotary axes need not rotate over 360°. A rotary axis can be driven by a linear device (*e.g.* a screw or a rack-andpinion).

2. For the purposes of 2B, the number of axes which can be co-ordinated simultaneosly for "contouring control" is the number of axes which affect relative movement between any one workpiece and a tool, cutting head or grinding wheel which is cutting or removing material from the workpiece. This does not include any additional axes which affect other relative movement within the machine. Such axes include:

   a. Wheel-dressing systems in grinding machines;

   b. Parallel rotary axes designed for mounting of separate workpieces;

   c. Co-linear rotary axes designed for manipulating the same workpiece by holding it in a chuck from different ends.

3. Axis nomenclature shall be in accordance with International Standard ISO 841,'Numerical Control Machines — Axis and Motion Nomenclature'.

4. Stated positioning accuracy levels derived from measurements made according to ISO 230/2 (1988) (1) or national equivalents may be used for each machine tool model instead of individual machine tests. Stated positioning accuracy means the accuracy value provided to the competent authorities of the Member State in which the exporter is established as representative of the accuracy of a machine model.

   Determination of Stated Values

   a. Select five machines of a model to be evaluated;

   b. Measure the linear axis accuracies according to ISO 230/ 2 (1988) (1);

c. Determine the A-values for each axis of each machine. The method of calculating the A-value is described in the ISO standard;

d. Determine the mean value of the A-value of each axis. This mean value Â becomes the stated value of each axis for the model (Âx Ây...);

e. Since the Category 2 list refers to each linear axis there will be as many stated values as there are linear axes;

2B104 "Isostatic presses", having all of the following:

N.B.: SEE ALSO 2B204.

a. Maximum working pressure of 69 MPa or greater;

b. Designed to achieve and maintain a controlled thermal environment of 873 K (600 °C) or greater; and

c. Possessing a chamber cavity with an inside diameter of 254 mm or greater.

2B105 Chemical vapour deposition (CVD) furnaces, designed or modified for the densification of carbon-carbon composites.

2B109 Flow-forming machines, and specially designed components as follows:

N.B.: SEE ALSO 2B209.

a. Flow-forming machines having all of the following:

1. According to the manufacturer's technical specification, can be equipped with "numerical control" units or a computer control, even when not equipped with such units; and

2. With more than two axes which can be coordinated simultaneously for "contouring control".

b. Specially designed components for flow-forming machines specified in 2B109.a.

Note: 2B109 does not control machines that are not usable in the production of propulsion components and equipment (e.g. motor cases) for systems specified in 9A105.a.

Technical Note:

Machines combining the function of spin-forming and flow-forming are for the purpose of 2B109 regarded as flowforming machines.

2B116 Vibration test systems, equipment and components therefor, as follows:

a. Vibration test systems employing feedback or closed loop techniques and incorporating a digital controller, capable of vibrating a system at 10 g rms or more over the entire range 20 Hz to 2000 Hz and imparting forces of 50 kN, measured 'bare table', or greater;

b. Digital controllers, combined with specially designed vibration test "software", with a 'real-time control bandwidth' greater than 5 kHz and designed for use with vibration test systems specified in 2B116.a.;

Technical Note:

'Real-time control bandwidth' is defined as the maximum rate at which a controller can execute complete cycles of sampling, processing data and transmitting control signal

c. Vibration thrusters (shaker units), with or without associated amplifiers, capable of imparting a force of 50 kN, measured 'bare table', or greater and usable in vibration test systems specified in 2B116.a.;

d. Test piece support structures and electronic units designed to combine multiple shaker units in a system capable of providing an effective combined force of 50 kN, measured 'bare table', or greater, and usable in vibration systems specified in 2B116.a.

Technical Note:
In 2B1 16, 'bare table' means a flat table, or surface, with no fixture or fittings.

2B117 Equipment and process controls, other than those specified in 2B104 or 2B105, designed or modified for densification and pyrolysis of structural composite rocket nozzles and re-entry vehicle nose tips.

2B119 Balancing machines and related equipment, as follows:

N.B.: SEE ALSO 2B219.

a. Balancing machines having all the following characteristics:

1. Not capable of balancing rotors/assemblies having a mass greater than 3 kg;

2. Capable of balancing rotors/assemblies at speeds greater than 12 500 rpm;

3. Capable of correcting unbalance in two planes or more; and

4. Capable of balancing to a residual specific unbalance of 0,2 g mm per kg of rotor mass;

Note: 2B1 19.a. does not control balancing machines designed or modified for dental or other medical equipment.

b. Indicator heads designed or modified for use with machines specified in 2B1 19.a.

Technical Note:
Indicator heads are sometimes known as balancing instrumentation.

2B120 Motion simulators or rate tables having all of the following characteristics:

a. Two axes or more;

b. Designed or modified to incorporate slip rings or integrated non-contact devices capable of transferring electrical power, signal information, or both; and

c. Having any of the following characteristics:

1. For any single axis having all of the following:

   a. Capable of rates of 400 degrees/s or more, or 30 degrees/s or less; and

   b. A rate resolution equal to or less than 6 degrees/s and an accuracy equal to or less than 0,6 degrees/s;

2. Having a worst-case rate stability equal to or better (less) than plus or minus 0,05 % averaged over 10 degrees or more; or

3. A positioning "accuracy" equal to or less (better) than 5 arc second.

Note 1: 2B120 does not control rotary tables designed or modified for machine tools or for medical equipment.

Note:2 Motion simulators or rate tables specified in 2B120 remain controlled whether or not slip rings or integrated non-contact devices are fitted at time of export.

2B121 Positioning tables (equipment capable of precise rotary positioning in any axes), other than those specified in 2B120, having all the following characteristics:

a. Two axes or more; and

b. A positioning "accuracy" equal to or less (better) than 5 arc second.

Note: 2B121 does not control rotary tables designed or modified for machine tools or for medical equipment.

2B122 Centrifuges capable of imparting accelerations above 100g and designed or modified to incorporate sliprings or integrated non-contact devices capable of transferring electrical power, signal information, or both.

2B201 Machine tools and any combination thereof, as follows, for removing or cutting metals, ceramics or "composites", which, according to the manufacturer's technical specification, can be equipped with electronic devices for simultaneous "contouring control" in two or more axes:

a. Machine tools for turning, having all of the following characteristics:

1. Positioning accuracy with "all compensations available" equal to or less (better) than 6 μm according to ISO 230/2 (1988) (1) or national equivalents along any linear axis (overall positioning) for machines capable of machining diameters greater than 35 mm; and

2. Two or more axes which can be coordinated simultaneously for "contouring control";

Note: Item 2B201.a. does not control bar machines (Swissturn), limited to machining only bar feed thru, if maximum bar diameter is equal to or less than 42 mm and there is no capability of mounting chucks. Machines may have drilling and/or milling capabilities for machining parts with diameters less than 42 mm.

b. Machine tools for milling, having any of the following characteristics:

1. Positioning accuracies with "all compensations available" equal to or less (better) than 6 μm according to ISO 230/2 (1988) (1) or national equivalents along any linear axis; or

2. Two or more contouring rotary axes; or

3. Five or more axes, which can be coordinated simultaneously for "contouring control".

2B201. a. does not control milling machines having the following characteristics:

a. X-axis travel greater than 2m; and

b. Overall positioning accuracy on the x-axis more (worse) than 30 μm.

c. Machine tools for grinding, having any of the following characteristics:

1. Positioning accuracies with "all compensations available" equal to or less (better) than 4 μm according to ISO 230/2 (1988) (1) or national equivalents along any linear axis; or

2. Two or more contouring rotary axes.

3. Five or more axes, which can be coordinated simultaneously for "contouring control."

Note: 2B201.b. does not control the following grinding machines:

a. Cylindrical external, internal, and external-internal grinding machines having all of the following characteristics:

a. Limited to a maximum workpiece capacity of 150 mm outside diameter or length; and

b. Axes limited to x, z and c.

b. Jig grinders that do not have a z-axis or a w-axis with an overall positioning accuracy less (better) than 4 microns. Positioning accuracy is according to ISO 230/2 (1988).

d. Non-wire type Electrical discharge machines (EDM) of the non-wire type which have two or more rotary axes which can be coordinated simultaneously for "contouring control";

Note: Item 2B201 does not control special purpose machine tools limited to the manufacture of any of the following parts:

a. Gears
b. Crankshafts or camshafts
c. Tools or cutters
d. Extruder worms

Technical Note: Axis nomenclature shall be in accordance with International Standard ISO 841, 'Numerical Control Machines — Axis and Motion Nomenclature'.

1. Stated positioning accuracy levels derived from measurements made according to ISO 230/2 (1988) (1) or national equivalents may be used for each machine tool model if provided to, and accepted by, national authorities instead of individual machine tests. Stated positioning accuracy means the accuracy value

provided to the competent authorities of the Member State in which the exporter is established as representative of the accuracy of a machine model.

Determination of Stated Values

i. Select five machines of a model to be evaluated;

ii. Measure the linear axis accuracies according to ISO 230/2 (1988) (1);

iii. Determine the A-values for each axis of each machine. The method of calculating the A-value is described in the ISO standard;

iv. Determine the average accuracy value of each axis. This average value becomes the stated "positioning accuracy" of each axis for the model (Âx, Ây...);

v. Since the Category 2 list refers to each linear axis there will be as many stated values as there are linear axes;

vi. If any axis of a machine tool not controlled by Items 2B201.a., 2B201.b., or 2B201.c. has a stated "positioning accuracy" of 6 µm or better (less) for grinding machines, and 8 µm or better (less) for milling and turning machines, both according to ISO 230/2 (1988), then the builder should be required to reaffirm the accuracy level once every eighteen months.

2. Not counted in the total number of contouring axes are secondary parallel contouring axes (*e.g.*, the w-axis on horizontal boring mills or a secondary rotary axis the centerline of which is parallel to the primary rotary axis).

3. For the purposes of 2B201 the number of axes which can be coordinated simultaneously for "contouring control" is the number of axes along or around which, during processing of the workpiece, simultaneous and interrelated motions are performed between the workpiece and a tool. This does not include any additional axes along or around which other relative motions within the machine are performed, such as:

a. Wheel-dressing systems in grinding machines;

b Parallel rotary axes designed for mounting of separate workpieces;

c. Co-linear rotary axes designed for manipulating the same workpiece by holding it in a chuck from different ends.

4. A machine tool having at least 2 of the 3 turning, milling or grinding capabilities *(e.g.,* a turning machine with milling capability) must be evaluated against each applicable entry, 2B201.a., 2B201.b. and 2B201.c.

5. Items 2B201.b.3 and 2B201..c.3 include machines based on a parallel linear kinematic design *(e.g.,* hexapods) that have 5 or more axes none of which are rotary axes.

2B204 "Isostatic presses", other than those specified in 2B104, and related equipment, as follows:

a. "Isostatic presses" having both of the following characteristics:

1. Capable of achieving a maximum working pressure of 69 MPa or greater; and

2. A chamber cavity with an inside diameter in excess of 152 mm;

b. Dies, moulds and controls, specially designed for "isostatic presses" specified in 2B204.a.

Technical Note:
In 2B204 the inside chamber dimension is that of the chamber in which both the working temperature and the working pressure are achieved and does not include fixtures. That dimension will be the smaller of either the inside diameter of the pressure chamber or the inside diameter of the insulated furnace chamber, depending on which of the two chambers is located inside the other.

2B206 Dimensional inspection machines, instruments or systems, as follows:

a. Computer controlled or numerically controlled dimensional inspection machines having both of the following characteristics:

1. Two or more axes; and

2. A one-dimensional length "measurement uncertainty" equal to or less (better) than (1,25 + L/1 000) μm tested with a probe of an "accuracy" of less (better) than 0,2 μm (L is the measured length in millimetres) (Ref.: VDI/VDE 2617 Parts 1 and 2);

b. Linear and angular displacement measuring instruments, as follows:

1. Linear displacement measuring instruments having any of the following:

Technical Note:
For the purpose of 2B206.b.1. 'linear displacement' means the change of distance between the measuring probe and the measured object.

a. Non-contact type measuring systems with a "resolution" equal to or less (better) than 0,2 μm within a measuring range up to 0,2 mm;

b. Linear Variable differential transformer systems having all of the following characteristics:

1. "Linearity" equal to or less (better) than 0,1 % within a measuring range up to 5 mm; and

2. Drift equal to or less (better) than 0.1% per day at a standard ambient test room temperature ±1 K; or

c. Measuring systems having all of the following:

1. Containing a "laser"; and

2. Maintaining, for at least 12 hours, over a temperature range of ± 1 K around a standard temperature and at a standard pressure, all of the following:

a. A "resolution" over their full scale of 0,1 μm or less (better); and

b. A "measurement uncertainty" equal to or less (better) than (0,2 + L/2 000) μm (L is the measured length in mm);

Note: 2B206.b.1. does not control measuring interferometer systems, without closed or open loop feedback, containing a "laser" to measure slide movement errors of machine-tools, dimensional inspection machines or similar equipment.

2. Angular displacement measuring instruments having an "angular position deviation" equal to or less (better) than 0,00025°;

Note: 2B206.b.2. does not control optical instruments, such as autocollimators, using collimated light (e.g. laser light) to detect angular displacement of a mirror.

C. Systems for simultaneously linear-angular inspection of hemishells, having both of the following characteristics:

1. "Measurement uncertainty" along any linear axis equal to or less (better) than 3,5 μm per 5 mm; and

2. "Angular position deviation" equal to or less than 0,02°.

Note 1: Machine tools that can be used as measuring machines are controlled if they meet or exceed the criteria specified for the machine tool function or the measuring machine function.

Note 2: A machine specified in 2B206 is controlled if it exceeds the control threshold anywhere within its operating range.

Technical Notes:

1. *The probe used in determining the measurement uncertainty of a dimensional inspection system shall be described in VDI/VDE 2617 parts 2, 3 and 4.*

2. *All parameters of measurement values in 2B206 represent plus/minus i.e., not total band.*

2B207 "Robots", "end-effectors" and control units, as follows:

a. "Robots" or "end-effectors"

(i) specially designed to comply with national safety standards applicable to handling high explosives (for example, meeting electrical code ratings for high explosives); or

(ii) Specially designed or rated as radiation hardened to withstand a total radiation dose greater than 5×10^4 Gy (Silicon) without operational Degradation.

b. Control units specially designed for any of the "robots" or "end-effectors" specified in 2B207.a.

2B209 Flow forming machines, spin forming machines capable of flow forming functions, other than those specified in 2B109, and mandrels, as follows:

a. Machines having both of the following characteristics:

1. Three or more rollers (active or guiding); and

2. Which, according to the manufacturer's technical specification, can be equipped with "numerical control" units or a computer control;

b. Rotor-forming mandrels designed to form cylindrical rotors of inside diameter between 75 mm and 400 mm.

Note: 2B209.a. includes machines which have only a single roller designed to deform metal plus two auxiliary rollers which support the mandrel, but do not participate directly in the deformation process.

2B219 Centrifugal multiplane balancing machines, fixed or portable, horizontal or vertical, as follows:

a. Centrifugal balancing machines designed for balancing flexible rotors having a length of 600mm or more and having all of the following characteristics:

1. Swing or journal diameter greater than 75 mm;

2. Mass capability of from 0,9 to 23 kg; and

3. Capable of balancing speed of revolution greater than 5000 r.p.m.;

b. Centrifugal balancing machines designed for balancing hollow cylindrical rotor components and having all of the following characteristics:

1. Journal diameter greater than 75 mm;

2. Mass capability of from 0,9 to 23 kg;

3. Capable of balancing to a residual imbalance equal to or less than 0,01 kg × mm/kg per plane; and

4. Belt drive type.

2B225 Remote manipulators that can be used to provide remote actions in radiochemical separation operations or hot cells, having either of the following characteristics:

a. A capability of penetrating 0,6 m or more of hot cell wall (through-the-wall operation); or

b. A capability of bridging over the top of a hot cell wall with a thickness of 0,6 m or more (over-the-wall operation).

Technical Note:
Remote manipulators provide translation of human operator actions to a remote operating arm and terminal fixture. They may be of 'master/slave' type or operated by joystick or keypad.

2B226 Controlled atmosphere (vacuum or inert gas) induction furnaces, and power supplies therefor, as follows:

N.B.: SEE ALSO 3B.

a. Furnaces having all of the following characteristics:

1. Capable of operation above 1 123 K (850 °C);

2. Induction coils 600mm or less in diameter; and

3. Designed for power inputs of 5 kW or more;

b. Power supplies, with a specified power output of 5 kW or more, specially designed for furnaces specified in 2B226.a.

Note: 2B226.a. does not control furnaces designed for the processing of semiconductor wafers.

2B227 Vacuum or other controlled atmosphere metallurgical melting and casting furnaces and related equipment as follows:

a. Arc remelt and casting furnaces having both of the following characteristics:

1. Consumable electrode capacities between 1 000 cm^3 and 20 000 cm^3, and

2. Capable of operating with melting temperatures above 1 973 K (1 700 °C);

b. Electron beam melting furnaces and plasma atomization and melting furnaces, having both of the following characteristics:

1. A power of 50kW or greater; and

2. Capable of operating with melting temperatures above 1473 K (1200 °C).

c. Computer control and monitoring systems specially configured for any of the furnaces specified in 2B227.a. or b.

2B228 Rotor fabrication or assembly equipment, rotor-straightening equipment, bellows-forming mandrels and dies, as follows:

a. Rotor assembly equipment for assembly of gas centrifuge rotor tube sections, baffles, and end caps;

Note: 2B228.a. includes precision mandrels, clamps, and shrink fit machines.

b. Rotor straightening equipment for alignment of gas centrifuge rotor tube sections to a common axis;

Technical Note:
In 2B228.b. such equipment normally consists of precision measuring probes linked to a computer that subsequently controls the action of, for example, pneumatic rams used for aligning the rotor tube sections.

c. Bellows-forming mandrels and dies for producing single-convolution bellows.

Technical Note:
In 2B228.c. the bellows have all of the following characteristics:

1. *Inside diameter between 75 mm and 400 mm;*

2. *Length equal to or greater than 12,7 mm;*

3. *Single convolution depth greater than 2 mm; and*

4. *Made of high-strength aluminium alloys, maraging steel or high-strength "fibrous or filamentary materials".*

2B230 "Pressure transducers" capable of measuring absolute pressures at any point in the range 0 to 13 kPa and having both of the following characteristics:

a. Pressure sensing elements made of or protected by aluminium, aluminium alloy, nickel or nickel alloy with more than 60 % nickel by weight; and

b. Having either of the following characteristics:

1. A full scale of less than 13 kPa and an'accuracy' of better than ± 1 % of full scale; or

2. A full scale of 13 kPa or greater and an 'accuracy' of better than ± 130 Pa.

Technical Note:
For the purposes of 2B230, 'accuracy' includes non-linearity, hysteresis and repeatability at ambient temperature.

2B231 Vacuum pumps having all of the following characteristics:

a. Input throat size equal to or greater than 380 mm;

b. Pumping speed equal to or greater than $15 m^3/s$; and

c. Capable of producing an ultimate vacuum better than 13 mPa.

Technical Notes:

1. *The pumping speed is determined at the measurement point with nitrogen gas or air.*

2. *The ultimate vacuum is determined at the input of the pump with the input of the pump blocked off.*

2B232 Multistage light gas guns or other high-velocity gun systems (coil, electromagnetic, and electrothermal types, and other advanced systems) capable of accelerating projectiles to 2 km/s or greater.

2B350 Chemical manufacturing facilities, equipment and components, as follows:

a. Reaction vessels or reactors, with or without agitators, with total internal (geometric) volume greater than 0,1 m^3 (100 litres) and less than $20 m^3$ (20 000 litres), where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:

1. Alloys with more than 25 % nickel and 20 % chromium by weight;

2. Fluoropolymers;

3. Glass (including vitrified or enamelled coating or glass lining);

4. Nickel or alloys with more than 40 % nickel by weight;

5. Tantalum or tantalum alloys;

6. Titanium or titanium alloys; or

7. Zirconium or zirconium alloys;

b. Agitators for use in reaction vessels or reactors specified in 2B350.a.; and impellers, blades or shafts designed for such agitators, where all surfaces of the agitator that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:

1. Alloys with more than 25 % nickel and 20 % chromium by weight;

2. Fluoropolymers;

3. Glass (including vitrified or enamelled coatings or glass lining);

4. Nickel or alloys with more than 40 % nickel by weight;

5. Tantalum or tantalum alloys;

6. Titanium or titanium alloys; or

7. Zirconium or zirconium alloys;

c. Storage tanks, containers or receivers with a total internal (geometric) volume greater than 0,1 m3 (100 litres) where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:

1. Alloys with more than 25 % nickel and 20 % chromium by weight;

2. Fluoropolymers;

3. Glass (including vitrified or enamelled coatings or glass lining);

4. Nickel or alloys with more than 40 % nickel by weight;

5. Tantalum or tantalum alloys;

6. Titanium or titanium alloys; or

7. Zirconium or zirconium alloys;

d. Heat exchangers or condensers with a heat transfer surface area greater than 0,15m^2, and less than 20m^2; and tubes, plates, coils or blocks (cores) designed for such heat exchangers or condensers, where all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:

1. Alloys with more than 25 % nickel and 20% chromium by weight;
2. Fluoropolymers;
3. Glass (including vitrified or enamelled coatings or glass lining);
4. Graphite or 'carbon graphite';
5. Nickel or alloys with more than 40% nickel by weight;
6. Tantalum or tantalum alloys;
7. Titanium or titanium alloys;
8. Zirconium or zirconium alloys;
9. Silicon carbide; or
10. Titanium carbide;

e. Distillation or absorption columns of internal diameter greater than 0,1 m; and liquid distributers, vapour distributers or liquid collectors designed for such distillation or absorbtion columns, where all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:

1. Alloys with more than 25 % nickel and 20 % chromium by weight;
2. Fluoropolymers;
3. Glass (including vitrified or enamelled coatings or glass lining);

4. Graphite or 'carbon graphite';
5. Nickel or alloys with more than 40 % nickel by weight;
6. Tantalum or tantalum alloys;
7. Titanium or titanium alloys; or
8. Zirconium or zirconium alloys;

f. Remotely operated filling equipment in which all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:

1. Alloys with more than 25 % nickel and 20 % chromium by weight; or
2. Nickel or alloys with more than 40 % nickel by weight;

g. Valves with nominal sizes greater than 10 mm and casings (valve bodies) or preformed casing liners designed for such valves, in which all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:

1. Alloys with more than 25 % nickel and 20 % chromium by weight;
2. Fluoropolymers;
3. Glass (including vitrified or enamelled coatings or glass lining);
4. Nickel or alloys with more than 40 % nickel by weight;
5. Tantalum or tantalum alloys;
6. Titanium or titanium alloys; or
7. Zirconium or zirconium alloys;

h. Multi-walled piping incorporating a leak detection port, in which all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:

1. Alloys with more than 25 % nickel and 20 % chromium by weight;

2. Fluoropolymers;

3. Glass (including vitrified or enamelled coatings or glass lining);

4. Graphite or 'carbon graphite';

5. Nickel or alloys with more than 40 % nickel by weight;

6. Tantalum or tantalum alloys;

7. Titanium or titanium alloys; or

8. Zirconium or zirconium alloys;

i. Multiple-seal, canned drive, magnetic drive, bellows or diaphragm pumps, with manufacturer's specified maximum flow-rate greater than 0,6m^3/hour, or vacuum pumps with manufacturer's specified maximum flow-rate greater than 5m^3/hour (under standard temperature (273 K (0 °C)) and pressure (101,3 kPa) conditions); and casings (pump bodies), preformed casing liners, impellers, rotors or jet pump nozzles designed for such pumps, in which all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:

1. Alloys with more than 25 % nickel and 20% chromium by weight;

2. Ceramics;

3. Ferrosilicon;

4. Fluoropolymers;

5. Glass (including vitrified or enamelled coatings or glass lining);

6. Graphite or 'carbon graphite';

7. Nickel or alloys with more than 40% nickel by weight;

8. Tantalum or tantalum alloys;

9. Titanium or titanium alloys; or

10. Zirconium or zirconium alloys;

j. Incinerators designed to destroy chemicals specified in entry 1C350, having specially designed waste supply systems, special handling facilities and an average combustion chamber temperature greater than 1 273 K (1000 °C), in which all surfaces in the waste supply system that come into direct contact with the waste products are made from or lined with any of the following materials:

1. Alloys with more than 25 % nickel and 20 % chromium by weight;

2. Ceramics; or

3. Nickel or alloys with more than 40% nickel by weight.

Technical Note:
'Carbon graphite' is a composition consisting of amorphous carbon and graphite, in which the graphite content is eight percent or more by weight.

2B351 Toxic gas monitoring systems, as follows; and dedicated detectors therefor:

a. Designed for continuous operation and usable for the detection of chemical warfare agents, at concentrations of less than 0,3 mg/m^3; or

b. Designed for the detection of cholinesterase-inhibiting activity.

2B352 Equipment capable of use in handling biological materials, as follows:

a. Complete biological containment facilities at P3, P4 containment level;

Technical Note:
P3 or P4 (BL3, BL4, L3, L4) containment levels are as specified in the WHO Laboratory Biosafety manual (3rd edition, Geneva 2004).

b. Fermenters capable of cultivation of pathogenic "micro-organisms", viruses or capable of toxin production, without the propagation of aerosols, and having a total capacity of 20 litres or more;

Technical Note:
Fermenters include bioreactors, chemostats and continuous-flow systems.

c. Centrifugal separators, capable of continuous separation without the propagation of aerosols, having all the following characteristics:

1. Flow rate exceeding 100 litres per hour;

2. Components of polished stainless steel or titanium;

3. One or more sealing joints within the steam containment area; and

4. Capable of in-situ steam sterilisation in a closed state;

Technical Note:
Centrifugal separators include decanters.

d. Cross (tangential) flow filtration equipment and components as follows:

1. Cross (tangential) flow filtration equipment capable of separation of pathogenic micro-organisms, viruses, toxins or cell cultures, without the propagation of aerosols, having both of the following characteristics:

a. A total filtration area equal to or greater than $1m^2$; and

b. Capable of being sterilised or disinfected in-situ;

Technical Note:
In 2B352.d. 1.b. sterlised denotes the elimination of all viable microbes from the equipment through the use of either physical (e.g. steam) or chemical agents. Disinfected denotes the destruction of potential microbial infectivity in the equipment

through the use of chemical agents with a germicidal effect. Disinfection and sterilisation are distinct from sanitisation, the latter referring to cleaning procedures designed to lower the microbial content of equipment without necessarily achieving elimination of all microbial infectivity or viability.

2. Cross (tangential) flow filtration components (*e.g.* modules, elements, cassettes, cartridges, units or plates) with filtration area equal to or greater than $0,2m^2$ for each component and designed for use in cross (tangential) flow filtration equipment specified in 2B352.d.;

Note: 2B352.d. does not control reverse osmosis equipment, as specified by the manufacturer.

e. Steam sterilisable freeze drying equipment with a condenser capacity exceeding 10 kg of ice in 24 hours and less than 1000 kg of ice in 24 hours;

f. Protective and containment equipment, as follows:

1. Protective full or half suits, or hoods dependent upon a tethered external air supply and operating under positive pressure;

Note: 2B352.f.1. does not control suits designed to be worn with self-contained breathing apparatus.

2. Class III biological safety cabinets or isolators with similar performance standards;

Note: In 2B352.f.2., isolators include flexible isolators, dry boxes, anaerobic chambers, glove boxes and laminar flow hoods (closed with vertical flow).

g. Chambers designed for aerosol challenge testing with "microorganisms", viruses or "toxins" and having a capacity of 1 m^3 or greater.

2C Material

Blank

2D Software

2D101 "Software" specially designed or modified for the "use" of equipment specified in 2B104, 2B105, 2B109, 2B116, 2B117 or 2B119 to 2B122.

N.B.: SEE ALSO 9D004.

2D201 "Software" specially designed for the "use" of equipment specified in 2B204, 2B206, 2B207, 2B209, 2B219 or 2B227.

Note: "Software" specially designed for systems specified in Item 2B206.d includes "software" for simultaneous measurements of wall thickness and contour.

2D202 "Software" specially designed or modified for the "development", "production" or "use" of equipment specified in 2B201.

2D203 "Software" for any combination of electronic devices or system enabling such device(s) to function as a "numerical control" unit capable of controlling five or more interpolating axes that can be coordinated simultaneously for "contouring control".

Notes: 1 "Software" is controlled whether exported separately or residing in a "numerical control" unit or any electronic device or system.

2. Item 2D203. does not control "software" specially designed or modified by the manufacturers of the control unit or machine tool to operate a machine tool that is not specified in Item 2B201.

2E Technology

2E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 2B104, 2B109, 2B116, 2B119 to 2B122 or 2D101.

2E201 "Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 2A225, 2A226, 2B201, 2B204, 2B206, 2B207, 2B209, 2B225 to 2B232, 2D201 or 2D202.

2E301 "Technology" according to the General Technology Note for the "use" of goods specified in 2B350 to 2B352.

CATEGORY 3 ELECTRONICS

3A Systems, Equipment and Components

3A101 Electronic equipment, devices and components, as follows:

a. Analog to digital converters, usable in "missiles", designed to meet military specification for ruggedized equipment;

b. Accelerators capable of delivering electromagnetic radiation produced by bremsstrahlung from accelerated elec trons of 2MeV or greater, containing those accelerators.

Note: 3A101.b. above does not specify equipment specially medical purposes.

3A102 'Thermal batteries' designed or modified for 'missiles'.

Technical Notes:

1. In 3A102 'thermal batteries' are single use batteries that contain a solid non-conducting inorganic salt as the electrolyte. These batteries incorporate a pyrolytic material that, when ignited, melts the electrolyte and activates the battery.

2. In 3A102 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

3A201 Electronic components, as follows;

a. Pulse Discharge Capacitors having either of the following sets of characteristics:

1. a. Voltage rating greater than 1,4 kV;
   b. Energy storage greater than 10 J;
   c. Capacitance greater than 0,5 μF; and
   d. Series inductance less than 50 nH; or

2. a. Voltage rating greater than 750 V;

b. Capacitance greater than 0,25 μF; and

c. Series inductance less than 10 nH;

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

1. Capable of creating magnetic fields greater than 2 T;

2. A ratio of length to inner diameter greater than 2;

3. Inner diameter greater than 300 mm; and

4. Magnetic field uniform to better than 1% over the central 50% of the inner volume;

Note: 3A201.b. does not control magnets specially designed for and exported 'as parts of' medical nuclear magnetic resonance (NMR) imaging systems. The phrase 'as part of' does not necessarily mean physical part in the same shipment; separate shipments from different sources are allowed, provided the related export documents clearly specify that the shipments are dispatched 'as part of' the imaging systems.

c. Flash X-ray generators or pulsed electron accelerators having either of the following sets of characteristics:

1. a. An accelerator peak electron energy of 500 KeV or greater but less than 25 MeV; and

b. With a 'figure of merit' (K) of 0,25 or greater; or

2. a. An accelerator peak electron energy of 25 MeV or greater; and

b. A 'peak power' greater than 50 MW.

Note: 3A201.c. does not control accelerators that are component parts of devices designed for purposes other than electron beam or X-ray radiation (electron microscopy, for example) nor those designed for medical purposes.

Technical Notes:

1. *The 'figure of merit' K is defined as:*
   $K = 1,7 \times 10^3 V^{(2,65)} Q$

   V is the peak electron energy in million electron volts.

   If the accelerator beam pulse duration is less than or equal to 1 μs, then Q is the total accelerated charge in Coulombs. If the accelerator beam pulse duration is greater than 1 μs, then Q is the maximum accelerated charge in 1 μs.

   Q equals the integral of i with respect to t, over the lesser of 1 μs or the time duration of the beam pulse ($Q = \int idt$), where i is beam current in amperes and t is time in seconds.

2. *'Peak power' = (peak potential in volts) × (peak beam current in amperes).*
3. *In machines based on microwave accelerating cavities, the time duration of the beam pulse is the lesser of 1 μs or the duration of the bunched beam packet resulting from one microwave modulator pulse.*
4. *In machines based on microwave accelerating cavities, the peak beam current is the average current in the time duration of a bunched beam packet.*

3A225 Frequency changers or generators, having all of the following characteristics:

a. Multiphase output capable of providing a power of 40W or greater;

b. Capable of operating in the frequency range between 600 and 2000 Hz;

c. Total harmonic distortion better (less) than 10 %; and

d. Frequency control better (less) than 0,1 %.

Technical Note:
Frequency changers in 3A225 are also known as converters or inverters.

3A226 High power direct current power supplies, having both of the following characteristics:

a. Capable of continuously producing, over a time period of 8 hours, 100 V or greater with current output of 500A or greater; and

b. Current or voltage stability better than 0,1% over a time period of 8 hours.

3A227 High voltage direct current power supplies, having both of the following characteristics:

a. Capable of continuously producing, over a time period of 8 hours, 20 kV or greater with current output of 1 A or greater; and

b. Current or voltage stability better than 0,1% over a time period of 8 hours.

3A228 Switching devices, as follows:

a. Cold cathode tubes, whether gas filled or not, operating similarly to a spark gap, having all of the following characteristics:

1. Containing three or more electrodes;

2. Anode peak voltage rating of 2,5 kV or more;

3. Anode peak current rating of 100 A or more; and

4. Anode delay time of 10 μs or less;

Note: 3A228 includes gas krytron tubes and vacuum sprytron tubes.

b. Triggered spark-gaps having both of the following characteristics:

1. An anode delay time of 15 μs or less; and

2. Rated for a peak current of 500 A or more;

c. Modules or assemblies with a fast switching function having all of the following characteristics:

1. Anode peak voltage rating greater than 2 kV;

2. Anode peak current rating of 500A or more; and

3. Turn on time of 1 μs or less.

3A229 Firing sets and equivalent high current pulse generators as follows:

a. Explosive detonator firing sets designed to drive multiple controlled detonators specified in 3A232;

b. Modular electrical pulse generators (pulsers) having all of the following characteristics:

1. Designed for portable, mobile, or ruggedized-use;

2. Enclosed in a dust tight enclosure;

3. Capable of delivering their energy in less than 15 μs;

4. Having an output greater than 100 A;

5. Having a 'rise time' of less than 10 μs into loads of less than 40 ohms;

6. No dimension greater than 254 mm;

7. Weight less than 25 kg; and

8. Specified for use over an extended temperature range 223 K (– 50 °C) to 373 K (100 °C) or specified as suitable for aerospace applications.

Note: 3A229.b. includes xenon flash lamp drivers.

Technical Note:
In 3A229.b.5. "rise time" is defined as the time interval from 10% to 90% current amplitude when driving a resistive load.

3A230 High-speed pulse generators having both of the following characteristics:

a. Output voltage greater than 6 V into a resistive load of less than 55 ohms, and

b. 'Pulse transition time' less than 500 ps.

Technical Note:
In 3A230, 'pulse transition time' is defined as the time interval between 10% and 90% voltage amplitude.

3A231 Neutron generator systems, including tubes, having both of the following characteristics:

a. Designed for operation without an external vacuum system; and

b. Utilizing electrostatic acceleration to induce a tritium-deuterium nuclear reaction.

3A232 Detonators and multipoint initiation systems, as follows:

a. Electrically driven explosive detonators, as follows:

1. Exploding bridge (EB);
2. Exploding bridge wire (EBW);
3. Slapper;
4. Exploding foil initiators (EFI);

b. Arrangements using single or multiple detonators designed to nearly simultaneously initiate an explosive surface over greater than 5 000mm^2 from a single firing signal with an initiation timing spread over the surface of less than 2,5 μs.

Note: 3A232 does not control detonators using only primary explosives, such as lead azide.

Technical Note:
In 3A232 the detonators of concern all utilise a small electrical conductor (bridge, bridge wire or foil) that explosively vapourises when a fast, high-current electrical pulse is passed through it. In nonslapper types, the exploding conductor starts a chemical detonation in a contacting high-explosive material such as PETN (Pentaerythritoltetranitrate). In slapper detonators, the explosive vapourisation of the electrical conductor drives a flyer or slapper across a gap and the impact of the slapper on an explosive starts a chemical detonation. The slapper in some designs is driven by a magnetic force. The term exploding foil detonator may

refer to either an EB or a slapper-type detonator. Also, the word initiator is sometimes used in place of the word detonator.

3A233 Mass spectrometers, capable of measuring ions of 230 atomic mass units or greater and having a resolution of better than 2 parts in 230, as follows, and ion sources therefor:

a. Inductively coupled plasma mass spectrometers (ICP/MS);

b. Glow discharge mass spectrometers (GDMS);

c. Thermal ionization mass spectrometers (TIMS);

d. Electron bombardment mass spectrometers which have a source chamber constructed from, lined with or plated with materials resistant to UF_6;

e. Molecular beam mass spectrometers having either of the following characteristics:

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

2. A source chamber constructed from, lined with or plated with materials resistant to UF_6;

f. Mass spectrometers equipped with a microfluorination ion source designed for actinides or actinide fluorides.

3B Test, Inspection and Production Equipment

Blank

3C Materials

Blank

3D Software

3D101 "Software" specially designed or modified for the "use" of equipment specified in 3A101 .b.

3E Technology*

3E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 3A101 or 3D101.

3E102 "Technology" according to the General Technology Note for the "development" of "software" specified in 3D101.

3E201 "Technology" according to the General Technology Note for the "use" of equipment specified in 3A201, 3A225 to 3A233.

CATEGORY 4 COMPUTERS

4A Systems, Equipment and Components

4A101 Analogue computers, "digital computers" or digital differential analysers, which are ruggedized and designed or modified for use in sounding rockets specified in 9A104.

4A102 "Hybrid computers" specially designed for modelling, simulation or design integration sounding rockets specified in 9A104.

Note: This control only applies when the equipment is supplied with "software" specified in 7D103 or 9D103.

4B Test, Inspection and Production Equipment

Blank

4C Materials

Blank

4D Software

Blank

4E Technology

Blank

CATEGORY 5

TELECOMMUNICATIONS AND "INFORMATION SECURITY"

5A1 Systems, Equipment and Components

5A101 Telemetering and telecontrol equipment, *including ground equipment*, designed or modified for 'missiles'.

Technical Note:
In 5A101 '"missiles" means complete rocket systems and unmanned aerial vehicle systems, capable of delivering at least 500 kg payload to a range of at least 300 km.

Note: 5A101 does not control:

a. *Equipment designed or modified for manned aircraft or satellites;*

b. *Ground based equipment designed or modified for terrestrial or marine applications;*

c. *Equipment designed for commercial, civil or 'Safety of Life' (e.g. data integrity, flight safety) GNSS services;*

5B1 Test, Inspection and Production Equipment

Blank

5C1 Materials

Blank

5D1 Software

5D101 "Software" specially designed or modified for the "use" of equipment specified in 5A101.

5E1 Technology

5D101 "Technology" according to the General Technology Note for the "development", "production" or "use" of equipment specified in 5A101.

5A2 Systems, Equipment and Components

Blank

5B2 Test, Inspection and Production Equipment

Blank

5C2 Materials

Blank

5D2 Software

Blank

5E2 Technology

Blank

CATEGORY 6

SENSORS AND LASERS

6A Systems, Equipment and Components

6A102 Radiation hardened 'detectors' specially designed or modified for protecting against nuclear effects (e.g. electromagnetic pulse (EMP), X-rays, combined blast and thermal effects) and usable for "missiles", designed or rated to withstand radiation levels which meet or exceed a total irradiation dose of 5×10^5 rads (silicon).

Technical Note:
In 6A 102, a 'detector' is defined as a mechanical, electrical, optical or chemical device that automatically identifies and records, or registers a stimulus such as an environmental change in pressure or temperature, an electrical or electromagnetic signal or radiation from a radioactive material. This includes devices that sense by one time operation or failure.

6A107 Gravity meters (gravimeters) and components for gravity meters and gravity gradiometers, as follows:

a. Gravity meters designed or modified for airborne or marine use, and having a static or operational accuracy of 7×10^{-6} m/s^2 (0,7 milligal) or less (better), and having a time-to-steady-state registration of two minutes or less;

b. Specially designed components for gravity meters specified in 6A107.a.

6A108 Radar systems and tracking systems, as follows:

a. Radar and laser radar systems designed or modified for use in sounding rockets specified in 9A104;

Note: 6A108.a. includes the following:

a. Terrain contour mapping equipment;

b. Imaging sensor equipment;

c. Scene mapping and correlation (both digital and analogue) equipment;

d. Doppler navigation radar equipment.

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

1. Tracking systems which use a code translator in conjunction with either surface or airborne references or navigation satellite systems to provide real-time measurements of in-flight position and velocity;

2. Range instrumentation radars including associated optical/ infrared trackers with all of the following capabilities:

a. Angular resolution better than 1,5 milliradians;

b. Range of 30 km or greater with a range resolution better than 10 m rms;

c. Velocity resolution better than 3 m/s.

Technical Note:
In 6A108.b. 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

6A202 Photomultiplier tubes having both of the following characteristics:

a. Photocathode area of greater than 20 cm^2; and

b. Anode pulse rise time of less than 1 ns.

6A203 Cameras and components, as follows:

a. Mechanical rotating mirror cameras, as follows, and specially designed components therefor:

1. Framing cameras with recording rates greater than 225000 frames per second;

2. Streak cameras with writing speeds greater than 0,5 mm per microsecond;

Note:
In 6A203.a. components of such cameras include their synchronizing electronics units and rotor assemblies consisting of turbines, mirrors and bearings.

b. Electronic streak cameras, electronic framing cameras, tubes and devices, as follows:

1. Electronic streak cameras capable of 50 ns or less time resolution;

2. Streak tubes for cameras specified in 6A203.b.1.;

3. Electronic (or electronically shuttered) framing cameras capable of 50 ns or less frame exposure time;

4. Framing tubes and solid-state imaging devices for use with cameras specified in 6A203.b.3., as follows:

a. Proximity focused image intensifier tubes having the photocathode deposited on a transparent conductive coating to decrease photocathode sheet resistance;

b. Gate silicon intensifier target (SIT) videcon tubes, where a fast system allows gating the photoelectrons from the photocathode before they impinge on the SIT plate;

c. Kerr or Pockels cell electro-optical shuttering;

d. Other framing tubes and solid-state imaging devices having a fast-image gating time of less than 50 ns specially designed for cameras specified in 6A203.b.3.;

c. Radiation-hardened TV cameras, or lenses therefor, specially designed or rated as radiation hardened to withstand a total radiation dose greater than 50×10^3 Gy(silicon) [5×10^6 rad (silicon)] without operational degradation.

Technical Note:
The term Gy(silicon) refers to the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionising radiation.

6A205 "Lasers", "laser" amplifiers and oscillators, as follows:

a. Argon ion "lasers" having both of the following characteristics:

1. Operating at wavelengths between 400 nm and 515 nm; and

2. An average output power greater than 40 W;

b. Tunable pulsed single-mode dye laser oscillators having all of the following characteristics:

1. Operating at wavelengths between 300 nm and 800 nm;

2. An average output power greater than 1 W;

3. A repetition rate greater than 1 kHz; and

4. Pulse width less than 100 ns;

c. Tunable pulsed dye laser amplifiers and oscillators, having all of the following characteristics:

1. Operating at wavelengths between 300 nm and 800 nm;

2. An average output power greater than 30 W;

3. A repetition rate greater than 1 kHz; and

4. Pulse width less than 100 ns;

Note: 6A205.c. does not control single mode oscillators;

d. Pulsed carbon dioxide "lasers" having all of the following characteristics:

1. Operating at wavelengths between 9000 nm and 11000 nm;

2. A repetition rate greater than 250 Hz;

3. An average output power greater than 500 W; and

4. Pulse width of less than 200 ns;

e. Para-hydrogen Raman shifters designed to operate at 16 micrometre output wavelength and at a repetition rate greater than 250 Hz;

f. Pulse-excited, Q-switched neodymium-doped (other than glass) "lasers", having all of the following characteristics:

1. An output wavelength exceeding 1000 nm but not exceeding 1100 nm;

2. A pulse duration equal to or more than 1 ns; and

3. A multiple-transverse mode output having an average power exceeding 50 W.

OR

Incorporating frequency doubling to give an output wavelength between 500 and 550 nm with an average output power of greater than 40 W.

g. Copper vapor lasers having both of the following characteristics:

1. Operating at wavelengths between 500 and 600 nm; and

2. An average output power equal to or greater than 40 W;

h. Alexandrite lasers having all of the following characteristics:

1. Operating at wavelengths between 720 and 800 nm;

2. A bandwidth of 0.005 nm or less;

3. A repetition rate greater than 125 Hz; and

4. An average output power greater than 30 W;

i. Pulsed excimer lasers (XeF, XeCl, KrF) having all of the following characteristics:

1. Operating at wavelengths between 240 and 360 nm;

2. A repetition rate greater than 250 Hz; and

3. An average output power greater than 500 W;

6A225 Velocity interferometers for measuring velocities exceeding 1 km/s during time intervals of less than 10 microseconds.

Note: 6A225 includes velocity interferometers such as VISARs (Velocity interferometer systems for any reflector) and DLIs (Doppler laser interferometers).

6A226 Pressure sensors, as follows:

a. Manganin gauges for pressures greater than 10 GPa;

b. Quartz pressure transducers for pressures greater than 10 GPa.

6B Test, Inspection and Production Equipment

6B108 Systems, specially designed for radar cross section measurement usable for "missiles" and their subsystems.

6C Materials

Blank

6D Software

6D102 "Software" specially designed or modified for the "use" of goods specified in 6A1 08.

6D103 "Software" which processes post-flight, recorded data, enabling determination of vehicle position throughout its flight path, specially designed or modified for 'missiles'.

Technical Note:
In 6D103 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

6E Technology

6E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 6A102, 6A107, 6A108, 6B108, 6D102 or 6D103.

Note: 6E101 only specifies "technology" for equipment specified in 6A when it is designed for airborne applications and is usable in "missiles".

6E201 "Technology" according to the General Technology Note for the "use" of equipment specified in 6A202, 6A203, 6A205, 6A225 or 6A226.

CATEGORY 7

NAVIGATION AND AVIONICS

7A Systems, Equipment and Components

7A101 Accelerometers, as follows, and specially designed components therefor:

a. Accelerometers with a threshold of 0,05 g or less, or a linearity error within 0,25 % of full scale output, or both, which are designed for use in inertial navigation systems or in guidance systems of all types;

Note: 7A 101.a. does not specify accelerometers which are specially designed and developed as MWD (Measurement While Drilling) Sensors for use in downhole well service operations.

b. Accelerometers or gyros of any type, designed for use in inertial navigation system or in guidance system of all types, specified to function at acceleration levels greater than 100 g.

Note: 7A101.b. does not include accelerometer that are designed to measure vibration or shock.

7A102 All types of gyros, usable in "missiles", with a rated "drift rate" "stability" of less than 0,5° (1 sigma or rms) per hour in a 1 g environment and specially designed components therefor.

7A103 Instrumentation, navigation equipment and systems, as follows; and specially designed components therefor:

a. Inertial or other equipment using accelerometers specified in 7A101 or gyros specified in 7A102 and systems incorporating such equipment;

Note: 7A103.a. does not specify equipment containing accelerometers specially designed and developed as MWD (Measurement While Drilling) sensors for use in downhole well services operations.

b. Integrated flight instrument systems, which include gyrostabilisers or automatic pilots, designed or modified for use in sounding rockets specified in 9A104;

c. 'Integrated navigation systems', designed or modified for sounding rockets specified in 9A104 and capable of providing a navigational accuracy of 200m Circle of Equal Probability (CEP) or less.
Technical Note:
An 'integrated navigation system' typically incorporates the following components:

1. An inertial measurement device (e.g., an attitude and heading reference system, inertial reference unit, or inertial navigation system);

2. One or more external sensors used to update the position and/or velocity, either periodically or continuously throughout the flight (e.g., satellite navigation receiver, radar altimeter, and/or Doppler radar); and

3. Integration hardware and software.

d. Three axis magnetic heading sensors, designed or modified to be integrated with flight control and navigation systems, having all the following characteristics, and specially designed components therefor;

1. Internal tilt compensation in pitch (± 90 degrees) and roll (± 180 degrees) axes;

2. Capable of providing azimuthal accuracy better (less) than 0,5 degrees rms at latitude of± 80 degrees, reference to local magnetic field.

Note: Flight control and navigation systems in 7A103.d. Include gyrostabilizers, automatic pilots and inertial navigation systems.

7A104 Gyro-astro compasses and other devices, which derive position or orientation by means of automatically tracking celestial bodies or satellites and specially designed components therefor.

7A105 Receiving equipment for Global Navigation Satellite Systems (GNSS; e.g. GPS, GLONASS, or Galileo), having any of the following characteristics, and specially designed components therefor:

a. Designed or modified for use in sounding rockets specified in 9A104; or

b. Designed or modified for airborne applications and having any of the following:

1. Capable of providing navigation information at speeds in excess of 600 m/s (1165 nautical miles/hour);

2. Employing decryption, designed or modified for military or governmental services, to gain access to GNSS secured signal/data; or

3. Being specially designed to employ anti-jam features (e.g. null steering antenna or electronically steerable antenna) to function in an environment of active or passive countermeasures.

Note: 7A105.b.2. and 7A105.b.3. do not control equipment designed for commercial, civil or "Safety of Life" (e.g., data integrity, flight safety) GNSS services.

7A106 Altimeters, of radar or laser radar type, designed or modified for use in sounding rockets specified in 9A104.

7A115 Passive sensors for determining bearing to specific electromagnetic source (direction finding equipment) or terrain characteristics, designed or modified for use in sounding rockets specified in 9A104.

Note:
7A115 includes sensors for the following equipment:

a. Terrain contour mapping equipment;

b. Imaging sensor equipment (both active and passive);

c. Passive interferometer equipment.

7A116 Flight control systems and servo valves, as follows; designed or modified for use in sounding rockets specified in 9A104.

a. Hydraulic, mechanical, electro optical, or electro mechanical flight control systems (including fly-bywire types);

b. Attitude control equipment;

c. Flight control servo valves designed or modified for the systems specified in 7A116.a. or 7A116.b., and designed or modified to operate in a vibration environment of more than 10 g rms over the entire range between 20 Hz and 2 kHz.

7A117 "Guidance sets", usable in "missiles" capable of achieving system accuracy of 3,33 % or less of the range (e.g., a "CEP" of 10 km or less at a range of 300 km).

7B Test, Inspection and Production Equipment

7B102 Reflectometers specially designed to characterise mirrors, for "laser" gyros, having a measurement accuracy of 50 ppm or less (better).

7B103 "Production facilities" and 'production equipment' as follows:

a. "Production facilities" specially designed for equipment specified in 7A117.

b. Production equipment, and other test, calibration and alignment equipment, designed or modified to be used with equipment specified in 7A.

7C Materials

Blank.

7D Software

7D101 "Software" specially designed or modified for the "use" of equipment specified in 7A101 to 7A106, 7A115, 7A116.a., 7A116.b., 7B102 or 7B103.

7D102 Integration "software" as follows:

a. Integration "software" for the equipment specified in 7A103.b.

b. Integration "software" specially designed for the equipment specified in 7A103.a.

c. Integration "software" designed or modified for the equipment specified in 7A103.c.

Note: A common form of integration "Software" employs Kalman filtering.

7D103 "Software" specially designed for modelling or simulation of the "guidance sets" specified in 7A117 or for their design integration with the sounding rockets specified in 9A104.

Note: "Software" specified in 7D103 remains controlled when combined with specially designed hardware specified in 4A102.

7E Technology

7E101 "Technology", according to the General Technology Note for the "use" of equipment specified in 7A101 to 7A106, 7A115 to 7A117, 7B102, 7B103, 7D101 to 7D103.

7E102 "Technology" for protection of avionics and electrical subsystems against electromagnetic pulse (EMP) and electromagnetic interference (EMI) hazards, from external sources, as follows:

a. Design "technology" for shielding systems;

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

c. Design "technology" for the determination of hardening criteria of 7E102.a. and 7E1 02.b.

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

CATEGORY 8

MARINE

Blank (For later use)

CATEGORY 9

PROPULSION SYSTEMS, SPACE VEHICLES AND RELATED EQUIPMENT

9A Systems, Equipment and Components

9A011 Ramjet, scramjet or combined cycle engines and specially designed components therefor.

N.B.: SEE ALSO 9A111 and 9A118.

9A101 Lightweight turbojet and turbofan engines (including turbocompound engines) usable in "missiles" as follows;

a. Engines having both of the following characteristics:

1. Maximum thrust value greater than 400 N (achieved un-installed) excluding civil certified engines with a maximum thrust value greater than 8890 N (achieved un-installed), and

2. Specific fuel consumption of 0,15 kg/N/hr or less (at maximum continuous power at sea level static and standard conditions);

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

9A102 'Turboprop engine systems' specially designed for unmanned aerial vehicles specified in 9A104, and specially designed components therefore, having a 'maximum power' greater than 10 kW.

Note:9A102 does not control civil certified engines.

Technical Notes:

1. *For the purposes of 9A102 a 'turboprop engine system' incorporates all of the following:*

   a. *Turboshaft engine; and*

   b. *Power transmission system to transfer the power to a propeller.*

2. *For the purposes of 9A102 the 'maximum power' is achieved uninstalled at sea level standard conditions.*

9A104 Complete rocket systems (including ballistic missile systems, space lunch vehicles, and sounding rockets) and complete unmanned aerial vehicle systems (including cruise missile systems, target drones and reconnaissance drones) capable of delivering at least a 500 kg "payload" to a "range" of at least 300 km.

9A105 Liquid propellant rocket engines, as follows:

N.B.: SEE ALSO 9A119.

a. Liquid propellant rocket engines usable in "missiles" having a total impulse capacity of 1,1 MNs or greater;

b. Liquid propellant rocket engines, usable in complete rocket systems or unmanned air vehicles, capable of a range of 300 km, other than those specified in 9A105.a., having a total impulse capacity of 0,841 MNs or greater.

9A106 Systems or components, usable in "missiles", as follows, specially designed for liquid rocket propulsion systems:

a. Ablative liners for thrust or combustion chambers;

b. Rocket nozzles;

c. Thrust vector control sub systems;

Technical Note:
Examples of methods of achieving thrust vector control specified in 9A106. c. are:

1. *Flexible nozzle;*

2. *Fluid or secondary gas injection;*

3. *Movable engine or nozzle;*

4. *Deflection of exhaust gas stream (jet vanes or probes); or*

5. *Thrust tabs.*

d. Liquid and slurry propellant (including oxidisers) control systems, and specially designed components therefor, designed or modified to operate in vibration environments of more than 10 g rms between 20 Hz and 2 000 Hz.

Note: The only servo valves and pumps specified in 9A106. d., are the following:

a. *Servo valves designed for flow rates of 24 litres per minute or greater, at an absolute pressure of 7 Mpa or greater, that have an actuator response time of less than 100 ms;*

b. *Pumps, for liquid propellants, with shaft speeds equal to or greater than 8 000 r.p.m. or with discharge pressures equal to or greater than 7 MPa.*

9A107 Solid propellant rocket engines, usable in complete rocket systems or unmanned air vehicles, capable of a range of 300 km, having total impulse capacity of 0,841 MNs or greater.

N.B.: SEE ALSO 9A119.

9A108 Components usable in "missiles", as follows, specially designed for solid rocket propulsion systems:

a. Rocket motor cases, "interior lining" and "insulation" therefor;

b. Rocket nozzles;

c. Thrust vector control sub-systems.

Technical Note:
Examples of methods of achieving thrust vector control specified in 9A108.c. are:

1. Flexible nozzle;

2. Fluid or secondary gas injection;

3. Movable engine or nozzle;

4. Deflection of exhaust gas stream (jet vanes or probes); or

5. Thrust tabs.

9A109 Hybrid rocket motors, usable in "missiles" and specially designed components therefor.

N.B.: SEE ALSO 9A119.

9A110 Composite structures, laminates and manufactures thereof, specially designed for sounding rockets specified in 9A104 or the subsystems specified in 9A105.a., 9A106 to 9A108, 9A116 or 9A119.

9A111 Pulse jet engines, usable in "missiles", and specially designed components therefor.

N.B.: SEE ALSO 9A011 and 9A118.

9A115 Launch support equipment as follows:

a. Apparatus and devices for handling, control, activation or launching, designed or modified for sounding rockets specified in 9A104;

b. Vehicles for transport, handling, control, activation or launching, designed or modified for sounding rockets specified in 9A104.

9A116 Re-entry vehicles, usable in "missiles", and equipment designed or modified therefor, as follows:

a. Re-entry vehicles;

b. Heat shields and components therefor fabricated of ceramic or ablative materials;

c. Heat sinks and components therefor fabricated of light-weight, high heat capacity materials;

d. Electronic equipment specially designed for re-entry vehicles. 9A117 Staging mechanisms, separation mechanisms, and interstages, usable in "missiles".

9A118 Devices to regulate combustion usable in engines, which are usable in "missiles", specified in 9A011 or 9A111.

9A119 Individual rocket stages, usable in complete rocket systems or unmanned air vehicles, capable of a range of 300 km, other than those specified in 9A105, 9A107 and 9A109.

9A120 Liquid propellant tanks specially designed for propellants specified in 1C111 or 'other liquid propellants' used in rocket systems capable of delivering at least a 500 kg payload to a rang of at least 300 km.

9B Test, Inspection and Production Equipment

9B105 Wind tunnels for speeds of Mach 0,9 or more, usable for "missiles" and their subsystems.

9B106 Environmental chambers and anechoic chambers, as follows:

a. Environmental chambers capable of simulating the following flight conditions:

1. Having any of the following

a. Altitude equal to or greater than 15 km; or

b. Temperature range from below 223K (– 50 °C) to above 398K (+ 125 °C)

2. Incorporating, or 'designed or modified' to incorporate, a shaker unit or other vibration test equipment to produce vibration environments equal to or greater than 10 g rms, measured 'bare table', between 20 Hz and 2 kHz imparting forces equal to or greater than 5 kN;

Technical Notes:

1. *9B106.a.2. describes systems that are capable of generating a vibration environment with a single wave(e.g., a sine wave) and systems capable of generating a broad band random vibration (i.e., powerspectrum).*

2. *In 9B106.a.2., 'designed or modified' means the environmental chamber provides appropriate interfaces (e.g., sealing devices) to incorporate a shaker unit or other vibration test equipment as specified in2B116.*

3. *In 9B106.a.2. 'bare table' means a flat table, or surface, with no fixture or fittings.*

b. Environmental chambers capable of simulating the following flight conditions:

1. Acoustic environments at an overall sound pressure level of 140 dB or greater (referenced to 20 μPa) or with a total rated acoustic power output of 4 kW or greater; and

2. Altitude equal to or greater than 15 km; or

3. Temperature range from below 223 K (– 50 °C) to above 398 K (+ 125 °C).

9B115 Specially designed "production equipment" for the systems, subsystems and components specified in 9A101, 9A105 to 9A109, 9A111, 9A116 to 9A119.

9B116 Specially designed "production facilities" for the systems, sub-systems, and components specified in 9A101, 9A104 to 9A109, 9A111, or 9A116 to 9A119.

9B117 Test benches and test stands for solid or liquid propellant rockets or rocket motors, having either of the following characteristics:

a. The capacity to handle more than 68 kN of thrust; or

b. Capable of simultaneously measuring the three axial thrust components.

9C Materials

9C110 Resin impregnated fibre prepregs and metal coated fibre preforms therefor, for composite structures, laminates and manufactures specified in 9A110, made either with organic matrix or metal matrix utilising fibrous or filamentary reinforcements having a "specific tensile strength" greater than $7,62 \times 10^4$ m and a "specific modulus" greater than $3,18 \times 10^6$ m.

N.B.: SEE ALSO 1C010 and 1C210.

Note: The only resin impregnated fibre prepregs specified in entry 9C1 10 are those using resins with a glass transition temperature (Tg), after cure, exceeding 418 K (145 °C) as determined by ASTM D4065 or equivalent

9D Software

9D101 "Software" specially designed or modified for the "use" of goods specified in 9B105, 9B106, 9B116 or 9B117.

9D103 "Software" specially designed for modelling, simulation or design integration of the sounding rockets specified in 9A104, or the subsystems specified in 9A105.a, 9A106, 9A108, 9A116 or 9A119.

Note: "Software" specified in 9D103 remains controlled when combined with specially designed hardware specified in 4A102.

9D104 "Software" specially designed or modified for the "use" of goods specified in 9A1 01, 9A105, 9A106.c., 9A106.d., 9A107, 9A108.c., 9A109, 9A111, 9A115.a., 9A116.d., 9A117 or 9A118.

9D105 "Software" which coordinates the function of more than one subsystem, specially designed or modified for "use' in sounding rockets specified in 9A104.

9E Technology

9E101 "Technology" according to the General Technology Note for the "development" or "production" of goods specified in 9A101, 9A104 to 9A111 or 9A1 15 to 9A119.

9E102 "Technology" according to the General Technology Note for the "use" of space launch vehicles specified in 9A011, 9A101, 9A104 to 9A111, 9A115 to 9A119, 9B105, 9B106,. 9B115, 9B116, 9B117, 9D101 or 9D103.

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