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Information Circular

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Communication of 30 September 2015 from the Permanent Mission of Pakistan to the Agency concerning the export control policies of the Government of Pakistan and a Statutory Regulatory Order

The Director General has received a communication dated 30 September 2015 from the Permanent Mission of Pakistan to the Agency attaching a note on 'Pakistan Strategic Export Controls and Revised Control Lists' and the Statutory Regulatory Order (SRO) 276 (I)/2015 amending the Control Lists of Goods, Technologies, Materials and Equipment related to Nuclear and Biological Weapons and their Delivery Systems contained in SRO 699 (I)/2011.

As requested in that communication, the communication, the note and the Statutory Regulatory Order[1] are herewith circulated for the information of all Member States.

[1] The Statutory Regulatory Order is available in English in the online version of this document.

PERMANENT MISSION OF PAKISTAN
TO THE INTERNATIONAL
ORGANIZATIONS
VIENNA

30 September 2015

Dear Director General,

I would like to inform you that the Government of Pakistan has notified the revised Control Lists of Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems as Statutory Regulatory Order (SRO)276(1)/2015 on 28 March 2015.

The Control Lists were initially notified in 2005 pursuant to the Export Control on Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems Act -2004. The lists were subsequently revised in 2011 by a standing inter-ministerial Joint Working Group. The revised Control Lists were circulated by the agency as INFCIRC/832 on 30 November 2011.

The revised Control Lists encompass lists and scope of export controls maintained by the Nuclear Suppliers Group (NSG), the Australia Group (AG) and the Missile Technology Control Regime (MTCR).

The revision of Control Lists highlights Pakistan's policy to implement its national and international non-proliferation commitments as a responsible nuclear weapons state and further strengthens regulatory controls over sensitive dual-use goods and technologies.

Lists controlling the exports of Chemical Weapons related agents and their delivery system are maintained by Pakistan pursuant to the Chemical Weapons Convention Implementation Ordinance 2000.

Pakistan, in view of its growing energy needs for development and scarcity of natural fossil fuel reserves, under its national Energy Plan, plans to generate 8800 MWs of nuclear power by the year 2030 through setting up of additional nuclear plants, under IAEA safeguards. All of Pakistan's existing nuclear generation plants are under IAEA safeguards. Effective and robust export controls should also facilitate international cooperation in the area of civilian nuclear technology under safeguards.

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I would greatly appreciate if you could kindly arrange for circulation of this letter, along with the enclosed information and the Statutory Regulatory Order (SRO) to all the IAEA Member States as an INFCIRC document as a further manifestation of Pakistan's support for the objectives of non-proliferation as well as the Statutory responsibilities of the IAEA.

Please accept the assurances of my highest consideration.

Yours sincerely,

(Ayesha Riyaz)
Ambassador

Mr. Yukiya Amanao
Director General,
International Atomic Energy Agency (IAEA),
Vienna

Pakistan Strategic Export Controls and Revised Control Lists

- The Government of Pakistan fully honours its national and international commitments as a responsible nuclear weapons state.

- Pakistan, through its strategic export controls, desires to further contribute to the international efforts aimed at non-proliferation of Weapons of Mass Destruction (WMD) and their means of delivery.

- In 2004, Pakistan adopted the "Export Control on Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems Act" (circulated by the Agency as INFCIRC/636 on 23 November 2004). Chemical weapons related aspects are covered by a separate legislation adopted in the year 2000.

- The Export Control Act strengthens controls over export, re-export, trans-shipment and transit of goods, technologies, material and equipment, including prohibition of diversion of controlled goods and technologies; covers intangible technology transfers; and includes catch-all provisions.

- Pursuant to the Act, in 2005, the Government of Pakistan notified national Control Lists of Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems (circulated by the Agency as INFCIRC/669 on 20 February 2006).

- The Control Lists encompass the lists and scope of export controls maintained by the Nuclear Suppliers Group (NSG), Australia Group (AG), and the Missile Technology Control Regime (MTCR). The classification system is based on the European Union's integrated list.

- In 2007, as required by Article 3 of the Export Control Act, the Strategic Export Control Division (SECDIV) was established as part of the Ministry of Foreign Affairs. SECDIV formulates and enforces rules and regulations for the implementation of export controls and also acts as a licensing body.

- In addition, an independent Oversight Board was also constituted to oversee implementation of the Export Control Act and functioning of SECDIV.

- In 2009, "Export Control (Licensing and Enforcement) Rules" were promulgated which includes detailed procedures in this regard (Available at

http://www.mofa.gov.pk/secdiv/documents/doc-3,Licensing%20%26%20Enforcement%20Rules.pdf)

- Various initiatives have also been launched, at different tiers, to further strengthen the enforcement mechanism. These include the deployment of detection equipment, training, awareness raising and inter-agency coordination.

- In July 2011, the Control Lists were revised through a comprehensive inter-agency review and notified through a Statutory Regulatory Order (SRO). The revised Control Lists incorporated the relevant amendments and modifications made by the NSG, MTCR and AG. The lists were circulated by the Agency as INFCIRC/832 on 30 November 2011.

- To promote self-regulation and facilities the relevant entities including academic and research institutions in fostering a compliance culture and setting up an effective internal compliance system, "Internal Compliance Programme (ICP) Guidelines" were notified vide Gazette of Pakistan Notification No. 2(24)/2013-SECDIV(P) dated 3 October 2014 (copy of the documents is attached with this note).

- As an on-going process, the Control Lists have been revised by a standing inter-ministerial Joint Working Group in March 2015. The lists have been notified vide Gazette of Pakistan SRO 276(1)/2015 dated 28 March 2015 and are at par with the export control standards maintained by the NSG, MTCR and AG. A copy of the SRO containing the revised Control List is attached with this note.

- The successful completion of the review process, and other measures and initiatives undertaken to further strengthen export controls, signifies the continuing resolve and policy of Pakistan to advance the shared goals of non-proliferation and effective export controls.

- Pakistan believes in an equitable, non-discriminatory and criteria-based approach to advance the universally shared goals of non-proliferation and peaceful uses of nuclear energy. Pakistan is keen to join and qualifies to become a member of NSG and other international export control regimes on non-discriminatory basis.

- Pakistan Energy Security Plan-2005 envisages to achieve nuclear power capacity of 8,800 MW by the year 2030. All of Pakistan's operating and under-construction nuclear power plants are covered by IAEA safeguards. Effective and robust export controls should facilitate international cooperation in civil nuclear technology under IAEA safeguards.

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ISLAMABAD, WEDNESDAY, DECEMBER 3, 2014

PART III

Other Notifications, Orders, etc.

GOVERNMENT OF PAKISTAN

MINISTRY OF FOREIGN AFFAIRS

NOTIFICATION

Islamabad, the 3rd October, 2014

No. 2(24)/2013-SECDIV(P).—In exercise of the powers conferred by Seciton 3 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 following Internal Compliance Programme (ICP) Guidelines:-

ZAFAR ALI,
Director General (SECDIV).

[5204(2014)/Ex. Gaz.] *Price: Rs. 20.50*

Commitment, Responsibility, Due Diligence

Internal Compliance Programme (ICP) Guidelines

Strategic Export Control Division (SECDIV)
Ministry of Foreign Affairs, Islamabad

April 2014

MINISTRY OF FOREIGN AFFAIRS
SRTATEGIC EXPORT CONTROL DIVISION (SECDIV)
ISLAMABAD

INTERNAL COMPLIANCE PROGRAMME (ICP) GUIDELINES

SECTION-1: COMMON GUIDELINES

Introduction

1. Proliferation of Weapons of Mass Destruction poses a threat to international peace and security. In pursuance of its commitment to non-proliferation, Pakistan has instituted a comprehensive legislative, regulatory and implementation system involving transfer of sensitive goods and technologies. *Export Control on Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems Act – 2004* was passed by the National Assembly on 14 September 2004. The Act further strengthens controls over exports of sensitive goods and technologies particularly related to Nuclear and Biological Weapons and their means of delivery, and enables governmental controls over export, re-export, transit, and transshipment of goods, technologies, material and equipment related therewith.

2. Effective implementation of laws derives from shouldering respective responsibility on the part of Government as well as entities and individuals. The establishment of an effective institutional ICP provides a method of routinely screening transactions, contacts, and dealings etc, in order to eliminate suspicious approaches, thereby ensuring that only legitimate transactions proceed and the risk of breaching the law is minimized. The need for an effective ICP to avoid law violations has increased exponentially, driven by the increasing contacts between small businesses and foreign clients, increasing focus on stemming the flow of financial resources to terrorist organizations, and emergence of new and dual use technologies.

3. Self regulation contributes to overall effectiveness of the country's export control system. Relevant entities are urged to establish enforceable prohibitions against efforts by individuals/entities to assist others in acquiring the technology, materials, and knowhow needed to develop WMDs or their delivery systems.

4. ICP provides two significant benefits to an entity: it reduces the chances of law violations and may mitigate penalties in case of a minor offence. As per our system ICP is not a legally binding requirement nonetheless; entities are encouraged to set up ICP, and declare information on their compliance programmme in export license. As part of export control practice, ICP involves risk detection, solving problems, and exporting in a responsible manner. However, ICP differs from one entity to another given the nature and size of the entity concerned. There are, however, a number of essential elements common to all programmes. Large entities including industries and manufacturing firms, multinationals, could adopt their own codes of conduct to combat proliferation problems. Nonetheless, it is important to understand that export authorization would be needed for sensitive goods and technologies regardless of the method of transfer.

Aim of the Guidelines

5. To assist entities, institutions, companies, exporters and others involved in the export chain in evolving an effective system of self regulation by establishing an effective export compliance programme within the

Develop a compliance culture

entity/organization. If adequately implemented this would foster export control culture, facilitate export decision making, maintain consistency in policy/procedures, and enhance compliance with relevant export control laws. Violation of export laws could result in both criminal and administrative penalties and businesses/entities might lose lucrative market place or attract bad reputation.

6. These Guidelines are not exhaustive and entities/organizations may have specific requirements depending on the nature of business activities, resources, customer base, etc. However, these might serve as starting point for evolving an ICP that is flexible to cater for varying needs and future expansions.

What is Export and Export Control?[1]

7. Export Control relates to Governmental restrictions on export of goods, materials, equipment, technologies, software, and/or sharing information and materials internationally or within Pakistan with the knowledge or intent of its being transferred or shipped outside by any means or method.

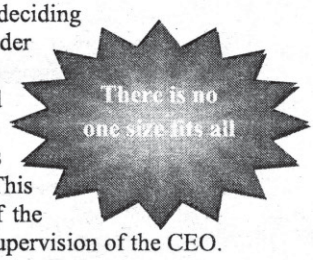
8. 'Export' means shipment, transfer or transmission of goods or technology out of the territory of Pakistan; and a transfer of goods or technology within Pakistan with the knowledge or intent that the goods or technology will be shipped, transferred or transmitted to an unauthorized recipient outside Pakistan.

What is an ICP?

10. ICP is an in-house mechanism that entities' adopt to facilitate compliance with national export control requirements. It is a set of policies, procedures and guidelines an entity/organization implements for minimizing the risk of law violations through a regulatory system wherein all the employees are aware of their responsibilities and obligations, and comply with the entity's policies and procedures on transfer of goods and technologies. An effective ICP protects business interests and minimizes the risk of law violation.

11. Every entity involved in export/transfer of sensitive goods/technologies/information/software should have an ICP that is tailor made to its unique requirement/business activities. An export applicant is required to furnish information on how ICP is implemented within the respective entity. This notwithstanding, there are certain key elements, which are relevant to all organizations whether small, medium or large.

12. It is also important to understand that there is no one-size-fits-all solution for designing and implementing an ICP. Nonetheless, ICP could assist in deciding whether export compliance responsibilities should be centralized under a single person, small/large team, or located within various departments. Depending on peculiar structure, size and environment, internal organizational structure, responsible for export control, could either be established as a stand-alone unit or as an additional task for an appropriate unit within the entity. This notwithstanding, export compliance unit should be independent of the sales and marketing departments and preferably work under direct supervision of the CEO.



[1] Export Control on Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems Act-2004.

Key Elements of a Compliance Programme

13. An effective compliance within an entity is based on some key factors, which together contribute to efficacy of the programmme. Some key elements are as under:-

a. Management Commitment.

b. Written Operational Guidelines and Procedures.

c. Continuous Risk Assessment.

d. Screening at each stage including initial negotiation, contracts, and actual export chain.

e. Compliance Training and Awareness Raising.

f. Cradle to Grave Export Compliance Security.

g. Record Keeping.

h. Procedures for Handling and Reporting Export Compliance Problems and Violations.

i. Compliance Monitoring and Auditing.

j. Follow Through and Corrective Action.

k. Establish Good Working Relationship between Enterprise/Entity and Export Licensing Authorities.

Conceptualizing an ICP

14. As noted above, each entity should evolve a compliance programme that is unique to its requirement and business activities. In evolving an ICP, the following factors may be considered:-

a. The nature of business activities.

b. Size, organizational structure and resources.

c. Sensitivity of the items and volume of exports/re-export etc, the scope, frequency and level of interaction involving possible transfer of sensitive information, technology, software, and services etc.

d. Recipient, end users and other beneficiaries.

e. Production and distribution network.

f. Geographic location of the customers.

15. Internationally suggested elements for structuring an ICP are given below. However, the list is not exhaustive and entities involved in the export chain or interaction involving transfer of goods, technologies, information, software, and services could add on, based on their peculiar requirements:-

a. **Management Commitment:** Establish written export compliance standards, devote sufficient resources, designate officials and set out compliance commitment (Example given at **Annex-I**).

b. **Designate Officials with responsibility for implementing ICP**: Empowered and authorized Chief Compliance Officer (CCO) assisted by Compliance Managers(CM)/Compliance Officers (CO) as the case may be, or a Compliance Team (CT) may be designated, by the management, who should be responsible for structuring, setting up, functioning and overseeing implementation of ICP.

c. **Evolve Formal Written ICP, Policies and Procedures:** Based on risk assessment, evolve a formal written ICP with manual of policies and procedures. Risk assessment is a continuous process for adapting ICP to confront emerging threats.

d. **Set UP a Screening System:** A system to screen all enquiries, orders, brokers/freight forwarders/exporters, end users, and end use. 'Cradle to Grave' export compliance and screening system should be the focus.

e. **Establish an Effective Product Classification Procedure:** Capitalize on the knowledge of subject matter experts. Product classification table given at **Annex-II**.

f. **Order Processing and Shipping Procedure:** Should be established to monitor and track the whole process.

g. **Compliance Training and Awareness:** Tailor made compliance and awareness training modules should be developed and implemented periodically.

h. **Record Keeping:** Adherence to record keeping and regulatory requirements is important for effective monitoring and eventual investigation in case of possible violations. It may be noted that record keeping is mandatory according to Article 6 of Export Control Act-2004. Proper documentation of all decisions, minutes, and transactions should be kept, preferably for a period of at least ten years.

i. Compliance Monitoring and Periodic Audits/Assessments.

j. **Handle Compliance Problems:** Internal system for handling compliance problems including reporting and escalating export violations.

k. **Taking Corrective Actions:** Completing appropriate corrective actions in response to export violations.

16. To summarize, important elements of an effective compliance system include elaborate structures and processes on Compliance Organization Structure, Corporate Commitment and Policy, Identification, Receipt and Tracking of Control Lists/Non-listed items having possible WMD uses, Re-Exports/Retransfers, Screening customers/carriers/country and possible diversion, Record Keeping/Audit/Monitoring, Training/Awareness Raising, Penalties/Punishments for Violations and Awards/Rewards for Best Compliance Standards.

Benefits of an ICP

17. ICP accrues many benefits to an entity and assists in compliance with laws, promoting market reputation while minimizing violation risks.:-

a. Enhance trust and confidence by reinforcing senior management commitment to compliance.

b. Allocate responsibilities within an organization.

c. Assist in taking correct decisions.

d. Institute a system of checks, accountability and audits.

e. Ensuring screening at all stages of the export/transaction chain.

f. Facilitate processing of orders by indentifying items that would not require a license.

g. Establishing trust of the licensing authorities.

h. Streamline the process and reduce time of compliance processes.

i. Reduce the chances of non-compliance and risk of inadvertent violation.

j. Foster export control culture in employees and institution.

k. Reduce time spent on compliance activities when employees have written instructions, tools and on-going training.

Importance of Public-Private Partnership

18. Today's proliferation threats are far more diverse and increasingly difficult to counter as goods and technologies with legitimate commercial use, frequently have military applications. The challenges of globalization spurred by fast paced technological developments, diffusion of technology, the changing proliferation patterns and the threat from non-state actors suggest that export controls on sensitive goods and technologies should be continuously evaluated and adapted.

19. Public-Private partnership is elemental in promoting and advancing Pakistan's non-proliferation and security (national/international) objectives and preventing diversion of goods and technologies, especially dual use items, or access thereto by state and non-state actors for destructive or harmful purposes. It is in this context that the individual/entities' or companies' role becomes important and require due diligence in evaluating its customers/clients and prospective transactions in order for it to contribute towards national security and foreign policy objectives.

20. Effective national export control system is possible if all stakeholders, including manufacturers of critical goods, exporters, freight forwarders, intermediaries, subsidiaries joint partners, engineers/scientists, and persons with technical knowhow recognize the need for such controls and support them with all resources available to them.

Developing an ICP Architecture

21. It is recommended that the CEO or his designated official/team representing all relevant organs of the entity, should first define scope and parameters of the proposed ICP based on the factors for conceptualizing an ICP (Paragraph 14 & 15 above). The team should follow a sequential process and recommend building blocks of the ICP architecture, which may include:-

Investment in compliance programme is investment in the entity's reputation and business sustenance

a. Export compliance commitment from the entity's senior management. A written statement communicating CEO/senior management's resolve for compliance,

willingness to allocate adequate resources, and investment in instituting and implementing an effective ICP.

b. CEO/senior management's commitment is a written formal policy document (Example given at **Annex-I**). This should include an introductory paragraph, importance of export controls for national security, foreign policy interests, and entity's reputation and sustenance of legitimate business, dual use risks statement, statement on proceeding against violations, and on whom to direct questions/queries within the set up.

1) Should be a formal declaration explicitly conveying that export/transfer of goods and technologies/software will not be pursued at the expense of compliance.

2) Compliance is essential for entity/company's business interest and reputation.

3) Every individual has compliance responsibility.

Be alert for prohibited activities, destinations and entities/persons

4) Should be communicated to all individuals, contractors, middlemen, brokers, partners etc involved in export/transfer.

5) The statement should be customized in a way appropriate for the entity/company.

c. Formulate entity/organization's export control policy.

d. Establish export compliance positions preferably under direct supervision of the entity's senior most executive, and may include CCO who should be in-charge of export controls (Head of Export Control and ICP), Administrators/Managers, Product Classification and Technical Experts etc.

e. Resource allocation.

f. Chalk out a plan for training, meetings, company/entity reports. Compliance posters prominently displayed at appropriate places are always helpful.

g. Develop methodology of risk assessment covering each stage starting from export inquiry to actual shipment. Risks specific to the entity's products, technology, software, and activities should be listed.

h. Institute a system of verifying your customer/interlocutor.

i. Institute a system of incentive and rewards including punishments for violators. It may be stressed that export violations could draw a punishment that may extend to 14 years imprisonment and/or 500 million rupees fine, and confiscation of assets/property or both.

j. Clear instructions on how export inquiries will be responded and in case of any doubt /question; who should be consulted.

k. Based on the suggested approach above, the entity/organization should be able to develop a comprehensive ICP manual that outlines organizational policies, risk assessment, procedures of processing inquiries, research projects, export orders,

accountability and checks at each stage of the transaction/transfer with adequate guidelines to enable decision making. Suggested elements of ICP manual are:-

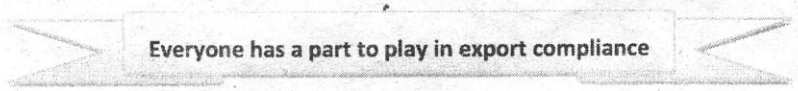
1) This is a set of formal written policies and procedures.
2) A guidance document on all matters related to export compliance.
3) Should be kept up to date and consistent with the entity/organization's overall policies and procedure.
4) Based on relevant national laws, rules, procedure and policies.

Compliance Training

22. Export Control framework should include training modules for compliance in order to minimize the chances of inadvertent violations. All employees who are involved in export-related functions including top management, compliance officials, contractors, consultants, etc should fully understand export compliance responsibilities. Such training need to be job specific and focus on individual responsibilities, raising awareness on current laws/rules/regulations, licensing, proliferation risks, ways in which the entity's products can be misused, red flag indicators, auditing and detecting irregularities, etc.

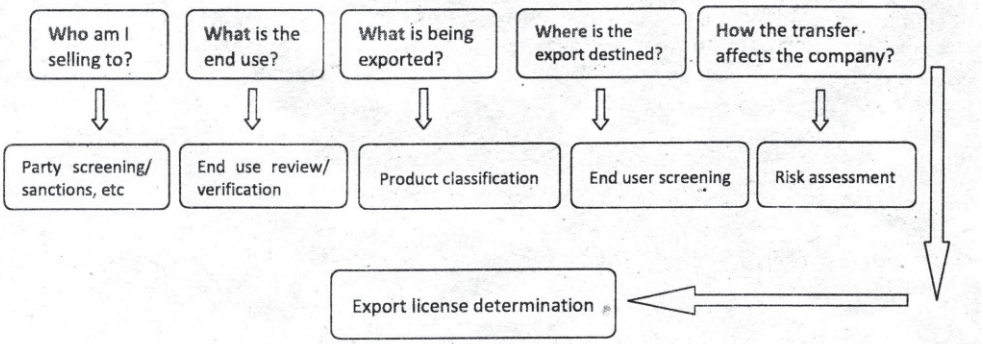
23. The training should be made interesting and encompass exercises, quizzes, and competitions. Separate training modules for basic, mid career, advance, and refresher trainings may be developed besides on-job-training and making use of information circulars/intranet, newsletters, etc for reminding individual responsibilities and sharing latest changes and developments.

24. Security awareness on marketing within and outside the country should also form part of compliance training for those involved in marketing the entity's products/services.



Compliance Procedures

25. ICP is intended to institute a system of safeguards to prevent sale/transfer of sensitive goods technologies, software and information to unauthorized entities. Have procedures in place to guard against transfer/pilferage/theft/diversion of tangible and intangible sensitive goods and technologies at all stages including demonstration/exhibitions, manufacturing, production, transportation, marketing, post shipment verification, etc. In conducting screening for a proposed transaction, the questions identified in the following diagram may be deliberated:-



Commodity Classification

26. Commodity classification is critical for arriving at correct export decision; this also facilitates export application processing. Item's classification is based on SECDIV control lists, which are periodically reviewed. Entity's export control department must be aware of the latest edition of control lists, promulgated through Statutory Regulatory Order and, also posted on SECDIV web page. Every item on SECDIV control lists has SECDIV Classification Number called *Control Lists Classification Number* (CLCN).

27. SECDIV control lists categorize the goods and related technology it covers into ten categories, each subdivided into lists of specific items. Items are further arranged into five product groups, and each item is given a specific classification number called Control Lists Classification Number (CLCN). An example of how to classify an item is given at **Annex-III**.

28. Export control department of the entity should indentify the most appropriate classification of the commodity, consulting entity's relevant technical experts, if required. For this, a team of relevant experts may be designated who should use a standard report format, developed by export control department, for recording their expert input/views on the most appropriate classification of the item in question. If the entity is uncertain of the exact classification of the item, the matter may be raised with SECDIV using the form at **Annex-IV**.

Catch All Controls

29. Any item, goods, technology, software, data, etc that is not specifically mentioned in the control lists but has possible use in WMDs or their delivery systems or if there are end user/use concerns, it would require export license under the 'Catch-All' control provided for in Article 5 (3) of the Act.

30. An exporter is under legal obligation to notify to the competent authority if the exporter is aware or suspects that the goods or technology are intended, in their entirety or in part, in connection with nuclear or biological weapons or missiles capable of delivering such weapons.

31. An authorization is also required from the GoP/SECDIV for the transfer of non-listed items where the exporter is informed by the competent authority or the exporter is aware that the items in question may be intended, in their entirety or in part, for use in connection with WMD activities.

32. **List of Countries/Entities/Individuals under Sanctions/or of Concern.** SECDIV, Ministry of Foreign Affairs may be consulted on case to case basis.

Record Keeping

33. Record keeping requirements mentioned in Article 6 of Export Control Act – 2004 apply to all transactions under the Act. Record should be located and be available for examination of the designated authority, when required. Regardless of the filing system used (manual, digital, electronic), an entity must be able to maintain, retrieve required documents, in the original form in which they were created or received. The record must also be capable of being produced on paper. In a computer based environment it is important to note that every employee/individual involved in the export business of the entity becomes a records manager responsible for ensuring that records can be located, easily shared, and are not at risk of being lost.

34. Inadvertent violations of export laws and regulations could occur during informal technical exchanges with foreign nationals, visitors or customers through telephone, facsimile, electronic mail, or in person. A system of documenting all such communications is considered

useful besides putting in place a system to prevent the release of controlled technology and software.

35. Maintain a back-up system for all electronic files. Record retention may also be clearly defined in contractual agreements with the importers, brokers, freight forwarders, etc.

36. Maintaining record of all license applications, processes, decisions, minutes etc is mandatory for all relevant governmental departments. It is also mandatory for the exporters to keep a complete record of their transactions, which is also liable to inspection by the designated authorities.

A Generalized ICP Framework

37. Generalized ICP framework is given at **Annex-V,** which could serve as a baseline for the entities/institutions to put together the building blocks of an effective compliance system appropriate to their requirement and need.

SECTION-2: SPECIFIC TO RESEARCH/ACADEMIC INSTITIONS

Measures Specific to Research/Academic Institutions

38. Export controls present unique challenges for academic and research institutions because they have to balance national foreign policy/security interests with traditional concepts of unrestricted academic freedom, publication, dissemination of research findings, etc. Academicians, researchers and administrators should understand the extent to which the export control laws and procedures apply/do not apply to their activities and to obviate the chance of unknowingly falling into exchange/transfer of sensitive goods, technologies, software, knowledge whether directly or through joint research projects. Export Control Act-2004 provides for basic definition of 'services' and 'technology' under Article 2 (k) & 2 (l) respectively.

39. The purpose of this part of the document is to provide some basic information to assist academic and research institutions, individuals/researchers including faculty and students, and relevant administrators to identify when and how export control provisions may apply and what mechanism should be put in place to prevent dissemination of sensitive knowledge, technology and equipment etc, in and outside the country especially involving 'deemed exports'.

40. Export control on Goods, Technologies, Materials, Equipment related to Nuclear & Biological Weapons and their Delivery Systems Act-2004 and other laws apply to tangible and intangible goods and technologies irrespective of the method of transfer. These laws equally apply to 'deemed exports' and disclosure of specific information inside or outside Pakistan. When the activities of institutions/researchers/individuals involve dissemination/transfer/exchange/export of those specific things, services, information, software etc they come under SECDIV regulatory controls and would require prior license/permission of SECDIV.

41. This may not be construed as restriction on teaching and dissemination of information on instruction in courses or general scientific, mathematical, or engineering principles, research and experimentation commonly taught in colleges and universities as part of fundamental research and education purposes. SECDIV license/permission would not be required if such information is in the public domain or involves basic scientific research. Text of Export Control Act-2004 and Control Lists is available at http://www.mofa.gov.pk/secdiv/content.php?pageID=notification, for which, SECDIV in the

Ministry of Foreign Affairs is responsible for licensing. It is advisable to check the latest lists of sanctioned/embargoed entities and individuals before venturing into a project that may be liable to export control regulations.

42. Export control laws may restrict researchers from freely sharing certain types of information with certain individuals. It also may restrict what equipment, software, and information can be released for international destinations. Penalties for violations of export control regulations can be quite severe.

How Does Something Become Export Controlled

43. A matter becomes export controlled if it involves goods, technologies/software, materials and equipment given in the control lists, or if there are destination concerns e.g. sanctions/embargoes, or if there are end use and end user concerns. If research involves export/transfer including 'deemed exports' of goods, technologies/software, materials and equipment mentioned in control lists, SECDIV approval would be required before such a transaction takes place.

Benefits of Compliance Programme for Academic/Research Institutions

44. Export control laws govern how certain information, technologies/software, services and commodities can be exported/ transferred. The scope of the regulation is broad and encompasses a variety of commodities that may have dual application and may include the fields of science, engineering, science and technology and apply to research and other academic activities regardless of the method of transfer/export. Non compliance could have serious consequences both for the institution and individuals and may include fines and possibly imprisonment. Compliance programme is the expression of the institutions' commitment to carry out its educational, research and other activities in compliance with all relevant laws and regulations. Some significant benefits of an effective compliance program are as follow:

a. Instituting a culture that does not tolerate illegal or actionable behavior.

b. Increasing the likelihood of early detection of an unlawful activity or conduct.

c. Risk minimization.

d. Enhance reputation, efficiency, and improve outcomes.

e. Avert consequences of non-compliance.

f. May reduce or mitigate penalties in case of inadvertent violation.

g. Contribute towards national security and foreign policy interests.

Undertaking Research or Venturing into Areas involving Sensitive Information

45. Vast majority of activities, items and services do not require license. Only goods and technologies falling under Export Control Act 2004 and Control Lists issued there under, and in certain cases goods and technologies with commercial as well as possible WMD applications would require a license, even if not listed in SECDIV control lists (refer Article 5 (3) of the Act). While undertaking a research project or venturing into areas involving exchange/dissemination of critical goods, technologies/software or information, the following questions needs to be asked:-

a. Does it involve sharing sensitive information, technology/software, services or equipment?

b. Is it a joint project involving foreign nationals inside and outside Pakistan?

c. Will it require physical export of some equipment, data, technology/software or components?

d. Are there any contractual restrictions on dissemination of information and research results, etc?

e. Does the project fall under one of the export-control technologies as given in the Act and Control Lists?

f. Is the country, individual or entity with whom a joint project or collaborative activity is intended, under national and international/UN sanctions/embargoes? It is important to check with SECDIV, Ministry of Foreign Affairs if any such restrictions or sanctions exist.

g. Does it require a license on the part of the individual or institution?

46. It is advisable that export control administrators of the research or academic institution informs, in writing, the researcher/individual/entity undertaking a specific project that involves or could result into sensitive information. Mandatory acknowledgement certification (Specimen at **Annex-VI**) should be submitted, to the compliance office, by the researcher/individual/entity.

47. Export of materials that could possibly be used in chemical or biological weapons such as human pathogens, animal pathogens, genetically modified microorganisms, and plant pathogens given in the control lists, are regulated under the export control laws. Individuals/departments/institutions planning to work with these materials should check with the appropriate institutional export control compliance officials as to the need for a license if the materials are to be exported/ transferred.

48. The fundamental research exclusion does not apply to export/re-export of materials, equipment, and technology that fall in the control lists. Actual shipment of these items is subject to SECDIV licensing, regardless of destination.

49. A best practice guide is at **Annex-VII.**

Setting up a Compliance Framework

50. It is important that academic and research institutions set up a system that is able to filter all research activities, publications or dissemination of information, data, technology/software, or articles and be responsible for export control matters. To prevent law violations it is important to create an institutional compliance program with a mandate to coordinate, monitor, implement, and improve compliance functions. Most institutions have compliance mechanisms in place however, on occasions it is either not formalized or focused in selected areas. As an additional function, the existing set ups could be adequately geared and mandated for export compliance as well.

51. Establish a compliance office or a compliance committee under a designated officer as Chief Compliance Officer/Director Compliance/Compliance Administrator.

52. If required, the compliance committee may be supported and assisted in its oversight responsibilities by a compliance officer in each subsidiary department/organization. Each compliance officer is responsible for the day-to-day operations of the compliance programme as it relates to his specific organization/area.

53. The designated official/administrator should be able to assist researchers and university administration in the identification and management assessment of export control matters.

54. He should be the official contact person for both the governmental agencies as well as the researchers with respect to the treatment of all the issues raised above, and may be assisted by a research/foreign visitors' coordinator.

55. If the designated official is not a technical expert, it would be advisable to set up a technical review committee to assist in terms of recommendation on assessment of the proposed activity/project as fundamental research or otherwise and to determine if a license would be required in line with the Export Control Act.

56. Set up a system for training/awareness raising on specific export control matters, for the administrators, researchers and expert committee members including general training cum awareness raising programme for students and faculty members albeit focusing on departments, individuals with high likelihood of receiving/involving in projects that trigger export regulatory requirement i.e. engineering, chemical/biological labs/research work, computer and space sciences, etc.

57. Develop and disseminate institutional policies and procedures on compliance with export control laws. Policies and procedures may also be developed for projects of high sensitivity involving foreign nationals and joint ventures. The development and distribution of written standards as well as policies and procedures that reflect the institution's commitment to compliance is important for effective implementation of export control laws.

58. Clear definition of roles and responsibilities would substantially assist in instituting an effective compliance mechanism.

59. Develop policies and procedures for the investigation of identified instances of non-compliance and initiation of appropriate corrective action and preventive measures. Appropriate disciplinary action should be taken against violators of the institution's policies and those trying to circumvent the system.

60. All departments should be able to provide their Annual Compliance Reports to the Compliance Office for compilation of the institution's overall Annual Compliance Report.

License acquisition may take a long time, so plan ahead

61. Institution's website is a useful tool to disseminate essential information on fundamentals of export control laws and institute's policy, procedures and compliance guidelines. Contact details for directing questions/inquiries would further assist individual researchers.

SECTION-3: CONCLUSION

62. When business entities/academic and research institutions/individuals/administrators are aware of regulations governing the transfer of proliferation-relevant technologies and items, understand how to comply with national strategic trade regulations, and possess tools such as internal procedures to screen potential customers and review proposed export deals, compliance with export regulations increases and the likelihood of illicit transfers is substantially reduced.

This Document Is Not and Should Not Be Used as Formal Legal Advice

Further Assistance/Inquiries

63. For further assistance or inquires SECDIV officials may be contacted on the following address/telephone numbers:-

Address: Strategic Export Control Division (SECDIV)
Ministry of Foreign Affairs, Islamabad

Phone: 051- 9266152 .

Fax: 051- 9266543

Website: http://www.mofa.gov.pk/secdiv/ (The website has information on export control law, licensing and enforcement regulations, control lists, and policies/procedures on export/transfer of sensitive goods and technologies, etc).

Annex-I

Example of a Company/Organization's Policy Statement

(To be circulated to all relevant employees/individuals/entities and affirmation recorded periodically)

_____ (Name of the entity/organization) is committed to contribute towards the national policy of non-proliferation through effective compliance with Export Control on Goods, Technologies, Material and Equipment related to Nuclear and Biological Weapons and their Delivery Systems Act-2004 and implementing regulations/policies/procedures issued by Strategic Export Control Division (SECDIV).

The _____ (Name of the entity/organization) and affiliated organs/individuals will not undertake any export business or indulge in transfer of sensitive goods, technologies, services and information etc, in contravention to national laws, policies and regulations on non-proliferation of nuclear, biological and chemical weapons or their delivery means including dual use items that are usable in weapons of mass destruction.

Failure to comply may result in the imposition of criminal and/or administrative penalties including termination of service of those involved in unauthorized transaction.

Particular attention must be given to transactions involving dual use/non-listed items usable in WMDs and their delivery systems including related technology/services, and release of technical information to foreign nationals, electronic transmission of data/software, etc.

Every employee of _____ (Name of the entity/organization) and affiliated entities/individuals whether in Pakistan or abroad are asked to take the matter seriously and support the entity/organization in pursuit of its genuine business interests, upholding reputation and sustenance of legitimate business activities.

For any inquiry/question on legitimacy of a transaction or reports and information on potential export control violations/non-compliance, please contact the designated authority given below:-

(Name, Designation, Phone, E-Mail, etc)

Annex-II

Product Classification Table

Item	Description & Model*	Uses i.e. Commercial, WMD including Delivery Systems	Control Parameters of CL	Classification & CL description	Control Reference MECRs	Remarks

*Complete specifications to be attached

Classification Assessment by the Compliance Officer

Date:

Signature
(Name, Designation, Stamp)

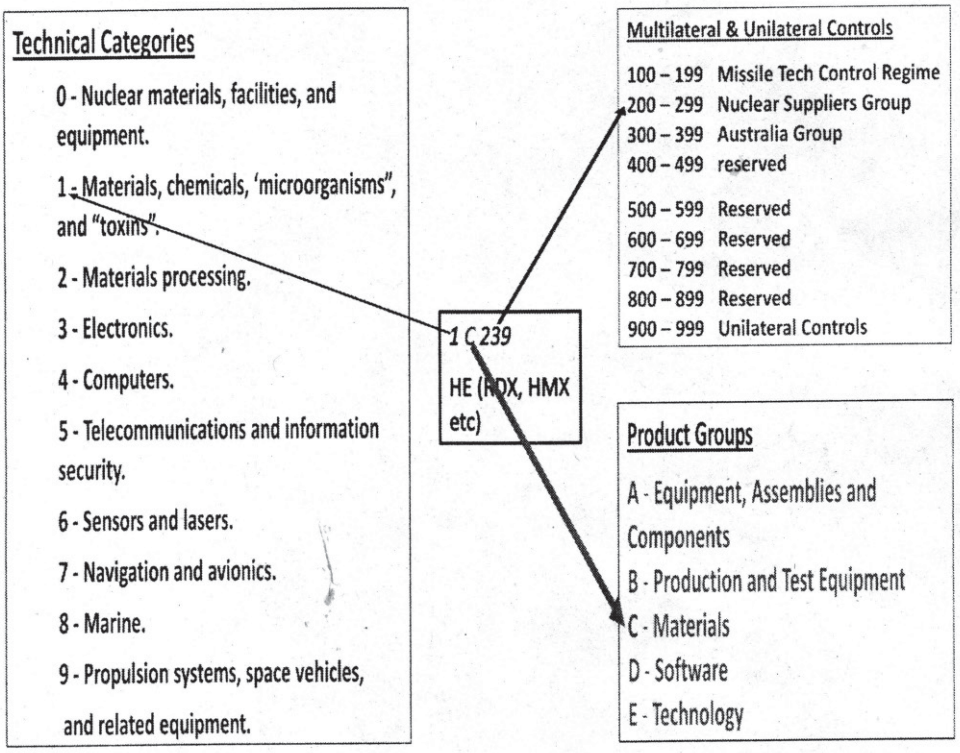
Final Classification Assessment By CCO

Date:

Signature
(Name, Designation, Stamp)

Annex-III

Control Lists Classification



Annex-IV

Export Authorization Decision Template

Item Description	Technical Specifications	CLCN	Route, Destination & Intermediate Countries	End-Use of the Item (Commercial and WMD?)	Stated End Use	End User Concerns/ Sanctions etc	License Required/Not Required	Remarks

Remarks of CCO (Chief Compliance Officer)

Date:

Signature
(Name, Designation, Stamp)

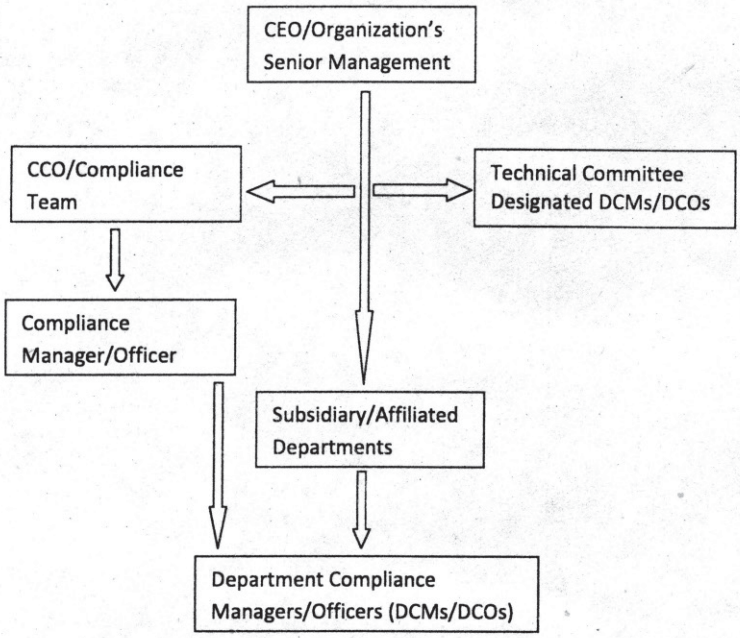
Decision by the CEO

Date:

Signature
(Name, Designation, Stamp)

Annex-V

Generalized ICP Framework



Annex-VI

The University of _____ (or name of research institute)

Export Control Acknowledgement and Certification

I/We, the undersigned, acknowledge that it is unlawful under the Export Control on Goods, Technologies, Materials, Equipment related to Nuclear and Biological Weapons and their Delivery Systems Act -2004 (Act No V of 2004) and rules/regulations promulgated there under, to export, transfer or share (by any means viz tangible or intangible), goods and technologies mentioned in the control lists or those which could have possible use in nuclear and biological weapons or their delivery systems, without proper approval.

I/We also understand that an export license may be required from Strategic Export Control Division if any such item as mentioned above is to be transferred/shared with a person/entity within Pakistan who may ultimately export it using any means.

I/We understand that a laptop or any data storage device/gadget fall under the category of a 'controlled' item due to controlled information or software stored on the system and I/We will comply with all applicable export control laws, rules, and regulations. In such a case the institute/entity's compliance office will be approached for removing the 'controlled' data, and seeking certification to this effect.

I/We understand that I/We may be subject to civil and criminal penalties including imprisonment, for unlawful export and sharing of export controlled item, technology or information and therefore agree to take appropriate security measures and to contact the export compliance office before making any type of transfer/disclosure of export-controlled information to any person.

By signing below, I/We certify that I/We have understood my/our legal obligations under the export control laws including the _____ (name of the institution) policies/procedures and agree to comply with these. I/We also understand that failure to comply with export control laws, rules, regulations and policies may constitute just cause for disciplinary action, up to and including termination, as well as criminal prosecution.

Date: _____

Signature: _____
Name: _____
Designation: _____

Chief Compliance Officer: _____

Registrar: _____

Annex-VII

Best Practice Guide for Academic and Research Institutions

- Have designated officials to handle export control matters besides designating some faculty member as research/foreign visitors' coordinator.
- Widely disseminated institutional compliance policies and procedures.
- Setting up exclusive areas, with access control etc for research areas falling under export controls.
- Access control, securing computers/gadgets, documents containing sensitive information/data.
- Training in export control matters, laws, policies, procedures and making it clear when, where and how do they apply.
- Close liaison and coordination with officials of SECDIV for guidance and updates on the current export control policies, procedures and restrictive/sanctions lists.
- Compliance with proprietary rights and non-disclosure requirement of any parties involved in the project.
- Factoring in national export compliance requirement as part of contractual obligations for joint ventures or projects involving foreign nationals.
- Do not export any items, materials, or equipment, even at the request of a government sponsor, without consulting the institutions compliance officer.
- Take adequate precaution against 'deemed exports'.
- Never agree to contract language that requires you to provide indemnification for violations of the export regulations.
- Seek guidance before travelling to or undertaking research/project in sanctioned/embargoed countries or with denied persons.
- The University/entity shall conduct periodic risk assessments to evaluate and prioritize the compliance-related risks facing the more heavily regulated areas of the University/entity.
- Institution's website is a useful tool to disseminate essential information on fundamental of export control laws and institutes policy, procedures and compliance guidelines. Contact details for directing questions/inquiries would further assist individual researchers.

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ISLAMABAD, MONDAY, APRIL 6, 2015

Part II

Statutory Notifications (S.R.O)

GOVERNMENT OF PAKISTAN

MINISTRY OF FOREIGN AFFAIRS

NOTIFICATION

Islamabad, the 28th March, 2015

S.R.O. 276 (I) 2015.— In exercise of the powers conferred by section 4 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. 699(I)/2011, Islamabad dated 6th July, 2011 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).

[552 (2015)/Ex. Gaz.] *Price : Rs. 93.50*

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.

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

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:

"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.

"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.

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

"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.

"Circuit element" means a single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc.

"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".

"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.

"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).

"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.

"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.

"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.*

"Discrete component" means a separately packaged "circuit element" with its own external connections.

"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.

"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.

"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.*

"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.

"Fibre Preforms" 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".

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

"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.*

"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.

"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.

"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.

"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.

"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.

"Microprogrammes" 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.

"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.

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

"Nuclear reactor" means a reactor capable of operation so as to maintain a controlled self-sustaining fission chain reaction, it basically includes 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 or come in 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).

"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.

Note: The particular equipment, subsystems, or components to be included in the "payload" depends on the type and configuration of the vehicle under consideration.

Technical Notes:

1. *Ballistic Missiles*

   a. *"Payload" for systems with separating re-entry vehicles (RVs) includes:*

      1. *The RVs, including:*

         a. *Dedicated guidance, navigation, and control equipment;*

         b. *Dedicated countermeasures equipment;*

      2. *Munitions of any type (e.g. explosive or non-explosive);*

      3. *Supporting structures and deployment mechanisms for themunitions (e.g. hardware used to attach to, or separate the RV from, the bus/post-boost vehicle) that can be removed without violating the structural integrity of the vehicle;*

      4. *Mechanisms and devices for safing, arming, fuzing or firing;*

      5. *Any other countermeasures equipment (e.g. decoys, jammers or chaff dispensers) that separate from the RV bus/post-boost vehicle;*

6. *The bus/post-boost vehicle or attitude control/velocity trim module not including systems/subsystems essential to the operation of the other stages.*

b. *"Payload" for systems with non-separating re-entry vehicles includes:*

1. *Munitions of any type (e.g. explosive or non-explosive);*

2. *Supporting structures and deployment mechanisms for the munitions that can be removed without violating the structural integrity of the vehicle;*

3. *Mechanisms and devices for safing, arming, fuzing or firing;*

4. *Any countermeasures equipment (e.g. decoys, jammers or chaff dispensers) that can be removed without violating the structural integrity of the vehicle.*

2. *Space Launch Vehicles*

"Payload" includes:

a. *"Spacecraft" (single or multiple), including satellites;*

b. *Spacecraft-to-launch vehicle adapters including, if applicable, apogee/perigee kick motors or similar manoeuvering systems and separation systems.*

3. *Sounding Rockets*

"Payload" includes:

a. *Equipment required for a mission, such as data gathering, recording or transmitting devices for mission-specific data;*

b. *Recovery equipment (e.g. parachutes) that can be removed without violating the structural integrity of the vehicle.*

4. *Cruise Missiles*

"Payload" includes:

a. *Munitions of any type (e.g. explosive or non-explosive);*

b. *Supporting structures and deployment mechanisms for the munitions that can be removed without violating the structural integrity of the vehicle;*

c. *Mechanisms and devices for safing, arming, fuzing or firing;*

d. *Countermeasures equipment (e.g. decoys, jammers or chaff dispensers) that can be removed without violating the structural integrity of the vehicle;*

e. *Signature alteration equipment that can be removed without violating the structural integrity of the vehicle.*

5. *Other UAVs*

"Payload" includes:

a. *Munitions of any type (e.g. explosive or non-explosive);*

b. *Mechanisms and devices for safing, arming, fuzing or firing;*

c. *Countermeasures equipment (e.g. decoys, jammers or chaff dispensers) that can be removed without violating the structural integrity of the vehicle;*

d. *Signature alteration equipment that can be removed without violating the structural integrity of the vehicle;*

e. *Equipment required for a mission such as data gathering, recording or transmitting devices for mission-specific data and supporting structures that can be removed without violating the structural integrity of the vehicle;*

f. *Recovery equipment (e.g. parachutes) that can be removed without violating the structural integrity of the vehicle.*

g. *Munitions supporting structures and deployment mechanisms that can be removed without violating the structural integrity of the vehicle.*

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

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

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

"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.

"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.

Technical Notes:

1. *The maximum capability based on the design characteristics of the system, when fully loaded with fuel or propellant, will be taken into consideration in determining "range".*

2. *The "range" for both rocket systems and UAV systems will be determined independently of any external factors such as operational restrictions, limitations imposed by telemetry, data links or other external constraints.*

3. *For rocket systems, the "range" will be determined using the trajectory that maximises "range", assuming ICAO standard atmosphere with zero wind.*

4. *For UAV systems, the "range" will be determined for a one-way distance using the most fuel-efficient flight profile (e.g. cruise speed and altitude), assuming ICAO standard atmosphere with zero wind.*

"Repeatability" means the closeness of agreement among repeated measurements of the same variable under the same operating conditions when changes in conditions or non-operating periods occur between measurements. (Refer-ence: IEEE STD 528-2001, definition section paragraph 2.214)

"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. 1: 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 "programmes" or modify

programmed instructions or numerical "programme" 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.2: 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 inter-connections; or*

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

N.B.3: The above definition does not include the following devices:

1. *Manipulation mechanisms, which are only manually/tele-operator 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.*

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

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

"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.

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

"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/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) %.

"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) %.

"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.

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

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

N.B.: 'Strand' is a bundle of "monofilaments" (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.

"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.

"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 inter-connections; 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.

"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
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
CEP	Circular error probable
CRISLA	Chemical reaction by isotope selective laser activation
CVD	Chemical vapour deposition
EDM	Electrical discharge machines
FFT	Fast Fourier Transform
GLONASS	Global navigation satellite system
GPS	Global positioning system
HBT	Hetero-bipolar transistors
IEEE	Institute of Electrical and Electronic Engineers
Mach	Ratio of speed of an object to speed of sound (after Ernst Mach)
MLIS	Molecular laser isotopic separation

Mtops	Million theoretical operations per second
NBC	Nuclear, Biological and Chemical
ppm	Parts per million
PSD	Power spectral density
RF	Radio frequency
UV	Ultraviolet
UTS	Ultimate tensile strength

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 tubes or zirconium alloy tubes (or assemblies of tubes) specially designed or prepared for use as fuel cladding in a "nuclear reactor" and in quantities exceeding 10 kg;

Note: Zirconium metal tubes or zirconium alloy tubes for use in a nuclear reactor consist of zirconium in which the relation of hafnium to zirconium is typically less than 1:500 parts by weight.

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

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

Technical 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 as follows:

1. Steam generators specially designed or prepared for use in the primary, or intermediate coolant circuit of a "nuclear reactor";

2. Other heat exchangers especially designed or prepared for use in the primary, or intermediate coolant circuit of a "nuclear reactor";

j. Neutron detectors specially designed or prepared for determining neutron flux levels within the core of a "nuclear reactor";

k. 'External thermal shields' specially designed or prepared for use in a "nuclear reactor" for the reduction of heat loss and also for the containment vessel protection.

Technical Note:

In 0A001.k. 'external thermal shields' means major structures placed over the reactor vessel which reduce heat loss from the reactor and reduce temperature within the containment vessel.

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. Electromagnetic separation plant;

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

Technical 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 1,95 GPa or more;

b. Aluminum alloys capable of an ultimate tensile strength of 0,46 GPa 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 650 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 650 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 650 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 650 mm diameter to fit the ends of a rotor tube, made from 'high strength-to-density ratio materials';

7. Magnetic suspension bearings as follows:

   a. Bearing assemblies 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;

   b. Active magnetic bearings specially designed or prepared for use with gas centrifuges;

Technical Note:

These bearings usually have the following characteristics:

a. Designed to keep centred a rotor spinning at 600 Hz or more; and

b. Associated to a reliable electrical power supply and/or to an uninterruptible power supply (UPS) unit in order to function for more than one hour;

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 at a frequency of 600 Hz or greater and a power of 40 VA or greater;

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 to locate the bearings and with one or more flanges for mounting;

12. Scoops consisting of tubes for the extraction of UF_6 gas from within a centrifuge rotor tube by a Pitot tube action;

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 frequency output of 600 Hz or greater; and

b. High stability (Frequency control better than 0,2%);

14. Shut-off and control valves as follows:

a. Shut-off valves specially designed or prepared to act on the feed, product or tails UF_6 gaseous streams of an individual gas centrifuge;

b. Bellows-sealed valves, shut-off or control, made of or protected by "materials resistant to corrosion by UF_6", with an inside diameter of 10 mm to 160 mm, specially designed or prepared for use in main or auxiliary systems of gas centrifuge enrichment plants;

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

1. Gaseous diffusion barriers and barrier materials 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. Especially designed or prepared compressors or gas blowers with a suction volume capacity of 1 m_3/min or more of UF_6, and discharge pressure up to 500kPa, designed for long-term operation in the UF_6 environment, as well as separate assemblies of such compressors and gas blowers. These compressors and gas blowers have a pressure ratio of 10:1 and are made of or protected by "materials resistant to corrosion by UF_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. Especially designed or prepared heat exchangers made of or protected by "materials resistant to corrosion by UF_6,

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. Especially designed or prepared bellows-sealed valves, manual or automated, shut-off or control, made of or protected by "materials resistant to corrosion by UF_6", for installation in main and auxiliary systems of gaseous diffusion enrichment plants;

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" 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 UF_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 fluorinated hydrocarbon 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 fluorinated hydrocarbon 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, polyphenylsulphate, 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. Electron beam guns designed to achieve a delivered power (1 kW or greater)on the target sufficient to generate uranium metal vapour at a rate required for the laser enrichment function; as derived.

N.B.: See also 2A225.

2. Liquid or vapour uranium metal handling systems for molten uranium or molten uranium alloys or uranium metal vapour for use in laser enrichment, 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 crucible.

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 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 UF_6";

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. UF_6 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 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 20 000 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, cold traps, or pumps 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. Especially designed or prepared vacuum manifolds or vacuum headers; 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 from UF_6 gas streams and having all of the following:

1. Capable of measuring ions of 320 atomic mass units or greater and having a resolution of better than 1 part in 320;

2. Ion sources constructed of or protected by nickel, nickel-copper alloys with a nickel content of 60 % or more by weight, or nickel-chrome alloys;

3. Electron bombardment ionisation sources; and

4. Having a 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 with diameters of 1,5 m or greater and capable of operating at pressures greater than or equal to 2 MPa especially designed or prepared for heavy water production utilizing the water-hydrogen sulphide exchange process;

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;

9. Ammonia synthesis converters or synthesis units specially designed or prepared for heavy water production utilizing the ammonia-hydrogen exchange process.

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;

d. Checks the finish treatment of the sealed fuel; or

e. Is used for assembling reactor fuel elements.

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;

Technical 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. Neutron measurement systems specially designed or prepared for integration and use with automated process control systems in a plant for 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 any other deuterium compoundin which the ratio of deuterium to hydrogen exceeds 1:5000 for use in a nuclear reactor in quantities exceeding 200 kg of deuterium atoms for any one recipient country in any period of 12 months.

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, in quantities exceeding 1 kg.

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 and useable in the systems specified in 9A104.a. and complete rocket systems specified in 9A104.b.

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 1C210.c.

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

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, fibers, prepregs or performs usable in systems specified in 9A104,as follows; and specially designed components and accessories therefor:

N.B.: See also 1B201.

Note: Components and accessories specified in 1B101 include moulds, mandrels, dies, fixtures and tooling for the preform pressing, curing, casting, sintering or bonding of composite structures, laminates and manufactures thereof.

c. 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;

d. 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;

e. 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);

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

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

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

Note: 1B101.e does not control textile machinery not modified for the end-uses stated.

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, spheroidal, or atomised materials specified in 1C111.a.1., 1C111.a.2, and 1C111.a.6.

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 specified in 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.

Note: 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 (1300 °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.

Note: In 1B117.b. the term 'mixing/kneading shaft' does not refer to deagglomerators or knife-spindles.

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 in 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 tubes with an internal diameter between 75 and 650mm and lengths of 300mm 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 1B20

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 1: 1B226 includes separators:

a. Capable of enriching stable isotopes;

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

Note 2: Item 1B226 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.

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.

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 H2-compatible; and

d. With internal diameters of 30 cm or greater and 'effective lengths' of 4m or greater.

Technical Note:

The term 'effective length' means the active height of packing material in a packed-type column, or the active height of internal contactor plates in a plate-type column.

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 1 000 kg/h or greater.

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

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

b. Equipment for the separation of lithium isotopes based on the lithium-mercury amalgam process, 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.

c. Ion exchange systems specially designed for lithium isotope separation, and specially designed component parts therefor;

d. Chemical exchange systems (employing crown ethers, cryptands, or lariat ethers) specially designed for lithium isotope separation, and specially designed component parts therefor.

N.B.: Certain lithium isotope separation equipment and components for the plasma separation process (PSP) are also directly applicable to uranium isotope separation and are controlled under 0B001.

1B234 High explosive containment vessels, chambers, containers and other similar containment devices designed for the testing of high explosives or explosive devices and having both of the following characteristics:

a. Designed to fully contain an explosion equivalent to 2 kg of TNT or greater; and

b. Having design elements or features enabling real time or delayed transfer of diagnostic or measurement information.

1C Materials

1C101 Materials and devices for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures usable in systems

specified in 9A104, 9A105, 9A107, 9A109 and 9A119and 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 and usable in systems specified in 9A104.a. and complete rocket systems specified in 9A104.b.

1C107 Graphite and ceramic materials as follows:

a. Fine grain 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 rocket nozzles and re-entry vehicle nose tips, which can be machined to any of the following products:

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 usable in systems specified in 9A104.a. and complete rocket systems specified in 9A104.b.;

c. Ceramic composite materials (dielectric constant less than 6 at frequencies from100 MHz to 100 GHz) usable for "missile"

radomes usable in systems specified in 9A104.a. and complete rocket systems specified in 9A104.b.;

d. Bulk machinable silicon-carbide reinforced unfired ceramic, usable for "missile" nose tips usable in systems specified in 9A104.a.and complete rocket systems specified in 9A104.b.;

e. Reinforced silicon-carbide ceramic composites usable for nose tips, re-entry vehicles, nozzle flaps usable in systems specified in 9A104.a.and complete rocket systems specified in 9A104.b.

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

a. Propulsive substances:

1. Spherical or spheroidal aluminium powder, (CAS 7429-90-5) in particle size 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, if at least 90 % of the total particles by particle volume or weight are made up of particles of less than 60 µm(determined by measurement techniques such as usinga sieve, laser diffraction or optical scanning),whether spherical, atomized, spheroidal, flaked or ground, consisting 97 % by weight or more of any of the following:

a. Zirconium (7440-67-7);

b. Beryllium (7440-41-7);

c. Magnesium (7439-95-4); 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. Oxidisers/fuels as follows:

a. Perchlorates, chlorates or chromates mixed with powdered metals or other high energy fuel components.

b. liquid oxidizer substances as follows:

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

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

3. Dinitrogenpentoxide (CAS 10102-03-1);

4. Mixed Oxides of Nitrogen (MON);

5. Inhibited Red Fuming Nitric Acid (IRFNA) (CAS 8007-58-7);

6. Compounds composed of fluorine and one or more of other halogen oxygen or nitrogen;

Technical Note:

Mixed Oxides of Nitrogen (MON) are solutions of Nitric Oxide (NO) in Dinitrogen Tetroxide/Nitrogen Dioxide (N2O4/NO2) 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).

c. Oxidiser substances usable in solid propellant rocket motors as follows:

1. Ammonium perchlorate (AP) (CAS 7790-98-9);

2. Ammonium dinitramide (ADN) (CAS 140456-78-6);

3. Nitro-amines (cyclotetramethylene - tetranitramine (HMX) (CAS 2691-41-0); cyclotrimethylene - trinitramine (RDX) (CAS 121-82-4);

4. Hydraziniumnitroformate (HNF) (CAS 20773-28-8);

5. 2,4,6,8,10,12-Hexanitrohexaazaisowurtzitane (CL-20) (CAS 135285-90-4).

4. Hydrazine (CAS 302-01-2) with a concentration of more than 70% and its derivatives as follows:

a. Trimethylhydrazine (CAS 1741-01-1);

b. Tetramethylhydrazine (CAS 6415-12-9);

c. N,Ndiallylhydrazine(CAS 5164-11-4)

d. Allylhydrazine (CAS 7422-78-8);

e. Ethylenedihydrazine;

f. Monomethylhydrazinedinitrate;

g. Unsymmetricaldimethylhydrazine nitrate;

h. Hydraziniumazide (CAS 14546-44-2);

i. Dimethylhydraziniumazide;

j. Hydraziniumdinitrate(13464-98-7)

k. Diimidooxalicaciddihydrazine;

l. 2-hydroxyethylhydrazine nitrate (HEHN);

m. Hydraziniumdiperchlorate;

n. Methylhydrazine nitrate (MHN) (CAS 29674-96-2);

o. Diethylhydrazine nitrate (DEHN);

p. 3,6-dihydrazino tetrazine nitrate (1,4-dihydrazine nitrate) (DHTN);

q. Monomethylhydrazine (MMH) (CAS 60-34-4);

r. Unsymmetrical dimethylhydrazine (UDMH) (CAS 57-14-7);

s. Hydrazine mononitrate;

t. Diimido oxalic acid dihydrazine (CAS 3457-37-2);

5. High energy density materials, usable in the systems specified in 9A104, as follows:

a. Mixed fuels that incorporate both solid and liquid fuels, such as boron slurry, having a mass- based energy density of 40 x 10^6 J/kg or greater;

b. Other high energy density fuels and fuel additives (*e.g.*, cubane, ionic solutions, JP-10) having a volume-based energy density of 37.5 x 10^9 J/m^3 or greater, measured at 20 °C and one atmosphere (101,325 kPa) pressure.

Note: Item 1C111.a.5. does not control fossil refined fuels and biofuels produced from vegetables, including fuels for engines certified for use in civil aviation, unless specifically formulated for systems specified in 9A104.

6. Metal powders of either boron (CAS 7440-42-8) or boron alloys with a boron content of 85 % or more by weight, if at least 90 % of the total particles by particle volume or weight are made up of particles of less than 60 µm (determined by measurement techniques such as using a sieve, laser diffraction or optical scanning), whether spherical, atomised, spheroidal, flaked or ground;

Note: In a multimodal particle distribution (e.g. mixtures of different grain sizes) in which one or more modes are controlled, the entire powder mixture is controlled.

b. Polymeric substances:

1. Carboxy-terminated polybutadiene (including Carboxyl - terminated polybutadiene) (CTPB);

2. Hydroxy-terminated polybutadiene (including Hydroxyl-terminated polybutadiene) (HTPB);

3. Polybutadiene-acrylic acid (PBAA);

4. Polybutadiene-acrylic acid-acrylonitrile (PBAN);

5. Glycidylazide polymer (GAP)

6. Polytetrahydrofuran polyethylene glycol (TPEG)

7. Polyglycidyl nitrate (PGN or poly-GLYN) (CAS 27814-48- 8)

Technical Note:

Polytetrahydrofuran polyethylene glycol (TPEG) is a block co-polymer of poly 1,4-Butanediol (CAS 110-63-4) and polyethylene glycol (PEG) (CAS 25322-68-3).

c. Other propellant additives and agents:

1. Triethylene glycol dinitrate (TEG DN)(CAS111-22-8);

2. 2-Nitrodiphenylamine (CAS119-75-5);

3. Trimethylolethanetrinitrate (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. Pentylferrocene (CAS1274-00-6);

d. Dicyclopentylferrocene (CAS 20733-28-8);

e. Dicyclohexylferrocene;

f. Diethyl ferrocene;

g. Dipropylferrocene;

h. Dibutylferrocene (CAS1274-08-4);

i. Dihexylferrocene (CAS 93894-59-8);

j. Acetyl ferrocenes (CAS 1271-55-2) / 1,1'-diacetyl ferrocene (CAS 1273-94-5);

k. Other ferrocene derivatives usable as rocket propellant burning rate modifiers;

l. Catocene (CAS 37206-42-1);

m. N-butyl ferrocene (CAS 31904-29-7);

n. Ferrocenecarboxlylic acid (CAS 1271-42-7) / 1,1'-ferrocenedicarboxylic acid (CAS 1293-87-4);

o. Butacene (CAS 125856-62-4);

Note: Item 1C111.c.5.k. does not control ferrocene derivatives that contain a six carbon aromatic functional group attached to the ferrocene molecule.

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);

9. 1,2,4-butanetriol trinitrate (BTTN) (CAS 6659-60-5);

10. N-methyl-p-nitroaniline (CAS 100-15-2);

11. Carboranes, decarboranes, pentaboranes and derivatives thereof;

12. Triphenyl bismuth (TPB) (CAS 603-33-8);

13. Bonding agents as follows:

    a. Tris (1-(2-methyl) aziridinyl) phosphine oxide (MAPO) (CAS 57-39-6);

    b. 1,1′,1″-trimesoyl-tris (2-ethylaziridine) (HX-868, BITA) (CAS 7722-73-8);

    c. Tepanol (HX-878), reactionproduct of tetraethlyl-enepentamine, acrylonitrile and glycidol (CAS 68412-46-4);

    d. Tepan (HX-879), reactionproduct of tetraethlyl-enepentamine and acrylonitrile (CAS 68412-45-3);

    e. Polyfunctionalaziridine amides withisophthalic, trimesic, isocyanuric, or trimethy ladipic backbone also havinga 2-methyl or 2-ethyl aziridine group;

    Note: Item 1C111.c.13.e. includes:

    1. 1,1'-Isophthaloyl-bis(2-methylaziridine) (HX-752) (CAS 7652-64-4);

    2. 2,4,6-tris(2-ethyl-1-aziridinyl)-1,3,5-triazine (HX-874) (CAS 18924-91-9);

    3. 1,1'-trimethyladipoylbis(2-ethylaziridine)(HX-877) (CAS 71463-62-2).

14. Hydrazine replacement fuels as follows:

    1.2-Dimethylaminoethylazide (DMAZ) (CAS 86147-04-8);

d. Composite and composite modified double base propellants.

1C116 Maraging steels, usable in the systems specified in 9A104.a. and complete rocket systems specified in 9A104.b. having all of the following:

a. Having an ultimate tensile strength, measured at 20 °C, equal to or greater than:

1. 0,9 GPa in the solution annealed stage; or

2. 1,5 GPa in the precipitation hardened stage; and

b. Any of the following forms:

1. Sheet, plate or tubing with a wall or plate thickness equal to or less than 50 mm; or

2. Tubular forms with a wall thickness equal to or less than 50 mm and having an inner diameter equal to or greater than 270 mm.

N.B.: See also 1C216.

Technical Note:

Maraging steels are iron alloys:

a. Generally characterised by high nickel, very low carbon content and use substitutional elements or precipitates to produce strengthening and age-hardening of the alloy; and

b. *Subjected to heat treatment cycles to facilitate the martensitic transformation process (solution annealed stage) and subsequently age hardened (precipitation hardened stage).*

1C117 Materials for the fabrication of "missile" components in the systems specified in 9A104, as follows:

a. Tungsten and alloys in particulate form with a tungsten content of 97 % by weight or more and a particle size of 50 $x10^{-6}$ m (50 µm) or less;

b. Molybdenum and alloys in particulate form with a molybdenum content of 97 % by weight or more and a particle size of 50 $x10^{-6}$ m (50 μm) or less;

c. Tungsten materials in the solid form having all of the following:

1. Any of the following material compositions:

a. Tungsten and alloys containing 97 % by weight or more of tungsten;

b. Copper infiltrated tungsten containing 80 % by weight or more of tungsten; or

c. Silver infiltrated tungsten containing 80 % by weight or more of tungsten; and

14. Able to be machined to any of the following products:

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

b. 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; or

c. Blocks having a size of 120 mm x 120 mm x 50 mm or greater.

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-1181-87 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 235×10^3m 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 1950 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 other than magnesium; and

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

IC228 Magnesium having both of the following characteristics:

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

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

1C229 Bismuth having both of the following characteristics:

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

b. Containing less than 10 ppm (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 Radionuclides appropriate for making neutron sources based on alpha–n reaction in the following forms:

a. Elemental;

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

c. Mixtures having a total 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 3,7GBq (100 millicuries) of activity.

Technical Note:

In 1C236 'radionuclides' are any of the following: actinium 225, curium 244, polonium 209, actinium 227, einsteinium 253, polonium 210, californium 253, einsteinium 254, radium 223, curium 240, gadolinium 148, thorium 227, curium 241, plutonium 236, thorium 228, curium 242, plutonium 238, uranium 230, curium 243, polonium 208, and uranium 232.

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 0,37GBq (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. Aminodinitrobenzo-furoxan or 7-amino-4,6 nitrobenzofurazane-1-oxide (ADNBF) (CAS 97096-78-1);

e. 1,1-diamino-2,2-dinitroethylene (DADE or FOX7) (CAS 145250-81-3);

f. 2,4-dinitroimidazole (DNI) (CAS 5213-49-0);

g. Diaminoazoxyfurazan (DAAOF or DAAF) (CAS78644-89-0);

h. Diaminotrinitrobenzene (DATB) (CAS 1630-08-6);

i. Dinitroglycoluril (DNGU or DINGU) (CAS 55510-04-8);

j. j.2,6-Bis (picrylamino)-3,5-dinitropyridine (PYX) (CAS 38082-89-2);

k. k.3,3′-diamino-2,2′,4,4′,6,6′-hexanitrobiphenyl or dipicramide (DIPAM) (CAS 17215-44-0);

l. Diaminoazofurazan (DAAzF) (CAS 78644-90-3);

m. 1,4,5,8-tetranitro-pyridazino[4,5-d] pyridazine (TNP) (CAS 229176-04-9);

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

o. Any explosive with a crystal density greater than 1,8 g/cm3 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.

1C241 Rhenium, and alloys containing 90 % by weight or more rhenium; and alloys of rhenium and tungsten containing 90 % by weight or more of any combination of rhenium and tungsten, having both of the following characteristics:

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

b. A mass greater than 20 kg.

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;

33. Andes virus;

34. Chapare virus;

35. Choclo virus;

36. Lujo virus;

37. Laguna Negra 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. Coxiellaburnetii;

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. Brucellaabortus;

3. Brucellamelitensis;

4. Brucellasuis;

5. Chlamydia psittaci;

6. Clostridium botulinum;

7. Francisellatularensis;

8. Burkholderia mallei (Pseudomonas mallei);

9. Burkholderiapseudomallei (Pseudomonas pseudomallei);

10. Salmonella typhi;

11. Shigelladysenteriae;

12. Vibrio cholerae;

13. Yersinia pestis;

14. Clostridium perfringens epsilon toxin producing types;

15. Enterohaemorrhagic Escherichia coli, serotype O157 and other verotoxin producing serotypes;

16. Clostridium argentinense (formerly known as Clostridium botulinum Type G), botulinum neurotoxin producing strains;

17. Clostridium baratii, botulinum neurotoxin producing strains;

18. Clostridium butyricum, botulinum neurotoxin producing strains;

19. Shiga toxin producing Escherichia coli (STEC) of serogroups O26, O45, O103, O104, O111, O121, O145, O157, and other shiga toxin producing serogroups;

Note: 1C351.c.14. does not control other Clostridium perfringens strains to be used as positve control cultures for food testing and quality control.

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

1. Botulinum toxins;

2. Clostridium perfringens alpha, beta 1, beta 2, epsilon and iota toxins;

3. Conotoxin;

4. Ricin;

5. Saxitoxin;

6. Shiga toxin;

Technical Note:

Shiga toxin producing Escherichia (STEC) is also known as enterohaemorrhagic E. coli (EHEC) or verocyto toxin producing E. coli (VTEC).

7. Staphylococcus aureusenterot oxins, hemolysin alpha toxin, and toxic shock syndrome toxin (formerly known as Staphylococcus enterotoxin F);

8. Tetrodotoxin;

9. Verotoxinandshiga-like ribosome inactivating proteins;

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. Coccidioidesimmitis;

2. Coccidioidesposadasii.

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. Rabies virus and all other members of the Lyssa virus genus;

9. Newcastle disease virus;

10. Peste des petits ruminants virus;

11. Porcine entero virus 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: 1C352 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 1C351.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 tymo virus;

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 campestrispv. 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 ssp. graminis var. graminis / Puccinia graminis ssp. graminis var. stakmanii [Puccinia graminis (syn. Puccinia graminis f. sp. tritici)];

5. Puccinia striiformis (syn. Puccinia glumarum);

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

7. Peronosclerospora philippinensis (Peronosclerospora sacchari);

8. Sclerophthora rayssiae var. zeae;

9. Synchytrium endobioticum;

10. Tilletiaindica;

11. Thecaphorasolani

1D Software

1D101 "Software" specially designed or modified for the "operation or maintenance" of goods specified in 1B101, 1B102, 1B115, 1B117, 1B118 or 1B119 for the "production" and handling of materials specified in 1C111.

1D103 "Software" specially designed for analysis of reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures systems specified in 9A104 and 9A012.

Note: 1D103 includes "software" specially designed for analysis of signature reduction.

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

1E Technology

1E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment, materials or "software" specified in 1A, 1B, 1C or 1D.

1E101 "Technology" according to the General Technology Note for the "use" of goods specified in 1A102, 1B101, 1B102, 1B115 to 1B119, 1C101,1C102, 1C107, 1C111 to 1C117, 1C118, 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 1 573 K (1300 °C) to 3 173 K (2900 °C) temperature range at pressures of 130 Pa to 20 kPa including "technology" for the composition of precursor gases, flow-rates, and process control schedules and parameters.

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 therefor:

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 monel or beryllium;

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

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

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

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

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.

2A101 Radial ball bearings, other than those specified in 2A001, having all tolerances specified in accordance with ISO 492 Tolerance Class 2 (or

ANSI/ABMA Std 20 Tolerance Class ABEC-9 or other national equivalents), or better and having all the following characteristics:

a. An inner ring bore diameter between 12 mm and 50 mm;

b. An outer ring bore diameter between 25 mm and 100 mm; and

c. A width between 10 mm and 20 mm.

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 (150 ml) and 8 000 cm^3 (8 litres); and

2. Made of or coated with any of the following materials or combination of the materials, having an overall impurity level of 2 % or less 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 (50 ml) and 2 000 cm^3 (2 liters); 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 (50 ml) and 2 000 cm^3 (2 liters);

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 5 mm 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-and-pinion).

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

   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) 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);

   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 $\hat{A}$ becomes the stated value of each axis for the model ($\hat{A}x$ $\hat{A}y$...);

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 flow-forming machines.

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

a. Electrodynamic 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 2B116, '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: 2B119.a. does not control balancing machines designed or modified for dental or other medical equipment.

b. Indicator heads designed or modified for use with machines specified in 2B119.a.

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 over10 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.

Note2: 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 100 g 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) 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) 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";

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

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

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

   2. *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:

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

   2. *Stated positioning accuracy levels derived from measurements made according to ISO 230/2 (1988) 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.*

3. *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).*

4. *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.

5. 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.

6. 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.

7. Rotary axes do not necessarily have to rotate over 360 degrees. A rotary axis can be driven by a linear device, e.g., a screw or a rack- and-pinion.

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 either of the following characteristics:

1. Having only two axes and having a maximum permissible error of length measurement along any axis (one dimensional), identified as any combination of $E_{ox,MPE}$, $E_{oy,MPE}$ or $E_{oz,MPE}$, equal to or less(better) than (1,25 + L/1 000) µm (where L is the measured length in mm) at any point within the operating range of the machine (*i.e.*, within the length of the axis), according to ISO 10360-2(2009); or

2. Three or more axes and having a three dimensional (volumetric) maximum permissible error of length measurement ($E_{o,MPE}$ equal to or less (better) than (1,7 + L/800) µm (where L is the measured length in mm) at any point within the operating range of the machine (i.e., within the length of the axis), according to ISO 10360-2(2009).

Technical Note:

The $E_{o,MPE}$ of the most accurate configuration of the CMM specified according to ISO 10360-2(2009) by the manufacturer (e.g., best of the following: probe, stylus length, motion parameters, environment) and with all compensations available shall be compared to the 1,7 + L/800 µm threshold.

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 % measured from 0 to the full operating range, for LVDTs with an operating range up to 5 mm ; or

2. "Linearity" equal to or less (better) than 0,1 % measured from 0 to 5 mm for LVDTs with an operating range greater than 5 mm; and

3. Drift equal to or less (better) than 0,1 % per day at a standard ambient test room temperature ±1 K;

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.c. 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 simultaneous 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"

1. Specially designed to comply with national safety standards applicable to handling high explosives (for example, meeting electrical code ratings for high explosives); or

2. 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 600 mm 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 5 000 rpm;

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. or2B227.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 All type of pressure transducers capable of measuring absolute pressures and having all of the following characteristics:

a. Pressure sensing elements made of or protected by aluminium, aluminium alloy, aluminum oxide (alumina or sapphire) nickel, nickel alloy with more than 60 % nickel by weight; or fully fluorinated hydrocarbon polymers;

b. Seals, if any, essential for sealing the pressure sensing element, and in direct contact with the process medium, made of or protected by aluminium, aluminium alloy, aluminium oxide (alumina or sapphire), nickel, nickel alloy with more than 60 % nickel by weight, or fully fluorinated hydrocarbon polymers; and

c. 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 when measured at 13 kPa.

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 High velocity gun systems (propellant, gas, coil, electromagnetic, and electrothermal types, and other advanced systems) capable of accelerating projectiles to 1,5 km/s or greater.

Note: 2B232 does not control guns specially designed for high velocity weapon systems.

2B233 Bellows-sealed scroll-type compressors and bellows-sealed scroll-type vacuum pumps having all of the following characteristics:

a. Capable of an inlet volume flow rate of 50 m^3/h or greater;

b. Capable of a pressure ratio of 2:1 or greater; and

c. Having all surfaces that come in contact with the process gas made from any of the following materials:

1. Aluminium or aluminium alloy;

2. Aluminium oxide;

3. Stainless steel;

4. Nickel or nickel alloy;

5. Phosphor bronze; or

6. Fluoropolymers.

Technical Notes:

1. *In a scroll compressor or vacuum pump, crescent-shaped pockets of gas are trapped between one or more pairs of intermeshed spiral vanes, or scrolls, one of which moves while the other remains stationary. The moving scroll orbits the stationary scroll; it does not rotate. As the moving scroll orbits the stationary scroll, the gas pockets diminish in size (i.e., they are compressed) as they move toward the outlet port of the machine.*

2. *In a bellows-sealed scroll compressor or vacuum pump, the process gas is totally isolated from the lubricated parts of the pump and from the external atmosphere by a metal bellows. One end of the bellows is attached to the moving scroll and the other end is attached to the stationary housing of the pump.*

3. Fluoropolymers include, but are not limited to, the following materials:

   a. Polytetrafluoroethylene (PTFE),

   b. Fluorinated Ethylene Propylene (FEP),

   c. Perfluoroalkoxy (PFA),

   d. Polychlorotrifluoroethylene (PCTFE); and

   e. Vinylidene fluoride-hexafluoropropylene copolymer.

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;

8. Niobium (columbium) or Niobium 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;

8. Niobium (columbium) or Niobium alloys;

c. Storage tanks, containers or receivers with a total internal (geometric) volume greater than 0,1 m^3 (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;

8. Niobium (columbium) or Niobium alloys;

d. Heat exchangers or condensers with a heat transfer surface area greater than 0,15 m^2, and less than 20 m^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;

11. Niobium (columbium) or Niobium alloys;

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;

9. Niobium (columbium) or Niobium 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 and components as follows:

1. Valveswith '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 'corrosion resistant materials':

2. Valves, other than those specified in 2B350.g.1., having all of the following;

a. A 'nominal size' equal to or greater than 25,4 mm and equal to or less than 101,6 mm;

b. Casings (valve bodies) or preformed casing liners;

c. A closure element designed to be interchangeable; and

d. All surfaces of the casing (valve body) or preformed case liner that come in direct contact with the chemical(s) being produced, processed, or contained are made from 'corrosion resistant materials';

3. Components, designed for valves specified in 2B350.g.1. or 2B350.g.2., in which all surfaces that come in direct contact with the chemical(s) being produced, processed, or contained are made from 'corrosion resistant materials', as follows:

a. Casings (valve bodies);

b. Preformed casing liners;

Technical Notes:

1. The 'nominal size' is defined as the smaller of the inlet and outlet diameters.

2. For the purposes of 2B350.g. 'corrosion resistant materials' means 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;*

8. *Niobium (columbium) or Niobium alloys;*

9. *Ceramic materials as follows:*

   a. *Silicon Carbide with a purity of 80 % or more by weight;*

   b. *Aluminum oxide (alumina) with a purity of 99,9 % or more by weight;*

   c. *Zirconium oxide (zirconia)*

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;

9. Niobium (columbium) or Niobium alloys;

i. Multiple-seal, canned drive, magnetic drive, bellows or diaphragm pumps, with manufacturer's specified maximum flow-rate greater than 0,6 m^3/hour, or vacuum pumps with manufacturer's specified maximum flow-rate greater than 5 m^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;

11. Niobium (columbium) or Niobium 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 (1 000 °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 and components as follows;

1. 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;

2. Components designed for such fermenters, as follows:

a. Cultivation chambers designed to be sterilized or disinfected in situ;

b. Cultivation chamber holding devices; or

c. Process control units capable of simultaneously monitoring and controlling two or more fermentation system parameters (*e.g.* temperature, pH, nutrients, agitation, dissolved oxygen, air flow, foam control).

Technical Note:

Fermenters include bioreactors (including single use (disposable) 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. Having any of the following characteristics:

      1. Capable of being sterilised or disinfected in-situ; or

      2. Using disposable or single-use filtration components.

         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 0,2 m^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 1 000 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 "micro-organisms", viruses or "toxins" and having a capacity of 1 m^3 or greater;

h. Spray drying equipment capable of drying toxins or pathogenic "microorganisms" having all of the following characteristics:

1. A water evaporation capacity of $\geq$ 0,4 kg/h and $\leq$ 400 kg/h;

2. The ability to generate a typical mean product particle size of $\leq$10 micrometers with existing fittings or by minimal modification of the spray-dryer with atomization nozzles enabling generation of the required particle size; and

3. Capable of being sterilized or disinfected in situ.

i. Spraying or fogging systems and components therefor, as follows:

1. Complete spraying or fogging systems, specially designed or modified for fitting to aircraft, lighter than air vehicles or UAVs, capable of delivering, from a liquid suspension, an initial droplet "VMD" of less than 50 microns at a flow rate of greater than two litres per minute;

2. Spray booms or arrays of aerosol generating units, specially designed or modified for fitting to aircraft, lighter than air

vehicles or UAVs, capable of delivering, from a liquid suspension, an initial droplet "VMD" of less than 50 microns at a flow rate of greater than two litres per minute;

3. Aerosol generating units specially designed for fitting to systems that fulfil all the criteria specified in 2B352.i.1. and 2B352.i.2. Aerosol generating units specially designed for fitting to systems that fulfill all the criteria specified in 2B352.i.1.and 2B352.i.2.

Technical Notes:

1. *Aerosol generating units are devices specially designed or modified for fitting to aircraft such as nozzles, rotary drum atomisers and similar devices.*

2. *This entry does not control spraying or fogging systems and components as specified in 2B352.i above that are demonstrated not to be capable of delivering biological agents in the form of infectious aerosols.*

3. *Droplet size for spray equipment or nozzles specially designed for use on aircraft or UAVs should be measured using either of the following methods:*

   a. *Doppler laser method*

   b. *Forward laser diffraction method*

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.

2D201 "Software" specially designed or modified for the "use" of equipment specified in 2B204, 2B206, 2B104, 2B207, 2B209, 2B116, 2B219 or 2B226, 2B227.

Note: "Software" specially designed or modified 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.

Note: 2B201 does not control part programming "software" that generates "numerical control" command codes but does not allow direct use of equipment for machining various parts.

2D203 "Software" for any combination of electronic devices or system enabling such device(s) to function as a "numerical control" unit for machine tools, that is capable of controlling five or more interpolating axes that can be coordinated simultaneously for "contouring control".

Note 1: "Software" is controlled whether exported separately or residing in a "numerical control" unit or any electronic device or system.

Note 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

2E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment or "software" specified in 2A, 2B, or 2D.

2E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 2B104, 2B105, 2B109, 2B116, 2B117, 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", having any of the following characteristics:

1. Designed to meet military specification for ruggedized equipment; or

2. Designed or modified for military use and being any of the following types:

a. Analogue-to-digital converter "microcircuits", which are "radiation-hardened" or have all of the following characteristics:

1. Having a quantisation corresponding to 8 bits or more when coded in the binary system;

2. Rated for operation in the temperature range from below -54 °C to above +125 °C; and

3. Hermetically sealed; or

b. Electrical input type analogue-to-digital converter printed circuit boards or modules, having all of the following characteristics:

1. Having a quantisation corresponding to 8 bits or more when coded in the binary system;

2. Rated for operation in the temperature range from below -45 °C to above +55 °C; and

3. Incorporating "microcircuits" specified in 3A101.a.2.a.

b. Accelerators capable of delivering electromagnetic radiation produced by bremsstrahlung from accelerated electrons of 2 MeV or greater, containing those accelerators usable for systems specified in 9A104 and their subsystems.

Note: 3A101.b. above does not specify equipment specially medical purposes.

c. Electronic assemblies and components, designed or modified for use in the systems specified in 9A104.a. or complete rocket systems specified in 9A104.b. and specially designed for military use and operation at temperatures in excess of 125 °C.

Notes:

1. *Equipment specified in 3A101.c. includes the following:*

   a. *Terrain contour mapping equipment;*

   b. *Scene mapping and correlation (both digital and analogue) equipment;*

   c. *Doppler navigation radar equipment;*

   d. *Passive interferometer equipment;*

   e. *Imaging sensor equipment (both active and passive).*

2. *Equipment specified in 3A101.c. may be exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.*

d. "Radiation Hardened" "microcircuits" usable in protecting rocket systems and unmanned aerial vehicles against nuclear effects (*e.g.* electromagnetic pulse (EMP), X-rays, combined blast and thermal effects), and usable for the systems specified in 9A104.a.

3A102 'Thermal batteries' designed or modified for systems specified in 9A104.

Technical Note:

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.

3A103 Umbilical and interstage electrical connectors specially designed for systems specified in 9A104.a.and complete rocket systems specified in 9A104.b.

Technical Note:

Interstage connectors referred to in 3A103 also include electrical connectors installed between systems specified in 19A104.a. and complete rocket systems specified in 9A104.b. and their "payload".

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:

$K = 1,7 \times 10^3 V^{2,56} \times Q$

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, usable as a variable frequency or fixed frequency motor drive,having all of the following characteristics:

a. Multiphase output providing a power of 40 VA or greater;

b. Operating at a frequency of 600 Hz or more; and

Frequency control better (less) than 0,2 %.

Notes:

1. *Item 3A225 only controls frequency changers intended for specific industrial machinery and/or consumer goods (machine tools, vehicles, etc.) if the frequency changers can meet the characteristics above when removed, and subject to General Note 2.*

2. *For the purpose of export control, the Government will determine whether or not a particular frequency changer meets the characteristics above, taking into account hardware and software constraints.*

Technical Notes:

1. *Frequency changers in 3A225 are also known as converters or inverters.*

2. *The characteristics specified in item 3A225 may be met by certain equipment marketed such as generators, electronic test equipment, AC power supplies, variable speed motor drives,*

variable speed drives (VSDs), variable frequency drives (VFDs), adjustable frequency drives (AFDs), or adjustable speed drives (ASDs).

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 500 A or greater; and

b. Current or voltage stability better than 0,1 % over a time period of 8 hours.

3A227 High voltage direct current power supplies, 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 500 A or more; and

3. Turn on time of 1 µs or less.

3A229 Firing sets and equivalent high current pulse generators as follows:

a. Detonator (initiation systems, firesets), including electronically-charged, explosively-driven and optically-drivenfiring 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. Capable of delivering their energy in less than 15 µs into loads of less than 40 ohms;

3. Having an output greater than 100 A;

4. No dimension greater than 300 mm;

5. Weight less than 30 kg; and

6. Specified for use over an extended temperature range 223 K (– 50 °C) to 373 K (100 °C) or specified as suitable for aerospace applications.

c. Micro-firing units having all of the following characteristics:

1. No dimension greater than 35 mm;

2. Voltage rating of equal to or greater than 1 kV; and

3. Capacitance of equal to or greater than 100 nF.

Note: Optically driven firing sets include both those employing laser initiation and laser charging. Explosively-driven firing sets include both explosive ferroelectric and explosive ferromagnetic firing set types. Item 3A229.b. includes xenon flash lamp drivers.

3A230 High-speed pulse generators, and pulse heads therefor, 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 Notes:

1. *In 3A230, 'pulse transition time' is defined as the time interval between 10 % and 90 % voltage amplitude.*

2. *Pulse heads are impulse forming networks designed to accept a voltage step function and shape it into a variety of pulse forms that can include rectangular, triangular, step, impulse, exponential, or monocycle types. Pulse heads can be an integral part of the pulse generator, they can be a plug-in module to the device or they can be an externally connected device.*

3A231 Neutron generator systems, including tubes, having both of the following characteristics:

a. Designed for operation without an external vacuum system; and

b. 1. Utilizing electrostatic acceleration to induce a tritium-deuterium nuclear reaction; or

2. Utilizing electrostatic acceleration to induce a deuterium-deuterium nuclear reaction and capable of an output of 3×10^9 neutrons/s or greater.

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 5 000 mm^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; having both of the following features:

1. A molecular beam inlet system that injects a collimated beam of analyte molecules into a region of the ion source where the molecules are ionized by an electron beam; and

2. One or more 'cold traps' that can be cooled to a temperature of 193 K (-80 °C) or less in order to trap analyte molecules that are not ionized by the electron beam;

e. Mass spectrometers equipped with a microfluorination ion source designed for actinides or actinide fluorides.

Technical Notes:

1. Item 3A233.d. describes mass spectrometers that are typically used for isotopic analysis of UF_6 gas samples.

2. Electron bombardment mass spectrometers in Item 3A233.d. are also known as electron impact mass spectrometers or electron ionization mass spectrometers.

3. In Item 3A233.d.2., a 'cold trap' is a device that traps gas molecules by condensing or freezing them on cold surfaces. For the purposes of this entry, a closed-loop gaseous helium cryogenic vacuum pump is not a 'cold trap'.

3A234 Striplines to provide low inductance path to detonators with the following characteristics:

a. Voltage rating greater than 2 kV; and

b. Inductance of less than 20 nH.

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. to 3A101.c. and 3A225.

3D102 "Software" or encryption keys/codes specially designed to enhance or release the performance characteristics of equipment not controlled in Item 3A225 so that it meets or exceeds the characteristics specified in Item 3A225.

3D103 "Software" specially designed to enhance or release the performance characteristics of equipment controlled in Item 3A225.

3E Technology

3E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment or "software" specified in 3A, or 3D.

3E101 "Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 3A101, 3A102 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 systems specified in 9A104.a., having any of the following characteristics:

a. Rated for continuous operation at temperatures from below -45 °C to above +55 °C; or

b. Designed as ruggedised or "radiation hardened".

Note: Item 4A101 equipment may be exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

4A102 "Hybrid computers" specially designed for modelling, simulation or design integration of systems specified in 9A104.a. and their subsystems.

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

4E101 "Technology", in accordance with the General Technology Note, for the "development", "production" or "use" of equipment specified in 4A101.

CATEGORY 5

TELECOMMUNICATIONS AND "INFORMATION SECURITY"

5A1 Systems, Equipment and Components

5A101 Telemetering and telecontrol equipment, including ground equipment, designed or modified for systems specified in 9A104.

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

5E101 "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 6A102, 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) or gravity gradiometers designed or modified for airborne or marine use, usable for systems specified in 9A104.a., as follows, and specially designed components therefor:

a. Gravity meters having all of the following:

1. A static or operational accuracy of 7×10^{-6} m/s^2 (0,7 milli gal) or less (better); and

2. A time-to-steady-state registration of two minutes or less;

b. Gravity gradiometers.

6A108 Radar systems and tracking systems, as follows:

a. Radar and laser radar systems, including altimeters, designed or modified for use in systems specified in 9A104.a.;

Technical Note:

Laser radar systems embody specialised transmission, scanning, receiving and signal processing techniques for utilisation of lasers

for echo ranging, direction finding and discrimination of targets by location, radial speed and body reflection characteristics.

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 systems specified in 9A104, as follows:

1. Tracking systems which use a code translator installed on the rocket or unmanned aerial vehicle 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.

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 High-speed cameras and imaging devices and components therefor, as follows:

N.B.: "Software" specially designed to enhance or release the performance of cameras or imaging devices to meet the characteristics below is controlled in 6D101and 6D102.

a. Streak cameras, and specially designed components therefor, as follows:

1. Streak cameras with writing speeds greater than 0,5 mm per microsecond;

2. Electronic streak cameras capable of 50 ns or less time resolution;

3. Streak tubes for cameras specified in 6A203.a.2.;

4. Plug-ins specially designed for use with streak cameras which have modular structures and that enable the performance specifications in 6A203.a.1. and 6A203.a.2.;

5. Synchronizing electronics units, rotor assemblies consisting of turbines, mirrors and bearings specially designed for cameras specified in 6A203.a.1.;

b. Framing cameras and specially designed components therefor as follows:

1. Framing cameras with recording rates greater than 2 25 000 frames per second;

2. Framing cameras capable of 50 ns or less frame exposure time;

3. Framing tubes and solid–state imaging devices having a fast image gating (shutter) time of 50 ns or less specially designed for cameras specified in 6A203.b.1. or 6A203.b.2.;

4. Plug-ins specially designed for use with framing cameras which have modular structures and that enable the performance specifications in 6A203.b.1 or 6A203.b.2.;

5. Synchronizing electronics units, rotor assemblies consisting of turbines, mirrors and bearings specially designed for cameras specified in 6A203.b.1 or 6A203.b.2.;

c. Solid state or electron tube cameras and specially designed components therefor as follows:

1. Solid-state cameras or electron tube cameras with a fast image gating (shutter) time of 50 ns or less;

2. Solid-state imaging devices and image intensifiers tubes having a fast image gating (shutter) time of 50 ns or less specially designed for cameras specified in 6A203.c.1.;

3. Electro-optical shuttering devices (Kerr or Pockels cells) with a fast image gating (shutter) time of 50 ns or less;

4. Plug-ins specially designed for use with cameras which have modular structures and that enable the performance specifications in 6A203.c.1.

Technical Note:

High speed single frame cameras can be used alone to produce a single image of a dynamic event, or several such cameras can be combined in a sequentially-triggered system to produce multiple images of an event.

d. 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 9 000 nm and 11 000 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;

Note: Item 6A205.d. does not control the higher power (typically 1 to 5 kW) industrial CO2 lasers used in applications such as cutting and welding, as these latter lasers are either continuous wave or are pulsed with a pulse width greater 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 1 000 nm but not exceeding 1 100 nm;

2. A pulse duration equal to or more than 1 ns;

3. A multiple-transverse mode output having an average power exceeding 50 W; and

4. single-transverse mode output with an average output power greater than 40 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 30 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;

j. Pulsed carbon monoxide lasers having all of the following characteristics:

1. Operating at wavelengths between 5 000 and 6000 nm;

2. A repetition rate greater than 250 Hz;

3. An average output power greater than 200 W; and

4. Pulse width of less than 200 ns.

Note: Item 6A205.j. does not control the higher power (typically 1 to 5 kW) industrial CO lasers used in applications such as cutting and welding, as these latter lasers are either continuous wave or are pulsed with a pulse width greater than 200 ns.

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), DLIs (Doppler Laser Interferometers) and PDV (Photonic Doppler Velocimeters) also known as Het-V (Heterodyne Velocimeters)laser interferometers).

6A226 Pressure sensors, as follows:

a. Shock pressure gauges capable of measuring pressures greater than 10 GPa, including gauges made with manganin, ytterbium, and polyvinylidene bifluoride (PVBF, PVF2);

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 systems specified in 9A104 and their subsystems.

6C Materials

Blank

6D Software

6D102 "Software" specially designed or modified for the "use" of goods specified in 6A108.

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.

6D203 "Software" or encryption keys/codes as follows:

1. Specially designed to enhance or release the performance characteristics of equipment not controlled in Item 6A203 so that it meets or exceeds the characteristics specified in Item 6A203.

2. Specially designed to enhance or release the performance characteristics of equipment controlled in Item 6A203.

6E Technology

6E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment or "software" specified in 6A, 6B, or 6D.

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. Linear accelerometers, designed for use in inertial navigation systems or in guidance systems of all types, usable in the systems specified in 9A104, having all of the following characteristics, and specially designed components therefor:

a. 'Scale factor' "repeatability" less (better) than 1250 ppm; and

b. 'Bias' "repeatability" less (better) than 1 250 micro g.

Note: 7A101.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.

Technical Note:

In 7A101 the measurement of 'bias' and 'scale factor' refers to a one sigma standard deviation with respect to a fixed calibration over a period of one year.

7A102 All types of gyros, usable in systems specified in 9A104, 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.

Technical Notes:

1. *'Drift rate' is defined as the component of gyro output that is functionally independent of input rotation and is expressed as an angular rate (IEEE STD 528-2001 paragraph 2.56).*

2. *'Stability' is defined as a measure of the ability of a specific mechanism or performance coefficient to remain invariant when continuously exposed to a fixed operating condition (IEEE STD 528-2001 paragraph 2.247) (This definition does not refer to dynamic or servo stability).*

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 down-hole well services operations.

b. Integrated flight instrument systems, which include gyrostabilisers or automatic pilots, designed or modified for use in systems specified in 9A104;

c. 'Integrated navigation systems', designed or modified for systems 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.

3. Designed or modified to be integrated with flight control and navigation systems.

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 systems specified in 9A104.a.; 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 (1 165 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 systems 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 systems specified in 9A104.a.

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 systems specified in9A104.a.

a. Hydraulic, mechanical, electro optical, or electro mechanical flight control systems (including fly-by-wire 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.

Note: Systems, equipment or valves specified in 7A116 may be exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

7A117 "Guidance sets", usable in "missiles" specified in 9A104.a. 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.

Note: Equipment specified in 7B103.b. includes the following:

a. For laser gyro equipment, the following equipment used to characterise mirrors, having the threshold accuracy shown or better:

1. Scatterometer (10 ppm);

2. Reflectometer (50 ppm);

3. Profilometer (5 Angstroms);

b. For other inertial equipment:

1. Inertial Measurement Unit (IMU) Module Tester;

2. IMU Platform Tester;

3. IMU Stable Element Handling Fixture;

4. IMU Platform Balance Fixture;

5. Gyro Tuning Test Station;

6. Gyro Dynamic Balance Station;

7. Gyro Run-In/Motor Test Station;

8. *Gyro Evacuation and Filling Station;*

9. *Centrifuge Fixture for Gyro Bearings;*

10. *Accelerometer Axis Align Station;*

11. *Accelerometer Test Station;*

12. *Fiber optic Gyro Coil Winding Machines.*

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.,7A116.c., 7A117, 7B102 or 7B103.

Note: "Software" specified in 7D101 may be exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

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.; and

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 "development", "production" or "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; and

c. Design "technology" for the determination of hardening criteria of 7E102.a. and7E102.b.

7E104 "Technology" for the integration of the flight control, guidance, and propulsion data into a flight management system, designed or modified for the systems specified in 9A104.a. or UAVs specified in 9A104.b., for optimisation of rocket system trajectory.

7E105 Design "technology" for integration of air vehicle fuselage, propulsion system and lifting control surfaces, designed or modified for the systems specified in 9A104.a. or UAVs specified in 9A104.b., to optimise aerodynamic performance throughout the flight regime of an unmanned aerial vehicle.

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, useable for systems specified in 9A104.a. and UAVs specified in 9A104.b.

N.B.: See also 9A111 and 9A118.

9A012 "Unmanned aerial vehicles" "UAVs" having all of the following:

a. Having any of the following:

1. An autonomous flight control and navigation capability; or

2. Capability of controlled-flight out of the direct vision range involving a human operator; and

b. Having any of the following:

1. Incorporating an aerosol dispensing system/mechanism with a capacity greater than 20 litres; or

2. Designed or modified to incorporate an aerosol dispensing system/mechanism with a capacity greater than 20 litres.

Note: Item 9A012does not control model aircraft, specially designed for recreational or competition purposes.

Technical Notes:

1. An aerosol consists of particulate or liquids other than fuel components, by-products or additives, as part of the "payload" to be dispersed in the atmosphere. Examples of aerosols include pesticides for crop dusting and dry chemicals for cloud seeding.

2. An aerosol dispensing system/mechanism contains all those devices (mechanical, electrical, hydraulic, etc.), which are necessary for storage and dispersion of an aerosol into the atmosphere. This includes the possibility of aerosol injection into the combustion exhaust vapour and into the propeller slip stream.

9A101 Turbojet and turbofan engines 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 8 890 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 conditions using the ICAO standard atmosphere);

b. Engines designed or modified for use in systems specified in 9A104.a.and UAVs specified in 9A104.b.

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(achieved un-installed at sea level static conditions using the ICAO standard atmosphere).

Note: 9A102 does not control civil certified engines.

Technical Notes:

1. *For the purposes of 9A102 a 'turboprop engine syste' 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 un-installed at sea level standard conditions.*

9A104 Complete rocket systems (including ballistic missile systems, space launch vehicles, and sounding rockets) and complete unmanned aerial vehicle systems (including cruise missile systems, target drones and reconnaissance drones) as follows:

a. Capable of delivering at least a 500 kg "payload" to a "range" of at least 300 km.

b. Capable of a "range" equal to or greater than 300 km.

9A105 Liquid propellant rocket engines, as follows:

N.B.: See also 9A119.

a. Liquid propellant rocket engines integrated , or designed or modified to be integrated, into a liquid propellant propulsion systemusable 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.

Note:Liquid propellant apogee engines or station-keeping engines specified in 9A105.a., designed or modified for use on satellites, may be treated as 9A105.b., if the subsystem is exported subject to end-use statements and quantity limits appropriate for the excepted end-use stated above, when having a vacuum thrust not greater than 1kN.

9A106 Systems or components, usable in "missiles" specified in 9A104.a., as follows, specially designed for liquid rocket propulsion systems:

a. Ablative liners for thrust or combustion chambers for systems specified in 9A104;

b. Rocket motor cases, and "insulation" components;

c. Rocket nozzles;

d. Thrust vector control sub systems;

Technical Note:

Examples of methods of achieving thrust vector control specified in 9A106.d. 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.

e. Liquid, slurry and gel 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 1: The only servo valves, pumps and gas turbines 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 rpm at the maximum operating modeor with discharge pressures equal to or greater than 7 MPa.

Note 2: Gas turbines, for liquid propellant turbopumps, with shaft speed equal to or greater than 8 000 rpm at the maximum operating mode.

9A107 Solid propellant rocket engines as follows:

a. Solid propellant rocket engines having a total impulse capacity of 1,1 MNs or greater,

b. 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, but less than 1,1 MNs.

N.B.: See also 9A119.

9A108 Components usable in "missiles" specified in 9A104.a., as follows; specially designed for solid rocket propulsion systems:

a. Rocket motor cases, "interior lining" and "insulation" therefor;

b. Rocket nozzles; and

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 as follows:

a. Usable in "missiles" and specially designed components therefor having a total impulse capacity of 1,1 MNs or greater;

b. Usable in systems specified 9A104.b. having total impulse capacity of 0,841 MNs or greater, but less than 1,1 MNs and specially designed components therefor.

N.B.: See also 9A119.

9A110 Composite structures, laminates and manufactures thereof, specially designed for systems specified in 9A104 or the subsystems specified in 9A105, 9A106 to 9A108, 9A116 or 9A119, or 9A121.

9A111 Pulse jet engines, usable in systems specified in 9A104.a. and UAVs specified in 9A104.b. 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 systems specified in 9A104; and

b. Vehicles for transport, handling, control, activation or launching, designed or modified for systems specified in 9A104.a.

9A116 Re-entry vehicles, usable in "missiles" specified in 9A104.a., 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; and

d. Electronic equipment specially designed for re-entry vehicles.

9A117 Staging mechanisms, separation mechanisms, and interstages, usable in "missiles" specified in 9A104.a.

9A118 Devices to regulate combustion usable in engines, which are usable in systems specified in 9A104.a. and UAVs specified in 9A104.b.

9A119 Individual rocket stages, usable in, systems specified in 9A104 and 9A012 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 range of at least 300 km.

9A121 Weapon or warhead safing, arming, fuzing, and firing mechanisms, usable in the systems specified in 9A104.a.

9A122 Rocket motor cases, "insulation" components and nozzles therefor, usable in complete rocket systems specified in 9A104.b. and specially designed components therefor.

9A123 Radomes designed to withstand a combined thermal shock greater than $4{,}184 \times 10^6$ J/m^2 accompanied by a peak over pressure of greater than 50 kPa, usable in protecting rocket systems and unmanned aerial vehicles against nuclear effects (*e.g.*, electromagnetic pulse (EMP), X-rays, combined blast and thermal effects), and usable for the systems specified in 9A104.a.

9B Test, Inspection and Production Equipment

9B105 'Aerodynamic test facilities' for speeds of Mach 0,9 or more, usable for systems specified in 9A104, 9A105, 9A107, 9A109 and 9A119 and their subsystems.

Note: Item 9B105 does not control wind-tunnels for speeds of Mach 3 or less with dimension of the 'test cross section size' equal to or less than 250 mm.

Technical Notes:

1. 'Aerodynamic test facilitie' includes wind tunnels and shock tunnels for the study of airflow over objects.

2. 'Test cross section size' means the diameter of the circle, or the side of the square, or the longest side of the rectangle, or the major axis of the ellipse at the largest 'test cross section' location. 'Test cross section' is the section perpendicular to the flow direction.

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 223 K (–50 °C) to above 398 K (+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 while 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., power spectrum).

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 in 2B116.*

3. *In 9B106.a.2. 'bare table' means a flat table, or surface, with no fixture or fittings.*

b. Environmental chambers capable of simulating all of 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. Any of the following:

a. Altitude equal to or greater than 15 km; or

b. 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 9A011, 9A101, 9A102, 9A105 to 9A109, 9A111, 9A116 to 9A119, 9A120 and 9A121.

9B116 Specially designed "production facilities" for the systems, sub-systems, and components specified in 9A011, 9A101, 9A102, 9A104 to 9A109, 9A111, or 9A116 to 9A119, 9A120 and 9A121.

9B117 Test benches and test stands usable for systems specified in 9A104 having the capacity to handle solid or liquid propellant rockets or rocket motors or engines, 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

9C108 "Interior lining", and "insulation" material in bulk form usable for rocket motor cases or specially designed for systems in the systems specified in 9A104.

Technical Notes:

1. *In 9C108 "interior lining" suited for the bond interface between the solid propellant and the case or insulating liner is usually a liquid polymer based dispersion of refractory or insulating materials e.g. carbon filled HTPB or other polymer with added curing agents to be sprayed or screeded over a case interior.*

2. *In 9C108 "insulation" intended to be applied to the components of a rocket motor, i.e. the case, nozzle inlets, case closures, includes cured or semi-cured compounded rubber sheet stock containing an insulating or refractory material.*

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 9C110 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 (except 9A104.b.), or 9B117.

9D103 "Software" specially designed for modelling, simulation or design integration of the systems specified in 9A104, or the subsystems specified in 9A105.a., 9A106, 9A108, 9A116 or 9A119.

Technical Note:

The modelling includes in particular the aerodynamic and thermodynamic analysis of the systems.

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 9A011, 9A101, 9A102, 9A105, 9A106.c., 9A106.d., 9A106.e., 9A107, 9A108.c., 9A109, 9A111, 9A115.a., 9A116.d., 9A117 or 9A118 and 9A121.

Note: "Software" for liquid propellant apogee engines or station-keeping engines specified in 9A105.a., designed or modified for use on satellite applications, may be treated as "software" for 9A105.b., if exported subject to end-use statements.

9D105 "Software" which coordinates the function of more than one subsystem, specially designed or modified for "use" in systems specified in 9A104.

9D106 "Software" specially designed or modified for the "development" of equipment specified in 9A011, 9A106.b., 9A106.c., 9A108.a., 9A108.b., 9A109, 9A111, 9A117, and 9A118.

9E Technology

9E101 "Technology" according to the General Technology Note for the "development" or "production" of goods specified in 9A011, 9A101, 9A102, 9A104 to 9A111 or 9A115 to 9A119, 9A120, 9A121, 9A123, 9B115, 9B116, 9C108, 9C110, 9D101, 9D103, 9D104, and 9D106.

9E102 "Technology" according to the General Technology Note for the "use" of systems specified in 9A011, 9A101, 9A102, 9A104 to 9A111, 9A115 to 9A119, 9A120, 9A121, 9A123, 9B105, 9B106, 9B115, 9B116, 9B117, 9C108, 9C110, 9D101 or 9D103, 9D104, 9D105 and 9D106.

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SECDIV

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