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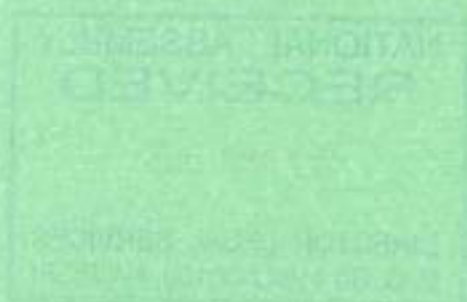
**NATIONAL ASSEMBLY BILLS, 2026**

**NAIROBI, 24th March, 2026**

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**THE STRATEGIC GOODS CONTROL BILL, 2026****A Bill for**

**AN ACT of Parliament to provide for the control of the trade in strategic goods, technology and related services; to prevent the proliferation of nuclear, chemical or biological weapons and their means of delivery; and for connected purposes**

**ENACTED** by the Parliament of Kenya as follows—

**PART I—PRELIMINARY**

1. This Act may be cited as the Strategic Goods Control Act, 2026, and shall come into operation on such date as the Cabinet Secretary may, by notice in the *Gazette*, appoint.

Short title and commencement

2. In this Act, unless the context otherwise requires—

Interpretation

“broker” means a person that provides brokering services related to conventional arms or if such services are offered in connection to weapons of mass destruction or their means of delivery or if destined to military end-use in an embargoed destination or to prohibited restricted users;

“brokering” means the selling or buying of a strategic good that is located in one foreign country and for the transfer of that strategic good to another foreign country;

“Cabinet Secretary” means the Cabinet Secretary for the time being responsible for matters relating to internal security;

“certificate” means the certificate of registration issued under section 9(4);

“chairperson” means the chairperson of the Committee;

“Committee” means the Strategic Goods Control Committee established under section 5;

“Director” means the Director appointed under section 8;

“dual-use good” means an item, software or technology which can be used for both civil and military applications or in connection with the development, production, handling, operation, maintenance, storage,

detection, identification or dissemination of weapons of mass destruction or their means of delivery;

“end-user” means a person who is the owner of a strategic good;

“end-use control” means a procedure authorising the establishment of controls over any item, software or technology, not listed in the National Control List, that is based on concerns related to weapons of mass destruction, their means of delivery, or military end-use in destinations subject to United Nations Security Council embargo, for prohibited and restricted end uses and end-users;

“export” means to take or cause to be taken a strategic good out of Kenya including transmission of technology and software by electronic means;

“financing” means making available or providing funds or assets in connection with any uses related to weapons of mass destruction or their means of delivery, for military end-use in a destination subject to United Nations Security Council;

“general licence” means an authorisation to enable a person engage in strategic trade with one or more countries under the conditions specified in the licence;

“global licence” means an authorisation to enable a person engage in strategic trade regarding one category of dual-use goods which may be valid for one or more specific end-uses or in one or more countries;

“import” means to bring or cause a strategic good to be brought into Kenya and includes the transmission of computer data by electronic means;

“in-country transfer” means the reallocation of a strategic good previously exported from Kenya, from one person to another within a single foreign country by any means and includes the electronic transmission of software or technology;

“individual licence” means an authorisation to enable a person to engage in strategic trade with respect to one end-user, consignee or covering one or more dual-use goods;

“inspector” means a person appointed under section 26;

“licence” means a licence issued under section 15;

“means of delivery” means missiles, rockets and other manned or unmanned systems capable of delivering nuclear, biological or chemical weapons and are specifically designed for such use;

“military end-use” means the—

- (a) incorporation into conventional weapons and arms;
- (b) use of production, test or analytical equipment and its components for the development, production or maintenance of conventional weapons and arms; or
- (c) use of any unfinished products in a plant to produce conventional weapons and arms;

“military goods” include—

- (a) weapons, munitions, bombs, explosives, armaments, vessels, vehicles and aircraft designed or produced manufactured for use in war, war-like operations or security operations and any other articles of war; and
- (b) any component, equipment, system, processes, software and technology of whatever nature capable of being used in the design, development, production, upgrading, refurbishment or maintenance of anything contemplated in paragraph (a);

“nationally controlled goods” means strategic goods or technology, tangible or intangible, that are placed under unilateral controls for reasons of national security, foreign policy, anti-terrorism, crime control or public health and safety;

“National Control List” means the list set out in the Schedule;

“national security organ” means a national security organ specified in Article 239(1) of the Constitution;

“re-export” means the exportation of a strategic good that was previously imported from a foreign country;

“register” means the register maintained in accordance with section 11;

“related service” means brokering, financing, transportation or the provision of technical services;

“service provider” means a broker, a person who funds, transporter or technical services provider;

“Secretariat” means the Secretariat of the Committee established under section 7;

“software” means a collection of one or more programs or micro programs recorded, stored or embodied in any device;

“strategic goods” means military goods, dual use-goods, weapons of mass destruction and their means of delivery and nationally controlled goods and includes any component used in their production, means of delivery and their related service;

“strategic trade” means the production, sale, export, import, re-export, in-country transfer, transit and transshipment of strategic goods and the provision of related services;

“technical services” means technical support, including repairs, development, manufacture, assembly, testing, maintenance, overhaul or any other service, which may take such forms as instruction, training, transmission of working knowledge or skills or consulting services provided in relation to a strategic good;

“technical service provider” means a person providing technical services in connection with weapons of mass destruction or their means of delivery, or to military end-use in an embargoed destination, or to prohibited restricted users;

“transmission” means making software and technology available in an electronic form to persons within and outside Kenya as well as the oral and written transmission of technology including when technology is described over a voice transmission medium;

“transit” means the movement of strategic goods through the territory of Kenya from a foreign country to another foreign country;

“transshipment” means the transfer, either directly or indirectly, of a strategic good from an aircraft, vehicle or vessel arriving in Kenya from a foreign country to an aircraft, vehicle or vessel departing to a foreign country;

“transportation” means the act of transferring or undertaking to transfer, a strategic good, a supporting service being provided to a transport provider or any act calculated to promote the delivery of a strategic good;

“transporter” means a person who provides transportation services in accordance with this Act and includes transportation between foreign countries;

“visiting forces” means the armed forces or a member of the armed forces of a designated country which for the time being is lawfully present in Kenya—

- (a) under a treaty or agreement to which the Government is party; or
- (b) during peacekeeping or a government humanitarian mission; and

“weapon of mass destruction” means a weapon designed to kill, harm or infect people, animals or plants, through nuclear explosion, dispersion of the toxic properties of a chemical weapon, or dispersion of the infectious or toxic properties of a biological weapon, and includes a means of delivery designed, adapted or intended for the deployment of such a weapon.

3. (1) This Act shall apply to—

*Application*

- (a) any person operating within Kenya who engages in strategic trade;
- (b) any person who handles a strategic good; or
- (c) a citizen of Kenya who engages in strategic trade outside Kenya.

(2) This Act shall not apply to—

- (a) the importation, storage, use, exportation, transit and transshipment of strategic goods and related

services by a national security organ or its agencies or similar organisation referred to in Article 239(4) of the Constitution; or

- (b) the transit, transshipment and temporary exportation and importation of conventional arms by visiting forces:

Provided that such conventional arms shall be approved for clearance by the Ministry responsible for defence.

4. (1) The National Control List set out in the Schedule shall— National Control List

- (a) specify the strategic goods that are subject to the provisions of this Act; and
- (b) be in conformity with the international and regional commitments of Kenya.

(2) The Cabinet Secretary may, on the recommendation of the Committee, amend the National Control List by notice in the *Gazette*.

#### **PART II —THE STRATEGIC GOODS CONTROL COMMITTEE**

5. (1) There is established the Strategic Goods Control Committee. Establishment of the Strategic Goods Control Committee

- (2) The Committee shall consist of—
  - (a) the Principal Secretary responsible for matters relating to internal security, who shall be the chairperson;
  - (b) the Principal Secretary responsible for matters relating to Defence or his representative;
  - (c) the Principal Secretary responsible for matters relating to finance or his representative;
  - (d) the Principal Secretary responsible for matters relating to Information, Communication and Technology or his representative;
  - (e) the Principal Secretary responsible for matters relating to health or his representative;
  - (f) the Principal Secretary responsible for matters relating to trade or his representative;

- (g) the Solicitor-General or his representative;
- (h) the Chief of the Kenya Defence Forces or his representative;
- (i) the Director-General of the National Intelligence Service or his representative;
- (j) the Inspector-General of the National Police Service or his representative;
- (k) the Commissioner-General of the Kenya Revenue Authority or his representative;
- (l) one person nominated by the Kenya Private Sector Alliance;
- (m) one person nominated by the Kenya National Chamber of Commerce; and
- (n) the Director, who shall be an *ex officio* member and Secretary to the Committee.

(3) The members appointed under subsection (2)(l) and (m) shall be persons possessing skills and competencies that may be required for the achievement of the functions of the Committee.

(4) The chairperson shall preside at every meeting of the Committee at which he or she is present, but in the absence of the chairperson the members present may elect a chairperson from among their number to preside.

(5) The quorum for a meeting of the Committee shall be two-thirds of the members.

(6) Except as provided in this Act, the Committee shall regulate its own procedure.

(7) The Committee may co-opt any other person to attend its meetings and participate in its deliberations, but that person shall not vote.

6. (1) The functions of the Committee shall be to—

- (a) provide oversight of strategic trade;
- (b) develop standards and procedures for the effective implementation of this Act;
- (c) review the National Control List;

Functions of the  
Committee.

- (d) approve, monitor and evaluate the budget proposals provided by the Secretariat;
- (e) establish and maintain the coordination, cooperation, assistance and sharing of information within Government agencies, academia, private institutions, any other person and other countries for the effective implementation of this Act;
- (f) report to the Cabinet Secretary on matters relating to strategic trade;
- (g) issue, suspend or revoke a licence or a certificate for purposes of this Act;
- (h) establish and operate end-use controls and compliance checks; and
- (i) perform such other functions necessary for the effective implementation of this Act.

7. (1) There shall be a secretariat of the Committee which shall consist of such public officers as may be seconded to the Secretariat.

Secretariat

(2) The secretariat shall be hosted by the Ministry responsible for matters relating to internal security.

(3) The secretariat shall—

- (a) establish and maintain a comprehensive database on strategic goods and related services;
- (b) implement the provisions of this Act in collaboration with other agencies;
- (c) conduct administrative investigations under this Act;
- (d) coordinate, collaborate and share relevant information with other Government agencies in the implementation of this Act;
- (e) prepare and submit budget proposals for consideration by the Committee;
- (f) monitor strategic trade and end-user controls;
- (g) inspect end-use activities and end-user controls for strategic goods;
- (h) submit quarterly reports on matters relating to strategic trade; and

- (i) perform such other functions that are necessary for the effective implementation of this Act.

8. (1) The secretariat shall be headed by a Director who shall be a public officer appointed by the Cabinet Secretary on the recommendation of the Committee.

Director

(2) The Director shall—

- (a) be the head of the secretariat and be responsible for the day-to-day management of the secretariat;
- (b) keep all records of the Committee;
- (c) communicate the decisions of the Committee; and
- (d) perform such other functions as may be assigned by the Committee.

(3) The Director shall be appointed on such terms and conditions as may be determined by the Cabinet Secretary.

### **PART III—REGISTRATION AND LICENSING**

9. (1) A person who intends to engage or engages in strategic trade shall register with the Committee.

Registration

(2) An application for registration under subsection (1) shall be in the prescribed form and shall be accompanied by payment of the prescribed fee.

(3) The Committee may approve or refuse to grant the application under subsection (2).

(4) Where the Committee approves an application, the Committee shall issue a certificate of registration to the applicant and enter the details of the applicant in the Register.

(5) The Committee may refuse to approve an application made under subsection (2) if—

- (a) the applicant falsely represents or conceals any material fact or submits misleading information, including submitting a forged document;
- (b) the applicant is found liable for violating an international embargo or sanction that binds Kenya;
- (c) the applicant is the subject of ongoing civil or criminal proceedings related to national security; or

(d) there are prevailing national security concerns against the applicant.

(6) A registration under this section shall remain valid unless cancelled or suspended by the Committee.

10. (1) The Committee may suspend the registration of a person engaged in strategic trade where it has reasonable grounds to believe that there is a contravention of the provisions of this Act by that person.

Cancellation, suspension or revocation of registration.

(2) The Committee may restore a suspended registration if the contravention of the provisions of this Act is not established.

(3) The Committee may cancel the registration of a person engaged in strategic trade if—

(a) the registered person—

- (i) so requests in writing;
- (ii) contravenes the provisions of this Act or any other law relating to national security;
- (iii) violates an international sanction or embargo that binds Kenya;
- (iv) dies;
- (v) is adjudged bankrupt;
- (vi) is a body corporate that has been dissolved or wound up;
- (vii) fails to engage in strategic trade for a period of three years;

(b) new facts emerge which if they would have been known at the time of registration would have resulted in a denial of the application for registration at the time when the application was made;

(c) an entry with regards to the registration has been incorrectly or fraudulently made;

(d) there is a change of shareholders, directors or signatories of the body corporate without written notification to the Committee; or

(e) any other national security concerns arise.

(4) The Committee shall remove from the Register the name of a person whose registration has been cancelled under subsection (3).

(5) A person whose name has been removed from the Register shall cease, from the date of such removal, to engage in strategic trade, and any licence or certificate issued to that person under this Act shall be revoked.

11. (1) The Director shall maintain a Register of persons engaged in strategic trade. Register

(2) The Register maintained under subsection (1) shall contain, in respect of each application for registration under section 9(2), a copy of—

- (a) the application;
- (b) the certificate or licence issued under this Act; and
- (c) any other information the Committee may consider necessary.

12. (1) The Committee shall impose end-use controls on a strategic good specified in the National Control List. End-use control

(2) The Committee may impose end-use controls on a strategic good that is not specified in the National Control List.

(3) Where the Committee imposes an end use control on a strategic good, the end user of the strategic good shall sign an end user certificate.

(4) The end user certificate signed under subsection (3) shall specify the end user, the quantity, value and purpose of the strategic good.

(5) The Committee shall certify the end-user certificate.

(6) A person who intends to change the end user shall, within forty-eight hours, notify the Committee in writing of any change concerning the end-user or another party to an export, import, transit, use, storage, transshipment of strategic goods or provision of related services.

(7) The Committee shall, upon receipt of the notification under subsection (6), approve a change of end-

user in accordance with the class of licence held by the applicant within ninety days from the date of receipt of the notification.

(8) A person who engages in strategic trade shall comply with the end-user undertakings.

13. (1) The Committee may prohibit the export, re-export, transit, transfer, transmission and transshipment of a good not specified in the National Control List or the provision of a related service if the goods or services in question are or may be intended, in their entirety or in part, for use in connection with weapons of mass destruction, their means of delivery or for military applications to a destination which is subject to a United Nations Security Council sanction or embargo, prohibited or restricted end-uses and end-users.

Shipment of goods specified in the National Control List.

(2) The Committee may stop the shipment of strategic goods specified in the National Control List or the provision of related services at any stage in order to verify that the shipment of the strategic goods or the provision of the related services has been approved under this Act.

(3) Where a shipment is already in transit, the Committee may direct that the shipment be returned or unloaded at any port of call.

14. (1) A person shall not engage in strategic trade of any strategic good specified in the National Control List or provide a related service unless the person is the holder of a licence issued under this Act.

Licensing.

(2) A person who intends to engage in strategic trade shall apply for a licence in the prescribed form, upon payment of the prescribed fee.

(3) The Cabinet Secretary may, on the recommendation of the Committee, exempt an applicant from the requirements of this section.

(4) No person, other than a national security organ, shall engage in strategic trade for military applications.

15. (1) The Committee may issue a licence to an applicant subject to such conditions as set out under this Act.

Conditions for the issuance of a licence.

(2) In deciding whether to issue a licence under subsection (1), the Committee shall consider the following

- (a) the national security of Kenya;
  - (b) international obligations and commitments under any international treaty or agreement including—
    - (i) United Nations Security Council Resolutions; and
    - (ii) the African Union Peace and Security Council Resolutions;
  - (c) the preservation of regional peace, security and stability;
  - (d) the internal tensions or armed conflict in the destination country;
  - (e) human rights and international humanitarian law;
  - (f) terrorism or organized criminal activities;
  - (g) the security interests of a country which is an ally to Kenya;
  - (h) the risk of diversion to an unauthorised end-user or end-use; and
  - (i) any other relevant national security consideration.
- (3) The Committee shall refuse to issue a licence if—
- (a) the applicant does not fulfil the conditions and requirements of this Act;
  - (b) the applicant submitted false documents, made misleading representations or concealed material facts in the application;
  - (c) the applicant has contravened any written law relating to national security;
  - (d) the applicant has violated an international embargo or sanction that binds Kenya;
  - (e) the applicant is subject to ongoing criminal or civil proceedings related to national security;
  - (f) the goods for which the licence is being sought are the subject of a police investigation or court proceedings;

- (g) the proposed strategic trade is in breach of a United Nations Security Council sanction or embargo;
- (h) the proposed strategic trade will impede the fulfilment of international commitments or obligations of Kenya;
- (i) there is credible information that the proposed strategic trade may endanger national or international security, regional stability, or contribute to terrorist acts;
- (j) there is credible information that the proposed strategic trade may result in the diversion of the strategic good or service to an unauthorized end-use or end-user; or
- (k) there are any other national security concerns.

16. (1) The validity period of a licence issued under this Act shall be as follows—

Validity of licence.

- (a) an individual licence shall be valid for a period of three years from the date of issue;
- (b) a global licence shall be valid for a period of five years from the date of issue; and
- (c) a general licence shall be valid for a period of five years from the date of issue or until it is revoked.

(2) The Cabinet Secretary shall, by notice in the *Gazette*, notify the public of the issuance of a general licence under this Act.

17. Where a licence is lost or destroyed, the holder of the licence shall notify the Committee of the loss or destruction within seven days of the occurrence.

Notification of lost or destroyed licence.

18. In determining whether to revoke or suspend a licence, the Committee shall, where applicable, comply with Article 47 of the Constitution and the Fair Administrative Action Act.

Fair hearing.  
Cap 7L.

19. (1) Where the Committee suspects that the strategic trade is being conducted in contravention of existing conditions of a licence, the Committee may suspend the licence.

Suspension of licence.

(2) The Committee shall, in writing, inform the holder of the licence of the failure to comply with the conditions of the licence and shall specify the corrective action to be taken by the holder of the licence.

(3) Where the holder of the licence does not take the corrective action specified by the Committee under subsection (2), the Committee may suspend the licence until the holder of the licence complies with the corrective action recommended by the Committee.

(4) The Committee may suspend a licence for a shipment of a strategic good specified in the National Control List or the provision of related services to any country experiencing a deterioration in security.

(5) The Committee shall, in writing, notify the holder of a licence of the suspension of the licence and the period of the suspension.

(6) Where at the end of the period specified in subsection (5), the grounds for suspension are still valid, the period of suspension may be extended, and the holder of the licence shall be notified of such extension in writing.

(7) The suspension of the licence may be lifted where the Committee considers it appropriate to do so.

(8) The period for the performance of any action under this section shall be determined on a case by case basis and subject to relevant regulations.

**20. (1)** The Committee may revoke a licence if—

- (a) the holder of the licence so requests, in writing;
- (b) new facts emerge which, had they been known or existed at the time of the application, would have resulted in the Committee refusing to issue the licence;
- (c) a material change in the information specified in the licence occurs;
- (d) the holder of the licence fails to comply with the obligations, terms or conditions of the licence;
- (e) the holder of the licence contravenes this Act or any other law relating to national security;

Revocation of  
licence.

- (f) the holder of the licence fails to furnish the Committee with additional information relating to the activities conducted under the licence;
- (g) the holder of the licence dies;
- (h) the registered person is a body corporate that is dissolved or wound up;
- (i) there is a change of shareholders, directors or signatories of the body corporate;
- (j) the Committee becomes aware of any other reasons related to national security; or
- (k) the Committee, for any other reason, deems it fit to revoke the licence.

(2) The Committee shall revoke the licence of a person whose registration has been cancelled.

21. The Committee shall, by notice in the *Gazette*, notify the public of the revocation of a general licence under this Act.

Publication of  
revocation of  
general licence

22. The Committee shall notify the relevant Government agencies or State departments immediately it revokes or suspends a licence issued under this Act.

Notification to  
Government  
agencies

23. (1) A person aggrieved by a decision of the Committee may appeal to the Cabinet Secretary within thirty days of being notified of the decision.

Administrative  
appeals

(2) An appeal under subsection (1) shall be heard and determined within sixty days after it is lodged.

(3) Where at the end of the period specified in subsection (2), the grounds for appeal are still valid, the Committee may extend the period of suspension or revocation of the licence and notify the holder of the licence of such extension, in writing.

(4) The right to appeal to the Cabinet Secretary shall be in addition to any other remedy available in law to the aggrieved person.

#### **PART IV—ENFORCEMENT, OFFENCES AND PENALTIES**

24. (1) A person who engages in strategic trade shall—

Compliance  
requirements

- (a) comply with the conditions upon which the licence was issued;
- (b) inform the Committee immediately of any change that occurs in an export, import, transit or transshipment of a strategic good or the provision of a related service;
- (c) inform the Committee of the finalisation of the activity for which the licence was issued and submit the relevant documents to the Committee;
- (d) notify the Committee of the grounds for suspecting that strategic goods are or may be used, partly or entirely, for any of the uses related to weapons of mass destruction, their means of delivery for military end-use in an embargoed destination by restricted persons or for suspecting that the related service which he intends to provide would facilitate that use;
- (e) confirm the delivery and receipt of the strategic goods;
- (f) indicate clearly in relevant commercial documents including any sales contract, order confirmation, invoice or dispatch note relating to domestic transfers of goods in the National Control List produced in Kenya, that those strategic goods are subject to controls, if exported from Kenya;
- (g) notify the Committee within twenty-four hours of any loss or theft of strategic goods or goods in the National Control list in their possession;
- (h) put in place internal compliance measures for effective compliance with the provisions of this Act; and
- (i) comply with other obligations, terms and conditions of a licence or certificate issued under this Act.

25. (1) The Secretariat shall, in consultation and cooperation with other regulatory authorities and enforcement agencies, be responsible for verifying compliance by all persons engaged in strategic trade.

Verification of  
compliance

(2) The verification of compliance shall be conducted before, during and after the issuance of a licence.

(3) During verification of compliance, the Committee may, in collaboration with other regulatory authorities—

- (a) request necessary information from the applicant or holder of a licence for purposes of compliance control;
- (b) inspect the documents of an applicant or holder of a licence and the business premises, including offices, production facilities, warehouses, and distribution centres, related to strategic goods and nationally controlled goods as well as the goods themselves;
- (c) audit the internal compliance measures of the holder of a licence;
- (d) request information from any other institution or organisation necessary for the purposes of this section;
- (e) request for assistance from competent authorities of other countries in order to collect additional information necessary for the purposes of this section;
- (f) monitor compliance of the holder of the licence with the obligations, terms, and conditions of the licence;
- (g) monitor the end-users of the strategic good; and
- (h) undertake enforcement activities within the Committees or the regulatory authority's respective mandate.

26. (1) The Cabinet Secretary may, on the recommendation of the Committee, by notice in the *Gazette*, appoint a suitably qualified person to be a strategic goods inspector. Inspector

(2) An inspector may—

- (a) investigate an administrative violation committed under this Act;
- (b) undertake the enforcement of this Act in cooperation with other agencies; and

(c) perform such other functions as may be assigned by the Director.

(3) No person appointed under subsection (1) shall, while being so appointed, engage in strategic trade.

(4) The Cabinet Secretary shall issue an inspector appointed under subsection (1) with a certificate of appointment.

(5) An inspector shall, upon entering any place or premises for purposes of subsection (2), be required to produce the certificate of appointment issued under subsection (4) to the person in charge of the premises.

27. (1) An inspector shall, with a warrant, have full and free access to any building, place, property, documents, network or data storage device for the purposes of administering this Act.

Access to places  
or premises.

(2) Where an inspector enters any place or premises for purposes of this Act, the inspector may—

- (a) require any person therein to produce any books, accounts or other documents, including computerized data or other record, whether in print or electronic format, or items which such person is required to keep under the provisions of this Act;
- (b) examine any books, accounts or other documents, including computerized data or other record, whether in print or electronic format, facility, apparatus, equipment, device or item and make copies of, or take extracts from, any such books, accounts, documents or records;
- (c) seize or detain any books, accounts or other documents, including computerized data or other record, whether in print or electronic format, facility, apparatus, equipment, device or item which contains or is reasonably suspected to contain information relating to any offence suspected to have been committed under this Act;
- (d) require any person therein to answer questions relating to—
  - (i) any book, data, document or other record or item;

- (ii) any entry in any book, data, document or other record; or
  - (iii) any other item that the inspector may deem necessary.
- (e) require, at the expense of any person therein, to open and examine any container, envelope, package or other items and materials in any such place or premises; or
- (f) take a sample of any item, good or thing for analysis and testing.

(3) If, by reason of its nature, size or amount, it is not practicable to remove any item, books, accounts or other documents, including computerized data or other record, whether in print or electronic format, seized or detained under this section, the inspector shall, by any means, seal such item, book, accounts or other documents, including computerized data, or other record in the place or premises or container in which it is found.

(4) Where the inspector is unable to obtain free access to any place or premises or to any container in that place or premises, the inspector may, at any time, enter such place or premises and open such container in such manner, if necessary by force, as the inspector may deem necessary.

(5) Where, on the entry upon any place or premises under the provisions of this Act, any strategic goods are found in relation to which an offence has been committed, such strategic goods shall be liable for forfeiture.

**28. (1)** An inspector may, with a warrant—

- (a) board any conveyance;
- (b) require the master of a vessel, pilot of an aircraft or person in control of any other conveyance to give such information relating to the conveyance, cargo, stores, crew, passengers or voyage as the inspector may consider necessary;
- (c) search all parts of such conveyance for strategic goods;
- (d) examine all items on board and all items being loaded or unloaded;

Power to search conveyances.

- (e) demand all documents of items which ought to be on board; or
- (f) require all or any such document to be submitted to him for inspection.

(2) A master of a vessel, pilot of an aircraft or person in control of any conveyance who refuses to allow an authorised officer to board or search such conveyance or refuses to give such information or to produce such documents on demand commits an offence and shall, on conviction be liable to a fine not exceeding one million shillings or to imprisonment for a term not exceeding three years, or to both.

(3) If any place, box or chest on board in such conveyance is locked and the key withheld, the inspector may break open any such place, box or chest at the expense of the owner.

29. An inspector may, without a warrant, exercise any power referred to in sections 27 and 28 where a delay in obtaining the warrant would defeat the object of the warrant.

Entry and search  
of premises  
without warrant

30. Where any strategic good and any container, package, conveyance or other article in which the strategic good is stored, kept or found, record, book, account, document or electronic data are seized, the inspector seizing the items shall prepare a list of the items seized and shall thereafter deliver a copy signed by the inspector to the owner or person in charge of the place, premises or conveyance which has been searched, or to such owner's or person's agent or servant, at that place, premises or conveyance.

List of items  
seized or detained

31. (1) The Committee may at any time it considers appropriate, obtain a court order for the disposal of the strategic goods together with any container, package, conveyance or other article in which the strategic goods are stored, kept or found, record, book, account, document or electronic data seized subject to the following procedures being complied with—

Disposal of seized  
strategic goods

- (a) an inventory specifying the description, markings and other particulars which clearly identify the items seized prepared by an inspector;

- (b) photographs of the items seized taken in the presence of the inspector, and the said inspector has certified that the photographs are true; and
- (c) copies of any record, book, account, document or electronic data seized are duly certified by an inspector.

(2) The disposal of goods under subsection (1) shall be carried out at the expense of the owner of the goods.

(3) The Cabinet Secretary shall by notice in the *Gazette*, appoint a technical ad-hoc committee to handle the disposal of the strategic goods under this section.

(4) The Cabinet Secretary shall, in appointing the ad-hoc committee under sub-section (3), take into consideration the category of the strategic good to be destroyed and the technical expertise of the members in dealing with the strategic good.

32. (1) Where there is no prosecution or conviction in respect of any strategic goods or electronic data seized in the exercise of any power conferred under this Act, the strategic goods or electronic data shall be held for a period of ninety days from the date of seizure and at the end of that period shall be deemed forfeited, unless a written claim thereto is received within such period.

Forfeiture of  
strategic goods  
when there is no  
prosecution

(2) Any person claiming ownership of any strategic goods, container, package, conveyance, article, records, books, accounts, documents, or computerized data seized under this Act and that the strategic goods, container, package, conveyance, article, records, books, accounts, documents, or electronic data are not liable to forfeiture may personally or by his agent authorised in writing, give written notice to the inspector who made the seizure of his claim.

(3) On receipt of the written notice under subsection (2), the inspector shall refer the matter to the Director.

(4) The Committee shall conduct an inquiry on such claims and the person making the claim shall be entitled to appear and to be heard in person or to be represented by an advocate.

(5) For purposes of proceedings at any inquiry held under this Act, the Committee shall have power to—

- (a) administer oaths;
- (b) summon persons to attend and give evidence; and
- (c) order the production of documents.

(6) Any summons and orders issued under the hand of the Director shall be deemed to be issued by the Committee.

(7) The Director shall record or cause to be recorded a summary of any oral evidence given at any inquiry held by the Committee.

(8) The Committee shall regulate its own procedure at an inquiry held under this Act.

(9) Where there is proof that an offence has been committed under this Act and that the strategic goods, container, package, conveyance, article, records, books, accounts, documents, or computerized data that were the subject matter of or were used in the commission of the offence, the Committee shall order that the strategic goods, container, package, conveyance, article, records, books, accounts, documents or computerized data be forfeited or may, in the absence of such proof, order the release of such strategic goods, container, package, conveyance, article, records, books, accounts, documents or computerized data to the person entitled to them.

33. Where any strategic good, or any container, package, conveyance or other article in which the strategic goods are stored, kept or found, record, book, account, document or electronic data seized under this Act, is held in the custody of the Government pending completion of any proceedings in respect of an offence under this Act, the cost of holding such strategic goods, container, package, conveyance, article, record, book, account, document or electronic data in custody shall, in the event of any person being convicted of an offence, be a civil debt due to the Government by such person and shall be recoverable accordingly.

Cost of holding seized strategic goods.

34. A person shall not, in any proceedings before any court in respect of any strategic goods, or any container, package, conveyance or other article in which the strategic goods are stored, kept or found, record, book, account,

No costs or damages arising from seizure to be recoverable.

document or electronic data seized in the exercise of any power conferred under this Act, be entitled to the costs of such proceedings or to any damages or other relief unless such seizure was made without reasonable cause.

**35.** (1) A person shall not obstruct, impede or interfere with an inspector in the performance of the inspector's functions under this Act.

Obstruction of an inspector

(2) A person shall not impersonate an inspector.

(3) A person who contravenes subsections (1) or (2) commits an offence and shall, on conviction, be liable to a fine not exceeding five million shillings or to imprisonment for a term not exceeding five years, or to both.

**36.** (1) A person who—

Offences

- (a) makes false or misleading representations or conceals any material fact in any submission to the Committee;
- (b) fails to act in accordance with any order or instructions issued by the Committee;
- (c) fails to report to or notify the Committee as required by this Act;
- (d) fails to comply with the record keeping requirements under this Act;
- (e) causes, aids or abets a contravention of this Act or any order or conditions of a licence issued under this Act;
- (f) attempts to contravene a provision of this Act or any order or licence issued under this Act;
- (g) conspires or acts in concert with one or more persons to contravene the provisions of this Act;
- (h) obstructs or hinders the Committee, its representatives, any government agency or any inspector in the execution of its powers conferred under this Act; or
- (i) forges or alters any registration, licence, end-use certificate, or any other document issued under the provisions of this Act,

commits an offence.

(2) A person who commits an offence under subsection (1) shall, on conviction, be liable to a fine not exceeding fifty million shillings or to imprisonment for a term not exceeding ten years, or to both.

(3) A person who—

- (a) engages in strategic trade or provides related services without being registered and licenced under this Act;
- (b) fails to furnish any information as required under this Act;
- (c) uses any confidential information for any purpose not authorised under this Act;
- (d) uses strategic goods in a manner inconsistent with registration certificate and licence issued under this Act; or
- (e) obstructs or fails to assist the Committee or an inspector in the performance of their duties under this Act,

commits an offence and shall, on conviction, be liable to a fine not exceeding twenty million shillings or to imprisonment for a term not exceeding ten years, or to both.

(4) A person who knowingly facilitates or finances the handling of strategic goods, if this endangers public safety and security commits an offence and shall, on conviction, be liable to a fine not exceeding five million shillings or to imprisonment for a term not exceeding three years, or to both.

(5) A person who is in possession of conventional weapons prescribed in the National Control List or components thereof without a licence or certificate issued under this Act commits an offence and shall, on conviction, be liable to a fine not exceeding five million shillings or to imprisonment for a term not exceeding three years, or to both.

(6) A person who knowingly offers to provide or provides strategic goods to be used for terrorism purposes commits an offence as pursuant to section 11 of the Cap. 59B.

Prevention of Terrorism Act and shall, on conviction, be liable to the penalty stipulated thereunder.

37. The Committee may refer any matter that falls within its jurisdiction to the relevant law enforcement agencies or the Director of Public Prosecutions.

Reference to enforcement agencies

#### PART V—MISCELLANEOUS PROVISIONS

38. A person who contravenes any of the provisions of this Act for which no penalty is provided shall, on conviction, be liable to a fine not exceeding five million shillings, or imprisonment for a term not exceeding five years, or to both.

General penalty

39. (1) Any confidential information obtained under this Act shall not be disclosed to any other party except in the furtherance of justice and law enforcement or national security, as may be determined by the Committee, or unless the party providing such information has consented to its disclosure.

Confidentiality

(2) The Committee shall keep confidential, trade and production secrets.

(3) The information obtained and maintained under this Act shall be handled, retained and disposed of in accordance with the provisions of the Access to Information Act, the Data Protection Act and any other related legislation.

Cap 7M.  
Cap 411C

40. A person who contravenes any provisions of this Act and voluntarily discloses to the Committee such contravention shall have the benefit of such disclosure when the Committee determines the administrative sanction, if any, applicable to that person.

Voluntary disclosure

41. (1) No action or thing done by a member of the Committee or by an inspector, employee or agent of a government authority shall, if the action or thing is done in good faith for executing the functions, powers or duties under this Act render the member, officer, employee or agent or any person acting on their direction personally liable to any action, claim or demand whatsoever.

Protection from personal liability

(2) Where the Committee suspends or revokes a licence or registration issued under this Act, the Committee shall not be liable for any damages that may be caused by such acts.

42. No civil action or proceedings based on or arising out of this Act or in general shall lie or be instituted unless it is commenced within three years next after the act, neglect or default complained or in the case of continuing injury or damage within twelve months next after the cessation thereof.

Limitation of actions.

43. (1) The Cabinet Secretary shall, in consultation with the Committee, make regulations for the better carrying out of the objects and purposes of this Act.

Regulations.

(2) Without prejudice to the generality of subsection (1), the Cabinet Secretary shall make regulations prescribing—

- (a) the safety, storage, transportation, disposal and security of strategic goods;
- (b) any fees payable under this Act;
- (c) procedures for voluntary disclosure;
- (d) any forms to be used for the purposes this Act;
- (e) the manner of record keeping by persons registered under the Act; and
- (f) any other matter necessary for the implementation of this Act.

#### **PART VI—CONSEQUENTIAL AMENDMENTS AND SAVINGS**

44. The Firearms Act is amended—

Amendment of Cap. 114.

- (a) in section 2 by inserting the following definition in proper alphabetical sequence—

“armoured vehicle” means a vehicle which is armour-plated for protection against bullets or any other munition and includes components for armour plating;

- (b) in section 3—

- (i) by inserting the words “certificate of approval” immediately after the word “licence” appearing in subsection (5)(b);
- (c) by inserting the following new subsection immediately after subsection (5)—

“(6) Notwithstanding the provisions of subsection (5)(b), where a licence, certificate of approval or permit relates to a strategic good listed in the National Control List under the Strategic Goods Control Act, the Board shall issue the licence, certificate of approval or permit under subsection (5)(b) with the approval of the Strategic Goods Control Committee.”

45. The Explosives Act is amended by inserting the following new section immediately after section 9—

Amendment of section 8 of Cap 115

License and permits under the Act.

9A. The provisions of this Act relating to permits, licenses and regulatory compliance shall be subject to further regulatory control under the Strategic Goods Control Act.

46. The Nuclear Regulatory Act is amended in section 4 by inserting the following new subsection immediately after subsection (2)—

Amendment of section 4 of Cap 243

“(3) Despite the provisions of this Act, any person dealing with nuclear or radioactive material, activities or facilities shall further comply with the provisions of the Strategic Goods Control Act.”

47. The Pharmacy and Poisons Act is amended by inserting the following new section immediately after section 3B—

Amendment of Cap 244

Approval for medicinal substance or poison listed under the National Control List.

3C. Despite the provisions of section 3B (2)(e), where a medicinal substance licensed under section 3B(2)(e) relates to a medicinal substance listed on the National Control List under the Strategic Goods Control Act, the Board shall only issue the licence with the approval of the Strategic Goods Control Committee.

48. The Mining Act is amended in section 20(1)(e) by inserting the words “and the Strategic Goods Control Act” immediately after the words “this Act”.

Amendment of section 20 of Cap 306.

49. The Fertilizers and Animal Foodstuffs Act is amended in section 2B—

Amendment of section 2B of Cap 345.

- (a) by re-numbering the existing provision as (1);
- (b) in subsection (1)—
- (i) in paragraph (a), by inserting the words “exportation, transshipment” immediately after the word “importation”;
  - (ii) in paragraph (f), by inserting the words “exporters, importers” immediately after the word “manufacturers”;
  - (iii) by inserting the following new paragraph immediately after paragraph (h)—
    - “(i) implement administrative strategies and measures to ensure that persons do not use fertilizers in a manner prejudicial to national security.”
- (c) by inserting the following new subsection immediately after sub section (1)—
- “(2) Despite the provisions of subsection (1), fertilizers and animal foodstuffs that are listed in the National Control List shall be regulated in accordance with the provisions of the Strategic Goods Control Act.”

50. Section 2C of the Fertilizers and Animal Foodstuffs Act is amended in subsection (1) by inserting the following new paragraph immediately after paragraph (h)—

Amendment of section 2C of Cap. 345.

“(ha) one person representing the National Intelligence Service; and”

51. Section 2E of the Fertilizers and Animal Foodstuffs Act is amended in subsection (2) by inserting the following new paragraph immediately after paragraph (b)—

Amendment of section 2E of Cap. 345.

“(ba) prescribe the concentration of the ingredients in a fertilizer in consultation with the Kenya Bureau of Standards.”

52. Section 9 of the Fertilizers and Animal Foodstuffs Act is amended in subsection (1)—

Amendment of section 9 of Cap. 345.

- (a) in paragraph (a) by inserting the word “exportation” immediately after the word “importation”;

- (b) in paragraph (b) by inserting the word "exportation" immediately after the word "importation."

53. The Pest Control Products Act is amended in section 6 by—

Amendment of section 6 of Cap 246

- (a) renumbering the existing provision as (1);  
(b) inserting the following new subsection immediately after sub section (1)—

"(2) Despite the provisions of subsection (1), a pest control product that is listed in the National Control List under the Strategic Goods Control Act shall not be registered by the Board except with the approval of the Strategic Goods Control Committee."

54. Any registration, licence, certificate or written authority to engage in strategic trade issued under any written law immediately before the commencement of this Act shall be deemed to have been issued under this Act:

Savings

Provided that the person who is registered or is the holder of a licence, certificate or written authority shall apply to the Committee for registration within a period of twelve months after the commencement of this Act.

## SCHEDULE

[5.

4(1)]

## THE NATIONAL CONTROL LIST

PART A: Military List

PART B: List of Dual Use Goods

## PART A: MILITARY LIST

## Definition of terms used in the List

The following are the definition of the terms used in this List, in alphabetical order.

Category	Term	Definition
ML 8, 10	"aircraft"	A fixed wing, swivel wing, rotary wing (helicopter), tilt rotor or tilt-wing airborne vehicle.
ML 7, 22	"biocatalysts"	'Enzymes' for specific chemical or biochemical reactions or other biological compounds which bind to and accelerate the degradation of CW agents.
ML 7	"biological agents"	Pathogens or toxins, selected or modified (such as altering purity, shelf life, virulence, dissemination characteristics, or resistance to UV radiation) to produce casualties in humans or animals, degrade equipment or damage crops or the environment.
ML 17, 21, 22	"development"	Is related to all stages 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.
ML 17	"end-effectors"	Grippers, 'active tooling units' and any other tooling that is attached to the baseplate on the end of a "robot"

Category	Term	Definition
		manipulator arm.
ML 8	"energetic materials"	Substances or mixtures that react chemically to release energy required for their intended application. "Explosives", "pyrotechnics" and "propellants" are subclasses of energetic materials.
ML 8	"explosives"	Solid, liquid or gaseous substances or mixtures of substances which, in their application as primary, booster, or main charges in warheads, demolition and other applications, are required to detonate.
ML 15	"first generation image intensifier tubes"	Electrostatically focused tubes, employing input and output fibre optic or glass face plates, multi-alkali photocathodes (S-20 or S-25), but not microchannel plate amplifiers.
ML 17	"fuel cell"	An electrochemical device that converts chemical energy directly into Direct Current (DC) electricity by consuming fuel from an external source.
ML 17, 19	"laser"	An item that produces spatially and temporally coherent light through amplification by stimulated emission of radiation.
ML 10	"lighter-than-air vehicles"	Balloons and "airships" that rely on hot air or on lighter-than-air gases such as helium or hydrogen for their lift.
ML 17	"nuclear reactor"	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 into direct contact with or control the primary

Category	Term	Definition
		coolant of the reactor core.
ML 8	"precursors"	Specialty chemicals used in the manufacture of explosives.
ML 7, 8, 18, 21, 22, 23	"production"	Means all production stages, such as: product engineering, manufacture, integration, assembly (mounting), inspection, testing, quality assurance.
ML 8	"propellants"	Substances or mixtures that react chemically to produce large volumes of hot gases at controlled rates to perform mechanical work.
ML 2, 8	"pyrotechnic(s)"	Mixtures of solid or liquid fuels and oxidizers which, when ignited, undergo an energetic chemical reaction at a controlled rate intended to produce specific time delays, or quantities of heat, noise, smoke, visible light or infrared radiation. Pyrophorics are a subclass of pyrotechnics, which contain no oxidizers but ignite spontaneously on contact with air.
ML 23	"required"	As applied to "technology", refers to only that portion of "technology" which is peculiarly responsible for achieving or exceeding the controlled performance levels, characteristics or functions. Such "required" "technology" may be shared by

Category	Term	Definition
		different products.
ML 7	"riot agents" control	Substances which, under the expected conditions of use for riot control purposes, produce rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination of exposure. (Tear gases are a subset of "riot control agents".)
ML 17	"robot"	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; <u>and</u>
ML 21	"software"	A collection of one or more "programs" or "microprograms" fixed in any tangible medium of expression.
ML 10	"sub-orbital craft"	A craft having an enclosure designed for the transport of people or cargo, which is designed to— (a) operate above the stratosphere; (b) only perform non-orbital

Category	Term	Definition
		trajectories; and (c) land back on earth with the people or cargo intact.
ML 20	"superconductive"	Refers to materials, (i.e. metals, alloys or compounds) which can lose all electrical resistance (i.e. which can attain infinite electrical conductivity and carry very large electrical currents without Joule heating).
ML 23	"technology"	Specific information necessary for the "development", "production" or "use" of a product. The information takes the form of 'technical data' or 'technical assistance'.
ML10	"unmanned aerial vehicle" ("UAV")	Any "aircraft" capable of initiating flight and sustaining controlled flight and navigation without any human presence on board.

#### **CLASSIFICATIONS IN THE MILITARY LIST**

Category	Contents
ML1	Smooth-bore weapons with a calibre of less than 20 mm, other arms and automatic weapons.
ML2	Smooth-bore weapons with a calibre of 20 mm or more, other weapons or armament, projectors and accessories.
ML3	Ammunition and fuze setting devices.
ML4	Bombs, torpedoes, rockets, missiles, other explosive devices and charges.
ML5	Fire control, surveillance and warning equipment, and related systems, test and alignment and countermeasure equipment.
ML6	Ground vehicles and components.
ML7	Chemical agents, "biological agents", "riot control agents", radioactive materials, related equipment, components and materials.
ML8	Energetic materials" and related substances.
ML9	Vessels of war, special naval equipment, accessories, components and other surface vessels.
ML10	Aircraft, "lighter-than-air vehicles", "Unmanned Aerial Vehicles" ("UAVs"), aero-engines, "sub-orbital craft" and "aircraft" equipment, related equipment.
ML11	Electronic equipment, "spacecraft" and components.
ML12	High velocity kinetic energy weapon systems and related equipment.
ML13	Armoured or protective equipment, constructions, components, and accessories.
ML14	'Specialised equipment for military training' or for simulating military scenarios and simulators for training.
ML15	Imaging or countermeasure equipment.
ML16	Forgings, castings and other unfinished products.
ML17	Miscellaneous equipment, materials and "libraries".
ML18	'Production' equipment, environmental test facilities and components.
ML19	Directed Energy Weapon (DEW) systems, related or

	countermeasure equipment and test models.
<b>ML20</b>	Cryogenic and "superconductive" equipment.
<b>ML21</b>	Software.
<b>ML22</b>	Other security and para-military police equipment.
<b>ML23</b>	Technology.

## **MILITARY LIST**

### **ML1**

**Smooth-bore weapons with a calibre of less than 20 mm, other arms and automatic weapons with a calibre of 12,7 mm (calibre 0,50 inches) or less and accessories, as follows, and specially designed components therefor:**

- a. Rifles and combination guns, handguns, machine, sub-machine and volley guns;
- b. Smooth-bore weapons as follows:
- c. Weapons using caseless ammunition;
- d. Accessories designed for arms specified by ML1.a., ML1.b. or ML1.c., as follows:
  1. Detachable cartridge magazines;
  2. Sound suppressors or moderators;
  3. 'Gun-mountings';
  4. Flash suppressors;
  5. Optical weapon-sights with electronic image processing;
  6. Optical weapon-sights specially designed for military use.

### **ML2**

**Smooth-bore weapons with a calibre of 20 mm or more, other weapons or armament with a calibre greater than 12,7 mm (calibre 0,50 inches), projectors specially designed or modified for military use and accessories, as follows, and specially designed components therefor:**

- a. Guns, howitzers, cannon, mortars, anti-tank weapons, projectile launchers, military flame throwers, rifles, recoilless rifles and smooth-bore weapons;
- b. Projectors, specially designed or modified for military use, as follows:
  1. Smoke canister projectors;
  2. Gas canister projectors;
  3. Pyrotechnics projectors;

- c. Accessories specially designed for the weapons specified in ML2.a., as follows:
1. Weapon sights and weapon sight mounts, specially designed for military use;
  2. Signature reduction devices;
  3. Mountings;
  4. Detachable cartridge magazines;
- d. Not used since 2019.

### **ML3**

**Ammunition and fuze setting devices, as follows, and specially designed components therefor:**

- a. Ammunition for weapons specified by ML1, ML2 or ML12;
- b. Fuze setting devices specially designed for ammunition specified by ML3.a.

### **ML4**

**Bombs, torpedoes, rockets, missiles, other explosive devices and charges and related equipment and accessories, as follows, and specially designed components therefor:**

- a. Bombs, torpedoes, grenades, smoke canisters, rockets, mines, missiles, depth charges, demolition-charges, demolition-devices, demolition-kits, "pyrotechnic" devices, cartridges, submunitions therefor and simulators (i.e. equipment simulating the characteristics of any of these items), specially designed for military use;
- b. Equipment having all of the following:
  1. Specially designed for military use; and
  2. Specially designed for 'activities' relating to any of the following:
    - a. Items specified by ML4.a.; or
    - b. Improvised Explosive Devices (IEDs);
    - c. Aircraft Missile Protection Systems (AMPS).

### **ML5**

**Fire control, surveillance and warning equipment, and related systems, test and alignment and countermeasure equipment, as**

follows, specially designed for military use, and specially designed components and accessories therefor:

- a. Weapon sights, bombing computers, gun laying equipment and weapon control systems;
- b. Other fire control, surveillance and warning equipment, and related systems, as follows:
  1. Target acquisition, designation, range-finding, surveillance or tracking systems;
  2. Detection, recognition or identification equipment;
  3. Data fusion or sensor integration equipment;
- c. Countermeasure equipment for items specified by ML5.a. or ML5.b.;
- d. Field test or alignment equipment, specially designed for items specified by ML5.a., ML5.b. or ML5.c.

#### **ML6**

**Ground vehicles and components, as follows:**

- a. Ground vehicles and components therefor, specially designed or modified for military use; This *includes*:
  1. Tanks and other military armed vehicles and military vehicles fitted with mountings for arms or equipment for mine laying or the launching of munitions specified by ML4;
  2. Armoured vehicles;
  3. Amphibious and deep-water fording vehicles;
  4. Recovery vehicles and vehicles for towing or transporting ammunition or weapon systems and associated load handling equipment;
  5. Trailers.

Modification of a ground vehicle for military use specified by ML6.a. entails a structural, electrical or mechanical change involving one or more components that are specially designed for military use. Such components include:

1. Pneumatic tyre casings of a kind specially designed to be bullet-proof;
2. Armoured protection of vital parts (e.g. fuel tanks or vehicle cabs);

3. Special reinforcements or mountings for weapons;
  4. Black-out lighting.
- b. Other ground vehicles and components, as follows:
1. Vehicles having all of the following:
    - a. Manufactured or fitted with materials or components to provide ballistic protection equal to or better than level III (NIJ 0108.01, September 1985), or "equivalent standards";
    - b. A transmission to provide drive to both front and rear wheels simultaneously, including those for vehicles having additional wheels for load bearing purposes whether driven or not;
    - c. Gross Vehicle Weight Rating (GVWR) greater than 4 500 kg; and
    - d. Designed or modified for off-road use;
  2. Components having all of the following:
    - a. Specially designed for vehicles specified in ML6.b.1.;  
and
    - b. Providing ballistic protection equal to or better than level III (NIJ 0108.01, September 1985), or "equivalent standards".

**ML7**

**Chemical agents, "biological agents", "riot control agents", radioactive materials, related equipment, components and materials, as follows:**

- a. "Biological agents" or radioactive materials selected or modified to increase their effectiveness in producing casualties in humans or animals, degrading equipment or damaging crops or the environment;
- b. Chemical warfare (CW) agents, including:
  1. CW nerve agents:
    - a. O-Alkyl (equal to or less than C10, including cycloalkyl) alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) - phosphonofluoridates, such as:

Sarin (GB):O-Isopropyl methylphosphonofluoridate (CAS 107-44-8); and

Soman (GD):O-Pinacolyl methylphosphonofluoridate (CAS 96-64-0);

- b. O-Alkyl (equal to or less than C10, including cycloalkyl) N,N-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphoramidocyanidates, such as:

Tabun (GA):O-Ethyl N,N-dimethylphosphoramidocyanidate (CAS 77-81-6);

- c. O-Alkyl (H or equal to or less than C10, including cycloalkyl) S-2-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl)-aminoethyl alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphonothiolates and corresponding alkylated and protonated salts, such as: VX: O-Ethyl S-2-diisopropylaminoethyl methyl phosphonothiolate (CAS 50782-69-9);

2. CW vesicant agents:

- a. Sulphur mustards, such as:

1. 2-Chloroethylchloromethylsulphide (CAS 2625-76-5);

2. Bis(2-chloroethyl) sulphide (CAS 505-60-2);

3. Bis(2-chloroethylthio) methane (CAS 63869-13-6);

4. 1,2-bis (2-chloroethylthio) ethane (CAS 3563-36-8);

5. 1,3-bis (2-chloroethylthio) -n-propane (CAS 63905-10-2);

6. 1,4-bis (2-chloroethylthio) -n-butane (CAS 142868-93-7);

7. 1,5-bis (2-chloroethylthio) -n-pentane (CAS 142868-94-8);

8. Bis (2-chloroethylthiomethyl) ether (CAS 63918-90-1);

9. Bis (2-chloroethylthioethyl) ether (CAS 63918-89-8);

- b. Lewisites, such as:

1. 2-chlorovinylchloroarsine (CAS 541-25-3);

2. Tris (2-chlorovinyl) arsine (CAS 40334-70-1);
3. Bis (2-chlorovinyl) chloroarsine (CAS 40334-69-8);
- c. Nitrogen mustards, such as:
  1. HN1: bis (2-chloroethyl) ethylamine (CAS 538-07-8);
  2. HN2: bis (2-chloroethyl) methylamine (CAS 51-75-2);
  3. HN3: tris (2-chloroethyl) amine (CAS 555-77-1);
3. CW incapacitating agents, such as: 3-Quinuclidinyl benzilate (BZ) (CAS 6581-06-2);
4. CW defoliants, such as:
  - a. Butyl 2-chloro-4-fluorophenoxyacetate (LNF);
  - b. 2,4,5-trichlorophenoxyacetic acid (CAS 93-76-5) mixed with 2,4-dichlorophenoxyacetic acid (CAS 94-75-7) (Agent Orange (CAS 39277-47-9));
  - c. CW binary precursors and key precursors, as follows:
    1. Alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) Phosphonyl Difluorides, such as: DF: Methyl Phosphonyldifluoride (CAS 676-99-3);
    2. O-Alkyl (H or equal to or less than C10, including cycloalkyl) O-2-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl)-aminoethyl alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphonites and corresponding alkylated and protonated salts, such as: QL: O-Ethyl O-2-diisopropylaminoethyl methylphosphonite (CAS 57856-11-8);
    3. Chlorosarin: O-Isopropyl methylphosphonochloridate (CAS 1445-76-7);
    4. Chlorosoman: O-Pinacolyl methylphosphonochloridate (CAS 7040-57-5);
    5. "Riot control agents", active constituent chemicals and combinations thereof, including:
    6.  $\alpha$ -Bromobenzeneacetonitrile, (Bromobenzyl cyanide) (CA) (CAS 5798-79-8);

7. [(2-chlorophenyl) methylene] propanedinitrile, (o-Chlorobenzylidene)malononitrile) (CS) (CAS 2698-41-1);
  8. 2-Chloro-1-phenylethanone, Phenylacetyl chloride ( $\omega$ -chloroacetophenone) (CN) (CAS 532-27-4);
  9. Dibenz-(b,f)-1,4-oxazaphine, (CR) (CAS 257-07-8);
  10. 10-Chloro-5,10-dihydrophenarsazine, (Phenarsazine chloride), (Adamsite), (DM) (CAS 578-94-9);
  11. N-Nonanoylmorpholine, (MPA) (CAS 5299-64-9);
- d. Equipment, specially designed or modified for military use, designed or modified for the dissemination of any of the following, and specially designed components therefor:
1. Materials or agents specified by ML7.a., ML7.b. or ML7.d.; or
  2. CW agents made up of precursors specified by ML7.c.;
- e. Protective and decontamination equipment, specially designed or modified for military use, components and chemical mixtures, as follows:
1. Equipment designed or modified for defence against materials specified by ML7.a., ML7.b. or ML7.d., and specially designed components therefor;
  2. Equipment designed or modified for decontamination of objects contaminated with materials specified by ML7.a. or ML7.b., and specially designed components therefor;
  3. Chemical mixtures specially developed or formulated for the decontamination of objects contaminated with materials specified by ML7.a. or ML7.b.; Equipment, specially designed or modified for military use designed or modified for the detection or identification of materials

- specified by ML7.a., ML7.b. or ML7.d., and specially designed components therefor;
- f. 'Biopolymers' specially designed or processed for the detection or identification of CW agents specified by ML7.b., and the cultures of specific cells used to produce them;
  - g. "Biocatalysts" for the decontamination or degradation of CW agents, and biological systems therefor, as follows:
    - a. "Biocatalysts" specially designed for the decontamination or degradation of CW agents specified by ML7; and
    - b. resulting from directed laboratory selection or genetic manipulation of biological systems;
  - h. Biological systems containing the genetic information specific to the production of "biocatalysts" specified by ML7.i.1., as follows:
    - a. 'Expression vectors';
    - b. Viruses;
    - c. Cultures of cells.

## **ML8**

### **Energetic materials" and related substances, as follows:**

- a. "Explosives" as follows, and 'mixtures' thereof:
  1. ADNBF (aminodinitrobenzofuroxan or 7-amino-4,6-dinitrobenzofurazane-1-oxide) (CAS 97096-78-1);
  2. BNCP (cis-bis (5-nitrotetrazolato) tetra amine-cobalt (III) perchlorate) (CAS 117412-28-9);
  3. CL-14 (diamino dinitrobenzofuroxan or 5,7-diamino-4,6-dinitrobenzofurazane-1-oxide) (CAS 117907-74-1);
  4. CL-20 (HNIW or Hexanitrohexaazaisowurtzitane) (CAS 135285-90-4); chlathrates of CL-20 (see also ML8. g.3. and ML.8.g.4. for its "precursors");
  5. CP (2-(5-cyanotetrazolato) penta amine-cobalt (III) perchlorate) (CAS 70247-32-4);
  6. DADE (1,1-diamino-2,2-dinitroethylene, FOX-7) (CAS 145250-81-3);

7. DATB (diaminotrinitrobenzene) (CAS 1630-08-6);
8. DDFP (1,4-dinitrodifurazanopiperazine);
9. DDPO (2,6-diamino-3,5-dinitropyrazine-1-oxide, PZO) (CAS 194486-77-6);
10. DIPAM (3,3'-diamino-2,2',4,4',6,6'-hexanitrobiphenyl or dipicramide) (CAS 17215-44-0);
11. DNGU (DINGU or dinitroglycoluril) (CAS 55510-04-8);
12. Furazans as follows:
  - a. DAAOF (DAAF, DAAFox, or diaminoazoxyfurazan);
  - b. DAAzF (diaminoazofurazan) (CAS 78644-90-3);
13. HMX and derivatives (see also ML8.g.5. for its "precursors"), as follows:
  - a. HMX (Cyclotetramethylenetetranitramine, octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazine, 1,3,5,7-tetranitro-1,3,5,7-tetraza-cyclooctane, octogen or octogene) (CAS 2691-41-0);
  - b. difluoroaminated analogs of HMX;
  - c. K-55 (2,4,6,8-tetranitro-2,4,6,8-tetraazabicyclo [3,3,0]octanone-3, tetranitrosemiglycouril or keto-bicyclic HMX) (CAS 130256-72-3);
14. HNAD (hexanitroadamantane) (CAS 143850-71-9);
15. HNS (hexanitrostilbene) (CAS 20062-22-0);
16. Imidazoles as follows:
  - a. BNNII (Octahydro-2,5-bis(nitroimino)imidazo [4,5-d]imidazole);
  - b. DNI (2,4-dinitroimidazole) (CAS 5213-49-0);
  - c. FDIA (1-fluoro-2,4-dinitroimidazole);
  - d. NTDNIA (N-(2-nitrotriazolo)-2,4-dinitroimidazole);
  - e. PTIA (1-picryl-2,4,5-trinitroimidazole);
17. NTNMH (1-(2-nitrotriazolo)-2-dinitromethylene hydrazine);
18. NTO (ONTA or 3-nitro-1,2,4-triazol-5-one) (CAS 932-64-9);

19. Polynitrocubanes with more than four nitro groups;
20. PYX (2,6-Bis(picrylamino)-3,5-dinitropyridine) (CAS 38082-89-2);
21. RDX and derivatives, as follows:
  - a. RDX (cyclotrimethylenetrinitramine, cyclonite, T4, hexahydro-1,3,5-trinitro-1,3,5-triazine, 1,3,5-trinitro-1,3,5-triaza-cyclohexane, hexogen or hexogene) (CAS 121-82-4);
  - b. Keto-RDX (K-6 or 2,4,6-trinitro-2,4,6-triazacyclohexanone) (CAS 115029-35-1);
22. TAGN (triaminoguanidinenitrate) (CAS 4000-16-2);
23. TATB (triaminotrinitrobenzene) (CAS 3058-38-6) (see also ML8.g.7 for its "precursors");
24. TEDDZ (3,3,7,7-tetrakis(difluoroamine) octahydro-1,5-dinitro-1,5-diazocine);
25. Tetrazoles as follows:
  - a. NTAT (nitrotriazol aminotetrazole);
  - b. NTNT (1-N-(2-nitrotriazolo)-4-nitrotetrazole);
26. Tetryl (trinitrophenylmethylnitramine) (CAS 479-45-8);
27. TNAD (1,4,5,8-tetranitro-1,4,5,8-tetraazadecalin) (CAS 135877-16-6) (see also ML8.g.6. for its "precursors");
28. TNAZ (1,3,3-trinitroazetidine) (CAS 97645-24-4) (see also ML8.g.2. for its "precursors");
29. TNGU (SORGUYL or tetranitroglycoluril) (CAS 55510-03-7);
30. TNP (1,4,5,8-tetranitro-pyridazino[4,5-d]pyridazine) (CAS 229176-04-9);
31. Triazines as follows:
  - a. DNAM (2-oxy-4,6-dinitroamino-s-triazine) (CAS 19899-80-0);
  - b. NNHT (2-nitroimino-5-nitro-hexahydro-1,3,5-triazine) (CAS 130400-13-4);
32. Triazoles as follows:
  - a. 5-azido-2-nitrotriazole;

- b. ADHTDN (4-amino-3,5-dihydrazino-1,2,4-triazole dinitramide) (CAS 1614-08-0);
  - c. ADNT (1-amino-3,5-dinitro-1,2,4-triazole);
  - d. BDNTA ((bis-dinitrotriazole)amine);
  - e. DBT (3,3'-dinitro-5,5-bi-1,2,4-triazole) (CAS 30003-46-4);
  - f. DNBT (dinitrobistriazole) (CAS 70890-46-9);
  - g. Not used since 2010
  - h. NTDNT (1-N-(2-nitrotriazolo) 3,5-dinitrotriazole);
  - i. PDNT (1-picryl-3,5-dinitrotriazole);
  - j. TACOT (tetranitrobenzotriazolobenzotriazole) (CAS 25243-36-1);
33. "Explosives" not listed elsewhere in ML8.a. and having any of the following:
- a. Detonation velocity exceeding 8 700 m/s, at maximum density, or
  - b. Detonation pressure exceeding 34 GPa (340 kbar);
34. Not used since 2013
35. DNAN (2,4-dinitroanisole) (CAS 119-27-7);
36. TEX (4,10-Dinitro-2,6,8,12-tetraoxa-4,10-diazaisowurtzitane);
37. GUDN (Guanylurea dinitramide) FOX-12 (CAS 217464-38-5);
38. Tetrazines as follows:
- a. BTAT (Bis(2,2,2-trinitroethyl)-3,6-diaminotetrazine);
  - b. LAX-112 (3,6-diamino-1,2,4,5-tetrazine-1,4-dioxide);
39. Energetic ionic materials melting between 343 K (70 °C) and 373 K (100 °C) and with detonation velocity exceeding 6 800 m/s or detonation pressure exceeding 18 GPa (180 kbar);
40. BTNEN (Bis(2,2,2-trinitroethyl)-nitramine) (CAS 19836-28-3);
41. FTDO (5,6-(3',4'-furazano)- 1,2,3,4-tetrazine-1,3-dioxide);

42. EDNA (Ethylenedinitramine) (CAS 505-71-5);
43. TKX-50 (Dihydroxylammonium 5,5'-bistetrazole-1,1'-diolate);
- b. "Propellants" as follows:
  1. Any solid "propellant" with a theoretical specific impulse (under standard conditions) of more than:
    - a. 240 seconds for non-metallized, non-halogenized "propellant";
    - b. 250 seconds for non-metallized, halogenized "propellant";  
or
    - c. 260 seconds for metallized "propellant";
  2. Not used since 2013
  3. "Propellants" having a force constant of more than 1 200 kJ/kg;
  4. "Propellants" that can sustain a steady-state linear burning rate of more than 38 mm/s under standard conditions (as measured in the form of an inhibited single strand) of 6,89 MPa (68,9 bar) pressure and 294K (21 °C);
  5. Elastomer Modified Cast Double Base (EMCDB) "propellants" with extensibility at maximum stress of more than 5 % at 233K (-40 °C);
  6. Any "propellant" containing substances specified by ML8.a.;
  7. "Propellants", not specified elsewhere in this Military List, specially designed for military use;
- c. "Pyrotechnics", fuels and related substances, as follows, and 'mixtures' thereof:
  1. "Aircraft" fuels specially formulated for military purposes;
  2. Alane (aluminium hydride) (CAS 7784-21-6);
  3. Boranes, as follows, and their derivatives:
    - a. Carboranes;
    - b. Borane homologues, as follows:
      1. Decaborane (14) (CAS 17702-41-9);
      2. Pentaborane (9) (CAS 19624-22-7);
      3. Pentaborane (11) (CAS 18433-84-6);

4. Hydrazine and derivatives, as follows (see also ML.8.d.8. and ML.8.d.9. for oxidising hydrazine derivatives):
  - a. Hydrazine (CAS 302-01-2) in concentrations of 70 % or more;
  - b. Monomethyl hydrazine (CAS 60-34-4);
  - c. Symmetrical dimethyl hydrazine (CAS 540-73-8);
  - d. Unsymmetrical dimethyl hydrazine (CAS 57-14-7);
5. Metal fuels, fuel 'mixtures' or "pyrotechnic" 'mixtures', in particle form whether spherical, atomized, spheroidal, flaked or ground, manufactured from material consisting of 99 % or more of any of the following:
  - a. Metals as follows and 'mixtures' thereof:
    1. Beryllium (CAS 7440-41-7) in particle sizes of less than 60  $\mu\text{m}$ ;
    2. Iron powder (CAS 7439-89-6) with particle size of 3  $\mu\text{m}$  or less produced by reduction of iron oxide with hydrogen;
  - b. 'Mixtures' containing any of the following:
    1. Zirconium (CAS 7440-67-7), magnesium (CAS 7439-95-4) or alloys of these in particle sizes of less than 60  $\mu\text{m}$ ; or
    2. Boron (CAS 7440-42-8) or boron carbide (CAS 12069-32-8) fuels of 85 % purity or higher and particle sizes of less than 60  $\mu\text{m}$ ;
6. Military materials, containing thickeners for hydrocarbon fuels, specially formulated for use in flame throwers or incendiary munitions, such as metal stearates (e.g. octal (CAS 637-12-7)) or palmitates;

7. Perchlorates, chlorates and chromates, composited with powdered metal or other high energy fuel components;
8. Spherical or spheroidal aluminium powder (CAS 7429-90-5) with a particle size of 60  $\mu\text{m}$  or less and manufactured from material with an aluminium content of 99 % or more;
9. Titanium subhydride ( $\text{TiH}_n$ ) of stoichiometry equivalent to  $n= 0,65-1,68$ ;
10. Liquid high energy density fuels not specified in ML8.c.1., as follows:
  - a. Mixed fuels, that incorporate both solid and liquid fuels (e.g. boron slurry), having a mass-based energy density of 40 MJ/kg or greater;
  - b. Other high energy density fuels and fuel additives (e.g. cubane, ionic solutions, JP-7, JP-10), having a volume-based energy density of 37,5 GJ per cubic meter or greater, measured at 293 K (20 °C) and one atmosphere (101,325 kPa) pressure;
11. "Pyrotechnic" and pyrophoric materials as follows:
  - a. "Pyrotechnic" or pyrophoric materials specifically formulated to enhance or control the production of radiated energy in any part of the IR spectrum;
  - b. Mixtures of magnesium, polytetrafluoroethylene (PTFE) and a vinylidene difluoride-hexafluoropropylene copolymer (e.g. MTV);
12. Fuel mixtures, "pyrotechnic" mixtures or "energetic materials", not specified elsewhere in ML8, having all of the following:

- a. Containing greater than 0,5 % of particles of any of the following:
  1. Aluminium;
  2. Beryllium;
  3. Boron;
  4. Zirconium;
  5. Magnesium; or
  6. Titanium;
- b. Particles specified by ML8.c.12.a. with a size less than 200 nm in any direction; and
- c. Particles specified by ML8.c.12.a. with a metal content of 60 % or greater;
- d. Oxidisers as follows, and 'mixtures' thereof:
  1. ADN (ammonium dinitramide or SR 12) (CAS 140456-78-6);
  2. AP (ammonium perchlorate) (CAS 7790-98-9);
  3. Compounds composed of fluorine and any of the following:
    - a. Other halogens;
    - b. Oxygen; or
    - c. Nitrogen;
  4. DNAD (1,3-dinitro-1,3-diazetidine) (CAS 78246-06-7);
  5. HAN (hydroxylammonium nitrate) (CAS 13465-08-2);

6. HAP (hydroxylammonium perchlorate) (CAS 15588-62-2);
  7. HNF (hydrazinium nitroformate) (CAS 20773-28-8);
  8. Hydrazine nitrate (CAS 37836-27-4);
  9. Hydrazine perchlorate (CAS 27978-54-7);
  10. Liquid oxidisers comprised of or containing inhibited red fuming nitric acid (IRFNA) (CAS 8007-58-7);
- e. Binders, plasticizers, monomers and polymers, as follows:
1. AMMO (azidomethylmethyloxetane and its polymers) (CAS 90683-29-7) (see also ML8.g.1. for its "precursors");
  2. BAMO (3,3-bis(azidomethyl)oxetane and its polymers) (CAS 17607-20-4) (see also ML8.g.1. for its "precursors");
  3. BDNPA (bis (2,2-dinitropropyl)acetal) (CAS 5108-69-0);
  4. BDNPF (bis (2,2-dinitropropyl)formal) (CAS 5917-61-3);
  5. BTTN (butanetrioltrinitrate) (CAS 6659-60-5) (see also

- ML8.g.8. for its "precursors");
6. Energetic monomers, plasticizers or polymers, specially formulated for military use and containing any of the following:
    - a. Nitro groups;
    - b. Azido groups;
    - c. Nitrate groups;
    - d. Nitraza groups; or
    - e. Difluoroamino groups;
  7. FAMA0 (3-difluoroaminomethyl-3-azidomethyl oxetane) and its polymers;
  8. FEFO (bis-(2-fluoro-2,2-dinitroethyl) formal) (CAS 17003-79-1);
  9. FPF-1 (poly-2,2,3,3,4,4-hexafluoropentane-1,5-diol formal) (CAS 376-90-9);
  10. FPF-3 (poly-2,4,4,5,5,6,6-heptafluoro-2-trifluoromethyl-3-oxaheptane-1,7-diol formal);
  11. GAP (glycidylazide polymer) (CAS 143178-24-9) and its derivatives;
  12. HTPB (hydroxyl terminated polybutadiene) with a hydroxyl functionality equal to or greater than 2,2 and less than or equal to 2,4, a hydroxyl value of less than 0,77 meq/g, and a viscosity at 30 oC of less than 47 poise (CAS 69102-90-5);

13. Alcohol functionalised poly(epichlorohydrin) with a molecular weight less than 10 000, as follows: a. Poly(epichlorohydrindiol);
  14. b. Poly(epichlorohydrintriol);
  15. NENAs (nitatoethylnitramine compounds) (CAS 17096-47-8, 85068-73-1, 82486-83-7, 82486-82-6 and 85954-06-9);
  16. PGN (poly-GLYN, polyglycidynitrate or poly(nitratomethyl oxirane)) (CAS 27814-48-8);
  17. Poly-NIMMO (poly (nitratomethylmethyloxetane) , poly-NMMO or poly(3-Nitratomethyl-3-methyloxetane)) (CAS 84051-81-0);
  18. Polynitroorthocarbonates;
  19. TVOPA (1,2,3-tris[1,2-bis(difluoroamino)ethoxy] propane or tris vinox propane adduct) (CAS 53159-39-0);
  20. 4,5 diazidomethyl-2-methyl-1,2,3-triazole (iso- DAMTR);
  21. PNO (Poly(3-nitrat oxetane));
  22. TMETN (Trimethylolethane trinitrate) (CAS 3032-55-1);
- f. 'Additives' as follows:
1. Basic copper salicylate (CAS 62320-94-9);
  2. BHEGA (bis-(2-hydroxyethyl) glycolamide) (CAS 17409-41-5);

3. BNO (butadienenitrileoxide);
4. Ferrocene derivatives as follows:
  - a. Butacene (CAS 125856-62-4);
  - b. Catocene (2,2-bis-ethylferrocenyl propane) (CAS 37206-42-1);
  - c. Ferrocene carboxylic acids and ferrocene carboxylic acid esters;
  - d. n-butyl-ferrocene (CAS 31904-29-7);
  - e. Other adducted polymer ferrocene derivatives not specified elsewhere in ML8.f.4.;
  - f. Ethyl ferrocene (CAS 1273-89-8);
  - g. Propyl ferrocene;
  - h. Pentyl ferrocene (CAS 1274-00-6);
  - i. Dicyclopentyl ferrocene;
  - j. Dicyclohexyl ferrocene;
  - k. Diethyl ferrocene (CAS 1273-97-8);
  - l. Dipropyl ferrocene;
  - m. Dibutyl ferrocene (CAS 1274-08-4);
  - n. Dihexyl ferrocene (CAS 93894-59-8);
  - o. Acetyl ferrocene (CAS 1271-55-2)/1,1'-diacetyl ferrocene (CAS 1273-94-5);
5. Lead beta-resorcyate (CAS 20936-32-7) or copper beta-resorcyate (CAS 70983-44-7);
6. Lead citrate (CAS 14450-60-3);
7. Lead-copper chelates of beta-resorcyate or salicylates (CAS 68411-07-4);
8. Lead maleate (CAS 19136-34-6);
9. Lead salicylate (CAS 15748-73-9);
10. Lead stannate (CAS 12036-31-6);
11. MAPO (tris-1-(2-methyl)aziridinyl phosphine oxide) (CAS 57-39-6); BOBBA 8 (bis(2-methyl aziridinyl)

12. 2-(2-hydroxypropanoxy) propylamino phosphine oxide); and other MAPO derivatives;
13. Methyl BAPO (bis(2-methyl aziridiny) methylamino phosphine oxide) (CAS 85068-72-0);
14. N-methyl-p-nitroaniline (CAS 100-15-2);
15. 3-Nitroaza-1,5-pentane diisocyanate (CAS 7406-61-9);
16. Organo-metallic coupling agents as follows:
  - a. Neopentyl[diallyl]oxy, tri[diethyl]phosphato-titanate (CAS 103850-22-2); also known as titanium IV, 2,2 [bis 2-propenolato-methyl, butanolato, tris (diethyl) phosphato] (CAS 110438-25-0); or LICA 12 (CAS 103850-22-2);
  - b. Titanium IV, [(2-propenolato-1) methyl, n-propanolatomethyl] butanolato-1, tris[diethyl] pyrophosphate or KR3538;
  - c. Titanium IV, [(2-propenolato-1)methyl, n-propanolatomethyl] butanolato-1, tris(diethyl)phosphate;
16. Polycyanodifluoroaminoethyleneoxide;
17. Bonding agents as follows:
  - a. 1,1R,1S-trimesoyl-tris(2-ethylaziridine) (HX-868, BITA) (CAS 7722-73-8);
  - b. Polyfunctional aziridine amides with isophthalic, trimesic, isocyanuric or trimethyladipic backbone also having a 2-methyl or 2-ethyl aziridine group;
18. Propyleneimine (2-methylaziridine) (CAS 75-55-8);

19. Superfine iron oxide ( $\text{Fe}_2\text{O}_3$ ) (CAS 1317-60-8) with a specific surface area more than 250  $\text{m}^2/\text{g}$  and an average particle size of 3,0 nm or less;
20. TEPAN (tetraethylenepentaamineacrylonitrile) (CAS 68412-45-3); cyanoethylated polyamines and their salts;
21. TEPANOL (tetraethylenepentaamineacrylonitrileglycidol) (CAS 68412-46-4); cyanoethylated polyamines adducted with glycidol and their salts;
22. TPB (triphenyl bismuth) (CAS 603-33-8);
23. TEPB (Tris (ethoxyphenyl) bismuth) (CAS 90591-48-3);
  - g. "Precursors" as follows:
    1. BCMO (3,3-bis(chloromethyl)oxetane) (CAS 78-71-7) (see also ML8.e.1. and ML8.e.2.);
    2. Dinitroazetidine-t-butyl salt (CAS 125735-38-8) (see also ML8.a.28.);
    3. Hexaazaisowurtzitane derivatives including HBIW (hexabenzylhexaazaisowurtzitane) (CAS 124782-15-6) (see also ML8.a.4.) and TAIW (tetraacetyldibenzylhexaazaisowurtzitane) (CAS 182763-60-6) (see also ML8.a.4.);
    4. Not used since 2013

5. TAT (1,3,5,7 tetraacetyl-1,3,5,7,-tetraaza cyclo-octane) (CAS 41378-98-7) (see also ML8.a.13.);
6. 1,4,5,8-tetraazadecalin (CAS 5409-42-7) (see also ML8.a.27.);
7. 1,3,5-trichlorobenzene (CAS 108-70-3) (see also ML8.a.23.);
8. 1,2,4-trihydroxybutane (1,2,4-butanetriol) (CAS 3068-00-6) (see also ML8.e.5.);
9. DADN (1,5-diacetyl-3,7-dinitro-1, 3, 5, 7-tetraaza-cyclooctane) (see also ML8.a.13);
- h. 'Reactive material' powders and shapes, as follows:
  1. Powders of any of the following materials, with a particle size less than 250  $\mu\text{m}$  in any direction and not specified elsewhere by ML8:
    - a. Aluminium;
    - b. Niobium;
    - c. Boron;
    - d. Zirconium;
    - e. Magnesium;
    - f. Titanium;
    - g. Tantalum;
    - h. Tungsten;
    - i. Molybdenum; or
    - j. Hafnium;

2. Shapes, not specified by ML3, ML4, ML12 or ML16, fabricated from powders specified by ML8.h.1. *Technical*

## ML9

**Vessels of war (surface or underwater), special naval equipment, accessories, components and other surface vessels, as follows:**

- a. Vessels and components, as follows:
  1. Vessels (surface or underwater) specially designed or modified for military use, regardless of current state of repair or operating condition, and whether or not they contain weapon delivery systems or armour, and hulls or parts of hulls for such vessels, and components therefor specially designed for military use;
  2. Surface vessels, not specified in ML9.a.1., having any of the following, fixed or integrated into the vessel:
    - a. Automatic weapons specified in ML1, or weapons specified in ML2, ML4, ML12 or ML19, or 'mountings' or hard points for weapons having a calibre of 12,7 mm or greater;
    - b. Fire control systems specified in ML5;
    - c. Having all of the following:
      1. 'Chemical, Biological, Radiological and Nuclear (CBRN) protection'; and
      2. 'Pre-wet or wash down system' designed for decontamination purposes; or
    - d. Active weapon countermeasure systems specified in ML4.b., ML5.c. or ML11.a. and having any of the following:
      1. 'CBRN protection';
      2. Hull and superstructure, specially designed to reduce the radar cross section;

3. Thermal signature reduction devices, (e.g. an exhaust gas cooling system), excluding those specially designed to increase overall power plant efficiency or to reduce the environmental impact; or
        4. A degaussing system designed to reduce the magnetic signature of the whole vessel;
  - b. Engines and propulsion systems, as follows, specially designed for military use and components therefor specially designed for military use:
    1. Diesel engines specially designed for submarines;
      2. Electric motors specially designed for submarines and having all of the following:
        - a. Power output of more than 0,75 MW (1 000 hp);
        - b. Quick reversing;
        - c. Liquid cooled; and
        - d. Totally enclosed;
      3. Diesel engines having all of the following:
        - a. Power output of 37,3 kW (50 hp) or more; and
        - b. 'Non-magnetic' content in excess of 75 % of total mass;
      4. 'Air Independent Propulsion' ('AIP') systems specially designed for submarines;
    2. Diesel engines having all of the following:
      - a. Power output of 37,3 kW (50 hp) or more; and
      - b. 'Non-magnetic' content in excess of 75 % of total mass;
  2. Diesel engines having all of the following:
    - a. Power output of 37,3 kW (50 hp) or more; and
    - b. 'Non-magnetic' content in excess of 75 % of total mass;
  3. Diesel engines having all of the following:
    - a. Power output of 37,3 kW (50 hp) or more; and
    - b. 'Non-magnetic' content in excess of 75 % of total mass;
  4. 'Air Independent Propulsion' ('AIP') systems specially designed for submarines;
- c. Underwater detection devices, specially designed for military use, controls therefor and components therefor specially designed for military use;
- d. Anti-submarine nets and anti-torpedo nets, specially designed for military use;
- e. Not used since 2003;
- f. Hull penetrators and connectors, specially designed for military use, that enable interaction with equipment external to a vessel, and components therefor specially designed for military use;

- g. Silent bearings having any of the following, components therefor and equipment containing those bearings, specially designed for military use:
  - 1. Gas or magnetic suspension;
  - 2. Active signature controls; or
  - 3. Vibration suppression controls;
- h. Nuclear power generating equipment or propulsion equipment, specially designed for vessels specified in ML9.a. and components therefor specially designed or 'modified' for military use.

**ML10**

**"Aircraft", "lighter-than-air vehicles", "Unmanned Aerial Vehicles" ("UAVs"), aero-engines, "sub-orbital craft" and "aircraft" equipment, related equipment, and components, as follows, specially designed or modified for military use:**

- a. Manned "aircraft" and "lighter-than-air vehicles", and specially designed components therefor;
- b. Not used since 2011
- c. Unmanned "aircraft" and "lighter-than-air vehicles", and related equipment, as follows, and specially designed components therefor:
  - 1. "UAVs", Remotely Piloted Air Vehicles (RPVs), autonomous programmable vehicles and unmanned "lighter-than-air vehicles";
  - 2. Launchers, recovery equipment and ground support equipment;
  - 3. Equipment designed for command or control;
- d. Propulsion aero-engines and specially designed components therefor;
- e. Airborne refuelling equipment specially designed or modified for any of the following, and specially designed components therefor:
  - 1. "Aircraft" specified by ML10.a.; or
  - 2. Unmanned "aircraft" specified by ML10.c.;

- f. Ground equipment specially designed for "aircraft" specified by ML10.a. or aero-engines specified by ML10.d.;
- g. Aircrew life support equipment, aircrew safety equipment and other devices for emergency escape, not specified in ML10.a., designed for "aircraft" specified by ML10.a. or "sub-orbital craft" specified in ML10.j.;
- h. Parachutes, paragliders and related equipment, as follows, and specially designed components therefor:
  - 1. Parachutes not specified elsewhere in this Military List;
  - 2. Paragliders;
  - 3. Equipment specially designed for high altitude parachutists (e.g. suits, special helmets, breathing systems, navigation equipment);
- i. Controlled opening equipment or automatic piloting systems, designed for parachuted loads.
- j. "Sub-orbital craft" and related equipment, as follows, and specially designed or modified components therefor:
  - 1. "Sub-orbital craft";
  - 2. Launch equipment, recovery equipment and ground support equipment;
  - 3. Equipment designed for command or control.

**ML11**

**Electronic equipment, "spacecraft" and components, not specified elsewhere on this Military List, as follows:**

- a. Electronic equipment specially designed for military use and specially designed components therefor;
- b. Jamming equipment designed or modified to hinder the reception, operation or effectiveness of positioning, navigation or timing services provided by "satellite navigation systems", and specially designed components therefor;
- c. "Spacecraft" specially designed or modified for military use, and "spacecraft" components specially designed for military use.

**ML12**

**High velocity kinetic energy weapon systems and related equipment, as follows, and specially designed components therefor:**

- a. Kinetic energy weapon systems specially designed for destruction or effecting mission-abort of a target;
- b. Specially designed test and evaluation facilities and test models, including diagnostic instrumentation and targets, for dynamic testing of kinetic energy projectiles and systems.

**ML13**

**Armoured or protective equipment, constructions, components, and accessories, as follows:**

- a. Metallic or non-metallic armoured plate, having any of the following:
  1. Manufactured to comply with a military standard or specification; or
  2. Suitable for military use;
- b. Constructions of metallic or non-metallic materials, or combinations thereof, specially designed to provide ballistic protection for military systems, and specially designed components therefor;
- c. Helmets and specially designed components and accessories therefor, as follows:
  1. Helmets manufactured according to military standards or specifications, or comparable national standards;
  2. Shells, liners, or comfort pads, specially designed for helmets specified in ML13.c.1.;
  3. Add-on ballistic protection elements, specially designed for helmets specified in ML13.c.1.;
- d. Body armour or protective garments, and components therefor, as follows:
  1. Soft body armour or protective garments, manufactured to military standards or specifications, or to their equivalents, and specially designed components therefor;

2. Hard body armour plates providing ballistic protection equal to or greater than level III (NIJ 0101.06, July 2008), or "equivalent standards".

**ML14**

'Specialised equipment for military training' or for simulating military scenarios, simulators specially designed for training in the use of any firearm or weapon specified by ML1 or ML2, and specially designed components and accessories therefor.

**ML15**

Imaging or countermeasure equipment, as follows, specially designed for military use, and specially designed components and accessories therefor:

- a. Recorders and image processing equipment;
- b. Cameras, photographic equipment and film processing equipment;
- c. Image intensifier equipment;
- d. Infrared or thermal imaging equipment;
- e. Imaging radar sensor equipment;
- f. Countermeasure or counter-countermeasure equipment, for the equipment specified by ML15.a. to ML15.e.

**ML16**

Forgings, castings and other unfinished products, specially designed for items specified by ML1 to ML4, ML6, ML9, ML10, ML12 or ML19.

**ML17**

Miscellaneous equipment, materials and "libraries", as follows, and specially designed components therefor:

- a. Diving and underwater swimming apparatus, specially designed or modified for military use, as follows:
  1. Self-contained diving rebreathers, closed or semi-closed circuit;
  2. Underwater swimming apparatus specially designed for use with the diving apparatus specified in ML17.a.1.;
- b. Construction equipment specially designed for military use;

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- c. Fittings, coatings and treatments, for signature suppression, specially designed for military use;
  - d. Field engineer equipment specially designed for use in a combat zone;
  - e. "Robots", "robot" controllers and "robot" "end-effectors", having any of the following characteristics:
    - 1. Specially designed for military use;
    - 2. Incorporating means of protecting hydraulic lines against externally induced punctures caused by ballistic fragments (e.g. incorporating self-sealing lines) and designed to use hydraulic fluids with flash points higher than 839 K (566 °C); *or*
    - 3. Specially designed or rated for operating in an 'Electromagnetic Pulse' ('EMP') environment;
  - f. "Libraries" specially designed or modified for military use with systems, equipment or components, specified by this Military List;
  - g. Nuclear power generating equipment or propulsion equipment, not specified elsewhere, specially designed for military use and components therefor specially designed or 'modified' for military use;
  - h. Equipment and material, coated or treated for signature suppression, specially designed for military use, not specified elsewhere in this Military List;
  - i. Simulators specially designed for military "nuclear reactors";
  - j. Mobile repair shops specially designed or 'modified' to service military equipment;
  - k. Field generators specially designed or 'modified' for military use;
  - l. ISO intermodal containers or demountable vehicle bodies (i.e. swap bodies), specially designed or 'modified' for military use;
  - m. Ferries, not specified elsewhere in this Military List, bridges and pontoons, specially designed for military use;

- n. Test models specially designed for the "development" of items specified by ML4, ML6, ML9 or ML10;
- o. "Laser" protection equipment (e.g. eye or sensor protection) specially designed for military use;
- p. "Fuel cells", not specified elsewhere in this Military List, specially designed or 'modified' for military use.

**ML18**

**'Production' equipment, environmental test facilities and components, as follows:**

- a. Equipment specially designed or modified for the 'production' of items specified by this Military List, and specially designed components therefor;
- b. Environmental test facilities specially designed for the certification, qualification or testing of items specified by this Military List, and specially designed equipment therefor, not specified elsewhere.

**ML19**

**Directed Energy Weapon (DEW) systems, related or countermeasure equipment and test models, as follows, and specially designed components therefor:**

- a. "Laser" 'weapon systems' not specified by ML19.f.;
- b. Particle beam 'weapon systems';
- c. High power Radio-Frequency (RF) 'weapon systems';
- d. Equipment specially designed for the detection or identification of, or defence against, systems specified by ML19.a. to ML19.c.;
- e. Physical test models for the systems, equipment and components, specified by ML19;
- f. "Laser" systems specially designed to cause permanent blindness to unenhanced vision, i.e. to the naked eye or to the eye with corrective eyesight devices.

**ML20**

**Cryogenic and “superconductive” equipment, as follows, and specially designed components and accessories therefor:**

- a. Equipment specially designed or configured to be installed in a vehicle for military ground, marine, airborne or space applications, capable of operating while in motion and of producing or maintaining temperatures below 103 K (- 170 °C);
- b. “Superconductive” electrical equipment (rotating machinery or transformers) specially designed or configured to be installed in a vehicle for military ground, marine, airborne or space applications and capable of operating while in motion.

**ML21**

**“Software” as follows:**

- a. “Software” specially designed or modified for any of the following:
  1. “Development”, “production”, operation or maintenance of equipment specified by this Military List;
  2. “Development” or “production” of materials specified by this Military List; or
  3. “Development”, “production”, operation or maintenance of “software” specified by the this Military List;
- b. Specific “software”, other than that specified by ML21.a., as follows:
  1. “Software” specially designed for military use and specially designed for modelling, simulating or evaluating military weapon systems;
  2. “Software” specially designed for military use and specially designed for modelling or simulating military operational scenarios;
  3. “Software” for determining the effects of conventional, nuclear, chemical or biological weapons;

4. "Software" specially designed for military use and specially designed for Command, Communications, Control and Intelligence (C3I) or Command, Communications, Control, Computer and Intelligence (C4I) applications;
  5. "Software" specially designed or modified for the conduct of military offensive cyber operations;
- c. "Software", not specified by ML21.a. or ML21.b., specially designed or modified to enable equipment not specified this Military List to perform the military functions of equipment specified by the this Military List.

**ML 22****Other security and para-military police equipment as follows—**

- a. Acoustic devices represented by the manufacturers or suppliers thereof as suitable for riot control purposes, and specially designed components therefor;
- b. Anti-riot and ballistic shields and specially designed components therefor;
- c. Shackles designed for restraining human beings having an overall dimension including chain, when measured from the outer edge of one cuff to the outer edge of the other cuff, of between 240mm and 280mm when locked;
- d. Water cannon and specially designed components therefor;
- e. Riot control vehicles which have been specially designed or modified to be electrified to repel boarders and components therefor specially designed or modified for that purpose;
- f. Components specially designed or modified for portable devices designed or modified for the purposes of riot control or self-protection by the administration of an electric shock (e.g. Electric-shock batons, electric-shock shields, stun-guns and electric-shock dart-guns).

**ML23****"Technology" as follows:**

- a. "Technology", other than specified in ML22.b, which is "required" for the "development", "production", operation, installation, maintenance (checking), repair, overhaul or refurbishing of items specified by this Military List;

b. "Technology" as follows:

1. "Technology" "required" for the design of, the assembly of components into, and the operation, maintenance and repair of, complete production installations for items specified by this Military List, even if the components of such production installations are not specified;
2. "Technology" "required" for the "development" and "production" of small arms, even if used to produce reproductions of antique small arms;
3. Not used since 2013
4. "Technology" "required" exclusively for the incorporation of "biocatalysts", specified by ML7.i.1., into military carrier substances or military material.

**PART B: LIST OF DUAL USE GOODS  
ACRONYMS AND ABBREVIATIONS**

ABEC	Annular Bearing Engineers Committee
ADC	Analogue-to-Digital Converter
AGMA	American Gear Manufacturers' Association
AHRS	Attitude and Heading Reference Systems
AISI	American Iron and Steel Institute
ALE	Atomic Layer Epitaxy
ALU	Arithmetic Logic Unit
ANSI	American National Standards Institute
APP	Adjusted Peak Performance
APU	Auxiliary Power Unit
ASTM	American Society for Testing and Materials
ATC	Air Traffic Control
BJT	Bipolar Junction Transistors
BPP	Beam Parameter Product
BSC	Base Station Controller
CAD	Computer-Aided-Design
CAS	Chemical Abstracts Service
CEP	Circular Error Probable
CCD	Charge Coupled Device
CDU	Control and Display Unit
CEP	Circular Error Probable
CMM	Coordinate Measuring Machine
CMOS Semiconductor	Complementary Metal Oxide
CNTD	Controlled Nucleation Thermal Deposition
CPLD	Complex Programmable Logic Device
CPU	Central Processing Unit
CVD	Chemical Vapour Deposition
CW	Chemical Warfare
CW (for lasers)	Continuous Wave
DAC	Digital-to-Analogue Converter
DANL	Displayed Average Noise Level
DBRN	Data-Base Referenced Navigation

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DDS	Direct Digital Synthesizer
DMA	Dynamic Mechanical Analysis
DME	Distance Measuring Equipment
DMOSFET	Diffused Metal Oxide Semiconductor Field Effect Transistor
DRM	Digital Rights Management
DS	Directionally Solidified
EB	Exploding Bridge
EB-PVD	Electron Beam Physical Vapour Deposition
EBW	Exploding Bridge Wire
ECM	Electro-Chemical Machining
EDM	Electrical Discharge Machines
EEPROMS	Electrically Erasable Programmable Read Only Memory
EFI	Exploding Foil Initiators
EIRD	Effective Isotropic Radiated Power
ENOB	Effective Number of Bits
ERF	Electrorheological Finishing
ERP	Effective Radiated Power
ETO	Emitter Turn-Off Thyristor
ETT	Electrical Triggering Thyristor
EUV	Extreme UltraViolet
FADEC	Full Authority Digital Engine Control
FFT	Fast Fourier Transform
FPGA	Field Programmable Gate Array
FPIC	Field Programmable Interconnect
FPLA	Field Programmable Logic Array
FPO	Floating Point Operation
FWHM	Full-Width Half-Maximum
GSM	Global System for Mobile Communications
GLONASS	Global Navigation Satellite System
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
GTO	Gate Turn-off Thyristor
HBT	Hetero-Bipolar Transistors

HEMT	High Electron Mobility Transistor
ICAO	International Civil Aviation Organisation
IEC	International Electro-technical Commission
IED	Improvised Explosive Device
IEEE Engineers	Institute of Electrical and Electronic
IFOV	Instantaneous-Field-Of-View
IGBT	Insulated Gate Bipolar Transistor
IGCT	Integrated Gate Commutated Thyristor
IHO	International Hydrographic Organization
ILS	Instrument Landing System
IMU	Inertial Measurement Unit
INS	Inertial Navigation System
IP	Internet Protocol
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISA	International Standard Atmosphere
ISAR	Inverse Synthetic Aperture Radar
ISO Standardization	International Organization for
ITU	International Telecommunication Union
JT	Joule-Thomson
LDAR	Light Detection and Ranging
LIDT	Laser Induced Damage Threshold
LOA	Length Overall
LRU	Line Replaceable Unit
MLS	Microwave Landing Systems
MMIC	Monolithic Microwave Integrated Circuit
MOCVD	Metal Organic Chemical Vapour Deposition
MOSFET	Metal-Oxide-Semiconductor Field Effect Transistor
MPM	Microwave Power Module
MRAM	Magnetic Random Access Memory
MRF	Magnetorheological Finishing
MRF	Minimum Resolvable Feature size
MRI	Magnetic Resonance Imaging

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MTBF	Mean-Time-Between-Failures
MTTF	Mean-Time-To-Failure
NA	Numerical Aperture
NDT	Non-Destructive Test
NEQ	Net Explosive Quantity
OAM	Operations, Administration or Maintenance
OSI	Open Systems Interconnection
PAI	Polyamide-imides
PAR	Precision Approach Radar
PCL	Passive Coherent Location
PDK	Process Design Kit
PIN	Personal Identification Number
PMR	Private Mobile Radio
PVD	Physical Vapour Deposition
PPM	Parts Per Million
QAM	Quadrature-Amplitude-Modulation
QE	Quantum Efficiency
RAP	Reactive Atom Plasmas
RF	Radio Frequency
RMS	Root Mean Square
RNC	Radio Network Controller
RNSS	Regional Navigation Satellite System
ROIC	Read-out Integrated Circuit
S-FIL	Step and Flash Imprint Lithography
SAR	Synthetic Aperture Radar
SAS	Synthetic Aperture Sonar
SC	Single Crystal
SCR	Silicon Controlled Rectifier
SFDR	Spurious Free Dynamic Range
SHPL	Super High Powered Laser
SLAR	Sidelooking Airborne Radar
SOI	Silicon-on-Insulator
SQUID Device	Superconducting Quantum Interference
SRA	Shop Replaceable Assembly

SRAM	Static Random Access Memory
SSB	Single Sideband
SSR	Secondary Surveillance Radar
SSS	Side Scan Sonar
SRE	Software Reverse Engineering
TIR	Total Indicated Reading
TVR	Transmitting Voltage Response
AMU	Atomic Mass Unit
UPR	Unidirectional Positioning Repeatability
UV	UltraViolet
UTS	Ultimate Tensile Strength
VJFET	Vertical Junction Field Effect Transistor
VOR Range	Very High Frequency Omni-directional
WLAN	Wireless Local Area Network

## DEFINITION OF TERMS

*N.B.* Category references are given in brackets after the defined term.

“Accuracy” (2 3 6 7 8), usually measured in terms of inaccuracy, means the maximum deviation, positive or negative, of an indicated value from an accepted standard or true value.

“Active flight control systems” (7) are systems that function to prevent undesirable “aircraft” and missile motions or structural loads by autonomously processing outputs from multiple sensors and then providing necessary preventive commands to effect automatic control.

“Active pixel” (6) is a minimum (single) element of the solid-state array which has a photoelectric transfer function when exposed to light (electromagnetic) radiation.

“Adjusted Peak Performance” (4) is an adjusted peak rate at which “digital computers” perform 64-bit or larger floating-point additions and multiplications, and is expressed in Weighted TeraFLOPS (WT) with units of  $10^{12}$  adjusted floating point operations per second.

“Aircraft” (1 6 7 9) means a fixed wing, swivel wing, rotary wing (helicopter), tilt rotor or tilt-wing airborne vehicle.

“Airship” (9) means a power-driven airborne vehicle that is kept buoyant by a body of gas (usually helium, formerly hydrogen) which is lighter than air.

“All compensations available” (2) means after all feasible measures available to the manufacturer to minimise all systematic positioning errors for the particular machine-tool model or measuring errors for the particular coordinate measuring machine are considered.

“Allocated by the ITU” (3 5) means the allocation of frequency bands according to the current edition of the ITU Radio Regulations for primary, permitted and secondary services.

“Angular position deviation” (2) means the maximum difference between angular position and the actual, very accurately measured angular position after the workpiece mount of the table has been turned out of its initial position.

“Angle random walk” (7) means the angular error build up with time that is due to white noise in angular rate (IEEE STD 528-2001).

“APP” (4) is equivalent to “Adjusted Peak Performance”.

“Asymmetric algorithm” (5) means a cryptographic algorithm using different, mathematically-related keys for encryption and decryption.

“Authentication” (5) means verifying the identity of a user, process or device, often as a prerequisite to allowing access to resources in an information system. This includes verifying the origin or content of a message or other information, and all aspects of access control where there is no encryption of files or text except as directly related to the protection of passwords, Personal Identification Numbers (PINs) or similar data to prevent unauthorised access.

“Average output power” (6) means the total “laser” output energy, in joules, divided by the period over which a series of consecutive pulses is emitted, in seconds. For a series of uniformly spaced pulses it is equal to the total “laser” output energy in a single pulse, in joules, multiplied by the pulse frequency of the “laser”, in Hertz. 10/237

“Basic gate propagation delay time” (3) means the propagation delay time value corresponding to the basic gate used in a “monolithic integrated circuit”. For a ‘family’ of “monolithic integrated circuits”, this may be specified either as the propagation delay time per typical gate within the given ‘family’ or as the typical propagation delay time per gate within the given ‘family’.

“Basic scientific research” (GTN NTN) means experimental or theoretical work undertaken principally to acquire new knowledge of the fundamental principles of phenomena or observable facts, not primarily directed towards a specific practical aim or objective.

“Bias” (accelerometer) (7) means the average over a specified time of accelerometer output, measured at specified operating conditions, that has no correlation with input acceleration or rotation. “Bias” is expressed in g or in metres per second squared (g or  $m/s^2$ ). (IEEE Std 528-2001) (Micro g equals  $1 \times 10^{-6}$  g).

“Bias” (gyro) (7) means the average over a specified time of gyro output measured at specified operating conditions that has no correlation with input rotation or acceleration. “Bias” is typically expressed in degrees per hour (deg/hr). (IEEE Std 528-2001).

“Biological agents” (1) are pathogens or toxins, selected or modified (such as altering purity, shelf life, virulence, dissemination characteristics, or resistance to UV radiation) to produce casualties in humans or animals, degrade equipment or damage crops or the environment.

“Cammings” (2) means axial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle faceplate, at a point next to the circumference of the spindle faceplate (Reference: ISO 230-1:1986, paragraph 5.63).

“Charge multiplication” (6) means a form of electronic image amplification defined as the generation of charge carriers as a result of an impact ionisation gain process. “Charge multiplication” sensors may take the form of an image intensifier tube, solid state detector or “focal plane array”

“CEP” (7) means “Circular Error Probable” - In a circular normal distribution, the radius of the circle containing 50 % of the individual measurements being made, or the radius of the circle within which there is a 50 % probability of being located.

“Chemical laser” (6) means a “laser” in which the excited species is produced by the output energy from a chemical reaction.

“Chemical mixture” (1) means a solid, liquid or gaseous product made up of two or more components which do not react together under the conditions under which the mixture is stored.

“Circulation-controlled anti-torque or circulation-controlled direction control systems” (7) are systems that use air blown over aerodynamic surfaces to increase or control the forces generated by the surfaces.

“Civil aircraft” (1 3 4 7) means those “aircraft” listed by designation in published airworthiness certification lists by the civil aviation authorities of one or more EU Member States or Wassenaar Arrangement Participating States to fly commercial civil internal and external routes or for legitimate civil, private or business use.

“Communications channel controller” (4) means the physical interface which controls the flow of synchronous or asynchronous digital information. It is an assembly that can be integrated into computer or telecommunications equipment to provide communications access.

“Compensation systems” (6) consist of the primary scalar sensor, one or more reference sensors (e.g., vector “magnetometers”) together with software that permit reduction of the rigid body rotation noise of the platform.

“Composite” (1 2 6 8 9) 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.

“III/V compounds” (3 6) means polycrystalline or binary or complex monocrystalline products consisting of elements of groups IIIA and VA of Mendeleyev's periodic classification table (e.g., gallium arsenide, gallium-aluminium arsenide, indium phosphide).

“Contouring control” (2) means two or more “numerically controlled” motions operating in accordance with instructions that specify the next required position and the required feed rates to that position. These feed rates are varied in relation to each other so that a desired contour is generated. (ref. ISO/DIS 2806 - 1980).

“Critical temperature” (1 3 5) (sometimes referred to as the transition temperature) of a specific “superconductive” material means the temperature at which the material loses all resistance to the flow of direct electrical current.

“Cryptographic activation” (5) means any technique that specifically activates or enables cryptographic capability of an item, by means of a mechanism implemented by the manufacturer of the item, where this mechanism is uniquely bound to any of the following:

- (a) A single instance of the item; or
- (b) One customer, for multiple instances of the item.

“Cryptography” (5) 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 unauthorised use. “Cryptography” is limited to the transformation of information using one or more ‘secret parameters’ (e.g., crypto variables) or associated key management.

“CW laser” (6) means a “laser” that produces a nominally constant output energy for greater than 0,25 seconds.

“Cyber incident response” (4) means the process of exchanging necessary information on a cybersecurity incident with individuals or organisations responsible for conducting or coordinating remediation to address the cybersecurity incident.

“Data-Based Referenced Navigation” (“DBRN”) (7) Systems means systems which use various sources of previously measured geo-mapping data integrated to provide accurate navigation information under dynamic conditions. Data sources include bathymetric maps, stellar maps, gravity maps, magnetic maps or 3-D digital terrain maps.

“Depleted uranium” (0) means uranium depleted in the isotope 235 below that occurring in nature.

“Development” (GTN NTN All) is related to all phases prior to serial production, such as: design, design research, design analyses, design concepts, assembly and testing of prototypes, pilot production schemes,

design data, process of transforming design data into a product, configuration design, integration design, layouts.

“Diffusion bonding” (1 2) means a solid state joining of at least two separate pieces of metals into a single piece with a joint strength equivalent to that of the weakest material, wherein the principal mechanism is interdiffusion of atoms across the interface.

“Digital computer” (4 5) 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.

“Digital transfer rate” (def) means the total bit rate of the information that is directly transferred on any type of medium.

“Drift rate” (gyro) (7) means the component of gyro output that is functionally independent of input rotation. It is expressed as an angular rate. (IEEE STD 528-2001).

“Effective gramme” (0 1) 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” (2 3 4) 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.

“Energetic materials” (1) means substances or mixtures that react chemically to release energy required for their intended application. “Explosives”, “pyrotechnics” and “propellants” are subclasses of energetic materials.

“End-effectors” (2) means grippers, ‘active tooling units’ and any other tooling that is attached to the baseplate on the end of a “robot” manipulator arm.

Equivalent density” (6) means the mass of an optic per unit optical area projected onto the optical surface.

“Equivalent standards” (1) means comparable national or international standards recognised by one or more EU Member States or Wassenaar Arrangement Participating States and applicable to the relevant entry.

“Explosives” (1) means solid, liquid or gaseous substances or mixtures of substances which, in their application as primary, booster, or main charges in warheads, demolition and other applications, are required to detonate.

“FADEC Systems” (9) means Full Authority Digital Engine Control Systems – A digital electronic control system for a gas turbine engine that is able to autonomously control the engine throughout its whole operating range from demanded engine start until demanded engine shut-down, in both normal and fault conditions.

“Fibrous or filamentary materials” (0 1 8 9) include:

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

“Film type integrated circuit” (3) means an array of ‘circuit elements’ and metallic interconnections formed by deposition of a thick or thin film on an insulating “substrate”.

“Fly-by-light system” (7) means a primary digital flight control system employing feedback to control the “aircraft” during flight, where the commands to the effectors/actuators are optical signals.

“Fly-by-wire system” (7) means a primary digital flight control system employing feedback to control the “aircraft” during flight, where the commands to the effectors/actuators are electrical signals.

“Focal plane array” (6 8) means a linear or two-dimensional planar layer, or combination of planar layers, of individual detector elements, with or without readout electronics, which work in the focal plane.

“Fractional bandwidth” (3 5) means the “instantaneous bandwidth” divided by the centre frequency, expressed as a percentage.

“Frequency hopping” (5 6) means a form of “spread spectrum” in which the transmission frequency of a single communication channel is made to change by a random or pseudo-random sequence of discrete steps.

“Frequency switching time” (3) means the time (i.e., delay) taken by a signal when switched from an initial specified output frequency, to arrive at or within any of the following:

- (a)  $\pm 100$  Hz of a final specified output frequency of less than 1 GHz; or
- (b)  $\pm 0,1$  part per million of a final specified output frequency equal to or greater than 1 GHz.

“Fuel cell” (8) is an electrochemical device that converts chemical energy directly into Direct Current (DC) electricity by consuming fuel from an external source.

“Fusible” (1) means capable of being cross-linked or polymerized further (cured) by the use of heat, radiation, catalysts, etc., or that can be melted without pyrolysis (charring).

“Gate-All-Around Field-Effect Transistor (“GAAFET”) (3) means a device having a single or multiple semiconductor conduction channel element(s) with a common gate structure that surrounds and controls current in all of the semiconductor conduction channel elements.

“Hard selectors” (5) means data or set of data, related to an individual (e.g., family name, given name, e-mail, street address, phone number or group affiliations).

“High output diesel engines” (9) means diesel engines with a specified brake mean effective pressure of 1,8 MPa or more at a speed of 2 300 r.p.m., provided the rated speed is 2 300 r.p.m. or more.

“Guidance set” (7) means systems that integrate the process of measuring and computing a vehicles position and velocity (i.e., navigation) with that of computing and sending commands to the vehicles flight control systems to correct the trajectory.

“Hybrid integrated circuit” (3) means any combination of integrated circuit(s), or integrated circuit with ‘circuit elements’ or ‘discrete

components' connected together to perform (a) specific function(s), and having all of the following characteristics:

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

"Image enhancement" (4) means the processing of externally derived information-bearing images by algorithms such as time compression, filtering, extraction, selection, correlation, convolution or transformations between domains (e.g., fast Fourier transform or Walsh transform). This does not include algorithms using only linear or rotational transformation of a single image, such as translation, feature extraction, registration or false coloration.

"Immunotoxin" (1) 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" (GSN GISN 5) 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", "cryptographic activation", 'cryptanalysis', protection against compromising emanations and computer security.

"Instantaneous bandwidth" (3 5 7) means the bandwidth over which output power remains constant within 3 dB without adjustment of other operating parameters.

"Interior lining" (9) 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.

Interleaved Analogue-to-Digital Converter (ADC)" (3) means devices that have multiple ADC units that sample the same analogue input at different times such that when the outputs are aggregated, the analogue

input has been effectively sampled and converted at a higher sampling rate.

“Intrinsic Magnetic Gradiometer” (6) is a single magnetic field gradient sensing element and associated electronics the output of which is a measure of magnetic field gradient.

“Intrusion software” (4 5) means “software” specially designed or modified to avoid detection by ‘monitoring tools’, or to defeat ‘protective countermeasures’, of a computer or network-capable device, and performing any of the following:

- (a) The extraction of data or information, from a computer or network-capable device, or the modification of system or user data; or
- (b) The modification of the standard execution path of a program or process in order to allow the execution of externally provided instructions.

“Isolated live cultures” (1) includes live cultures in dormant form and in dried preparations.

“Isostatic presses” (2) 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” (0 1 2 3 5 6 7 8 9) is an item that produces spatially and temporally coherent light through amplification by stimulated emission of radiation.

“Library” (1) (parametric technical database) means a collection of technical information, reference to which may enhance the performance of relevant systems, equipment or components.

“Lighter-than-air vehicles” (9) means balloons and “airships” that rely on hot air or other lighter-than-air gases such as helium or hydrogen for their lift.

“Linearity” (2) (Usually measured in terms of non-linearity) means the maximum deviation of the actual characteristic (average of upscale and downscale readings), positive or negative, from a straight line so positioned as to equalise and minimise the maximum deviations.

“Local area network” (4 5) is a data communication system having all of the following characteristics:

- (a) Allows an arbitrary number of independent ‘data devices’ to communicate directly with each other; and

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

"Magnetic Gradiometers" (6) are instruments designed to detect the spatial variation of magnetic fields from sources external to the instrument. They consist of multiple "magnetometers" and associated electronics the output of which is a measure of magnetic field gradient.

"Magnetometers" (6) are instruments designed to detect magnetic fields from sources external to the instrument. They consist of a single magnetic field sensing element and associated electronics the output of which is a measure of the magnetic field.

"Materials resistant to corrosion by UF<sub>6</sub>" (0) include copper, copper alloys, stainless steel, aluminium, aluminium oxide, aluminium alloys, nickel or alloys containing 60 % or more nickel by weight and fluorinated hydrocarbon polymers.

"Matrix" (1 2 8 9) means a substantially continuous phase that fills the space between particles, whiskers or fibres.

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

"Microcomputer microcircuit" (3) means a "monolithic integrated circuit" or "multichip integrated circuit" containing an arithmetic logic unit (ALU) capable of executing general purpose instructions from an internal storage, on data contained in the internal storage.

"Microprocessor microcircuit" (3) means a "monolithic integrated circuit" or "multichip integrated circuit" containing an arithmetic logic unit (ALU) capable of executing a series of general purpose instructions from an external storage.

"Microorganisms" (1 2) means bacteria, viruses, mycoplasmas, rickettsiae, chlamydiae or fungi, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures.

"Missiles" (1 2 3 6 7 9) means complete rocket systems and unmanned aerial vehicle systems, capable of delivering at least 500 kg payload to a range of at least 300 km.

“Monofilament” (1) or filament is the smallest increment of fibre, usually several micrometres in diameter.

“Monolithic integrated circuit” (3) 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.

“Monolithic Microwave Integrated Circuit” (“MMIC”) (3.5) means a “monolithic integrated circuit” that operates at microwave or millimetre wave frequencies.

“Monospectral imaging sensors” (6) are capable of acquisition of imaging data from one discrete spectral band.

“Multichip integrated circuit” (3) means two or more “monolithic integrated circuits” bonded to a common “substrate”.

“Multiple channel Analogue-to-Digital Converter (ADC)” (3) means devices that integrate more than one ADC, designed so that each ADC has a separate analogue input.

“Multispectral imaging sensors” (6) are capable of simultaneous or serial acquisition of imaging data from two or more discrete spectral bands. Sensors having more than twenty discrete spectral bands are sometimes referred to as hyperspectral imaging sensors.

“Natural uranium” (0) means uranium containing the mixtures of isotopes occurring in nature.

“Network access controller” (4) means a physical interface to a distributed switching network. It uses a common medium which operates throughout at the same “digital transfer rate” using arbitration (e.g., token or carrier sense) for transmission. Independently from any other, it selects data packets or data groups (e.g., IEEE 802) addressed to it. It is an assembly that can be integrated into computer or telecommunications equipment to provide communications access.

“Nuclear reactor” (0) means a complete reactor capable of operation so as to maintain a controlled self-sustaining fission chain reaction. A “nuclear reactor” includes all the items within or attached directly to the reactor vessel, the equipment which controls the level of power in the core, and the components which normally contain, come into direct contact with or control the primary coolant of the reactor core.

“Numerical control” (2) 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 2382:2015).

“Object code” (GSN) means an equipment executable form of a convenient expression of one or more processes (“source code” (source language)) which has been compiled by programming system.

“Operations, Administration or Maintenance” (“OAM”) (5) means performing one or more of the following tasks:

- (a) Establishing or managing any of the following:
  - (i) Accounts or privileges of users or administrators;
  - (ii) Settings of an item; or
  - (iii) Authentication data in support of the tasks described in paragraphs (a)(i) or (a)(ii);
- (b) Monitoring or managing the operating condition or performance of an item; or
- (c) Managing logs or audit data in support of any of the tasks described in paragraphs (a) or (b)

“Optical integrated circuit” (3) means a “monolithic integrated circuit” or a “hybrid integrated circuit”, containing one or more parts designed to function as a photosensor or photoemitter or to perform (an) optical or (an) electro-optical function(s).

“Optical switching” (5) means the routing of or switching of signals in optical form without conversion to electrical signals.

“Overall current density” (3) means the total number of ampere-turns in the coil (i.e., the sum of the number of turns multiplied by the maximum current carried by each turn) divided by the total cross-section of the coil (comprising the superconducting filaments, the metallic matrix in which the superconducting filaments are embedded, the encapsulating material, any cooling channels, etc.).

“Participating state” (7 9) is a state participating in the Wassenaar Arrangement.

“Peak power” (6) means the highest power attained in the “pulse duration”.

“Personal area network” (5) means a data communication system having all of the following characteristics:

- (a) Allows an arbitrary number of independent or interconnected 'data devices' to communicate directly with each other; and
- (b) Is confined to the communication between devices within the immediate physical vicinity of an individual person or device controller (e.g., single room, office, or automobile).

"Previously separated" (1) is the application of any process intended to increase the concentration of the controlled isotope.

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

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

"Production equipment" (1 7 9) 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" (7 9) means "production equipment" and specially designed software therefor integrated into installations for "development" or for one or more phases of "production".

"Program" (7) means a sequence of instructions to carry out a process in, or convertible into, a form executable by an electronic computer.

"Pulse compression" (6) means the coding and processing of a radar signal pulse of long time duration to one of short time duration, while maintaining the benefits of high pulse energy.

"Pulse duration" (6) is the duration of a "laser" pulse and means the time between the half-power points on the leading edge and trailing edge of an individual pulse.

"Pulsed laser" (6) means a "laser" having a "pulse duration" that is less than or equal to 0,25 seconds.

"Quantum cryptography" (5) means a family of techniques for the establishment of shared key for "cryptography" by measuring the

quantum-mechanical properties of a physical system (including those physical properties explicitly governed by quantum optics, quantum field theory or quantum electrodynamics).

“Radar frequency agility” (6) means any technique which changes, in a pseudo-random sequence, the carrier frequency of a pulsed radar transmitter between pulses or between groups of pulses by an amount equal to or larger than the pulse bandwidth.

“Radar spread spectrum” (6) means any modulation technique for spreading energy originating from a signal with a relatively narrow frequency band, over a much wider band of frequencies, by using random or pseudo-random coding.

“Radiant sensitivity” (6) is  $\text{Radiant sensitivity (mA/W)} = 0,807 \times (\text{wavelength in nm}) \times \text{Quantum Efficiency (QE)}$ .

“Real-time processing” (6) means the processing of data by a computer system providing a required level of service, as a function of available resources, within a guaranteed response time, regardless of the load of the system, when stimulated by an external event.

“Repeatability” (7) 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. (Reference: IEEE STD 528-2001 (one sigma standard deviation))

“Required” (GTN 3 5 6 7 9), as applied to “technology”, refers to only that portion of “technology” which is peculiarly responsible for achieving or extending the controlled performance levels, characteristics or functions. Such “required” “technology” may be shared by different goods.

“Riot control agent” (1) means substances which, under the expected conditions of use for riot control purposes, produce rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination of exposure.

“Robot” (2 8) 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.

"Roving" (1) is a bundle (typically 12-120) of approximately parallel 'strands'.

"Run-out" (2) (out-of-true running) means radial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle axis at a point on the external or internal revolving surface to be tested (Reference: ISO 230-1:1986, paragraph 5.61).

"Sample rate" (3) for an Analogue-to-Digital Converter (ADC) means the maximum number of samples that are measured at the analogue input over a period of one second, except for oversampling ADCs. For oversampling ADCs the "sample rate" is taken to be its output word rate. "Sample rate" may also be referred to as sampling rate, usually specified in Mega Samples Per Second (MSPS) or Giga Samples Per Second (GSPS), or conversion rate, usually specified in Hertz (Hz).

"Satellite navigation system" (5 7) means a system consisting of ground stations, a constellation of satellites, and receivers, that enables receiver locations to be calculated on the basis of signals received from the satellites. It includes Global Navigation Satellite Systems (GNSS) and Regional Navigation Satellite Systems (RNSS).

"Scale factor" (gyro or accelerometer) (7) 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.

"Signal analysers" (3) means apparatus capable of measuring and displaying basic properties of the single-frequency components of multi-frequency signals.

"Signal processing" (3 4 5 6) means the processing of externally derived information-bearing signals by algorithms such as time compression, filtering, extraction, selection, correlation, convolution or transformations between domains (e.g., fast Fourier transform or Walsh transform).

"Software" (GSN All) means a collection of one or more "programs" or 'microprograms' fixed in any tangible medium of expression.

“Source code” (or source language) (6 7 9) is a convenient expression of one or more processes which may be turned by a programming system into equipment executable form (“object code” (or object language)).

“Spacecraft” (9) means active and passive satellites and space probes.

“Spacecraft bus” (9) means equipment that provides the support infrastructure of the “spacecraft” and location for the “spacecraft payload”.

“Spacecraft payload” (9) means equipment, attached to the “spacecraft bus”, designed to perform a mission in space (e.g., communications, observation, science).

“Space-qualified” (3 6 7) means designed, manufactured or qualified through successful testing, for operation at altitudes greater than 100 km above the surface of the Earth.

“Special fissile material” (0) means plutonium-239, uranium-233, “uranium enriched in the isotopes 235 or 233”, and any material containing the foregoing.

“Specific modulus” (0 1 9) is Young’s modulus in pascals, equivalent to  $N/m^2$  divided by specific weight in  $N/m^3$ , measured at a temperature of  $(296 \pm 2) K$  ( $(23 \pm 2) ^\circ C$ ) and a relative humidity of  $(50 \pm 5)\%$ .

“Specific tensile strength” (0 1 9) is ultimate tensile strength in pascals, equivalent to  $N/m^2$  divided by specific weight in  $N/m^3$ , measured at a temperature of  $(296 \pm 2) K$  ( $(23 \pm 2) ^\circ C$ ) and a relative humidity of  $(50 \pm 5)\%$ .

“Spinning mass gyros” (7) means gyros which use a continually rotating mass to sense angular motion.

“Spread spectrum” (5) means the technique whereby energy in a relatively narrow-band communication channel is spread over a much wider energy spectrum.

“Spread spectrum” radar (6) - see “Radar spread spectrum”.

“Stability” (7) 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.

“States (not) Party to the Chemical Weapon Convention” (1) are those states for which the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons has (not) entered into force. (See [www.opcw.org](http://www.opcw.org))

“Steady State Mode” (9) defines engine operation conditions, where the engine parameters, such as thrust/power, rpm and others, have no appreciable fluctuations, when the ambient air temperature and pressure at the engine inlet are constant.

“Sub-orbital craft” (9) means a craft having an enclosure designed for the transport of people or cargo which is designed to:

- (a) Operate above the stratosphere;
- (b) Perform a non-orbital trajectory; and
- (c) Land back on Earth with the people or cargo intact.

“Substrate” (3) means a sheet of base material with or without an interconnection pattern and on which or within which ‘discrete components’ or integrated circuits or both can be located.

“Substrate blanks” (3 6) means monolithic compounds with dimensions suitable for the production of optical elements such as mirrors or optical windows.

“Sub-unit of toxin” (1) is a structurally and functionally discrete component of a whole “toxin”.

“Superalloys” (2 9) means nickel-, cobalt- or iron-base alloys having a stress rupture life greater than 1 000 hours at 400 MPa and an ultimate tensile strength greater than 850 MPa, at 922 K (649 °C) or higher.

“Superconductive” (1 3 5 6 8) means materials, i.e., metals, alloys or compounds, which can lose all electrical resistance, i.e., which can attain infinite electrical conductivity and carry very large electrical currents without Joule heating.

“Super High-Power Laser” (“SHPL”) (6) means a “laser” capable of delivering (the total or any portion of) the output energy exceeding 1 kJ within 50 ms or having an average or CW power exceeding 20 kW.

“Superplastic forming” (1 2) means a deformation process using heat for metals that are normally characterised by low values of elongation (less than 20 %) at the breaking point as determined at room temperature by conventional tensile strength testing, in order to achieve elongations during processing which are at least 2 times those values.

“Symmetric algorithm” (5) means a cryptographic algorithm using an identical key for both encryption and decryption.

“Tape” (1) is a material constructed of interlaced or unidirectional “monofilaments”, ‘strands’, “rovings”, “tows”, or “yarns”, etc., usually pre-impregnated with resin.

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

"Three dimensional integrated circuit" (3) means a collection of semiconductor dies or active device layers, integrated together, and having through semiconductor via connections passing completely through an interposer, substrate, die or layer to establish interconnections between the device layers. An interposer is an interface that enables electrical connections.

"Tilting spindle" (2) means a tool-holding spindle which alters, during the machining process, the angular position of its centre line with respect to any other axis.

"Time constant" (6) is the time taken from the application of a light stimulus for the current increment to reach a value of  $1-1/e$  times the final value (i.e., 63 % of the final value).

"Time-to-steady-state registration" (6) (also referred to as the gravimeter's response time) is the time over which the disturbing effects of platform induced accelerations (high frequency noise) are reduced.

"Tip shroud" (9) means a stationary ring component (solid or segmented) attached to the inner surface of the engine turbine casing or a feature at the outer tip of the turbine blade, which primarily provides a gas seal between the stationary and rotating components.

"Total control of flight" (7) means an automated control of "aircraft" state variables and flight path to meet mission objectives responding to real time changes in data regarding objectives, hazards or other "aircraft".

"Total digital transfer rate" (5) means the number of bits, including line coding, overhead and so forth per unit time passing between corresponding equipment in a digital transmission system.

"Tow" (1) is a bundle of "monofilaments", usually approximately parallel.

"Toxins" (1 2) 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".

"Tunable" (6) means the ability of a "laser" to produce a continuous output at all wavelengths over a range of several "laser" transitions. A line selectable "laser" produces discrete wavelengths within one "laser" transition and is not considered "tunable".

“Unidirectional positioning repeatability” (2) means the smaller of values  $R_{\uparrow}$  and  $R_{\downarrow}$  (forward and backward), as defined by 3.21 of ISO 230-2:2014 or national equivalents, of an individual machine tool axis.

“Unmanned Aerial Vehicle” (“UAV”) (9) means any aircraft capable of initiating flight and sustaining controlled flight and navigation without any human presence on board.

“Uranium enriched in the isotopes 235 or 233” (0) 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 0,71 per cent).

“Use” (GTN NTN All) means operation, installation (including on-site installation), maintenance (checking), repair, overhaul and refurbishing.

“User-accessible programmability” (6) means the facility allowing a user to insert, modify or replace “programs” by means other than:

- (a) A physical change in wiring or interconnections; or
- (b) The setting of function controls including entry of parameters.

“Vaccine” (1) is a medicinal product in a pharmaceutical formulation licensed by, or having marketing or clinical trial authorisation from, the regulatory authorities of either the country of manufacture or of use, which is intended to stimulate a protective immunological response in humans or animals in order to prevent disease in those to whom or to which it is administered.

“Vacuum electronic devices” (3) means electronic devices based on the interaction of an electron beam with an electromagnetic wave propagating in a vacuum circuit or interacting with radio-frequency vacuum cavity resonators. “Vacuum electronic devices” include klystrons, travelling-wave tubes, and their derivatives.

“Vulnerability disclosure” (4) means the process of identifying, reporting or communicating a vulnerability to, or analysing a vulnerability with, individuals or organisations responsible for conducting or coordinating remediation for the purposes of resolving the vulnerability.

“Yarn” (1) is a bundle of twisted ‘strands’.

**CLASSIFICATION OF DUAL USE GOODS**

<b>CATEGORY</b>	<b>CONTENTS</b>
Category 0	Nuclear materials, facilities and equipment
Category 1	Special materials and related equipment
Category 2	Materials processing
Category 3	Electronics
Category 4	Computers
Category 5	Telecommunications and "Information Security"
Category 6	Sensors and Lasers
Category 7	Navigation and avionics
Category 8	Marine
Category 9	Aerospace and Propulsion

**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;
- b. Metal vessels, or major shop-fabricated parts therefor, including the reactor vessel head for a reactor pressure vessel, specially designed or prepared to contain the core of a nuclear reactor;
- 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 both fuel elements and the primary coolant in a nuclear reactor;
- 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; For zirconium pressure tubes see 0A001.e. and for calandria tubes see 0A001.h.
- g. Coolant pumps or circulators specially designed or prepared for circulating the primary coolant of nuclear reactors;
- h. 'Nuclear reactor internals' specially designed or prepared for use in a nuclear reactor, including support columns for the core, fuel channels, calandria tubes, thermal shields, baffles, core grid plates, and diffuser plates;
- i. Heat exchangers as follows:
  1. Steam generators specially designed or prepared for the primary, or intermediate, coolant circuit of a nuclear reactor;
  2. Other heat exchangers specially designed or prepared for use in the primary coolant circuit of a nuclear reactor; 0A001.i. does not control heat exchangers for the supporting systems of the reactor, e.g., the emergency cooling system or the decay heat cooling system.

- 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. 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" or "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, or 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 —laserl isotope separation plant;
  - 7. Molecular "laser" isotope separation plant;
  - 8. Plasma separation plant;
  - 9. Electro-magnetic separation plant;
- b. Gas centrifuges and assemblies and components, specially designed or prepared for gas centrifuge separation process, as follows: In 0B001.b. 'high strength-to-density ratio material' means any of the following:
  - 1. Maraging steel capable of an ultimate tensile strength of 1,95 GPa or more;
  - 2. Aluminium alloys capable of an ultimate tensile strength of 0,46 GPa or more; or

3. "Fibrous or filamentary materials" with a "specific modulus" of more than  $3,18 \times 10^6$  m and a "specific tensile strength" greater than  $7,62 \times 10^4$  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 UF6" 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.
  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 more and a power of 40 VA or more;

11. Centrifuge housing/containers 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 that are parallel to each other and perpendicular to the cylinder's longitudinal axis to within 0.05° or less;
12. Scoops consisting of specially designed or prepared tubes for the extraction of UF<sub>6</sub> gas from within the rotor tube by a Pitot tube action and capable of being fixed to the central gas extraction system;
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. A multiphase frequency output of 600 Hz or greater; and
  - b. High stability (with 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<sub>6</sub> 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<sub>6</sub>", 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 made of porous metallic, polymer or ceramic "materials resistant to corrosion by UF<sub>6</sub>" 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 UF6";
  3. Compressors or gas blowers with a suction volume capacity of 1 m<sup>3</sup>/min or more of UF6, with a discharge pressure up to 500 kPa, and having a pressure ratio of 10:1 or less, and made of or protected by "materials resistant to corrosion by UF6";
  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 1,000 cm<sup>3</sup>/min;
  5. Heat exchangers made of or protected by "materials resistant to corrosion by UF6", and designed for a leakage pressure rate of less than 10 Pa per hour under a pressure differential of 100 kPa;
  6. Bellows-sealed valves, manual or automated, shut-off or control, made of or protected by "materials resistant to corrosion by UF6";
- 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 1 mm, resistant to corrosion by UF6, and having a knife-edge contained within the nozzle which separates the gas flowing through the nozzle into two streams;
  2. Cylindrical or conical tubes, (vortex tubes), made of or protected by "materials resistant to corrosion by UF6" and with one or more tangential inlets;
  3. Compressors or gas blowers made of or protected by "materials resistant to corrosion by UF6", and rotary shaft seals therefor;
  4. Heat exchangers made of or protected by "materials resistant to corrosion by UF6";
  5. Separation element housings, made of or protected by "materials resistant to corrosion by UF6" to contain vortex tubes or separation nozzles;
  6. Bellows-sealed valves, manual or automated, shut-off or control, made of or protected by "materials resistant to corrosion by UF6", with a diameter of 40 mm or more;

7. Process systems for separating UF<sub>6</sub> from carrier gas (hydrogen or helium) to 1 ppm UF<sub>6</sub> 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<sub>6</sub> from carrier gas;
  - d. UF<sub>6</sub> cold traps capable of freezing out UF<sub>6</sub>;
- 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, polyphenyl sulphate, polyether sulfone and resin-impregnated graphite);
  5. Feed preparation systems for producing high purity uranium chloride solution consisting of dissolution, solvent extraction and/or ion exchange equipment for purification and electrolytic cells for reducing the uranium U+6 or U+4 to U+3;
  6. Uranium oxidation systems for oxidation of U+3 to U+4;

- f. Equipment and components, specially designed or prepared for ion-exchange separation process, as follows:
  - 1. Fast reacting ion-exchange resins, pellicular or porous macro-reticulated resins in which the active chemical exchange groups are limited to a coating on the surface of an inactive porous support structure, and other composite structures in any suitable form, including particles or fibers, 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 s 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 1 000 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 laser-based separation processes using atomic vapour laser isotope separation, as follows:
  - 1. Uranium metal vaporization systems designed to achieve a delivered power of 1 kW or more on the target for use in laser enrichment;
  - 2. Liquid or vapour uranium metal handling systems specially designed or prepared for handling molten uranium, molten uranium alloys or uranium metal vapour for use in laser enrichment, and specially designed components therefor;
  - 3. Product and tails collector assemblies for collecting uranium metal in liquid or solid form, made of or protected by 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 specially designed or prepared for the separation of uranium isotopes with a spectrum frequency stabilization for operation over extended periods of time;
- h. Equipment and components, specially designed or prepared for laser-based separation processes using molecular laser isotope separation, as follows—
1. Supersonic expansion nozzles for cooling mixtures of UF<sub>6</sub> and carrier gas to 150 K (-123°C) or less and made from "materials resistant to corrosion by UF<sub>6</sub>";
  2. Product or tails collector components or devices specially designed or prepared for collecting uranium material or uranium tails material following illumination with laser light, made of "materials resistant to corrosion by UF<sub>6</sub>";
  3. Compressors made of or protected by "materials resistant to corrosion by UF<sub>6</sub>", and rotary shaft seals therefor;
  4. Equipment for fluorinating UF<sub>5</sub> (solid) to UF<sub>6</sub> (gas);
  5. Process systems for separating UF<sub>6</sub> from carrier gas (e.g. nitrogen, argon or other gas) 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<sub>6</sub> cold traps capable of freezing out UF<sub>6</sub>
  6. "Lasers" or "laser" systems specially designed or prepared for the separation of uranium isotopes with a spectrum frequency stabilization for operation over extended periods of time;
- 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. Product and tails collector assemblies for uranium metal in solid form, made of or protected by materials resistant to the heat and corrosion of uranium vapour such as yttria-coated graphite or tantalum;
  5. 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, ionizer, 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;
  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.

**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 UF6":**

- a. Feed autoclaves, ovens or systems used for passing UF6 to the enrichment process;
- b. Desublimers or cold traps, used to remove UF6 from the enrichment process for subsequent transfer upon heating;
- c. Product and tails stations for transferring UF6 into containers;
- d. Liquefaction or solidification stations used to remove UF6 from the enrichment process by compressing, cooling and converting UF6 to a liquid or solid form;
- e. Piping systems and header systems specially designed or prepared for handling UF6 within gaseous diffusion, centrifuge or aerodynamic cascades;
- f. Vacuum systems and pumps as follows:
  1. Vacuum manifolds, vacuum headers or vacuum pumps having a suction capacity of 5 m<sup>3</sup>/minute or more;
  2. Vacuum pumps specially designed for use in UF6 bearing atmospheres made of, or protected by, "materials resistant to corrosion by UF6"; or
  3. Vacuum systems consisting of vacuum manifolds, vacuum headers and vacuum pumps, and designed for service in UF6-bearing atmospheres;
- g. UF6 mass spectrometers/ion sources capable of taking on-line samples from UF6 gas streams and having all of the following characteristics:
  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 ionization 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;
  3. Combined Electrolysis and Catalytic Exchange (CECE) plants;
  4. Combined Industrial Reforming and Catalytic Exchange (CIRCE) plants;
  5. Bithermal Hydrogen-Water exchange (BHW) plants;
- b. Equipment and components, as follows:

1. Water-hydrogen sulphide exchange towers with diameters of 1,5 m or more, capable of operating at pressures greater than or equal to 2 MPa;
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% by weight hydrogen sulphide, H<sub>2</sub>S) with a throughput capacity greater than or equal to 56 m<sup>3</sup>/s when operating at pressures greater than or equal to 1,8 MPa suction and having seals designed for wet H<sub>2</sub>S 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 analyzers capable of on-line hydrogen/deuterium ratio analysis where deuterium concentrations are equal to or greater than 90% by weight;
7. Catalytic burners for the conversion of enriched deuterium gas into heavywater 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.
10. Complete columns or towers specially designed or prepared for hydrogen isotope exchange having all of the following:
  1. Packed with random or structured wet-proofed platinised catalysts;
  2. Constructed of carbon steel or stainless steel;

3. Capable of operating with pressure in the range of 0,1 to 4 MPa; and

4. Capable of operating at temperatures in the range of 293 K (20 °C) to 473 K (200 °C).

**0B005**

**Plant specially designed for the fabrication of “nuclear reactor” fuel elements and specially designed or prepared equipment therefor.**

Specially designed or prepared equipment for the fabrication of “nuclear reactor” fuel elements includes equipment which:

1. Normally comes into direct contact with or directly processes or controls the production flow of nuclear materials;
2. Seals the nuclear materials within the cladding;
3. Checks the integrity of the cladding or the seal;
4. Checks the finish treatment of the sealed fuel; or
5. Is used for assembling reactor elements.

**0B006**

**Plant for the reprocessing of irradiated “nuclear reactor” fuel elements, and specially designed or prepared equipment and components therefor to include:**

- 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 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. Solvent extractors, such as packed or pulsed columns, mixer settlers or centrifugal contractors, resistant to the corrosive effects of nitric acid and specially designed or prepared for use in a plant for the reprocessing of irradiated “natural uranium”, “depleted

- uranium” or “special fissile materials”; 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 with 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 to exclude 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.

**0C003**

Deuterium, heavy water (deuterium oxide) and other compounds of deuterium, and mixtures and solutions containing deuterium, in which the isotopic ratio of deuterium to hydrogen exceeds 1:5,000.

**0C004**

Graphite having a purity level better than 5 parts per million 'boron equivalent' and with a density greater than 1.50 g/cm<sup>3</sup> for use in a "nuclear reactor", in quantities exceeding 1kg.

**0C005**

Specially prepared compounds or powders for the manufacture of gaseous diffusion barriers, resistant to corrosion by UF<sub>6</sub> (e.g. nickel or alloys containing 60% by weight or more nickel, aluminium oxide and fully fluorinated hydrocarbon polymers), having a purity of 99.9% by weight or more and a particle size less than 10 µm 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: SPECIAL MATERIALS AND RELATED EQUIPMENT***1A Systems, Equipment and Components***1A001**

Components made from fluorinated compounds, seals, gaskets, sealants or fuel bladders, specially designed for "aircraft" or aerospace use, made from more than 50% by weight of any of the materials specified in 1C009.b. or 1C009.c.;

**1A002**

Composite structures or laminates, as follows:

- a. Made from any of the following:
  1. An organic "matrix" and "fibrous or filamentary materials" specified in 1C010.c. or 1C010.d.; or
  2. Prepregs or preforms specified in 1C010.e.;
- b. Made from a metal or carbon "matrix", and any of the following:
  1. Carbon —fibrous or filamentary materials| having all of the following—
    - a. A "specific modulus" exceeding  $10.15 \times 10^6$  m; and
    - b. A "specific tensile strength" exceeding  $17.7 \times 10^4$  m; or
  2. Materials specified in 1C010.c.

**1A003**

Manufactures of non-"fusible" aromatic polyimides in film, sheet, tape or ribbon form having any of the following:

- a. A thickness exceeding 0.254 mm; or
- b. Coated or laminated with carbon, graphite, metals or magnetic substances.

**1A004**

Protective and detection equipment and components not specially designed for military use, as follows:

- a. Full face masks/gas masks, filter canisters and decontamination equipment therefor, designed or modified for defense against any of the following, and specially designed components therefor

including: Powered Air Purifying Respirators (PAPR) that are designed or modified for defense against agents or materials;

- b. Protective suits, gloves and shoes, specially designed or modified for defence against any of the following:
  - 1. 'Biological agents';
  - 2. 'Radioactive materials'; or
  - 3. Chemical warfare (CW) agents;
- c. Detection systems, specially designed or modified for detection or identification of any of the following, and specially designed components therefor—
  - 1. Biological agents;
  - 2. 'Radioactive materials'; or
  - 3. Chemical warfare (CW) agents.
- d. Electronic equipment designed for automatically detecting or identifying the presence of "explosives" residues and utilizing 'trace detection' technique capable of less than 1 ppm vapour, or 1 mg solid or liquid. Techniques.

#### **1A005**

##### **Body armour and components therefor, as follows:**

- a. Soft body armour not manufactured to military standards or specifications, or to their equivalents and specially designed components therefor;
- b. Hard body armour plates providing ballistic protection equal to or less than level A (N U 0101.06, July 2008) or national equivalents to exclude body armour when accompanying its user for the user's own personal protection;
- c. Body armour designed to provide frontal protection only from both fragment and blast from non-military explosive devices;
- d. Control body armour designed to provide protection only from knife, spike, needle or blunt trauma.

#### **1A006**

##### **Equipment, specially designed or modified for the disposal of improvised explosive devices, as follows, and specially designed components and accessories therefor.**

- a. Remotely operated vehicles;

- b. Devices specially designed for the purpose of preventing the operation of an explosive device by projecting a liquid, solid or frangible projectile.

**1A007**

**Equipment and devices, specially designed to initiate charges and devices containing "energetic materials", by electrical means, as follows:**

- a. Explosive detonator firing sets designed to drive explosive detonators specified in 1A007(b);
- b. Electrically driven explosive detonators as follows:
  - 1. Exploding bridge (EB);
  - 2. Exploding bridge wire (EBW);
  - 3. Slapper;
  - 4. Exploding foil initiators (EFI)

**1A008**

**Charges, devices and components, as follows:**

- a. Explosive charges shaped to focus the effects of the explosive blast having all of the following:
  - 1. Net Explosive Quantity (NEQ) greater than 90 g; and
  - 2. Outer casing diameter equal to or greater than 75 mm;
- b. Linear shaped cutting charges having all of the following, and specially designed components therefor:
  - 1. An explosive load greater than 40 g/m; and
  - 2. A width of 10 mm or more;
- c. Detonating cord with explosive core load greater than 64 g/m;
- d. Cutters, other than those specified in 1A008.b., and severing tools, having a Net Explosive Quantity (NEQ) greater than 3.5 kg.

**1A102**

**Resaturated pyrolyzed carbon-carbon components designed for space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.**

**1A202**

**Composite structures, other than those specified in 1A002, in the form of tubes and having both of the following characteristics:**

- a. An inside diameter of between 75 mm and 650 mm;
- b. A thickness of 12 mm or less; and
- c. Made with any of the "fibrous or filamentary materials" specified in 1C010.a. or b. or 1C210(a) or with carbon prepreg materials specified in 1C210(c).

**1A225**

**Wet-proofed 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 viewing area of the window exposed to the lowest level of radiation in the design application, which is greater than 0.09 m<sup>2</sup>;
- b. A density greater than 3 g/cm<sup>3</sup>; and
- c. A thickness of 100 mm or greater.

*1B Test, Inspection and Production Equipment*

**1B001**

**Equipment for the production or inspection of "composite" structures or laminates specified in 1A002 or "fibrous or filamentary materials" specified in 1C010, as follows, and specially designed components and accessories therefor to include:**

- a. Filament winding machines, of which the motions for positioning, wrapping and winding fibers are coordinated and programmed in three or more 'primary servo positioning' axes, specially designed for the manufacture of "composite" structures or laminates, from "fibrous or filamentary materials";
- b. 'Tape-laying machines' which have the ability to lay one or more 'filament bands' limited to widths greater than 25,4 mm and less than or equal to 304,8 mm, and to cut and restart individual 'filament band' courses during the laying process, of which the motions for positioning and laying tape are coordinated and programmed in five or more 'primary servo positioning' axes, specially designed for the manufacture of "composite" airframe or complete rocket systems and unmanned aerial vehicle systems and structures;
- c. Multidirectional, multidimensional weaving machines or interlacing and knitting machines, including adapters and modification kits, specially designed or modified for weaving, interlacing or braiding fibers, for "composite" structures;
- d. Equipment specially designed or adapted for the production of reinforcement fibers, as follows:
  1. Equipment for converting polymeric fibers (such as polyacrylonitrile, rayon, pitch or polycarbosilane) into carbon fibers or silicon carbide fibers, including special equipment to strain the fiber during heating;
  2. Equipment for the chemical vapour deposition of elements or compounds, on heated filamentary substrates, to manufacture silicon carbide fibers;
  3. Equipment for the wet-spinning of refractory ceramics (such as aluminium oxide);
  4. Equipment for converting aluminium containing precursor fibers into alumina fibers by heat treatment;
- e. Equipment specially designed or modified for producing prepregs specified by the hot melt method;
- f. Non-destructive inspection equipment specially designed for "composite" materials, as follows:
  1. X-ray tomography systems for three-dimensional defect inspection;

2. Numerically controlled ultrasonic testing machines of which the motions for positioning transmitters or receivers are simultaneously coordinated and programmed in four or more axes to follow the three-dimensional contours of the component under inspection;
3. 'Tow-placement machines' with the ability to place one or more filament bands having widths less than or equal to 25,4 mm, and to cut and restart individual filament band courses during the placement process, of which the motions for positioning and laying tows are coordinated and programmed in two or more 'primary servo positioning' axes, specially designed for the manufacture of "composite" airframe or 'missile' structures.

#### **1B002**

**Equipment for producing metal alloys, metal alloy powder or alloyed materials, specially designed to avoid contamination and specially designed for use in one of the processes specified in 1C002.(c)2.**

#### **1B003**

**Tools, dies, moulds or fixtures, for "superplastic forming" or "diffusion bonding" titanium, aluminium or their alloys, specially designed for the manufacture of any of the following:**

- a. Airframe or aerospace structures;
- b. "Aircraft" or aerospace engines; or
- c. Specially designed components for structures specified in 1B003(a) or for engines specified in 1B003(b).

#### **1B101**

**Equipment, other than that specified in 1B001, for the "production" of structural composites as follows; and specially designed components and accessories therefor to include moulds, mandrels, dies, fixtures and tooling for the preform pressing, curing, casting, sintering or bonding of composite structures, laminates and manufactures thereof:**

- a. Filament winding machines or fiber placement machines, of which the motions for positioning, wrapping and winding fibers can be coordinated and programmed in three or more axes, designed to fabricate composite structures or laminates from "fibrous or filamentary materials", and coordinating and programming controls;

- b. Tape-laying machines of which the motions for positioning and laying tape and sheets can be coordinated and programmed in two or more axes, designed for the manufacture of composite airframe and "missile" structures;
- c. Equipment designed or modified for the "production" of "fibrous or filamentary materials" as follows:
  - 1. Equipment for converting polymeric fibers (such as polyacrylonitrile, rayon or polycarbosilane) including special provision to strain the fiber during heating;
  - 2. Equipment for the vapour deposition of elements or compounds on heated filament substrates;
  - 3. Equipment for the wet-spinning of refractory ceramics (such as aluminium oxide);
- d. Equipment designed or modified for special fiber surface treatment or for producing prepreps and preforms specified in entry 9C110.

**1B102**

Metal powder "production equipment", other than that specified in 1B002, and components as metal powder "production equipment" usable for the production, in a controlled environment, of spherical, spheroidal or atomized materials specified in 1C011.a., 1C011.b., 1C111.a.1., 1C111.a.2. or in the Military Goods Controls. Specially designed components for "production equipment" specified in 1B002 or 1B102(a).

**1B115**

Equipment, other than that specified in 1B002 or 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 1C011.a., 1C011.b., 1C111 or in the Military Goods Controls;
- b. "Production equipment" for the "production", handling, mixing, curing, casting, pressing, machining, extruding or acceptance testing of solid propellants or propellant constituents specified in 1C011.a., 1C011.b., 1C111 or in the Military Goods Controls.

**1B116**

Specially designed nozzles for producing pyrolytically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1,573 K (1,300°C) to 3,173 K (2,900°C) temperature range at pressures of 130 Pa to 20 kPa.

**1B117**

Batch mixers having all of the following, and specially designed components therefor:

- a. Designed or modified for mixing under vacuum in the range of zero to 13,326 kPa;
- b. Capable of controlling the temperature of the mixing chamber;
- c. A total volumetric capacity of 110 liters or more; and
- d. At least one 'mixing/kneading shaft' mounted off center with the exception of deagglomerators or knife- spindles.

**1B118**

Continuous mixers having all of the following, and specially designed components therefor:

- a. Designed or modified for mixing under vacuum in the range of zero to 13,326 kPa;
- b. Capable of controlling the temperature of the mixing chamber;
- c. Any of the following:
  1. Two or more mixing or kneading shafts; or
  2. All of the following:
    - a. A single rotating and oscillating shaft with kneading teeth or pins ; and
    - b. Kneading teeth or pins inside the casing of the mixing chamber.

**1B119**

Fluid energy mills usable for grinding or milling substances specified in 1C011(a), 1C011(b), 1C111 or in the Military Goods Controls, and specially designed components therefor.

**1B201**

Filament winding machines, other than those specified in 1B001 or 1B101, and related equipment, as follows:

- a. Filament winding machines having all of the following characteristics:
  1. Having motions for positioning, wrapping, and winding fibers 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 650 mm and lengths of 300 mm or greater;
- b. Coordinating and programming controls for the filament winding machines specified in 1B201(a);
- c. Precision mandrels for the filament winding machines specified in 1B201.a.

**1B225**

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

**1B226**

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

**1B228**

**Hydrogen-cryogenic distillation columns having all of the following characteristics—**

- a. Designed for operation with internal temperatures of 15 K (-258 °C) to 35 K (-238 °C);
- b. Designed for operation at an internal pressure of 0.1 MPa to 1 MPa;
- c. Constructed of either:
  1. Stainless steel of the Society of Automotive Engineers International (SAE) 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 hydrogen (H<sub>2</sub>)- compatible between 15 K (-258°C) and 35 K (-238 °C);
- d. With internal diameters of 30 cm or greater and the active height of packing material in a packed-type column, or the active height of internal contactor plates in a plate-type column of 4 m or greater.

#### **1B230**

**Pumps capable of circulating solutions of concentrated or dilute potassium amide catalyst in liquid ammonia (KNH<sub>2</sub>/NH<sub>3</sub>), having all of the following characteristics:**

- a. Airtight (i.e., hermetically sealed);
- b. A capacity greater than 8.5 m<sup>3</sup>/h; and
- c. Either of the following characteristics:
  1. For concentrated potassium amide solutions (1% or greater), an operating pressure of 1.5 MPa to 60 MPa; or
  2. For dilute potassium amide solutions (less than 1%), an operating pressure of 20 MPa to 60 MPa.

#### **1B231**

**Tritium facilities or plants, and equipment therefor, as follows:**

- a. Facilities or plants for the production, recovery, extraction, concentration, or handling of tritium;
- b. Equipment for tritium facilities or plants, as follows:
  1. Hydrogen or helium refrigeration units capable of cooling to 23 K (- 250°C) or less, with heat removal capacity greater than 150 W;
  2. Hydrogen isotope storage or purification systems using metal hydrides as the storage or purification medium.

#### **1B232**

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

- a. Designed for operation with an outlet temperature of 35 K (-238°C) or less; and
- b. Designed for a throughput of hydrogen gas of 1000 kg/h or greater.

**1B233**

**Lithium isotope separation facilities or plants, and 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 components therefor;
- d. Chemical exchange systems (employing crown ethers, cryptands, or lariat ethers), specially designed for lithium isotope separation, and specially designed components therefor.

**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 trinitrotoluene (TNT) or greater; and
- b. Having design elements or features enabling real time or delayed transfer of diagnostic or measurement information.

**1B235**

**Target assemblies and components for the production of tritium as follows:**

- a. Target assemblies made of or containing lithium enriched in the lithium-6 isotope specially designed for the production of tritium through irradiation, including insertion in a nuclear reactor;
- b. Components specially designed for the target assemblies specified in 1B235(a).

*1C Materials*

**1C001**

**Materials specially designed for absorbing electromagnetic radiation, or intrinsically conductive polymers, as follows:**

- a. Materials for absorbing frequencies exceeding  $2 \times 10^8$  Hz but less than  $3 \times 10^{12}$  Hz;
- b. Hair type absorbers, constructed of natural or synthetic fibers, with non-magnetic loading to provide absorption;
- c. Absorbers having no magnetic loss and whose incident surface is non-planar in shape, including pyramids, cones, wedges and convoluted surfaces;
- d. Planar absorbers, having all of the following:
  1. Made from any of the following:
    - a. Plastic foam materials (flexible or non-flexible) with carbon-loading, or organic materials, including binders, providing more than 5% echo compared with metal over a bandwidth exceeding  $\pm 15\%$  of the center frequency of the incident energy, and not capable of withstanding temperatures exceeding 450 K (177°C);
    - b. Ceramic materials providing more than 20% echo compared with metal over a bandwidth exceeding  $\pm 15\%$  of the center frequency of the incident energy, and not capable of withstanding temperatures exceeding 800 K (527°C).
    - c. Tensile strength less than  $7 \times 10^6$  N/m<sup>2</sup>; or
    - d. Compressive strength less than  $14 \times 10^6$  N/m<sup>2</sup>;
- e. Materials not transparent to visible light and specially designed for absorbing near-infrared radiation having a wavelength exceeding 810 nm but less than 2,000 nm (frequencies exceeding 150 THz but less than 370 THz);
- f. Intrinsically conductive polymeric materials with a 'bulk electrical conductivity' exceeding 10 000 S/m (Siemens per meter) or a 'sheet (surface) resistivity' of less than 100 ohms/square, based on any of the following polymers:
  1. Polyaniline;
  2. Polypyrrole;

3. Polythiophene;
4. Poly phenylene-vinylene; or
5. Poly thienylene-vinylene.

**1C002**

**Metal alloys, metal alloy powder and alloyed materials, as follows:**

1. Those containing a higher percentage by weight of the stated metal than of any other element.
2. 'Stress-rupture life' should be measured in accordance with ASTM standard E- 139 or national equivalents.
3. 'Low cycle fatigue life' should be measured in accordance with ASTM Standard E-606 'Recommended Practice for Constant-Amplitude Low-Cycle Fatigue Testing' or national equivalents. Testing should be axial with an average stress ratio equal to 1 and a stress- concentration factor (Kt) equal to 1. The average stress is defined as maximum stress minus minimum stress divided by maximum stress.
4. Aluminides, as follows:
  1. Nickel aluminides containing a minimum of 15% by weight aluminium, a maximum of 38% by weight aluminium and at least one additional alloying element;
  2. Titanium aluminides containing 10% by weight or more aluminium and at least one additional alloying element;
5. Metal alloys, as follows, made from the powder or particulate material specified in 1C0029c)
6. Nickel alloys having any of the following:
  - a. A 'stress-rupture life' of 10, 000 hours or longer at 923 K (650°C) at a stress of 676 MPa; or
  - b. A 'low cycle fatigue life' of 10,000 cycles or more at 823 K (550°C) at a maximum stress of 1 ,095 MPa;
7. Niniobium alloys having any of the following:
  - a. A 'stress-rupture life' of 10,000 hours or longer at 1 073 K (800°C) at a stress of 400 MPa; or
  - b. A 'low cycle fatigue life' of 10 000 cycles or more at 973 K (700°C) at a maximum stress of 700 MPa;

8. Titanium alloys having any of the following:
  - a. A 'stress-rupture life' of 10 000 hours or longer at 723 K (450°C) at a stress of 200 MPa; or
  - b. A 'low cycle fatigue life' of 10 000 cycles or more at 723 K (450°C) at a maximum stress of 400 MPa;
9. Aluminium alloys having any of the following:
  - i. A tensile strength of 240 MPa or more at 473 K (200°C); or
  - ii. A tensile strength of 415 MPa or more at 298 K (25°C);
10. Magnesium alloys having all of the following:
  - a. A tensile strength of 345 MPa or more; and
  - b. A corrosion rate of less than 1 mm/year in 3% sodium chloride aqueous solution measured in accordance with ASTM standard G-31 or national equivalents;
11. Metal alloy powder or particulate material, having all of the following:
  - a. Made from any of the following composition systems:
    - i. Nickel alloys (Ni-Al-X, Ni-X-Al) qualified for turbine engine parts or components, i.e. with less than 3 non-metallic particles (introduced during the manufacturing process) larger than 100 µm in 109 alloy particles;
    - ii. Niobium alloys (Nb-Al-X or Nb-X-Al, Nb-Si-X or Nb-X-Si, Nb-Ti-X or Nb-X-Ti);
    - iii. Titanium alloys (Ti-Al-X or Ti-X-Al);
    - iv. Aluminium alloys (Al-Mg-X or Al-X-Mg, Al-Zn-X or Al-X-Zn, Al-Fe-X or Al-X-Fe); or
    - v. Magnesium alloys (Mg-Al-X or Mg-X-Al);
  - b. Made in a controlled environment by any of the following processes:
    - i. 'Vacuum atomization';
    - ii. 'Gas atomization';
    - iii. 'Rotary atomization';
    - iv. 'Splat quenching';

- v. 'Melt spinning' and 'comminution';
  - vi. 'Melt extraction' and 'comminution';
  - vii. 'Mechanical alloying'; or
  - viii. 'Plasma atomization'; and
- c. Capable of forming materials specified in 1C002.(a.) or 1C002.(b.);

12. Alloyed materials having all of the following:

- a. Made from any of the composition systems specified in 1C002.c.1.;
- b. Nin the form of uncomminuted flakes, ribbons or thin rods; and
- c. Produced in a controlled environment by any of the following:
  - i. 'Splat quenching';
  - ii. 'Melt spinning'; or
  - iii. 'Melt extraction'.

### 1C003

**Magnetic metals, of all types and of whatever form, having any of the following:**

- a. Initial relative permeability of 120,000 or more and a thickness of 0.05 mm or less performed on fully annealed materials;
- b. Magnetostrictive alloys having any of the following:
  - 1. A saturation magnetostriction of more than  $5 \times 10^{-4}$ ; or
  - 2. A magnetomechanical coupling factor (k) of more than 0.8; or
- c. Amorphous or 'nanocrystalline' alloy strips, having all of the following:
  - 1. A composition having a minimum of 75% by weight of iron, cobalt or nickel;
  - 2. A crystal grain size of 50 nm or less, as determined by X-ray diffraction;
  - 3. A saturation magnetic induction (Bs) of 1.6 T or more; and
  - 4. Any of the following:

- a. A strip thickness of 0.02 mm or less; or
- b. An electrical resistivity of  $2 \times 10^{-4}$  ohm cm or more.

**1C004**

**Uranium titanium alloys or tungsten alloys with a "matrix" based on iron, nickel or copper, having all of the following:**

- a. A density exceeding  $17.5 \text{ g/cm}^3$ ;
- b. An elastic limit exceeding 880 MPa;
- c. An ultimate tensile strength exceeding 1 270 MPa; and
- d. An elongation exceeding 8%.

**1C005**

**"Superconductive" "composite" conductors in lengths exceeding 100 m or with a mass exceeding 100 g, as follows:**

- a. "Superconductive" "composite" conductors containing one or more niobium-titanium, wire, cylinder, film, tape or ribbon form 'filaments', having all of the following—
  1. Embedded in a "matrix" other than a copper or copper-based mixed "matrix"; and
  2. Having a cross-section area less than  $0.28 \times 10^{-4} \text{ mm}^2$  ( $6 \mu\text{m}$  in diameter for circular 'filaments');
- b. "Superconductive" "composite" conductors consisting of one or more "superconductive" 'filaments' other than niobium-titanium, having all of the following:
  1. A "critical temperature" at zero magnetic induction exceeding 9.85 K ( $-263.31^\circ\text{C}$ ); and
  2. Remaining in the "superconductive" state at a temperature of 4.2 K ( $-268.96^\circ\text{C}$ ) when exposed to a magnetic field oriented in any direction perpendicular to the longitudinal axis of conductor and corresponding to a magnetic induction of 12 T with critical current density exceeding  $1,750 \text{ A/mm}^2$  on overall cross-section of the conductor;
- c. "Superconductive" "composite" conductors consisting of one or more "superconductive" 'filaments' which remain "superconductive" above 115 K ( $-158.16^\circ\text{C}$ ).

**1C006****Fluids and lubricating materials, as follows:**

- a. Lubricating materials containing, as their principal ingredients, phenylene or alkylphenylene ethers or thio-ethers, or their mixtures, containing more than two ether or thio-ether functions or mixtures thereof;
- b. Damping or flotation fluids having all of the following:
  1. Purity exceeding 99.8%;
  2. Containing less than 25 particles of 200  $\mu\text{m}$  or larger in size per 100 ml; and
  3. Made from at least 85% of any of the following:
    - a. Dibromotetrafluoroethane (CAS 25497-30-7, 124-73-2, 27336-23-8);
    - b. Polychlorotrifluoroethylene (oily and waxy modifications only); or
    - c. Polybromotrifluoroethylene;
- c. Fluorocarbon electronic cooling fluids having all of the following:
  1. Containing 85% by weight or more of any of the following, or mixtures thereof:
    - a. A monomeric form of perfluoropolyalkylether-triazines or perfluoroaliphatic-ethers; perfluoroaliphatic-ethers;
    - b. Perfluoroalkylamines;
    - c. Perfluorocycloalkanes; or
    - d. Perfluoroalkanes;
  2. Density at 298 K (25°C) of 1.5 g/ml or more;
  3. In a liquid state at 273 K (0°C); and
  4. Containing 60% or more by weight of fluorine.

**1C007**

Ceramic powders, special purpose polymeric or metallo-organic materials used for the "production" of silicon carbide, silicon nitride, or ceramics with silicon, carbon and nitrogen. And special purpose polymeric or metallo-organic materials used for the "production" of

silicon carbide, silicon nitride, or ceramics with silicon, carbon and nitrogen., as follows: —

- a. Ceramic powders of titanium diboride (TiB<sub>2</sub>) (CAS 12045-63-5) having total metallic impurities, excluding intentional additions, of less than 5 000 ppm, an average particle size equal to or less than 5 µm and no more than 10% of the particles larger than 10 µm;
- b. Ceramic-"matrix" "composite" materials as follows:
  1. Ceramic-ceramic "composite" materials with a glass or oxide-"matrix" and reinforced with any of the following:
    - a. Continuous fibers made from any of the following materials:
      - a. Al<sub>2</sub>O<sub>3</sub> (CAS 1344-28-1); or
      - b. Si-C-N; or
    - b. Fibers made from any of the following materials:
      - a. Si-N;
      - b. Si-C;
      - c. Si-Al-O-N; or
      - d. Si-O-N; and
    - c. Having a "specific tensile strength" exceeding 12.7 x 10<sup>3</sup>m;
  2. Ceramic "matrix" "composite" materials, with a "matrix" formed of carbides or nitrides of silicon, zirconium or boron;
- c. Precursor materials' specially designed for the "production" of materials specified in 1C007.c., as follows:
  1. Polydiorganosilanes;
  2. Polysilazanes;
  3. Polycarbosilazanes.

#### 1C008

Non-fluorinated polymeric substances as follows:

- a. Imides as follows:
  1. Bismaleimides;

2. Aromatic polyamide-imides (PAI) having a 'glass transition temperature (T<sub>g</sub>)' exceeding 563 K (290°C);
  3. Aromatic polyimides having a 'glass transition temperature (T<sub>g</sub>)' exceeding 505 K (232°C);
  4. Aromatic polyetherimides having a 'glass transition temperature (T<sub>g</sub>)' exceeding 563 K (290°C);
- b. Polyarylene ketones;
  - c. Polyarylene sulphides, where the arylene group is biphenylene, triphenylene or combinations thereof;
  - d. Polybiphenylenethersulphone having a 'glass transition temperature (T<sub>g</sub>)' exceeding 563 K (290°C).

**1C009****Unprocessed fluorinated compounds as follows:**

- a. Fluorinated polyimides containing 10% by weight or more of combined fluorine;
- b. Fluorinated phosphazene elastomers containing 30% by weight or more of combined fluorine.

**1C010****"Fibrous or filamentary materials", as follows:**

- a. Organic "fibrous or filamentary materials", having all of the following:
  1. "Specific modulus" exceeding 12.7 x 10<sup>6</sup> m; and
  2. "Specific tensile strength" exceeding 23.5 x 10<sup>4</sup> m;
- b. Carbon "fibrous or filamentary materials", having all of the following:
  1. "Specific modulus" exceeding 14.65 x 10<sup>6</sup> m; and
  2. "Specific tensile strength" exceeding 26.82 x 10<sup>4</sup> m;
- c. Inorganic "fibrous or filamentary materials", having all of the following:
  1. "Specific modulus" exceeding 2.54 x 10<sup>6</sup> m; and
  2. Melting, softening, decomposition or sublimation point exceeding 1,922 K (1,649°C) in an inert environment;
- d. "Fibrous or filamentary materials", having any of the following:

1. Composed of any of the following:
  - a. Polyetherimides specified in 1C008(a);
  - b. Materials specified in 1C008(d) to 1C008(f); or
2. Composed of materials specified in 1C010(d)1.a. or 1C010.d.1.b. and 'commingled' with other fibers specified in 1C010.a., 1C010.b. or 1C010.c.;
- e. Fully or partially resin-impregnated or pitch-impregnated "fibrous or filamentary materials" (prepregs), metal or carbon-coated "fibrous or filamentary materials" (preforms) or 'carbon fiber preforms', having all of the following:
  1. Having any of the following:
    - a. Inorganic "fibrous or filamentary materials" specified in 1C010(c); or
    - b. Organic or carbon "fibrous or filamentary materials", having all of the following:
      1. "Specific modulus" exceeding  $10.15 \times 10^6$  m;
      2. "Specific tensile strength" exceeding  $17.7 \times 10^4$  m; and
  2. Having any of the following:
    - a. Resin or pitch, specified in 1C008 or 1C009(b);
    - b. 'Dynamic Mechanical Analysis glass transition temperature (DMA Tg)' equal to or exceeding 453 K (180°C) and having a phenolic resin; or
    - c. Dynamic Mechanical Analysis glass transition temperature (DMA Tg)' equal to or exceeding 505 K (232°C) and having a resin or pitch, not specified in 1C008 or 1C009.b., and not being a phenolic resin;

#### **1C011**

##### **Metals and compounds, as follows:**

- a. Metals in particle sizes of less than 60  $\mu\text{m}$  whether spherical, atomised, spheroidal, flaked or ground, manufactured from material consisting of 99% or more of zirconium, magnesium and alloys thereof;

- b. Boron or boron alloys whether or not the metals or alloys are encapsulated in aluminium, magnesium, zirconium or beryllium, with a particle size of 60  $\mu\text{m}$  or less, as follows:—
  1. Boron with a purity of 85% by weight or more;
  2. Boron alloys with a boron content of 85% by weight or more;
- c. Guanidine nitrate (CAS 506-93-4);
- d. Nitroguanidine (NQ) (CAS 556-88-7);
- e. Iodine pentafluoride (CAS 7783-66-6).

**1C012****Materials as follows:**

- a. Plutonium in any form with a plutonium isotopic assay of plutonium-238 of more than 50% by weight;
- b. "Previously separated" neptunium-237 in any form.

**1C101**

**Materials and devices for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures, other than those specified in 1C001, usable in 'missiles', "missile" subsystems or unmanned aerial vehicles specified in 9A012 or 9A112(a) including:**

- 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.

**1C102**

**Resaturated pyrolyzed carbon-carbon materials designed for space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.**

**1C107**

**Graphite and ceramic materials, other than those specified in 1C007, as follows: —**

- a. Fine grain graphites with a bulk density of 1.72  $\text{g/cm}^3$  or greater, measured at 288 K (15°C), and having a grain size of 100  $\mu\text{m}$  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; or
  3. Blocks having a size of 120 mm x 120 mm x 50 mm or greater;
- b. Pyrolytic or fibrous reinforced graphites, usable for rocket nozzles and reentry vehicle nose tips usable in "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104;
  - c. Ceramic composite materials (dielectric constant less than 6 at any frequency from 100 MHz to 100 GHz) for use in radomes usable in "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104;
  - d. Bulk machinable silicon-carbide reinforced unfired ceramic, usable for nose tips usable in "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104;
  - e. Reinforced silicon-carbide ceramic composites, usable for nose tips, reentry vehicles and nozzle flaps usable in "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.
  - f. Bulk machinable ceramic composite materials consisting of an 'Ultra High Temperature Ceramic (UHTC)' matrix with a melting point equal to or greater than 3,000°C and reinforced with fibers or filaments, usable for missile components (such as nose-tips, re-entry vehicles, leading edges, jet vanes, control surfaces or rocket motor throat inserts) in "missiles", space launch vehicles specified in 9A004, sounding rockets specified in 9A104 or 'missiles'.

### **1C111**

**Propellants and constituent chemicals for propellants, other than those specified in 1C011, as follows:**

- a. Propulsive substances:
  1. Spherical or spheroidal aluminium powder other than that specified in the Military Goods Controls, 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  $\mu\text{m}$ , according to SO 2591-1:1988 or national equivalents;

2. Metal powders, other than that specified in the Military Goods Controls, as follows:
  - a. Metal powders of zirconium, beryllium or magnesium, or alloys of these metals, if at least 90% of the total particles by particle volume or weight are made up of particles of less than 60  $\mu\text{m}$  (determined by measurement techniques such as using a sieve, laser diffraction or optical scanning), whether spherical, atomized, spheroidal, flaked or ground, consisting 97% by weight or more of any of the following:
    1. Zirconium;
    2. Beryllium; or
    3. Magnesium;
  - b. Metal powders of either boron 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  $\mu\text{m}$  (determined by measurement techniques such as using a sieve, laser diffraction or optical scanning), whether spherical, atomized, spheroidal, flaked or ground;
3. Oxidizer substances usable in liquid propellant rocket engines as follows:—
  - a. Dinitrogen trioxide (CAS 10544-73-7);
  - b. Nitrogen dioxide (CAS 10102-44-0)/dinitrogen tetroxide (CAS 0544- 72-6);
  - c. Dinitrogen pentoxide (CAS 10102-03-1);
  - d. Mixed Oxides of Nitrogen (MON);
4. Hydrazine derivatives as follows:
  - a. Trimethylhydrazine (CAS 1741-01-1);
  - b. Tetramethylhydrazine (CAS 6415-12-9);
  - c. N,N-Diallylhydrazine (CAS 5164-11-4);

- d. Allylhydrazine (CAS 7422-78-8);
  - e. Ethylene dihydrazine (CAS 6068-98-0);
  - f. Monomethylhydrazine dinitrate;
  - g. Unsymmetrical dimethylhydrazine nitrate;
  - h. Hydrazinium azide (CAS 14546-44-2);
  - i. 1,1-Dimethylhydrazinium azide (CAS 227955-52-4) / 1,2- / Dimethylhydrazinium azide (CAS 299177-50-7);
  - j. Hydrazinium dinitrate (CAS 13464-98-7);
  - k. Diimido oxalic acid dihydrazine (CAS 3457-37-2);
  - l. 2-hydroxyethylhydrazine nitrate (HEHN);
  - m. See Military Goods Controls for Hydrazinium perchlorate;
  - n. Hydrazinium diperchlorate (CAS 13812-39-0);
  - o. Methylhydrazine nitrate (MHN) (CAS 29674-96-2);
  - p. 1,1-Diethylhydrazine nitrate (DEHN) / 1,2-Diethylhydrazine nitrate (DEHN) (CAS 363453-17-2)
  - q. 3,6-Dihydrazino tetrazine nitrate (1,4-dihydrazine nitrate) (DHTN);
5. High energy density materials, other than that specified in the Military Goods Controls, usable in 'missiles' or unmanned aerial vehicles specified in 9A012 or 9A112(a)
    - a. Mixed fuel that incorporate both solid and liquid fuels, such as boron slurry, having a mass-based energy density of  $40 \times 10^6$  U/kg or greater;
    - b. Other high energy density fuels and fuel additives (e.g., cubane, ionic solutions, UP-10) having a volume-based energy density of  $37.5 \times 10^9$  U/m<sup>3</sup> or greater, measured at 20°C and one atmosphere (101,325 kPa) pressure;
  6. Hydrazine replacement fuels as follows
    - a. 2-Dimethylaminoethylazide (DMAZ) (CAS 86147-04-8);

b. Polymeric substances:

1. Carboxy-terminated polybutadiene (including carboxyl-terminated polybutadiene) (CTPB);
2. Hydroxy-terminated polybutadiene (including hydroxyl-terminated polybutadiene) (HTPB) (CAS 69102-90-5), other than that specified in the Military Goods Controls;
3. Polybutadiene-acrylic acid (PBAA);
4. Polybutadiene-acrylic acid-acrylonitrile (PBAN) (CAS 25265-19-4 / CAS 68891-50-9);
5. Polytetrahydrofuran polyethylene glycol (TPEG);
6. Polyglycidyl nitrate (PGN or poly-GLYN) (CAS 27814-48-8);

c. Other propellant additives and agents:

1. SEE MILITARY GOODS CONTROLS FOR Carboranes, decaboranes, pentaboranes and derivatives thereof
2. Glycol dinitrate (TEGDN) (CAS 111-22-8);
3. 2-Nitrodiphenylamine (CAS 119-75-5);
4. Trimethyloethane trinitrate (TMETN) (CAS 3032-55-1);
5. Diethylene glycol dinitrate (DEGDN) (CAS 693-21-0);
6. Ferrocene derivatives as follows:
  - a. SEE MILITARY GOODS CONTROLS FOR catocene (CAS 37206-42-1);
  - b. SEE MILITARY GOODS CONTROLS FOR Ethyl ferrocene (CAS 1273-89-8);
  - c. SEE MILITARY GOODS CONTROLS FOR n-Propyl ferrocene (CAS 1273-92-3)/iso-propyl ferrocene (CAS 12126-81-7);
  - d. SEE MILITARY GOODS CONTROLS FOR n-butyl ferrocene (CAS 31904-29-7);
  - e. SEE MILITARY GOODS CONTROLS FOR Pentyl ferrocene (CAS 1274-00-6);
  - f. SEE MILITARY GOODS CONTROLS FOR Dicyclopentyl ferrocene (CAS 125861-17-8);

- g. SEE MILITARY GOODS CONTROLS FOR Dicyclohexyl ferrocene;
  - h. SEE MILITARY GOODS CONTROLS FOR Diethyl ferrocene (CAS 1273-97-8);
  - i. SEE MILITARY GOODS CONTROLS FOR Dipropyl ferrocene;
  - j. SEE MILITARY GOODS CONTROLS FOR Dibutyl ferrocene (CAS 1274-08-4);
  - k. SEE MILITARY GOODS CONTROLS FOR Dihexyl ferrocene (CAS 93894-59-8);
  - l. SEE MILITARY GOODS CONTROLS FOR Acetyl ferrocene (CAS 1271-55-2) / 1,1'-diacetyl ferrocene (CAS 1273-94-5);
  - m. SEE MILITARY GOODS CONTROLS FOR Ferrocene carboxylic acid (CAS 1271-42-7) / 1,1'-Ferrocenedicarboxylic acid (CAS 1293-87-4);
  - n. SEE MILITARY GOODS CONTROLS FOR butacene (CAS 125856-62-4);
  - o. Other ferrocene derivatives usable as rocket propellant burning rate modifiers, other than those specified in the Military Goods Controls.
7. Diazidomethyl-2-methyl-1,2,3-triazole (iso-DAMTR); other than that specified in the Military Goods Controls.
- d. 'Gel propellants', other than that specified in the Military Goods Controls, specifically formulated for use in 'missiles'.

**1C116**

**Maraging steels, useable in 'missiles', having all of the following:**

- a. Having an ultimate tensile strength, measured at 293 K (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 5.0 mm;

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.

**1C117****Materials for the fabrication of 'missiles' components as follows:**

- a. Tungsten and alloys in particulate form with a tungsten content of 97% by weight or more and a particle size of  $50 \times 10^{-6}$  m (50  $\mu$ m) or less;
- b. Molybdenum and alloys in particulate form with a molybdenum content of 97% by weight or more and a particle size of  $50 \times 10^{-6}$  m (50  $\mu$ m) or less;
- c. Tungsten materials in 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
  2. 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 by 120 mm by 50 mm or greater.

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

- a. Having all of the following characteristics:
  1. Containing 17.0 – 23.0% by weight of chromium and 4.5 – 7.0% by weight of nickel;
  2. Having a titanium content of greater than 0.10% by weight; and

3. A ferritic-austenitic microstructure (also referred to as a two-phase microstructure) of which at least 10% by volume (according to ASTM E-1181-87 or national equivalents) is austenite; 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, other than those specified in 1C002(b)3. or(b)4., as follows:**

- a. Aluminium alloys before or after heat treatment, 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 before or after heat treatment, 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.

#### 1C210

**'Fibrous or filamentary materials' or preregs, other than those specified in 1C010(a), (b) or (e), 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  $23.5 \times 10^4$  m or greater;
- 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  $7.62 \times 10^4$  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.

**1C216**

**Maraging steel, other than that specified in 1C116, 'capable of' an ultimate tensile strength of 1,950 MPa or more, at 293 K (20°C).**

**1C225**

**Boron enriched in the Bboron-10 (10B) isotope to greater than its natural isotopic abundance, such as elemental boron, compounds, mixtures containing boron, manufactures thereof, waste or scrap of any of the foregoing.**

**1C226**

**Tungsten, tungsten carbide, and alloys containing more than 90% tungsten by weight, other than that specified in 1C117, 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.

**1C227**

**Calcium having both of the following characteristics:**

- a. Containing less than 1 000 ppm by weight of metallic impurities other than magnesium; and
- b. Containing less than 10 ppm by weight of boron.

**1C228**

**Magnesium having both of the following characteristics:**

- a. Containing less than 200 ppm by weight of metallic impurities other than calcium; and
- b. Containing less than 10 ppm 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 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.**

**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 (<sup>3</sup>He), mixtures containing helium-3, and products or devices containing any of the foregoing.**

**1C233**

**Lithium enriched in the lithium-6 (<sup>6</sup>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.**

**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, other than those specified in 0A001(f).**

**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.**

**1C236**

**'Radionuclides' appropriate for making neutron sources based on alpha-n reaction, other than those specified in 0C001 and 1C012.a., 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.

**1C237**

**Radium-226 (226Ra), radium-226 alloys, radium-226 compounds, mixtures containing radium-226, manufactures thereof, and products or devices containing any of the foregoing.**

**1C238**

**Chlorine trifluoride (ClF<sub>3</sub>).**

**1C239**

**High explosives, other than those specified in the Military Goods Controls, or substances or mixtures containing more than 2% by weight thereof, with a crystal density greater than 1.8 g/cm<sup>3</sup> and having a detonation velocity greater than 8,000 m/s.**

**1C240**

**Nickel powder and porous nickel metal, other than those specified in 0C005, 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 μm measured by American Society for Testing and Materials (ASTM) B330 standard;
- b. Porous nickel metal produced from materials specified in 1C240(a).

**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, other than those specified in 1C226, 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.

**1C350**

**Chemicals, which may be used as precursors for toxic chemical agents, as follows, and “chemical mixtures” containing one or more thereof:**

1. Thiodiglycol (CAS 111-48-8);
2. Phosphorus oxychloride (CAS 10025-87-3);
3. Dimethyl methylphosphonate (CAS 756-79-6);
4. Methyl phosphonyl difluoride (CAS 676-99-3);
5. Methyl phosphonyl dichloride (CAS 676-97-1);
6. Dimethyl phosphite (DMP) (CAS 868-85-9);
7. Phosphorus trichloride (CAS 7719-12-2);
8. Trimethyl phosphite (TMP) (CAS 121-45-9);
9. Thionyl chloride (CAS 7719-09-7);
10. 3-Hydroxy-1-methylpiperidine (CAS 3554-74-3);
11. N,N-Diisopropyl-(beta)-aminoethyl chloride (CAS 96-79-7);
12. N,N-Diisopropyl-(beta)-aminoethane thiol (CAS 5842-07-9);
13. 3-Quinuclidinol (CAS 1619-34-7);
14. Potassium fluoride (CAS 7789-23-3);
15. 2-Chloroethanol (CAS 107-07-3);
16. Dimethylamine (CAS 124-40-3);
17. Diethyl ethylphosphonate (CAS 78-38-6);
18. Diethyl N,N-dimethylphosphoramidate (CAS 2404-03-7);
19. Diethyl phosphite (CAS 762-04-9);
20. Dimethylamine hydrochloride (CAS 506-59-2);
21. Ethyl phosphinyl dichloride (CAS 1498-40-4);
22. Ethyl phosphonyl dichloride (CAS 1066-50-8);
23. Ethyl phosphonyl difluoride (CAS 753-98-0);
24. Hydrogen fluoride (CAS 7664-39-3);
25. Methyl benzilate (CAS 76-89-1);
26. Methyl phosphinyl dichloride (CAS 676-83-5);

27. N,N-Diisopropyl-(beta)-amino ethanol (CAS 96-80-0);
28. Pinacolyl alcohol (CAS 464-07-3);
29. O-Ethyl O-2-diisopropylaminoethyl methylphosphonite (QL) (CAS 57856-11-8);
30. Triethyl phosphite (CAS 122-52-1);
31. Arsenic trichloride (CAS 7784-34-1);
32. Benzilic acid (CAS 76-93-7);
33. Diethyl methylphosphonite (CAS 15715-41-0);
34. Dimethyl ethylphosphonate (CAS 6163-75-3);
35. Ethyl phosphinyl difluoride (CAS 430-78-4);
36. Methyl phosphinyl difluoride (CAS 753-59-3);
37. 3-Quinuclidone (CAS 3731-38-2);
38. Phosphorus pentachloride (CAS 10026-13-8);
39. Pinacolone (CAS 75-97-8);
40. Potassium cyanide (CAS 151-50-8);
41. Potassium bifluoride (CAS 7789-29-9);
42. Ammonium hydrogen fluoride or ammonium bifluoride (CAS 1341-49-7);
43. Sodium fluoride (CAS 7681-49-4);
44. Sodium bifluoride (CAS 1333-83-1);
45. Sodium cyanide (CAS 143-33-9);
46. Triethanolamine (CAS 102-71-6);
47. Phosphorus pentasulphide (CAS 1314-80-3)
48. Di-isopropylamine (CAS 108-18-9);
49. Diethylaminoethanol (CAS 100-37-8);
50. Sodium sulphide (CAS 1313-82-2);
51. Sulphur monochloride (CAS 10025-67-9);
52. Sulphur dichloride (CAS 10545-99-0);
53. Triethanolamine hydrochloride (CAS 637-39-8);
54. N,N-Diisopropyl-(beta)-aminoethyl chloride hydrochloride (CAS 4261-68-1);

55. Methylphosphonic acid (CAS 993-13-5);
56. Diethyl methylphosphonate (CAS 683-08-9);
57. N,N-Dimethylaminophosphoryl dichloride (CAS 677-43-0);
58. Triisopropyl phosphite (CAS 116-17-6);
59. Ethyldiethanolamine (CAS 139-87-7);
60. O,O-Diethyl phosphorothioate (CAS 2465-65-8);
61. O,O-Diethyl phosphorodithioate (CAS 298-06-6);
62. Sodium hexafluorosilicate (CAS 16893-85-9);
63. Methylphosphonothioic dichloride (CAS 676-98-2);
64. Diethylamine (CAS 109-89-7);
65. N,N-Diisopropylaminoethanethiol hydrochloride (CAS 41480-75-5);
66. Methyl dichlorophosphate (CAS 677-24-7);
67. Ethyl dichlorophosphate (CAS 1498-51-7);
68. Methyl difluorophosphate (CAS 22382-13-4);
69. Ethyl difluorophosphate (CAS 460-52-6);
70. Diethyl chlorophosphite (CAS 589-57-1);
71. Methyl chlorofluorophosphate (CAS 754-01-8);
72. Ethyl chlorofluorophosphate (CAS 762-77-6);
73. N,N-Dimethylformamidine (CAS 44205-42-7);
74. N,N-Diethylformamidine (CAS 90324-67-7);
75. N,N-Dipropylformamidine (CAS 48044-20-8);
76. N,N-Diisopropylformamidine (CAS 857522-08-8);
77. N,N-Dimethylacetamidine (CAS 2909-14-0);
78. N,N-Diethylacetamidine (CAS 14277-06-6);
79. N,N-Dipropylacetamidine (CAS 1339586-99-0);
80. N,N-Dimethylpropanamidine (CAS 56776-14-8);
81. N,N-Diethylpropanamidine (CAS 84764-73-8);
82. N,N-Dipropylpropanamidine (CAS 1341496-89-6);
83. N,N-Dimethylbutanamidine (CAS 1340437-35-5);

84. N,N-Diethylbutanamidine (CAS 53510-30-8);
85. N,N-Dipropylbutanamidine (CAS 1342422-35-8);
86. N,N-Diisopropylbutanamidine (CAS 1315467-17-4);
87. N,N-Dimethylisobutanamidine (CAS 321881-25-8);
88. N,N-Diethylisobutanamidine (CAS 1342789-47-2);
89. N,N-Dipropylisobutanamidine (CAS 1342700-45-1);
90. Dipropylamine (CAS 142-84-7);

**1C351****Human and animal pathogens 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. African horse sickness virus;
  2. African swine fever virus;
  3. Andes virus;
  4. Avian influenza virus, which are:
    - a. Un-characterised; or
    - b. Defined in Annex (2) EC Directive 2005/94/EC (O.U. L.10 14.1.2006 p.16) as having high pathogenicity, as follows—
      1. Type A viruses with an VP (intravenous pathogenicity index) in 6-week-old chickens of greater than 1,2; or
      2. Type A viruses of the subtypes H5 or H7 with genome sequences codified for multiple basic amino acids at the cleavage site of the haemagglutinin molecule similar to that observed for other HPA viruses, indicating that the haemagglutinin molecule can be cleaved by a host ubiquitous protease;
  5. Bluetongue virus;
  6. Chapare virus;
  7. Chikungunya virus;

8. Choclo virus;
9. Crimean-Congo hemorrhagic fever virus;
10. Dobrava-Belgrade virus;
11. Eastern equine encephalitis virus;
12. Ebola virus: all members of the Ebolavirus genus;
13. Foot-and-mouth disease virus;
14. Goatpox virus;
15. Guanarito virus;
16. Hantaan virus;
17. Hendra virus (Equine morbillivirus);
18. Suid herpesvirus 1 (Pseudorabies virus; Aujeszky's disease);
19. Classical swine fever virus (Hog cholera virus);
20. Japanese encephalitis virus;
21. Junin virus;
22. Kyasanur Forest disease virus;
23. Laguna Negra virus;
24. Lassa virus;
25. Louping ill virus;
26. Lujo virus;
27. Lumpy skin disease virus;
28. Lymphocytic choriomeningitis virus;
29. Machupo virus;
30. Marburgvirus: all members of the Marburgvirus genus;
31. Monkeypox virus;
32. Murray Valley encephalitis virus;
33. Newcastle disease virus;
34. Nipah virus;
35. Omsk hemorrhagic fever virus;
36. Oropouche virus;

37. Peste-des-petits-ruminants virus;
  38. Swine vesicular disease virus;
  39. Powassan virus;
  40. Rabies virus and all other members of the Lyssavirus genus;
  41. Rift Valley fever virus;
  42. Rinderpest virus;
  43. Rocio virus;
  44. Sabia virus;
  45. Seoul virus;
  46. Sheeppox virus;
  47. Sin Nombre virus;
  48. St. Louis encephalitis virus;
  49. Porcine Teschovirus;
  50. Tick-borne encephalitis virus (Far Eastern subtype);
  51. Variola virus;
  52. Venezuelan equine encephalitis virus;
  53. Vesicular stomatitis virus;
  54. Western equine encephalitis virus;
  55. Yellow fever virus;
  56. Severe acute respiratory syndrome-related coronavirus (SARS-related coronavirus);
  57. Reconstructed 1918 influenza virus;
  58. Middle East respiratory syndrome-related coronavirus (MERS-related coronavirus);
- b. Bacteria, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows—
1. *Bacillus anthracis*;
  2. *Brucella abortus*;
  3. *Brucella melitensis*;

4. *Brucella suis*;
  5. *Burkholderia mallei* (*Pseudomonas mallei*);
  6. *Burkholderia pseudomallei* (*Pseudomonas pseudomallei*);
  7. *Chlamydia psittaci* (*Chlamydophila psittaci*);
  8. *Clostridium argentinense* (formerly known as *Clostridium botulinum* Type G), botulinum neurotoxin producing strains;
  9. *Clostridium baratii*, botulinum neurotoxin producing strains;
  10. *Clostridium botulinum*;
  11. *Clostridium butyricum*, botulinum neurotoxin producing strains;
  12. *Clostridium perfringens* epsilon toxin producing types;
  13. *Coxiella burnetii*;
  14. *Francisella tularensis*;
  15. *Mycoplasma capricolum* subspecies *capripneumoniae* (strain F38);
  16. *Mycoplasma mycoides* subspecies *mycoides* SC (small colony);
  17. *Rickettsia prowazekii*;
  18. *Salmonella enterica* subspecies *enterica* serovar Typhi (*Salmonella typhi*);
  19. Shiga toxin producing *Escherichia coli* (STEC) of serogroups 026, 045, 0103, 0104, 0111, 0121, 0145, 0157, and other shiga toxin producing serogroups
  20. *Shigella dysenteriae*;
  21. *Vibrio cholerae*;
  22. *Yersinia pestis*;
- c. "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. Conotoxins;

4. Ricin;
  5. Saxitoxin;
  6. Shiga toxins (shiga-like toxins, verotoxins and verocytotoxins)
  7. Staphylococcus aureus enterotoxins, hemolysin alpha toxin, and toxic shock syndrome toxin (formerly known as Staphylococcus enterotoxin F);
  8. Tetrodotoxin;
  9. Microcystins (Cyanginosins);
  10. Aflatoxins;
  11. Abrin;
  12. Diacetoxyscirpenol;
  13. T-2 toxin;
  14. HT-2 toxin;
  15. Modeccin;
  16. Volkensin;
  17. Viscumin (Viscum Album Lectin 1);
  18. Brevetoxins;
  19. Gonyautoxins;
  20. Nodularins;
  21. Palytoxin;
  22. Neosaxitoxin (NEO).
- d. Fungi, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material including living material which has been deliberately inoculated or contaminated with such cultures, as follows:
1. *Coccidioides immitis*;
  2. *Coccidioides posadasii*.

**1C353**

**'Genetic elements' and 'genetically-modified organisms', as follows:**

- a. Any 'genetically-modified organism' which contains, or 'genetic element' that codes for, any of the following:

1. Any gene or genes specific to any virus specified in 1C351(a) or 1C354(a);
2. Any gene or genes specific to bacterium specified in 1C351(c) or 1C354(b) or fungus specified in 1C351(e) or 1C354(c), and which is any of the following:
  - i. In itself or through its transcribed or translated products represents a significant hazard to human, animal or plant health; or
  - ii. Could 'endow or enhance pathogenicity'; or
3. Any "toxins" specified in 1C351(d) or "sub- units of toxins" therefor.

### 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. Andean potato latent virus (potato Andean latent tymovirus);
  2. Potato spindle tuber viroid;
- b. Bacteria, whether natural, enhanced or modified, either in the form of "isolated live cultures" or as material which has been deliberately inoculated or contaminated with such cultures, as follows:
  1. *Xanthomonas albilineans*;
  2. *Xanthomonas axonopodis* pv. *citri* (*Xanthomonas campestris* pv. *citri* A) [*Xanthomonas campestris* pv. *citri*];
  3. *Xanthomonas oryzae* pv. *oryzae* (*Pseudomonas campestris* pv. *oryzae*);
  4. *Clavibacter michiganensis* subsp. *sepedonicus* (*Corynebacterium michiganensis* subsp. *sepedonicum* or *Corynebacterium sepedonicum*);
  5. *Ralstonia solanacearum*, race 3, biovar 2;
- 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 kahawae* (*Colletotrichum coffeanum* var. *virulans*);
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 oryzae* (*Pyricularia oryzae*);
7. *Peronosclerospora philippinensis* (*Peronosclerospora sacchari*);
8. *Sclerophthora rayssiae* var. *zeae*;
9. *Synchytrium endobioticum*;
10. *Tilletia indica*;
11. *Thecaphora solani*.

#### 1C450

**Toxic chemicals and toxic chemical precursors, as follows, and “chemical mixtures” containing one or more thereof.**

a. Toxic chemicals, as follows:

1. Amiton: O,O-Diethyl S-[2-(diethylamino)ethyl] phosphorothiolate (CAS 78-53-5) and corresponding alkylated or protonated salts;
2. PF B: 1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene (CAS 382-21-8);
3. SEE MI LI TARY GOODS CONTROLS for BZ: 3-Quinuclidinyl benzilate (CAS 6581-06-2);
4. Phosgene: Carbonyl dichloride (CAS 75-44-5);
5. Cyanogen chloride (CAS 506-77-4);
6. Hydrogen cyanide (CAS 74-90-8);
7. Chloropicrin: Trichloronitromethane (CAS 76-06-2);

b. Toxic chemical precursors, as follows:

1. Chemicals, other than those specified in the Military Goods Controls or in 1C350, containing a phosphorus atom to

- which is bonded one methyl, ethyl or propyl (normal or iso) group but not further carbon atoms;
2. N,N-Dialkyl [methyl, ethyl or propyl (normal or iso)] phosphoramidic dihalides, other than N,N-Dimethylaminophosphoryl dichloride;
  3. Dialkyl [methyl, ethyl or propyl (normal or iso)] N,N-dialkyl [methyl, ethyl or propyl (normal or iso)]-phosphoramidates, other than Diethyl-N,N-dimethylphosphoramidate which is specified in 1C350;
  4. N,N-Dialkyl [methyl, ethyl or propyl (normal or iso)] aminoethyl-2- chlorides and corresponding protonated salts, other than N,N- Diisopropyl-(beta)-aminoethyl chloride or N,N-Diisopropyl-(beta)- aminoethyl chloride hydrochloride which are specified in 1C350;
  5. N,N-Dialkyl [methyl, ethyl or propyl (normal or iso)] aminoethane- 2-ols and corresponding protonated salts, other than N,N- Diisopropyl-(beta)-aminoethanol (CAS 96-80-0) and N,N- Diethylaminoethanol (CAS 100-37-8) which are specified in 1C350;
  6. N,N-Dialkyl [methyl, ethyl or propyl (normal or iso)] aminoethane- 2-thiols and corresponding protonated salts, other than N,N- Diisopropyl-(beta)-aminoethane thiol (CAS 5842-07-9) and N,N- Diisopropylaminoethanethiol hydrochloride (CAS 41480- 75-5) which are specified in 1C350;
  7. See 1C350 for ethyldiethanolamine (CAS 139-87-7);
  8. Methyldiethanolamine (CAS 105-59-9).

#### *1D Software*

##### **1D001**

“Software” specially designed or modified for the “development”, “production” or “use” of equipment specified in 1B001 to 1B003.

##### **1D002**

“Software” for the “development” of organic “matrix”, metal “matrix” or carbon “matrix” laminates or “composites”.1D003  
“Software” specially designed or modified to enable equipment to perform the functions of equipment specified in 1A004(c) or 1A004.d.

**1D101**

“Software” specially designed or modified for the operation or maintenance of goods specified in 1B101, 1B102, 1B115, 1B117, 1B118 or 1B119.

**1D103**

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

**1D201**

“Software” specially designed for the “use” of goods specified in 1B201.

*1E Technology***1E001**

“Technology” according to the General Technology Note for the “development” or “production” of equipment or materials specified in 1A002 to 1A005, 1A006(b), 1A007, 1B or 1C.

**1E002**

Other “technology” as follows:

- a. “Technology” for the “development” or “production” of polybenzothiazoles or polybenzoxazoles;
- b. “Technology” for the “development” or “production” of fluoroelastomer compounds containing at least one vinyl ether monomer;
- c. “Technology” for the design or “production” of the following ceramic powders or non- “composite” ceramic materials:
  1. Ceramic powders having all of the following:
    - a. Any of the following compositions:
      1. Single or complex oxides of zirconium and complex oxides of silicon or aluminium;
      2. Single nitrides of boron (cubic crystalline forms);
      3. Single or complex carbides of silicon or boron; or
      4. Single or complex nitrides of silicon;

- b. Any of the following total metallic impurities (excluding intentional additions):
  - 1. Less than 1,000 ppm for single oxides or carbides; or
  - 2. Less than 5,000 ppm for complex compounds or single nitrides; and
- c. Being any of the following:
  - 1. Zirconia (CAS 1314-23-4) with an average particle size equal to or less than 1  $\mu\text{m}$  and no more than 10% of the particles larger than 5  $\mu\text{m}$ ; or
  - 2. Other ceramic powders with an average particle size equal to or less than 5  $\mu\text{m}$  and no more than 10% of the particles larger than 10  $\mu\text{m}$ ;
- 2. Non-“composite” ceramic materials composed of the materials specified in 1E002(c)1.;
- d. “Technology” for the installation, maintenance or repair of materials specified in 1C001;
- e. “Technology” for the repair of “composite” structures, laminates or materials specified in 1A002 or 1C007.c.;
- f. “Libraries” specially designed or modified to enable equipment to perform the functions of equipment specified in 1A004(c) or 1A004(d).

**1E101**

“Technology” according to the General Technology Note for the “use” of goods specified in 1A102, 1B001, 1B101, 1B102, 1B115 to 1B119, 1C001, 1C101, 1C107, 1C111 to 1C118, 1D101 or 1D103.

**1E102**

“Technology” according to the General Technology Note for the “development” of “software” specified in 1D001, 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” for the “production” of pyrolytically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1 573 K (1,300°C) to 3 173 K (2,900°C) temperature range at pressures of 130 Pa to 20 kPa 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 1A002, 1A007, 1A202, 1A225 to 1A227, 1B201, 1B225 to 1B234, 1C002(b)3. or (b)4., 1C010.b., 1C202, 1C210, 1C216, 1C225 to 1C241 or 1D201.

**1E202**

“Technology” according to the General Technology Note for the “development” or “production” of goods specified in 1A007, 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, (excluding control balls with tolerances specified by the manufacturer in accordance with ISO 3290:2001 as grade G5 (or national equivalents)) as follows, and components therefor:**

1. Ball bearings and solid roller bearings, having all tolerances specified by the manufacturer in accordance with ISO 492 Tolerance Class 4 or Class 2 (or national equivalents), or better, and having both 'rings' and 'rolling elements', made from monel or beryllium;
2. Active magnetic bearing systems using any of the following:
  - a. Materials with flux densities of 2,0 T or greater and yield strengths greater than 414 MPa;
  - b. All-electromagnetic 3D homopolar bias designs for actuators; or
  - c. 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 of the following characteristics:**

1. An inner ring bore diameter between 12 mm and 50 mm;
2. An outer ring outside diameter between 25 mm and 100 mm; and
3. 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<sup>3</sup> and 8 000 cm<sup>3</sup>; and
  - 2) Made of or coated with any of the following materials, or combination of the following

materials, having an overall impurity level of 2% or less by weight:

- a) Calcium fluoride (CaF<sub>2</sub>);
  - b) Calcium zirconate (metazirconate) (CaZrO<sub>3</sub>);
  - c) Cerium sulphide (Ce<sub>2</sub>S<sub>3</sub>);
  - d) Erbium oxide (erbia) (Er<sub>2</sub>O<sub>3</sub>);
  - e) Hafnium oxide (hafnia) (HfO<sub>2</sub>);
  - f) Magnesium oxide (MgO);
  - g) Nitrided niobium-titanium-tungsten alloy (approximately 50% Nb, 30%Ti, 20% W);
  - h) Yttrium oxide (yttria) (Y<sub>2</sub>O<sub>3</sub>); or
  - i) Zirconium oxide (zirconia) (ZrO<sub>2</sub>);
- b. Crucibles having both of the following characteristics:
- 1) A volume of between 50 cm<sup>3</sup> and 2000 cm<sup>3</sup>; 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<sup>3</sup> and 2,000cm<sup>3</sup>;
  - 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 and for valves with different inlet and outlet diameters, the 'nominal size' refers to the smallest diameter;
- 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.

*2B Test, Inspection and Production Equipment*

**2B001**

**Machine tools and any combination thereof, for removing (or cutting) metals, ceramics or composites”, which, according to the manufacturer’s technical specification, can be equipped with electronic devices for “numerical control”, as follows:**

- a) Machine tools for turning having two or more axes which can be coordinated simultaneously for “contouring control” having any of the following:
  - 1) “Unidirectional positioning repeatability” equal to or less (better) than 0.9  $\mu\text{m}$  along one or more linear axis with a travel length less than 1.0 m; or
  - 2) “Unidirectional positioning repeatability” equal to or less (better) than 1.1  $\mu\text{m}$  along one or more linear axis with a travel length equal to or greater than 1.0 m;
- b) Machine tools for milling having any of the following:
  - 1) Three linear axes plus one rotary axis which can be coordinated simultaneously for “contouring control” having any of the following:
    - a) “Unidirectional positioning repeatability” equal to or less (better) than 0.9  $\mu\text{m}$  along one or more linear axis with a travel length less than 1.0 m; or
    - b) “Unidirectional positioning repeatability” equal to or less (better) than 1.1  $\mu\text{m}$  along one or more linear axis with a travel length equal to or greater than 1.0m;
  - 2) Five or more axes which can be coordinated simultaneously for “contouring control” having any of the following:
    - a) “Unidirectional positioning repeatability” equal to or less (better) than 0.9  $\mu\text{m}$  along one or more linear axis with a travel length less than 1.0 m;
    - b) “Unidirectional positioning repeatability” equal to or less (better) than 1.4  $\mu\text{m}$  along one or more linear axis with a travel length

equal to or greater than 1 m and less than 4 m; or

- c) "Unidirectional positioning repeatability" equal to or less (better) than 6.0  $\mu\text{m}$  (along one or more linear axis with a travel length equal to or greater than 4 m;

3) A "unidirectional positioning repeatability" for jig boring machines, equal to or less (better) than 1.1  $\mu\text{m}$  along one or more linear axis; or

4) Fly cutting machines having all of the following:

- a) Spindle "run-out" and "camming" less (better) than 0.0004 mm TIR; and
- b) Angular deviation of slide movement (yaw, pitch and roll) less (better) than 2 seconds of arc, TIR over 300 mm of travel;

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

1. Having all of the following:

- a) "Unidirectional positioning repeatability" equal to or less (better) than 1.1  $\mu\text{m}$  along one or more linear axis; and
- b) Three or four axes which can be coordinated simultaneously for "contouring control"; or

2) Five or more axes which can be coordinated simultaneously for "contouring control" having any of the following:

- a) "Unidirectional positioning repeatability" equal to or less (better) than 1.1  $\mu\text{m}$  along one or more linear axis with a travel length less than 1 m;
- b) "Unidirectional positioning repeatability" equal to or less (better) than 1.4  $\mu\text{m}$  along one or more linear axis with a travel length equal to or greater than 1 m and less than 4 m; or
- c) "Unidirectional positioning repeatability" equal to or less (better) than 6.0  $\mu\text{m}$  along

one or more linear axis with a travel length equal to or greater than 4 m.

- d. Electrical discharge machines (EDM) of the non-wire type which have two or more rotary axes which can be coordinated simultaneously for "contouring control";
- e. Machine tools for removing metals, ceramics or "composites", having all of the following:
  - 1. Removing material by means of any of the following:
    - a. Water or other liquid jets, including those employing abrasive additives;
    - b. Electron beam; or
    - c. "Laser" beam; and
  - 2. At least two rotary axes having all of the following:
    - a. Can be coordinated simultaneously for "contouring control"; and
    - b. A positioning "accuracy" of less (better) than 0.003°;
- f. Deep-hole-drilling machines and turning machines modified for deep-hole-drilling, having a maximum depth-of-bore capability exceeding 5m.

**2B002**

**Numerically controlled optical finishing machine tools equipped for selective material removal to produce non-spherical optical surfaces having all of the following characteristics:**

- a. Finishing the form to less (better) than 1.0  $\mu\text{m}$ ;
- b. Finishing to a roughness less (better) than 100 nm rms.
- c. Four or more axes which can be coordinated simultaneously for "contouring control"; and

Using any of the following processes:

- 1. Magnetorheological finishing ('MRF');
- 2. Electrorheological finishing ('ERF');
- 3. 'Energetic particle beam finishing';
- 4. 'Inflatable membrane tool finishing'; or
- 5. 'Fluid jet finishing'.

**2B003**

Numerically controlled machine tools, specially designed for the shaving, finishing, grinding or honing of hardened ( $R_c=40$  or more) spur, helical and double-helical gears having all of the following:

- a. A pitch diameter exceeding 1,250 mm;
- b. A face width of 15% of pitch diameter or larger; and
- c. A finished quality of AGMA 14 or better (equivalent to ISO 1328 class 3).

**2B004**

Hot "isostatic presses" having all of the following, and specially designed components and accessories therefor:

- a. A controlled thermal environment within the closed cavity and a chamber cavity with an inside diameter of 406 mm or more; and
- b. Having any of the following:
  1. A maximum working pressure exceeding 207 MPa;
  2. A controlled thermal environment exceeding 1,773 K (1,500°C); or
  3. A facility for hydrocarbon impregnation and removal of resultant gaseous degradation products.

**2B005**

Equipment specially designed for the deposition, processing and in-process control of inorganic overlays, coatings and surface modifications, as follows, for substrates specified in column 2, by processes shown in column 1 in the Table following 2E003(f) and specially designed automated handling, positioning, manipulation and control components therefor:

- a. Chemical vapour deposition (CVD) production equipment having all of the following:
  1. A process modified for one of the following:
    - a. Pulsating CVD;
    - b. Controlled nucleation thermal deposition (CNTD); or
    - c. Plasma enhanced or plasma assisted CVD; and

2. Having any of the following:

- a. Incorporating high vacuum (equal to or less than 0.01 Pa) rotating seals; or
  - b. Incorporating in situ coating thickness control;
- b. Ion implantation production equipment having beam currents of 5 mA or more;
- c. Electron beam physical vapour deposition (EB-PVD) production equipment incorporating power systems rated for over 80 kW and having any of the following:
1. A liquid pool level “laser” control system which regulates precisely the ingots feed rate; or
  2. A computer controlled rate monitor operating on the principle of photo-luminescence of the ionised atoms in the evaporant stream to control the deposition rate of a coating containing two or more elements;
- d. Plasma spraying production equipment having any of the following—
1. Operating at reduced pressure controlled atmosphere (equal to or less than 10 kPa measured above and within 300 mm of the gun nozzle exit) in a vacuum chamber capable of evacuation down to 0.01 Pa prior to the spraying process; or
  2. Incorporating in situ coating thickness control;
- e. Sputter deposition production equipment capable of current densities of 0.1 mA/mm<sup>2</sup> or higher at a deposition rate of 15 µm/h or more;
- f. Cathodic arc deposition production equipment incorporating a grid of electromagnets for steering control of the arc spot on the cathode;
- g. Ion plating production equipment capable of the in situ measurement of any of the following:
1. Coating thickness on the substrate and rate control; or
  2. Optical characteristics.

**2B006****Dimensional inspection or measuring systems, equipment, position feedback units and "electronic assemblies", as follows:**

- a. Computer controlled or "numerical controlled" Coordinate Measuring Machines (CMM), having a three dimensional (volumetric) maximum permissible error of length measurement (E0,MPE) at any point within the operating range of the machine (i.e., within the length of axes) equal to or less (better) than  $(1,7 + L/1\ 000) \mu\text{m}$  (L is the measured length in mm), according to ISO 10360-2:2009;
- b. Linear displacement measuring instruments or systems, linear position feedback units, and "electronic assemblies", as follows:
  1. 'Non-contact type measuring systems' with a "resolution" equal to or less (better) than  $0.2 \mu\text{m}$  within 0 to 0.2 mm of the 'measuring range';
  2. Linear position feedback units specially designed for machine tools and having an overall "accuracy" less (better) than  $(800 + (600 \times L/1,000)) \text{nm}$  (L equals effective length in mm);
  3. Measuring systems having all of the following:
    - a. Containing a "laser";
    - b. A "resolution" over their full scale of 0.200 nm or less (better); and
    - c. Capable of achieving a "measurement uncertainty" equal to or less (better) than  $(1,6 + L/2,000) \text{nm}$  (L is the measured length in mm) at any point within a measuring range, when compensated for the refractive index of air and measured over a period of 30 seconds at a temperature of  $20 \pm 0,01^\circ\text{C}$ ; or
  4. "Electronic assemblies" specially designed to provide feedback capability in systems specified in 2B006(b)(3);
- c. Rotary position feedback units specially designed for machine tools or angular displacement measuring instruments, having an angular position "accuracy" equal to or less (better) than 0.9 second of arc;

- d. Equipment for measuring surface roughness (including surface defects), by measuring optical scatter with a sensitivity of 0.5 nm or less (better).

**2B007**

**“Robots” having any of the following characteristics and specially designed controllers and “end- effectors” therefor:**

- b. Specially designed to comply with national safety standards applicable to potentially explosive munitions environments;
- c. Specially designed or rated as radiation-hardened to withstand a total radiation dose greater than  $5 \times 10^3$  Gy (silicon) without operational degradation; or
- d. Specially designed to operate at altitudes exceeding 30,000 m.

**2B008**

**‘Compound rotary tables’ and “tilting spindles”, specially designed for machine tools, as follows:**

- c. ‘Compound rotary tables’ having all of the following:
  - 1. Designed for machine tools for turning, milling or grinding; and
  - 2. Two rotary axes designed to be coordinated simultaneously for contouring control;
- d. “Tilting spindles” having all of the following:
  - 1. Designed for machine tools for turning, milling or grinding; and
  - 2. Designed to be coordinated simultaneously for “contouring control”.

**2B009**

**Spin-forming machines and flow-forming machines, which, according to the manufacturer’s technical specification, can be equipped with “numerical control” units or a computer control and having all of the following:**

- a. Three or more axes which can be coordinated simultaneously for “contouring control”; and
- b. A roller force more than 60 kN.

**2B104**

**“Isostatic presses”, other than those specified in 2B004, having all of the following:**

- 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, other than those specified in 2B005(a) designed or modified for the densification of carbon-carbon composites.**

**2B109**

**Flow-forming machines, other than those specified in 2B009, usable in the “production” of propulsion components and equipment (e.g. motor cases and interstages) for “missiles”, and specially designed components as follows:**

- a. Flow-forming machines having all of the following:
  1. Equipped with, or, according to the manufacturer's technical specification, are capable of being equipped with “numerical control” units or computer control; and
  2. More than two axes which can be coordinated simultaneously for “contouring control”.
- b. Specially designed components for flow-forming machines specified in 2B009 or 2B109(a).

**2B116**

**Vibration test systems, equipment and components therefor, as follows:**

- a. ‘Vibration test systems employing feedback or closed loop techniques and incorporating a digital controller’, capable of vibrating a system at an acceleration equal to or greater than 10 g rms between 20 Hz and 2 kHz while imparting forces equal to or greater than 50 kN, measured ‘bare table’;
- b. Digital controllers, combined with specially designed vibration test software, with a ‘real-time control bandwidth’

greater than 5 kHz designed for use with vibration test systems specified in 2B116.a.

- c. Vibration thrusters (shaker units), with or without associated amplifiers, capable of imparting a force equal to or greater than 50 kN, measured 'bare table', 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 equal to or greater than 50 kN, measured 'bare table', and usable in vibration systems specified in 2B116a.

#### **2B117**

**Equipment and process controls, other than those specified in 2B004, 2B005a., 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:**

- a. Balancing machines having all of 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;
- b. Indicator heads designed or modified for use with machines specified in 2B119a.

#### **2B120**

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

- a. Two or more axes;

- b. Designed or modified to incorporate slip rings or integrated non-contact devices capable of transferring electrical power, signal information, or both; and
- c. Having any of the following characteristics:
  - 1. For any single axis having all of the following:
    - a. Capable of rates of 400 degrees/s or more, or 30 degrees/s or less; and
    - b. A rate resolution equal to or less than 6 degrees/s and an accuracy equal to or less than 0.6 degrees/s;
  - 2. Having a worst-case rate stability equal to or better (less) than plus or minus 0.05% averaged over 10 degrees or more; or
  - 3. A positioning "accuracy" equal to or less (better) than 5 arc second.

**2B121**

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

- a. Two or more axes; and
- b. A positioning "accuracy" equal to or less (better) than 5 arc second.

**2B122**

Centrifuges capable of imparting accelerations greater than 100 g and designed or modified to incorporate slip rings or integrated non-contact devices capable of transferring electrical power, signal information, or both.

**2B201**

Machine tools and any combination thereof, other than those specified in 2B001, 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 milling, having any of the following characteristics:

1. Positioning accuracies with "all compensations available" equal to or less (better) than 6  $\mu\text{m}$  according to ISO 230-2:1988(7) or national equivalents along any linear axis;
  2. Two or more contouring rotary axes; or
  3. Five or more axes which can be coordinated simultaneously for "contouring control";
- b. Machine tools for grinding, having any of the following characteristics:
1. Positioning accuracies with "all compensations available" equal to or less (better) than 4  $\mu\text{m}$  according to ISO 230-2:1988(7) or national equivalents along any linear axis;
  2. Two or more contouring rotary axes; or
  3. Five or more axes which can be coordinated simultaneously for "contouring control";
- c. Machine tools for turning, that have positioning accuracies with "all compensations available" better (less) than 6  $\mu\text{m}$  according to ISO 230-2:1988(7) along any linear axis (overall positioning) for machines capable of machining diameters greater than 35 mm; manufacturers calculating positioning accuracy in accordance with ISO 230-2:1997 or 2006 should consult the competent authorities of the Member State in which they are established;
1. Two or more contouring rotary axes.

#### **2B204**

**"Isostatic presses", other than those specified in 2B004 or 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).

**2B206**

**Dimensional inspection machines, instruments or systems, other than those specified in 2B006, as follows:**

- a. Computer controlled or numerically controlled coordinate measuring machines (CMM) 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  $E_{0x,MPE}$ ,  $E_{0y,MPE}$ , or  $E_{0z,MPE}$ , equal to or less (better) than  $(1.25 + L/1,000) \mu\text{m}$  (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 ( $E_{0,MPE}$ ) equal to or less (better) than  $(1,7 + L/800) \mu\text{m}$  (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;
- b. 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  $3.5 \mu\text{m}$  per 5 mm; and
  2. "Angular position deviation" equal to or less than  $0.02^\circ$ ;
- c. 'Linear displacement' measuring systems having all of the following characteristics:
  1. Containing a "laser"; and
  2. Capable of maintaining, for at least 12 hours, at a temperature of  $\pm 1 \text{ K}$  ( $\pm 1^\circ\text{C}$ ); around a standard temperature and standard pressure, all of the following:
    - a. A 'resolution' over their full scale of  $0.1 \mu\text{m}$  or better; and

- b. With a "measurement uncertainty" equal to or better (less) than  $(0.2 + L/2,000) \mu\text{m}$  ( $L$  is the measured length in mm);
- d. Linear variable differential transformer (LVDT) systems:
  - 1. Having the following characteristics:
    - a. "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
    - b. "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
  - 2. Drift equal to or better (less) than 0.1% per day at a standard ambient test room temperature  $\pm 1 \text{ K}$  ( $\pm 1^\circ\text{C}$ ).

**2B207**

**"Robots", "end-effectors" and control units, other than those specified in 2B007, as follows:**

- a. "Robots" or "end-effectors" specially designed to comply with national safety standards applicable to handling high explosives (for example, meeting electrical code ratings for high explosives);
- 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 2B009 or 2B109, and mandrels, as follows:**

- a. Machines having both of the following characteristics:
  - 1. Three or more rollers (active or guiding);
  - 2. Which, according to the manufacturer's technical specification, can be equipped with "numerical control" units or a computer control; and 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;

- b. Rotor-forming mandrels designed to form cylindrical rotors of inside diameter between 75 mm and 650 mm.

**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 r.p.m.;
- b. Centrifugal balancing machines designed for balancing hollow cylindrical rotor components and having all of the following characteristics:
1. Journal diameter greater than 75 mm;
  2. Mass capability of from 0.9 to 23 kg;
  3. A minimum achievable residual specific unbalance equal to or less than 10 g 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).

**2B226**

**Controlled atmosphere (vacuum or inert gas) induction furnaces, other than those specified in 9B001 and 3B001, and power supplies therefor, as follows:**

- a. Furnaces having all of the following characteristics:
  1. Capable of operation above 1,123 K (850°C);

2. Induction coils 600 mm 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).

**2B227**

**Vacuum or other controlled atmosphere metallurgical melting and casting furnaces and related equipment as follows:**

- a. Arc remelt furnaces, arc melt furnaces and arc melt and casting furnaces having both of the following characteristics:
  1. Consumable electrode capacities between 1,000 cm<sup>3</sup> and 20,000 cm<sup>3</sup>; and
  2. Capable of operating with melting temperatures above 1,973 K (1,700°C);
- b. Electron beam melting furnaces, plasma atomization furnaces and plasma melting furnaces, having both of the following characteristics:
  1. A power of 50 kW or greater; and
  2. Capable of operating with melting temperatures above 1,473 K (1,200°C);
- c. Computer control and monitoring systems specially configured for any of the furnaces specified in 2B227(a) or 2B227(b);
- d. Plasma torches specially designed for furnaces specified in 2B227(b) having both of the following characteristics:
  1. Operating at a power greater than 50 kW; and
  2. Capable of operating above 1473 K (1,200°C);
- e. Electron beam guns specially designed for the furnaces specified in 2B227.b. operating at a power greater than 50 kW.

**2B228**

**Rotor fabrication or assembly equipment, rotor straightening equipment, bellows-forming mandrels and dies, as follows:**

- a. Rotor assembly equipment including precision mandrels, clamps, and shrink fit machines for assembly of gas centrifuge rotor tube sections, baffles, and end caps;

- b. Rotor straightening equipment for alignment of gas centrifuge rotor tube sections to a common axis;
- c. Bellows-forming mandrels and dies for producing single-convolution bellows having all of the following characteristics:
  1. Inside diameter between 75 mm and 650 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 types of 'pressure transducers' capable of measuring absolute pressures and having all of the following:**

- 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, aluminum oxide (alumina or sapphire), nickel, nickel alloy with more than 60% nickel by weight, or fully fluorinated hydrocarbon polymers; and 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.

**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<sup>3</sup>/s determined at the measurement point with nitrogen gas or air; and

- c. Capable of producing an ultimate vacuum better than 13 mPa 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.

**2B233**

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

- a. Capable of an inlet volume flow rate of 50 m<sup>3</sup>/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.

**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<sup>3</sup> (100 liters) and less than 20 m<sup>3</sup> (20,000 liters), 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 (polymeric or elastomeric materials with more than 35% fluorine by weight);

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';
  7. Zirconium or zirconium 'alloys'; or
  8. Niobium (columbium) or niobium 'alloys';
- b. Agitators designed 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 (polymeric or elastomeric materials with more than 35% fluorine by weight);
  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';
  7. Zirconium or zirconium 'alloys'; or
  8. Niobium (columbium) or niobium 'alloys';
- c. Storage tanks, containers or receivers with a total internal (geometric) volume greater than 0.1 m<sup>3</sup> (100 liters) 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 (polymeric or elastomeric materials with more than 35% fluorine by weight);

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';
7. Zirconium or zirconium 'alloys'; or
8. Niobium (columbium) or niobium 'alloys';

d. Heat exchangers or condensers with a heat transfer surface area greater than 0.15 m<sup>2</sup>, and less than 20 m<sup>2</sup>; 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 (polymeric or elastomeric materials with more than 35% fluorine by weight);
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;
10. Titanium carbide; or
11. Niobium (columbium) or niobium 'alloys';

e. Distillation or absorption columns of internal diameter greater than 0.1 m; and liquid distributors, vapour distributors or liquid collectors designed for such distillation or absorption 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 (polymeric or elastomeric materials with more than 35% fluorine by weight);
  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'; or
  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. Valves, having both of the following:
    - a. A 'nominal size' greater than DN 10 or NPS 3/8; and
    - b. All surfaces that come in direct contact with the chemical(s) being produced, 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 DN 25 or NPS 1 and equal to or less than DN 100 or NPS ;
    - 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. Casing (valve bodies);
  - b. Performed casing liners;
- 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 (Polymeric Or Elastomeric Materials With More Than 35% Fluorine by weight);
  - 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'; or
  - 9. Niobium (columbium) or niobium 'alloys';
- i. Multiple-seal and seal-less pumps, with manufacturer's specified maximum flow- rate greater than 0.6 m<sup>3</sup>/hour, or vacuum pumps with manufacturer's specified maximum flow-rate greater than 5 m<sup>3</sup>/hour (under standard temperature (273 K (0oC)) and pressure

(101.3 kPa) conditions), other than those specified in 2B233; 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 (high silicon iron alloys);
4. Fluoropolymers (polymeric or elastomeric materials with more than 35% fluorine by weight);
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';
10. Zirconium or zirconium 'alloys'; or
11. Niobium (columbium) or niobium 'alloys';

j. Incinerators designed to destroy chemicals specified in entry IC350, having specially designed waste supply systems, special handling facilities and an average combustion chamber temperature greater than 1273 K (1000°C), in which all surfaces in the waste supply system that come into direct contact with the waste products are made from or lined with any of the following materials—

1. 'Alloys' with more than 25% nickel and 20% chromium by weight;
2. Ceramics; or
3. Nickel or 'alloys' with more than 40% nickel by weight;

k. Prefabricated repair assemblies having metallic surfaces that come in direct contact with the chemical(s) being processed which are made from tantalum or tantalum alloys as follows, and specially designed components therefor:

1. Designed for mechanical attachment to glass-lined reaction vessels or reactors specified in 2B350(a); or
2. Designed for mechanical attachment to glass-lined storage tanks, containers or receivers specified in 2B350(c).

#### **2B351**

**Toxic gas monitors and monitoring systems and their dedicated detecting components, other than those specified in 1A004, as follows; and detectors; sensor devices; and replaceable sensor cartridges therefor:**

- a. Designed for continuous operation and usable for the detection of chemical warfare agents or chemicals specified in 1C350, at concentrations of less than 0.3 mg/m<sup>3</sup>; or
- b. Designed for the detection of cholinesterase-inhibiting activity.

#### **2B352**

**Biological manufacturing and handling equipment, as follows:**

- a. Containment facilities and related equipment as follows:
  1. Complete containment facilities that meet the criteria for P3 or P4 (BL3, BL4, L3, L4) containment as specified in the WHO Laboratory Biosafety Manual (3rd edition, Geneva, 2004);
  2. Equipment designed for fixed installation in containment facilities specified in 2B352.a., as follows:
    - a. Double-door pass-through decontamination autoclaves;
    - b. Breathing air suit decontamination showers;
    - c. Mechanical-seal or inflatable-seal walkthrough doors;
- b. Fermenters including bioreactors, single-use (disposable) bioreactors, chemostats and continuous-flow systems and components as follows:
  1. Fermenters capable of cultivation of "microorganisms" or of live cells for the production

- of viruses or toxins, without the propagation of aerosols, having a total internal volume of 20 liters or more;
2. Components designed for fermenters specified in 2B352(b)1. as follows—
    - a. Cultivation chambers designed to be sterilized or disinfected in situ;
    - b. Cultivation chamber holding devices;
    - 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);
  - c. Centrifugal separators including decanters, capable of continuous separation without the propagation of aerosols, having all of the following characteristics:
    1. Flow rate exceeding 100 liters 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 sterilization in a closed state;
  - d. Cross (tangential) flow filtration equipment and components as follows:
    1. Cross (tangential) flow filtration equipment capable of separation of "microorganisms", viruses, toxins or cell cultures having all of the following characteristics:
      - a. A total filtration area equal to or greater than 1 m<sup>2</sup>; and
      - b. Having any of the following characteristics:
        1. Capable of being sterilized or disinfected in-situ; or Using disposable or single-use filtration components;

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<sup>2</sup> for each component and designed for use in cross (tangential) flow filtration equipment specified in 2B352(d);
- e. Steam, gas or vapour sterilizable freeze-drying equipment with a condenser capacity of 10 kg of ice or more 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;
  2. Biocontainment chambers, isolators, or biological safety cabinets having all of the following characteristics, for normal operation:
    - a. Fully enclosed workspace where the operator is separated from the work by a physical barrier;
    - b. Able to operate at negative pressure;
    - c. Means to safely manipulate items in the workspace;
    - d. Supply and exhaust air to and from the workspace is HEPA filtered;
- g. Aerosol inhalation equipment designed for aerosol challenge testing with "microorganisms", viruses or "toxins" as follows:
1. Whole-body exposure chambers having a capacity of 1 m<sup>3</sup> or more;
  2. Nose-only exposure apparatus utilizing directed aerosol flow and having capacity for exposure of any of the following:
    - a. 12 or more rodents; or
    - b. 2 or more animals other than rodents;
  3. Closed animal restraint tubes designed for use with nose-only exposure apparatus utilizing directed aerosol flow;

- h. Spray drying equipment capable of drying toxins or pathogenic "microorganisms" having all of the following:
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  $\leq 10$   $\mu\text{m}$  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. Nucleic acid assemblers and synthesizers, which are partly or entirely automated, and designed to generate continuous nucleic acids greater than 1,5 kilobases in length with error rates less than 5% in a single run.

*2C Materials*

None

*2D Software*

**2D001**

**"Software", other than that specified in 2D002, as follows:**

- a. "Software" specially designed or modified for the "development" or "production" of equipment specified in 2A001 or 2B001 to 2B009
- b. "Software" specially designed or modified for the "use" of equipment specified in 2A001.c., 2B001 or 2B003 to 2B009.

**2D002**

**"Software" for electronic devices, even when residing in an electronic device or system, enabling such devices or systems to function as a "numerical control" unit, capable of co-coordinating simultaneously more than four axes for "contouring control".**

**2D003**

**"Software" designed or modified for the operation of equipment specified in 2B002, that converts optical design, work-piece measurements and material removal functions into "numerical control" commands to achieve the desired work-piece form.**

**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 for the “use” of equipment specified in 2B204, 2B206, 2B207, 2B209, 2B219 or 2B227.

**2D202**

“Software” specially designed or modified for the “development”, “production” or “use” of equipment specified in 2B201.

2D351 “Software” other than that specified in 1D003, specially designed for “use” of equipment specified in 2B351.

2D352 “Software” specially designed for nucleic acid assemblers and synthesisers specified in 2B352.i., that is capable of designing and building functional genetic elements from digital sequence data.

*2E Technology*

**2E001**

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

**2E002**

“Technology” according to the General Technology Note for the “production” of equipment specified in 2A or 2B.

**2E003**

Other “Technology”, as follows”

a. “Technology” for metal-working manufacturing processes, as follows:

1. “Technology” for the design of tools, dies or fixtures specially designed for any of the following processes:

- a. “Superplastic forming”;
- b. “Diffusion bonding”; or
- c. ‘Direct-acting hydraulic pressing’;

b. “Technology” for the “development” or “Production” of hydraulic stretch-forming machines and dies therefor, for the manufacture of airframe structures;

- c. "Technology" for the "development" of integration "software" for incorporation of expert systems for advanced decision support of shop floor operations into numerical control units;
- d. "Technology" for the application of inorganic overlay coatings or inorganic surface modification coatings (specified in column 3 of the following table) to non-electronic substrates (specified in column 2 of the following table), by processes specified in column 1 of the following table.

**2E101**

"Technology" according to the General Technology Note for the "use" of equipment or software" specified in 2B004, 2B009, 2B104, 2B109, 2B116, 2B119 to 2B122 or 2D101.

**2E201**

"Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 2A225, 2A226, 2B001, 2B006, 2B007.b., 2B007(c), 2B008, 2B009, 2B201, 2B204, 2B206, 2B207, 2B209, 2B225 to 2B233, 2D201 or 2D202.

**2E301**

"Technology" according to the General Technology Note for the "use" of goods specified in 2B350 to 2B352.

**TABLE – DEPOSITION TECHNIQUES**

1. COATING PROCESS	2. SUBSTRATE	3. RESULTANT COATING
A. Chemical Vapour Deposition (CVD)	"Superalloys"	Aluminides for internal passages
	Ceramics (19) and Low expansion glasses (14)	Silicides Carbides Dielectric layers (15) Diamond Diamond-like carbon (17)
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15) Aluminides Alloyed aluminides (2) Boron nitride
	Cemented tungsten carbide (16), Silicon carbide (18)	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15) Diamond Diamond-like carbon (17)
	Sensor window materials	Dielectric layers (15)

1. COATING PROCESS	2. SUBSTRATE	3. RESULTANT COATING
		Diamond Diamond-like carbon (17)
B. Thermal-Evaporation Physical Vapour Deposition (TE-PVD)		
B.1. Physical Vapour Deposition (PVD): Electron-Beam (EB-PVD)	"Superalloys"	Alloyed silicides Alloyed aluminides (2) MCrAlX (5) Modified zirconia (12) Silicides Aluminides Mixtures thereof (4)
	Ceramics (19) and Low expansion glasses (14)	Dielectric layers (15)
	Corrosion resistant steel (7)	MCrAlX (5) Modified zirconia (12) Mixtures thereof (4)
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15) Boron nitride
	Cemented tungsten	Carbides

1. COATING PROCESS	2. SUBSTRATE	3. RESULTANT COATING
	carbide (16), Silicon carbide (18)	Tungsten Mixtures thereof (4) Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15) Borides Beryllium
	Sensor window materials (9)	Dielectric layers (15)
	Titanium alloys (13)	Borides Nitrides
B.2. Ion assisted resistive heating Physical Vapour Deposition (PVD) (Ion Plating)	Ceramics (19) and Low- expansion glasses	Dielectric layers (15) Diamond-like carbon (17)
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Dielectric layers (15)
	Cemented tungsten carbide (16), Silicon carbide	Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15)
	Sensor window materials (9)	Dielectric layers (15) Diamond-like carbon (17)

1. COATING PROCESS	2. SUBSTRATE	3. RESULTANT COATING
B.3. Physical Vapour Deposition (PVD): "Laser" Vaporization	Ceramics (19) and Low expansion glasses (14)	Silicides Dielectric layers (15) Diamond-like carbon (17)
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Dielectric layers (15)
	Cemented tungsten carbide (16), Silicon carbide	Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15)
	Sensor window materials (9)	Dielectric layers (15) Diamond-like carbon (17)
B.4. Physical Vapour Deposition (PVD): Cathodic Arc Discharge	"Superalloys"	Alloyed silicides Alloyed aluminides (2) MCrAlX (5)
	Polymers (11) and Organic "matrix" "composites"	Borides Carbides Nitrides Diamond-like carbon (17)
C. Pack cementation (see A above for out-of-pack cementation) (10)	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Mixtures thereof (4)

1. COATING PROCESS	2. SUBSTRATE	3. RESULTANT COATING
	Titanium alloys (13)	Silicides Aluminides Alloyed aluminides (2)
	Refractory metals and alloys (8)	Silicides Oxides
D. Plasma spraying	"Superalloys"	MCrAlX (5) Modified zirconia (12) Mixtures thereof (4) Abradable Nickel-Graphite Abradable materials containing Ni-Cr-Al Abradable Al-Si-Polyester Alloyed aluminides (2)
	Aluminium alloys (6)	MCrAlX (5) Modified zirconia (12) Silicides Mixtures thereof (4)
	Refractory metals and alloys (8)	Aluminides Silicides Carbides
	Corrosion resistant steel (7)	MCrAlX (5) Modified zirconia (12) Mixtures thereof (4)
	Titanium alloys (13)	Carbides Aluminides

1. COATING PROCESS	2. SUBSTRATE	3. RESULTANT COATING
		Silicides Alloyed aluminides (2) Abradable Nickel-Graphite Abradable materials containing Ni-Cr-Al Abradable Al-Si-Polyester
E. Slurry Deposition	Refractory metals and alloys (8)	Fused silicides Fused aluminides except for resistance heating elements
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Mixtures thereof (4)
F. Sputter Deposition	"Superalloys"	Alloyed silicides Alloyed aluminides (2) Noble metal modified aluminides (3) MCrAlX (5) Modified zirconia (12) Platinum Mixtures thereof (4)
	Ceramics and Low - expansion glasses (14)	Silicides Platinum Mixtures thereof (4) Dielectric layers (15) Diamond-like carbon (17)

1. COATING PROCESS	2. SUBSTRATE	3. RESULTANT COATING
	Titanium alloys (13)	Borides Nitrides Oxides Silicides Aluminides Alloyed aluminides (2) Carbides
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15) Boron nitride
	Carbon-carbon, Ceramic and Metal "matrix" "composites"	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15) Boron nitride
	Cemented tungsten carbide (16), Silicon carbide (18)	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15) Boron nitride
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Borides Dielectric layers (15) Beryllium

1. COATING PROCESS	2. SUBSTRATE	3. RESULTANT COATING
	Sensor window materials (9)	Dielectric layers (15) Diamond-like carbon (17)
	Refractory metals and alloys (8)	Aluminides Silicides Oxides Carbides
G. Ion Implantation	High temperature bearing steels	Additions of Chromium Tantalum or Niobium (Columbium)
	Titanium alloys (13)	Borides Nitrides
	Beryllium and Beryllium alloys	Borides
	Cemented tungsten carbide (16)	Carbides Nitrides
(*) The numbers in parenthesis refer to the Key following this Table		

**TABLE - DEPOSITION TECHNIQUES - KEY**

1. The term 'coating process' includes coating repair and refurbishing as well as original coating.
2. The term 'alloyed aluminide coating' includes single or multiple-step coatings in which an element or elements are deposited prior to or during application of the aluminide coating, even if these elements are deposited by another coating process. It does not, however, include the multiple use of single-step pack cementation processes to achieve alloyed aluminides.
3. The term 'noble metal modified aluminide' coating includes multiple-step coatings in which the noble metal or noble metals are laid down by some other coating process prior to application of the aluminide coating.
4. The term 'mixtures thereof' includes infiltrated material, graded compositions, co-deposits and multilayer deposits and are obtained by one or more of the coating processes specified in the Table.
5. 'MCrAlX' refers to a coating alloy where M equals cobalt, iron, nickel or combinations thereof and X equals hafnium, yttrium, silicon, tantalum in any amount or other intentional additions over 0,01 % by weight in various proportions and combinations, except:
  - a. CoCrAlY coatings which contain less than 22 % by weight of chromium, less than 7 % by weight of aluminium and less than 2 % by weight of yttrium;
  - b. CoCrAlY coatings which contain 22 to 24 % by weight of chromium, 10 to 12 % by weight of aluminium and 0,5 to 0,7 % by weight of yttrium; or
  - c. NiCrAlY coatings which contain 21 to 23 % by weight of chromium, 10 to 12 % by weight of aluminium and 0,9 to 1,1 % by weight of yttrium.
6. The term 'aluminium alloys' refers to alloys having an ultimate tensile strength of 190 MPa or more measured at 293 K (20 °C).
7. The term 'corrosion resistant steel' refers to AISI (American Iron and Steel Institute) 300 series or equivalent national standard steels.
8. 'Refractory metals and alloys' include the following metals and their alloys: niobium (columbium), molybdenum, tungsten and tantalum.

9. 'Sensor window materials', as follows: alumina, silicon, germanium, zinc sulphide, zinc selenide, gallium arsenide, diamond, gallium phosphide, sapphire and the following metal halides: sensor window materials of more than 40 mm diameter for zirconium fluoride and hafnium fluoride.
10. Category 2 does not include "technology" for single-step pack cementation of solid aerofoils.
11. 'Polymers', as follows: polyimide, polyester, polysulphide, polycarbonates and polyurethanes.
12. 'Modified zirconia' refers to additions of other metal oxides (e.g., calcia, magnesia, yttria, hafnia, rare earth oxides) to zirconia in order to stabilise certain crystallographic phases and phase compositions. Thermal barrier coatings made of zirconia, modified with calcia or magnesia by mixing or fusion, are not controlled.
13. 'Titanium alloys' refers only to aerospace alloys having an ultimate tensile strength of 900 MPa or more measured at 293 K (20 °C).
14. 'Low-expansion glasses' refers to glasses which have a coefficient of thermal expansion of  $1 \times 10^{-7}$  K<sup>-1</sup> or less measured at 293 K (20 °C).
15. 'Dielectric layers' are coatings constructed of multi-layers of insulator materials in which the interference properties of a design composed of materials of various refractive indices are used to reflect, transmit or absorb various wavelength bands. Dielectric layers refers to more than four dielectric layers or dielectric/metal "composite" layers.
16. 'Cemented tungsten carbide' does not include cutting and forming tool materials consisting of tungsten carbide/(cobalt, nickel), titanium carbide/(cobalt, nickel), chromium carbide/nickel-chromium and chromium carbide/nickel.
17. "Technology" for depositing diamond-like carbon on any of the following is not controlled:  
magnetic disk drives and heads, equipment for the manufacture of disposables, valves for faucets, acoustic diaphragms for speakers, engine parts for automobiles, cutting tools, punching-pressing dies, office automation equipment, microphones or medical devices or moulds, for casting or moulding of plastics, manufactured from alloys containing less than 5 % beryllium.

18. 'Silicon carbide' does not include cutting and forming tool materials.
19. Ceramic substrates, as used in this entry, does not include ceramic materials containing 5 % by weight, or greater, clay or cement content, either as separate constituents or in combination

### CATEGORY 3: ELECTRONICS

#### 3A *Systems, Equipment and Components*

#### 3A001

##### Electronic items as follows:

- a. General purpose integrated circuits, as follows:
  1. Integrated circuits designed or rated as radiation hardened to withstand any of the following:
    - a. A total dose of  $5 \times 10^3$  Gy (silicon) or higher;
    - b. A dose rate upset of  $5 \times 10^6$  Gy (silicon)/s or higher; or
    - c. A fluence (integrated flux) of neutrons (1 MeV equivalent) of  $5 \times 10^{13}$  n/cm<sup>2</sup> or higher on silicon, or its equivalent for other materials;
  2. "microprocessor microcircuits", "microcomputer microcircuits", microcontroller microcircuits, storage integrated circuits manufactured from a compound semiconductor, analogue-to-digital converters, integrated circuits that contain analogue- to-digital converters and store or process the digitized data, digital-to-analogue converters, electro-optical or "optical integrated circuits" designed for "signal processing", field programmable logic devices, custom integrated circuits for which either the function is unknown or the control status of the equipment in which the integrated circuit will be used is unknown, Fast Fourier Transform (FFT) processors, Static Random-Access Memories (SRAMs), or 'non-volatile memories', having any of the following—
    - a. Rated for operation at an ambient temperature above 398 K (125°C);

- b. Rated for operation at an ambient temperature below 218 K (-55°C); or
        - c. Rated for operation over the entire ambient temperature range from 218 K (- 55°C) to 398 K (125°C);
3. "Microprocessor microcircuits", "microcomputer microcircuits" and microcontroller microcircuits including digital signal processors, digital array processors and digital coprocessors, manufactured from a compound semiconductor and operating at a clock frequency exceeding 40 MHz;
5. Analogue-to-Digital Converter (ADC) and Digital-to-Analogue Converter (DAC) integrated circuits, as follows:
  - a. ADCs having any of the following:
    1. A resolution of 8 bit or more, but less than 10 bit, with a "sample rate" greater than 1,3 Giga Samples Per Second (GSPS);
    2. A resolution of 10 bit or more, but less than 12 bit, with a "sample rate" greater than 600 Mega Samples Per Second (MSPS);
    3. A resolution of 12 bit or more, but less than 14 bit, with a "sample rate" greater than 400 MSPS;
    4. A resolution of 14 bit or more, but less than 16 bit, with a "sample rate" greater than 250 MSPS; or
    5. A resolution of 16 bit or more with a "sample rate" greater than 65 MSPS;
  - b. Digital-to-Analogue Converters (DAC) having any of the following:
    1. A resolution of 10 bit or more but less than 12 bit, with an 'adjusted update rate' exceeding 3,500 MSPS; or
    2. A resolution of 12 bit or more, and having any of the following:

- a. An 'adjusted update rate' of more than 1,250 MSPS but not exceeding 3,500 MSPS and having any of the following:
    1. A settling time less than 9 ns to arrive at or within 0.024% of full scale from a full scale step; or
    2. A 'Spurious Free Dynamic Range' (SFDR) greater than 68 dBc (carrier) when synthesizing a full scale analogue signal of 100 MHz or the highest full scale analogue signal frequency specified below 100 MHz; or
  - b. An 'adjusted update rate' exceeding 3,500 MSPS;
6. Electro-optical and "optical integrated circuits", designed for "signal processing" and having all of the following:
- a. One or more than one internal "laser" diode;
  - b. One or more than one internal light detecting element; and
  - c. Optical waveguides;
7. Field programmable logic devices having any of the following:
- a. A maximum number of single-ended digital input/outputs of greater than 700; or
  - b. An 'aggregate one-way peak serial transceiver data rate' of 500 Gb/s or greater;
9. Neural network integrated circuits;
10. Custom integrated circuits for which the function is unknown, or the control status of the equipment in which the integrated circuits will be used is unknown to the manufacturer, having any of the following:
- a. More than 1,500 terminals;
  - b. A typical "basic gate propagation delay time" of less than 0.02 ns; or
  - c. An operating frequency exceeding 3 GHz;
11. Digital integrated circuits, other than those described in 3A001.a.3. to 3A001.a.10. and 3A001.a.12., based upon

any compound semiconductor and having any of the following:

- a. An equivalent gate count of more than 3,000 (2 input gates); or
- b. A toggle frequency exceeding 1.2 GHz;

12. Fast Fourier Transform (FFT) processors having a rated execution time for an N- point complex FFT of less than  $(N \log_2 N) / 20,480$  ms, where N is the number of points;

13. Direct Digital Synthesizer (DDS) integrated circuits having any of the following:

- a. A Digital-to-Analogue Converter (DAC) clock frequency of 3,5 GHz or more and a DAC resolution of 10 bit or more, but less than 12 bit; or
- b. A DAC clock frequency of 1.25 GHz or more and a DAC resolution of 12 bit or more;

14. Integrated circuits that perform or are programmable to perform all of the following:

- a. Analogue-to-digital conversions meeting any of the following:
  1. A resolution of 8 bit or more, but less than 10 bit, with a "sample rate" greater than 1,3 Giga Samples Per Second (GSPS);
  2. A resolution of 10 bit or more, but less than 12 bit, with a "sample rate" greater than 1,0 GSPS;
  3. A resolution of 12 bit or more, but less than 14 bit, with a "sample rate" greater than 1,0 GSPS;
  4. A resolution of 14 bit or more, but less than 16 bit, with a "sample rate" greater than 400 Mega Samples Per Second (MSPS); or
  5. A resolution of 16 bit or more with a "sample rate" greater than 180 MSPS; and

b. Any of the following:

1. Storage of digitized data; or
  2. Processing of digitized data;
- b. Microwave or millimeter wave items as follows:
1. "Vacuum electronic devices" and cathodes, as follows:
    - a. Travelling-wave "vacuum electronic devices", pulsed or continuous wave, as follows:
      1. Devices operating at frequencies exceeding 31,8 GHz;
      2. Devices having a cathode heater with a turn on time to rated RF power of less than 3 seconds;
      3. Coupled cavity devices, or derivatives thereof, with a "fractional bandwidth" of more than 7% or a peak power exceeding 2, 5 kW;
      4. Devices based on helix, folded waveguide, or serpentine waveguide circuits, or derivatives thereof, having any of the following:
        - a. An "instantaneous bandwidth" of more than one octave, and average power (expressed in kW) times frequency (expressed in GHz) of more than 0.5;
        - b. An "instantaneous bandwidth" of one octave or less, and average power

- (expressed in kW) times frequency (expressed in GHz) of more than 1;
        - c. Being "space-qualified"; or
        - d. Having a gridded electron gun;
  - 5. Devices with a "fractional bandwidth" greater than or equal to 10%, with any of the following:
    - a. An annular electron beam;
    - b. A non-axisymmetric electron beam; or
    - c. Multiple electron beams;
  - b. Crossed-field amplifier "vacuum electronic devices" with a gain of more than 17 dB;
  - c. Thermionic cathodes designed for "vacuum electronic devices" producing an emission current density at rated operating conditions exceeding 5 A/cm<sup>2</sup> or a pulsed (non-continuous) current density at rated operating conditions exceeding 10 A/cm<sup>2</sup>;
  - d. "Vacuum electronic devices" with the capability to operate in a 'dual mode'.
- 2. "Monolithic Microwave Integrated Circuits" ("MMIC") amplifiers that are any of the following:
  - a. Rated for operation at frequencies exceeding 2.7 GHz up to and including 6.8 GHz with a "fractional bandwidth" greater than 15%, and having any of the following:
    - 1. A peak saturated power output greater than 75 W (48.75 dBm) at any frequency exceeding 2.7 GHz up to and including 2.9 GHz;
    - 2. A peak saturated power output greater than

- 55 W (47.4 dBm) at any frequency exceeding 2.9 GHz up to and including 3.2 GHz;
- 3. A peak saturated power output greater than 40 W (46 dBm) at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; or
- 4. A peak saturated power output greater than 20 W (43 dBm) at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;
- b. Rated for operation at frequencies exceeding 6.8 GHz up to and including 16 GHz with a “fractional bandwidth” greater than 10%, and having any of the following:
  - 1. A peak saturated power output greater than 10 W (40 dBm) at any frequency exceeding 6.8 GHz up to and including 8.5 GHz; or
  - 2. A peak saturated power output greater than 5 W (37 dBm) at any frequency exceeding 8.5 GHz up to and including 16 GHz;
- c. Rated for operation with a peak saturated power output greater than 3 W (34.77 dBm) at any frequency exceeding 16 GHz up to and including 31.8 GHz, and with a “fractional bandwidth” of greater than 10%;
- d. Rated for operation with a peak saturated power output greater than 0.1 nW (-70 dBm) at any frequency exceeding 31.8 GHz up to and including 37 GHz;
- e. Rated for operation with a peak saturated power output greater than 1 W (30 dBm) at any frequency exceeding 37 GHz up to and including 43.5 GHz, and with a “fractional bandwidth” of greater than 10%;
- f. Rated for operation with a peak saturated power output greater than 31,62 mW (15 dBm) at any frequency exceeding 43.5 GHz up to and including 75 GHz, and with a “fractional bandwidth” of greater than 10%;
- g. Rated for operation with a peak saturated power output greater than 10 mW (10 dBm) at any frequency exceeding 75 GHz up to and including 90 GHz, and with a “fractional bandwidth” of greater than 5%; or
- h. Rated for operation with a peak saturated power output

greater than 0.1 nW (-70 dBm) at any frequency exceeding 90 GHz;

3. Discrete microwave transistors that are any of the following:

a. Rated for operation at frequencies exceeding 2.7 GHz up to and including 6.8 GHz and having any of the following:

1. A peak saturated power output greater than 400 W (56 dBm) at any frequency exceeding 2.7 GHz up to and including 2.9 GHz;
2. A peak saturated power output greater than 205 W (53.12 dBm) at any frequency exceeding 2.9 GHz up to and including 3.2 GHz;
3. A peak saturated power output greater than 115 W (50.61 dBm) at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; or
4. A peak saturated power output greater than 60 W (47.78 dBm) at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;

b. Rated for operation at frequencies exceeding 6.8 GHz up to and including 31.8 GHz and having any of the following:

1. A peak saturated power output greater than 50 W (47 dBm) at any frequency exceeding 6.8 GHz up to and including 8.5 GHz;
2. A peak saturated power output greater than 15 W (41.76 dBm) at any frequency exceeding 8.5 GHz up to and including 12 GHz;
3. A peak saturated power output greater than 40 W (46 dBm) at any frequency exceeding 12 GHz up to and including 16 GHz; or
4. A peak saturated power output greater than 7 W (38.45 dBm) at any frequency exceeding 16 GHz up to and including 31.8 GHz;

c. Rated for operation with a peak saturated power output

greater than 0.5 W (27 dBm) at any frequency exceeding 31.8 GHz up to and including 37 GHz;

d. Rated for operation with a peak saturated power output greater than 1 W (30 dBm) at any frequency exceeding 37 GHz up to and including 43.5 GHz;

e. Rated for operation with a peak saturated power output greater than 0.1 nW (-70 dBm) at any frequency exceeding 43.5 GHz; or

f. Other than those specified in 3A001b.3.a. to 3A001b.3.e and rated for operation with a peak saturated power output greater than 5 W (37.0 dBm) at all frequencies exceeding 8.5 GHz up to and including 31.8 GHz.

4. Microwave solid state amplifiers and microwave assemblies/modules containing microwave solid state amplifiers, that are any of the following:

a. Rated for operation at frequencies exceeding 2.7 GHz up to and including 6.8 GHz with a "fractional bandwidth" greater than 15%, and having any of the following:

1. A peak saturated power output greater than 500 W (57 dBm) at any frequency exceeding 2.7 GHz up to and including 2.9 GHz;

2. A peak saturated power output greater than 270 W (54.3 dBm) at any frequency exceeding 2.9 GHz up to and including 3.2 GHz;

3. A peak saturated power output greater than 200 W (53 dBm) at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; or

4. A peak saturated power output greater than 90 W (49.54 dBm) at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;

b. Rated for operation at frequencies exceeding 6.8 GHz up to and including 31.8 GHz with a "fractional bandwidth" greater than 10%, and having any of the following:

1. A peak saturated power output greater than

- 70 W (48.54 dBm) at any frequency exceeding 6.8 GHz up to and including 8.5 GHz;
  2. A peak saturated power output greater than 50 W (47 dBm) at any frequency exceeding 8.5 GHz up to and including 12 GHz;
  3. A peak saturated power output greater than 30 W (44.77 dBm) at any frequency exceeding 12 GHz up to and including 16 GHz; or
  4. A peak saturated power output greater than 20 W (43 dBm) at any frequency exceeding 16 GHz up to and including 31.8 GHz;
- c. Rated for operation with a peak saturated power output greater than 0.5 W (27 dBm) at any frequency exceeding 31.8 GHz up to and including 37 GHz;
- d. Rated for operation with a peak saturated power output greater than 2 W (33 dBm) at any frequency exceeding 37 GHz up to and including 43.5 GHz, and with a "fractional bandwidth" of greater than 10%;
- e. Rated for operation at frequencies exceeding 43.5 GHz and having any of the following:
1. A peak saturated power output greater than 0.2 W (23 dBm) at any frequency exceeding 43.5 GHz up to and including 75 GHz, and with a "fractional bandwidth" of greater than 10%;
  2. A peak saturated power output greater than 20 mW (13 dBm) at any frequency exceeding 75 GHz up to and including 90 GHz, and with a "fractional bandwidth" of greater than 5%; or
  3. A peak saturated power output greater than 0.1 nW (-70 dBm) at any frequency exceeding 90 GHz.
5. Electronically or magnetically tunable band-pass or band-stop filters, having more than 5 tunable resonators capable of tuning across a 1.5:1 frequency band ( $f_{max}/f_{min}$ ) in less than 10  $\mu$ s and

having any of the following:

- a. A band-pass bandwidth of more than 0.5% of center frequency; or
- b. A band-stop bandwidth of less than 0.5% of center frequency;

7. Converters and harmonic mixers that are any of the following:

- a. Designed to extend the frequency range of "signal analysers" beyond 110 GHz;
- b. Designed to extend the operating range of signal generators as follows:
  1. Beyond 110 GHz;
  2. To an output power greater than 100 mW (20 dBm) anywhere within the frequency range exceeding 43,5 GHz but not exceeding 110 GHz;

c. Designed to extend the operating range of network analysers as follows:

1. Beyond 110 GHz;
2. To an output power greater than 100mW (20 dBm) anywhere within the frequency range exceeding 43,5 GHz but not exceeding 1100 GHz;

d. Designed to extend the frequency range of microwave test receivers beyond 110 GHz.

8. Microwave power amplifiers containing "vacuum electronic devices" specified in 3A001b.1. and having all of the following:

- a. Operating frequencies above 3 GHz;
- b. An average output power to mass ratio exceeding 80 W/kg; and
- c. A volume of less than 400 cm<sup>3</sup>;

9. Microwave power modules (MPM) consisting of, at least, a travelling wave "vacuum electronic device", a "monolithic microwave integrated circuit" ("MMIC") and an integrated electronic power conditioner and having all of the following:

- a. A 'turn-on time' from off to fully operational in less than 10 seconds;
- b. A volume less than the maximum rated power in

Watts multiplied by 10 cm<sup>3</sup>/W; and

- c. An "instantaneous bandwidth" greater than 1 octave ( $f_{\max} > 2f_{\min}$ ) and having any of the following:
  1. For frequencies equal to or less than 18 GHz, an RF output power greater than 100 W; or
  2. A frequency greater than 18 GHz.
10. Oscillators or oscillator assemblies, specified to operate with a single sideband (SSB) phase noise, in dBc/Hz, less (better) than  $-(126 + 20_{\log} 10F - 20_{\log} 10f)$  anywhere within the range of  $10 \text{ Hz} \leq F \leq 10 \text{ kHz}$ .
11. 'Frequency synthesizer' "electronic assemblies" having a "frequency switching time" as specified by any of the following:
  - a. Less than 143 ps;
  - b. Less than 100  $\mu\text{s}$  for any frequency change exceeding 2,2 GHz within the synthesized frequency range exceeding 4,8 GHz but not exceeding 31,8 GHz;
  - c. D. Less than 500  $\mu\text{s}$  for any frequency change exceeding 550 MHz within the synthesized frequency range exceeding 31.8 GHz but not exceeding 37 GHz;
  - d. Less than 100  $\mu\text{s}$  for any frequency change exceeding 2.2 GHz within the synthesized frequency range exceeding 37 GHz but not exceeding 75 GHz;
  - e. Less than 100  $\mu\text{s}$  for any frequency change exceeding 5,0 GHz within the synthesized frequency range exceeding 75GHz but not exceeding 90 GHz; or
  - f. Less than 1 ms within the synthesized frequency range exceeding 90 GHz.
12. 'Transmit/receive modules', 'transmit/receive MMICs', 'transmit modules', and 'transmit MMICs', rated for operation at frequencies above 2.7 GHz and having all of the following:
  - a. A peak saturated power output (in watts),  $P_{\text{sat}}$ , greater than 505.62 divided by the maximum operating frequency (in GHz) squared [ $P_{\text{sat}} > 505.62$

- 
- $W \cdot \text{GHz}^2 / f \text{GHz}^2$ ] for any channel;
- b. A "fractional bandwidth" of 5% or greater for any channel;
  - c. Any planar side with length  $d$  (in cm) equal to or less than 15 divided by the lowest operating frequency in GHz [ $d \leq 15 \text{cm} \cdot \text{GHz} \cdot N / f \text{GHz}$ ] where  $N$  is the number of transmit or transmit/receive channels; and
  - d. An electronically variable phase shifter per channel.
- c. Acoustic wave devices as follows and specially designed components therefor—
1. Surface acoustic wave and surface skimming (shallow bulk) acoustic wave devices, having any of the following:
    - a. A carrier frequency exceeding 6 GHz;
    - b. A carrier frequency exceeding 1 GHz, but not exceeding 6 GHz and having any of the following:
      1. A 'frequency side-lobe rejection' exceeding 65 dB;
      2. A product of the maximum delay time and the bandwidth (time in  $\mu\text{s}$  and bandwidth in MHz) of more than 100;
      3. A bandwidth greater than 250 MHz; or
      4. A dispersive delay of more than 10  $\mu\text{s}$ ; or
    - c. A carrier frequency of 1 GHz or less and having any of the following:
      1. A product of the maximum delay time and the bandwidth (time in  $\mu\text{s}$  and bandwidth in MHz) of more than 100;
      2. A dispersive delay of more than 10  $\mu\text{s}$ ; or

3. A 'frequency side-lobe rejection' exceeding 65 dB and a bandwidth greater than 100 MHz;
2. Bulk (volume) acoustic wave devices which permit the direct processing of signals at frequencies exceeding 6 GHz;
3. Acoustic-optic "signal processing" devices employing interaction between acoustic waves (bulk wave or surface wave) and light waves which permit the direct processing of signals or images, including spectral analysis, correlation or convolution;
- d. Electronic devices and circuits containing components, manufactured from "superconductive" materials, specially designed for operation at temperatures below the "critical temperature" of at least one of the "superconductive" constituents and having any of the following—
  1. Current switching for digital circuits using "superconductive" gates with a product of delay time per gate (in seconds) and power dissipation per gate (in watts) of less than 10-14 J; or
  2. Frequency selection at all frequencies using resonant circuits with Q-values exceeding 10,000;

High energy devices as follows:

1. 'Cells' as follows:
  - a. 'Primary cells' having any of the following at 20°C:
    1. 'Energy density' exceeding 550 Wh/kg and a 'continuous power density' exceeding 50 W/kg; or
    2. 'Energy density' exceeding 50 Wh/kg and a 'continuous power density' exceeding 350 W/kg; or

- b. 'Secondary cells' having an 'energy density' exceeding 350 Wh/kg at 20°C.

2. High energy storage capacitors as follows:

- a. Capacitors with a repetition rate of less than 10 Hz (single shot capacitors) and having all of the following:

- 1. A voltage rating equal to or more than 5 kV;
- 2. An energy density equal to or more than 250 J/kg; and
- 3. A total energy equal to or more than 25 kJ;

- b. Capacitors with a repetition rate of 10 Hz or more (repetition rated capacitors) and having all of the following:

- 1. A voltage rating equal to or more than 5 kV;
- 2. An energy density equal to or more than 50 J/kg;
- 3. A total energy equal to or more than 100 J; and
- 4. A charge/discharge cycle life equal to or more than 10,000.

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

- a. Energy delivered during the discharge exceeding 10 kJ in the first second;
- b. Inner diameter of the current carrying windings of more than 250 mm; and
- c. Rated for a magnetic induction of more than 8 T or "overall current density" in the winding of more than 300 A/mm<sup>2</sup>.

4. Solar cells, cell-interconnect-cover glass (CIC) assemblies, solar panels, and solar arrays, which are "space-qualified", having a minimum average efficiency exceeding 20% at an operating temperature of 301 K (28°C) under simulated "Air Mass Zero" (AM0) illumination with an irradiance of 1 367 watts per square meter (W/m<sup>2</sup>).
- f. Rotary input type absolute position encoders having an "accuracy" equal to or less (better) than 1.0 second of arc and specially designed encoder rings, discs or scales therefor.
- g. Solid-state pulsed power switching thyristor devices and 'thyristor modules', using either electrically, optically, or electron radiation controlled switch methods and having any of the following:
  1. A maximum turn-on current rate of rise (di/dt) greater than 30,000 A/μs and off-state voltage greater than 1,100 V; or
  2. A maximum turn-on current rate of rise (di/dt) greater than 2,000 A/μs and having all of the following:
    - a. An off-state peak voltage equal to or greater than 3,000 V; and
    - b. A peak (surge) current equal to or greater than 3,000 A.
- h. Solid-state power semiconductor switches, diodes, or 'modules', having all of the following:
  1. Rated for a maximum operating junction temperature greater than 488 K (215°C);
  2. Repetitive peak off-state voltage (including drain to source voltage, collector to emitter voltage, repetitive peak reverse voltage and peak repetitive off-state blocking voltage) exceeding 300 V; and
  3. Continuous current greater than 1 A.
- i. Intensity, amplitude, or phase electro-optic modulators including electro-optic modulators having optical input and output connectors, designed for analogue signals and having any of the following:

1. A maximum operating frequency of more than 10 GHz but less than 20 GHz, an optical insertion loss equal to or less than 3 dB and having any of the following:
  - a. A 'half-wave voltage' ( $V\pi$ ) less than 2.7 V when measured at a frequency of 1 GHz or below; or
  - b. A  $V\pi$  of less than 4 V when measured at a frequency of more than 1 GHz; or
2. A maximum operating frequency equal to or greater than 20 GHz, an optical insertion loss equal to or less than 3 dB and having any of the following:
  - a. A  $V\pi$  less than 3.3 V when measured at a frequency of 1 GHz or below; or
  - b. A  $V\pi$  less than 5 V when measured at a frequency of more than 1 GHz

### 3A002

General purpose "electronic assemblies", modules and equipment, as follows:

- a. Recording equipment and oscilloscopes as follows:
  6. Digital data recorders having all of the following:
    - a. A sustained 'continuous throughput' of more than 6.4 Gbit/s to disk or solid-state drive memory; and
    - b. "Signal processing" of the radio frequency signal data while it is being recorded;
  7. Real-time oscilloscopes having a vertical root-mean-square (rms) noise voltage of less than 2% of full-scale at the vertical scale setting that provides the lowest noise value for any input 3dB bandwidth of 60 GHz or greater per channel
- c. "Signal analyzers" as follows:
  1. "Signal analyzers" having a 3 dB resolution bandwidth (RBW) exceeding 40 MHz anywhere

- within the frequency range exceeding 31,8 GHz but not exceeding 37 GHz;
2. "Signal analyzers" having a Displayed Average Noise Level (DANL) less (better) than - 160 dBm/Hz anywhere within the frequency range exceeding 43.5 GHz but not exceeding 110 GHz;
  3. "Signal analyzers" having a frequency exceeding 110 GHz;
  4. "Signal analyzers" having all of the following:
    - a. Real-time bandwidth' exceeding 520 MHz; and
    - b. Having any of the following:
      1. 100% probability of discovery with less than a 3 dB reduction from full amplitude due to gaps or windowing effects of signals having a duration of 8  $\mu$ s or less; or
      2. A 'frequency mask trigger' function with 100% probability of trigger (capture) for signals having a duration of 8  $\mu$ s or less;
- d. Signal generators, including arbitrary waveform and function generators, having any of the following:
1. Specified to generate pulse-modulated signals having all of the following, anywhere within the frequency range exceeding 31.8 GHz but not exceeding 37 GHz:
    - a. Pulse duration' of less than 25 ns; and
    - b. On/off ratio equal to or exceeding 65 dB;
  2. An output power exceeding 100 mW (20 dBm) anywhere within the frequency range exceeding 43.5 GHz but not exceeding 110 GHz;
  3. A "frequency switching time" as specified by any of the following:
    - b. Less than 100  $\mu$ s for any frequency change exceeding 2.2 GHz within the frequency range exceeding 4.8 GHz but not exceeding 31.8 GHz;

- d. Less than 500  $\mu$ s for any frequency change exceeding 550 MHz within the frequency range exceeding 31.8 GHz but not exceeding 37 GHz; or
  - e. Less than 100  $\mu$ s for any frequency change exceeding 2.2 GHz within the frequency range exceeding 37 GHz but not exceeding 75 GHz;
  - g. Less than 100  $\mu$ s for any frequency change exceeding 5.0 GHz within the frequency range exceeding 75 GHz but not exceeding 110 GHz
4. Single sideband (SSB) phase noise, in dBc/Hz, specified as being any of the following:
- a. Less (better) than  $-(126 + 20\log_{10}F - 20\log_{10}f)$  anywhere within the range of  $10 \text{ Hz} \leq F \leq 10 \text{ kHz}$  anywhere within the frequency range exceeding 3.2 GHz but not exceeding 110 GHz; or
  - b. Less (better) than  $-(206 - 20\log_{10}f)$  anywhere within the range of  $10 \text{ kHz} < F \leq 100 \text{ kHz}$  anywhere within the frequency range exceeding 3.2 GHz but not exceeding 110 GHz;
5. An "RF modulation bandwidth" of digital baseband signals as specified by any of the following:
- a. Exceeding 2.2 GHz within the frequency range exceeding 4.8 GHz but not exceeding 31.8 GHz;
  - b. Exceeding 550 MHz within the frequency range exceeding 31.8 GHz but not exceeding 37 GHz; or
  - c. Exceeding 2.2 GHz within the frequency range exceeding 37 GHz but not exceeding 75 GHz;
  - d. Exceeding 5.0 GHz within the frequency range exceeding 75 but not exceeding 110 GHz; or
6. A maximum frequency exceeding 110 GHz;
- e. Network analyzers having any of the following:

1. An output power exceeding 1 mW (0 dBm) anywhere within the operating frequency range exceeding 43,5 GHz but not exceeding 110 GHz;
  3. 'Nonlinear vector measurement functionality' at frequencies exceeding 50 GHz but not exceeding 110 GHz; or
  4. A maximum operating frequency exceeding 110 GHz;
- f. Microwave test receivers having all of the following:
1. A maximum operating frequency exceeding 110 GHz; and
  2. Being capable of measuring amplitude and phase simultaneously;
- g. Atomic frequency standards being any of the following:
1. "Space-qualified";
  2. Non-rubidium and having a long-term stability less (better) than  $1 \times 10^{-11}$ /month; or
  3. Non-"space-qualified" and having all of the following:
    - a. Being a rubidium standard;
    - b. Long-term stability less (better) than  $1 \times 10^{-11}$ /month; and
    - c. Total power consumption of less than 1 W;
- h. "Electronic assemblies", modules, or equipment including ADC cards, waveform digitizers, data acquisition cards, signal acquisition boards and transient recorders, specified to perform all of the following:
1. Analogue-to-digital conversions meeting any of the following:
    - a. A resolution of 8 bit or more, but less than 10 bit, with a "sample rate" greater than 1.3 Giga Samples Per Second (GSPS);
    - b. A resolution of 10 bit or more, but less than 12 bit, with a "sample rate" greater than 1.0 GSPS;
    - c. A resolution of 12 bit or more, but less than 14 bit, with a "sample rate" greater than 1.0 GSPS;

- d. A resolution of 14 bit or more but less than 16 bit, with a "sample rate" greater than 400 Mega Samples Per Second (MSPS); or
- e. A resolution of 16 bit or more with a "sample rate" greater than 180 MSPS; and

2. Any of the following:

- a. Output of digitized data;
- b. Storage of digitized data; or
- c. Processing of digitized data;

**3A003**

Spray cooling thermal management systems employing closed loop fluid handling and reconditioning equipment in a sealed enclosure where a dielectric fluid is sprayed onto electronic components using specially designed spray nozzles that are designed to maintain electronic components within their operating temperature range, and specially designed components therefor.

**3A101**

Electronic equipment, devices and components, other than those specified in 3A001, as follows:

- a. Analogue-to-digital converters, usable in "missiles", designed to meet military specifications for ruggedized equipment;
- b. Accelerators capable of delivering electromagnetic radiation produced by bremsstrahlung from accelerated electrons of 2 MeV or greater, and systems containing those accelerators.

**3A102**

'Thermal batteries' designed or modified for 'missiles'.

**3A201**

Electronic components, other than those specified in 3A001, as follows:

- a. 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  $\mu\text{F}$ ; and
    - d. Series inductance less than 50 nH; or
  - 2. a. Voltage rating greater than 750 V;
    - b. Capacitance greater than 0.25  $\mu\text{F}$ ; 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;
  - 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.

**3A225**

**Frequency changers or generators, other than those specified in 0B001.b.13., usable as a variable 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
- c. Frequency control better (less) than 0.2%.

**3A226**

**High-power direct current power supplies, other than those specified in 0B001.j.6., 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, other than those specified in 0B001.j.5., 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 including gas krytron tubes and vacuum spraytron tubes, 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  $\mu$ s or less;
- b. Triggered spark-gaps having both of the following characteristics:
  - 1. An anode delay time of 15  $\mu$ s or less; and
  - 2. Rated for a peak current of 500 A or more;
- c. Modules or assemblies with a fast switching function, other than those specified in 3A001.g. or 3A001.h., 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  $\mu$ s or less. 3A229

**3A229****High-current pulse generators as follows:**

- a. Detonator firing sets (initiator systems, firesets), including electronically- charged, explosively- driven and optically- driven firing sets, other than those specified in 1A007.a., designed to drive multiple controlled detonators specified in 1A007.b.;
- 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  $\mu$ s into loads of less than 40 ohms;
  3. Having an output greater than 100 A;
  4. No dimension greater than 30 cm;
  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.

**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

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

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

- b. Utilizing any of the following:
  - 1. Electrostatic acceleration to induce a tritium-deuterium nuclear reaction; or
  - 2. Electrostatic acceleration to induce a deuterium-deuterium nuclear reaction and capable of an output of  $3 \times 10^9$  neutrons/s or greater.

### 3A232

Multipoint initiation systems, other than those specified in 1A007, with arrangements using single or multiple detonators designed to nearly simultaneously initiate an explosive surface over an area greater than  $5,000 \text{ mm}^2$  from a single firing signal with an initiation timing spread over the surface of less than  $2.5 \mu\text{s}$ .

### 3A233

Mass spectrometers, other than those specified in 0B002.g., capable of measuring ions of 230 u 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 ( $-80 \text{ }^\circ\text{C}$ );
- f. Mass spectrometers equipped with a microfluorination ion source designed for actinides or actinide fluorides.

### 3A234

Strip lines 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***3B001**

**Equipment for the manufacturing of semiconductor devices or materials, as follows and specially designed components and accessories therefor:**

- a. Equipment designed for epitaxial growth as follows:
  1. Equipment designed or modified to produce a layer of any material other than silicon with a thickness uniform to less than  $\pm 2,5\%$  across a distance of 75 mm or more, including Atomic Layer Epitaxy (ALE) equipment;
  2. Metal Organic Chemical Vapour Deposition (MOCVD) reactors designed for compound semiconductor epitaxial growth of material having two or more of the following elements: aluminium, gallium, indium, arsenic, phosphorus, antimony, or nitrogen;
  3. Molecular beam epitaxial growth equipment using gas or solid sources;
- b. Equipment designed for ion implantation and having any of the following:
  1. Being designed and optimized to operate at a beam energy of 20 keV or more and a beam current of 10 mA or more for hydrogen, deuterium or helium implant;
  2. Direct write capability;
  3. A beam energy of 65 keV or more and a beam current of 45 mA or more for high energy oxygen implant into a heated semiconductor material "substrate"; or
  4. Being designed and optimized to operate at a beam energy of 20 keV or more and a beam current of 10 mA or more for silicon implant into a semiconductor material "substrate" heated to 600°C or greater;
- e. Automatic loading multi-chamber central wafer handling systems having all of the following:

1. Interfaces for wafer input and output, to which more than two functionally different 'semiconductor process tools' specified in 3B001.a.1., 3B001.a.2., 3B001.a.3. or 3B001.b. are designed to be connected; and
2. Designed to form an integrated system in a vacuum environment for 'sequential multiple wafer processing';

f. Lithography equipment as follows:

1. Align and expose step and repeat (direct step on wafer) or step and scan (scanner) equipment for wafer processing using photo-optical or X-ray methods and having any of the following:
  - a. A light source wavelength shorter than 193 nm; or
  - b. Capable of producing a pattern with a 'Minimum Resolvable Feature size' (MRF) of 45 nm or less;
2. Imprint lithography equipment capable of producing features of 45 nm or less including: Micro contact printing tools; Hot embossing tools; Nano-imprint lithography tools; and Step and flash imprint lithography (S-FIL) tools.
3. Equipment specially designed for mask making having all of the following:
  - a. A deflected focused electron beam, ion beam or "laser" beam; and
  - b. Having any of the following:
    1. A full-width half-maximum (FWHM) spot size smaller than 65 nm and an image placement less than 17 nm (mean + 3 sigma); or
    2. A second-layer overlay error of less than 23 nm (mean + 3 sigma) on the mask;
    3. Equipment designed for device processing using direct writing methods, having all of the following:

- a. A deflected focused electron beam; and
- b. Having any of the following:
  - 1. Minimum beam size equal to or smaller than 15 nm; or
  - 2. An overlay error less than 27 nm (mean + 3 sigma);
- g. Masks and reticles, designed for integrated circuits specified in 3A001;
- h. Multi-layer masks with a phase shift layer not specified in 3B001.g, and designed to be used by lithography equipment having a light source wavelength less than 245 nm;
- i. Imprint lithography templates designed for integrated circuits specified in 3A001.
- j. Mask "substrate blanks" with multilayer reflector structure consisting of molybdenum and silicon, and having all of the following:
  - 1. Specially designed for 'Extreme Ultraviolet' (EUV) lithography; and
  - 2. Compliant with SEMI Standard P37.

### **3B002**

**Test equipment specially designed for testing finished or unfinished semiconductor devices as follows and specially designed components and accessories therefor:**

- a. For testing S-parameters of items specified in 3A001.b.3.;
- b. For testing items specified in 3A001.b.2.

#### *3C Materials*

### **3C001**

**Hetero-epitaxial materials consisting of a "substrate" having stacked epitaxially grown multiple layers of any of the following:**

- a. Silicon (Si);
- b. Germanium (Ge);
- c. Silicon carbide (SiC);
- d. "III/V compounds" of gallium or indium;

- e. Gallium Oxide ( $\text{Ga}_2\text{O}_3$ ); or
- f. Diamond

### 3C002

Resist materials as follows and "substrates" coated with the following resists:

- a. Resists designed for semiconductor lithography as follows:
  - 1. Positive resists adjusted (optimized) for use at wavelengths less than 193 nm but equal to or greater than 15 nm;
  - 2. Resists adjusted (optimized) for use at wavelengths less than 15 nm but greater than 1 nm;
- b. All resists designed for use with electron beams or ion beams, with a sensitivity of 0,01  $\mu\text{coulomb}/\text{mm}^2$  or better;
- d. All resists optimized for surface imaging technologies;
- e. All resists designed or optimized for use with imprint lithography equipment specified in 3B001.f.2. that use either a thermal or photo-curable process.

### 3C003

Organo-inorganic compounds as follows:

- a. Organo-metallic compounds of aluminium, gallium or indium, having a purity (metal basis) better than 99.999%;
- b. Organo-arsenic, organo-antimony and organo-phosphorus compounds, having a purity (inorganic element basis) better than 99.999%.

### 3C004

Hydrides of phosphorus, arsenic or antimony, having a purity better than 99.999%, even diluted in inert gases or hydrogen.

### 3C005

High resistivity materials as follows:

- a. Silicon carbide (SiC), gallium nitride (GaN), aluminium nitride (AlN) or aluminium gallium nitride (AlGaN) gallium oxide ( $\text{Ga}_2\text{O}_3$ ) or diamond semiconductor "substrates", or ingots, boules, or other preforms of those materials, having resistivities greater than 10 000 ohm-cm at 20°C;

b. Polycrystalline “substrates” or polycrystalline ceramic “substrates”, having resistivities greater than 10,000 ohm-cm at 20°C and having at least one non-epitaxial single-crystal layer of silicon (Si), silicon carbide (SiC), gallium nitride (GaN), aluminium nitride (AlN), or aluminium gallium nitride (AlGaN), gallium oxide (Ga<sub>2</sub>O<sub>3</sub>) or diamond on the surface of the “substrate”.

### 3C006

Materials, not specified in 3C001, consisting of a “substrate” specified in 3C005 with at least one epitaxial layer of silicon carbide(SiC), gallium nitride(GaN), aluminium nitride(AlN), aluminium gallium nitride(AlGaN), gallium oxide (Ga<sub>2</sub>O<sub>3</sub>) or diamond.

### *3D Software*

#### 3D001

“Software” specially designed for the “development” or “production” of equipment specified in 3A001.b. to 3A002.h. or 3B.

#### 3D002

“Software” specially designed for the “use” of equipment specified in 3B001.a. to f., 3B002 or 3A225 3D003 ‘Physics-based’ simulation “software” specially designed for the “development” of lithographic, etching or deposition processes for translating masking patterns into specific topographical patterns in conductors, dielectrics or semiconductor materials.

#### 3D003

“Computational lithography”, “software” specially designed for the “development” of patterns on EUV-lithography masks or reticles.

#### 3D004

“Software” specially designed for the “development” of equipment specified in 3A003.

#### 3D005

“Software” specially designed to restore normal operation of a microcomputer, “microprocessor microcircuit” or “microcomputer microcircuit” within 1 ms after an Electromagnetic Pulse (EMP) or Electrostatic Discharge (ESD) disruption, without loss of continuation of operon.

**3D006**

“Electronic Computer-Aided Design”(ECAD) “software” specially designed for the “development” of integrated circuits having any “Gate-All-Around Field-Effect Transistor”(“GAAFET”) structure, and having any of the following.

- a. Specially designed for implementing “Register Transfer Level”(“RTL”) to “Geometrical Database Standard II”(“GDSII) or equivalent standard; or
- b. Specially designed for optimization of power or timing rules.

**3D101**

“Software” specially designed or modified for the “use” of equipment specified in 3A101.b.

**3D225**

“Software” specially designed to enhance or release the performance of frequency changers or generators to meet the characteristics of 3A225.

*3E Technology*

**3E001**

“Technology” according to the General Technology Note for the “development” or “production” of equipment or materials specified in 3A, 3B or 3C;

**3E002**

“Technology” according to the General Technology Note, other than that specified in 3E001, for the “development” or “production” of a “microprocessor microcircuit”, “microcomputer microcircuit” or microcontroller microcircuit core, or of digital signal processors and digital array processors, having an arithmetic logic unit with an access width of 32 bits or more and any of the following features or characteristics:

- a. A ‘vector processor unit’ designed to perform more than two calculations on floating-point vectors (one-dimensional arrays of 32-bit or larger numbers) simultaneously;
- b. Designed to perform more than four 64-bit or larger floating-point operation results per cycle; or
- c. Designed to perform more than eight 16-bit fixed-point multiply-accumulate results per cycle (e.g., digital manipulation of analogue information that has been

previously converted into digital form, also known as digital "signal processing").

**3E003**

**Other "technology" for the "development" or "production" of the following:**

- a. Vacuum microelectronic devices;
- b. Hetero-structure semiconductor electronic devices such as high electron mobility transistors (HEMT), hetero-bipolar transistors (HBT), quantum well and super lattice devices;
- c. "Superconductive" electronic devices;
- d. Substrates of diamond for electronic components.
- e. Substrates of silicon-on-insulator (SOI) for integrated circuits in which the insulator is silicon dioxide;
- f. Substrates of silicon carbide for electronic components;
- g. "Vacuum electronic devices" operating at frequencies of 31.8 GHz or higher;
- h. Substrates of gallium oxide for electronic components

**3E004**

"Technology" "required" for the slicing, grinding and polishing of 300 mm diameter silicon wafers to achieve a "Site Front least squares Range" ("SFQR") less than or equal to 20nm at any site of 26nm x 8mm on the front surface of the wafer and an edge exclusion less than or equal to 2mm.

**3E101**

"Technology" according to the General Technology Note for the "use" of equipment or "software" specified in 3A001.a.1. or 2., 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 3A001.e.2., 3A001.e.3., 3A001.g., 3A201, 3A225 to 3A234.

**3E225**

"Technology", in the form of codes or keys, to enhance or release the performance of frequency changers or generators to meet the characteristics of 3A225.

## CATEGORY 4: COMPUTERS

### *4A Systems, Equipment and Components*

#### 4A001

Electronic computers and related equipment, having any of the following and “electronic assemblies” and specially designed components therefor:

- a. Specially designed to have any of the following:
  1. Rated for operation at an ambient temperature below 228 K (-45°C) or above 358 K (85°C); or
  2. Radiation hardened to exceed any of the following specifications:
    - a. Total dose  $5 \times 10^3$  Gy (silicon);
    - b. Dose rate upset  $5 \times 10^6$  Gy (silicon)/s; or
    - c. Single event upset  $1 \times 10^{-8}$  Error/bit/day;

#### 4A003

“Digital computers”, “electronic assemblies”, and related equipment therefor, as follows and specially designed components therefor, including the following:

- ‘Vector processors’;
- Array processors;
- Digital signal processors;
- Logic processors;
- Equipment designed for “image enhancement”
  - a. “Digital computers” having an “Adjusted Peak Performance” (“APP”) exceeding 29 Weighted TeraFLOPS (WT);
  - b. “Electronic assemblies” specially designed or modified for enhancing performance by aggregation of processors so that the “APP” of the aggregation exceeds the limit specified in 4A003.b.;
  - c. Equipment specially designed for aggregating the performance of “digital computers” by providing external interconnections which allows communications at unidirectional data rates exceeding 2,0 Gbyte/s per link.

**4A004**

Computers as follows and specially designed related equipment, "electronic assemblies" and components therefor:

- a. 'Systolic array computers';
- b. 'Neural computers';
- c. 'Optical computers'.

**4A005**

Systems, equipment, and components therefor, specially designed or modified for the generation, command and control, or delivery of "intrusion software".

**4A101**

Analogue computers, "digital computers" or digital differential analyzers, other than those specified in 4A001(a)i., which are ruggedized and designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

**4A102**

Hybrid computers specially designed for modeling, simulation or design integration of space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

***4B Test, Inspection and Production Equipment***

None

***4C Materials***

None

***4D Software*****4D001**

"Software" as follows:

- a. "Software" specially designed or modified for the "development" or "production" of equipment or "software" specified in 4A001 to 4A004, or 4D.
- b. "Software", other than that specified in 4D001(a), specially designed or modified for the "development" or "production" of equipment as follows:
  1. "Digital computers" having an "Adjusted Peak Performance" ("APP") exceeding 15 Weighted TeraFLOPS (WT);

2. "Electronic assemblies" specially designed or modified for enhancing performance by aggregation of processors so that the "APP" of the aggregation exceeds the limit in 4D001(b)i.

**4D004**

"Software" specially designed or modified for the generation, command and control, or delivery of "intrusion software".

**4E Technology**

**4E001**

"Technology" as follows:

- a. "Technology" according to the General Technology Note, for the "development", "production" or "use" of equipment or "software" specified in 4A or 4D.
- b. "Technology", according to the General Technology Note, other than that specified in 4E001(a), for the "development" or "production" of equipment as follows:
  1. "Digital computers" having an "Adjusted Peak Performance" ("APP") exceeding 15 Weighted TeraFLOPS (WT);
  2. "Electronic assemblies" specially designed or modified for enhancing performance by aggregation of processors so that the "APP" of the aggregation exceeds the limit in 4E001(b)i.
- c. "Technology" for the "development" of "intrusion software".

**CATEGORY 5: TELECOMMUNICATIONS AND "INFORMATION SECURITY"**

**PART 1 – TELECOMMUNICATIONS**

**5A1 Systems, Equipment and Components**

**5A001**

Telecommunications systems, equipment, components and accessories as follows:

- a. Any type of telecommunications equipment having any of the following characteristics, functions or features:
  1. Specially designed to withstand transitory electronic effects or electromagnetic pulse effects, both arising from a nuclear explosion;
  2. Specially hardened to withstand gamma, neutron or ion radiation;

3. Electronic equipment specially designed to operate below 218 K (-55°C); or
  4. Electronic equipment specially designed to operate above 397 K (124°C);
- b. Telecommunication systems and equipment, and specially designed components and accessories therefor, having any of the following characteristics, functions or features:
1. Being underwater untethered communications systems having any of the following:
    - a. An acoustic carrier frequency outside the range from 20 kHz to 60 kHz;
    - b. Using an electromagnetic carrier frequency below 30 kHz;
    - c. Using electronic beam steering techniques; or
    - d. Using "lasers" or light-emitting diodes (LEDs) with an output wavelength greater than 400 nm and less than 700 nm, in a "local area network";
  2. Being radio equipment operating in the 1.5 MHz to 87.5 MHz band and having all of the following:
    - a. Automatically predicting and selecting frequencies and "total digital transfer rates" per channel to optimize the transmission; and
    - b. Incorporating a linear power amplifier configuration having a capability to support multiple signals simultaneously at an output power of 1 kW or more in the frequency range of 1.5 MHz or more but less than 30 MHz, or 250 W or more in the frequency range of 30 MHz or more but not exceeding 87.5 MHz, over an "instantaneous bandwidth" of one octave or more and with an output harmonic and distortion content of better than -80 dB;
  3. Being radio equipment employing "spread spectrum" techniques, including "frequency hopping" techniques, other than those specified in 5A001.b. iv. and having any of the following:
    - a. User programmable spreading codes; or
    - b. A total transmitted bandwidth which is 100 or more times the bandwidth of any one information channel and in excess of 50 kHz;

4. Being radio equipment employing ultra-wideband modulation techniques, having user programmable channelizing codes, scrambling codes or network identification codes and having any of the following:
  - a. A bandwidth exceeding 500 MHz; or
  - b. A "fractional bandwidth" of 20% or more;
5. Being digitally controlled radio receivers having all of the following:
  - a. More than 1 000 channels;
  - b. A 'channel switching time' (the time (i.e., delay) to change from one receiving frequency to another, to arrive at or within  $\pm 0,05\%$  of the final specified receiving frequency) of less than 1 ms;
  - c. Automatic searching or scanning of a part of the electromagnetic spectrum; and
  - d. Identification of the received signals or the type of transmitter; or
6. Employing functions of digital "signal processing" to provide 'voice coding' (the technique to take samples of human voice and then convert these samples into a digital signal, taking into account specific characteristics of human speech) output of continuous speech at rates of less than 700 bit/s.
  - c. Optical fibers of more than 500 m in length and specified by the manufacturer as being capable of withstanding a 'proof test' tensile stress of  $2 \times 10^9$  N/m<sup>2</sup> or more;
  - d. 'Electronically steerable phased array antennae' which forms a beam by means of phase coupling, (the beam direction is controlled by the complex excitation coefficients of the radiating elements) and the direction of that beam can be varied (both in transmission and reception) in azimuth or in elevation, or both, by application of an electrical signal as follows:
    1. Rated for operation above 31.8 GHz, but not exceeding 57 GHz, and having an Effective Radiated Power (ERP) equal to or greater than +20 dBm (22.15 dBm Effective Isotropic Radiated Power (EIRP));

2. Rated for operation above 57 GHz, but not exceeding 66 GHz, and having an ERP equal to or greater than +24 dBm (26.15 dBm EIRP);
3. Rated for operation above 66 GHz, but not exceeding 90 GHz, and having an ERP equal to or greater than +20 dBm (22.15 dBm EIRP);
4. Rated for operation above 90 GHz;
  - e. Radio direction finding equipment operating at frequencies above 30 MHz and having all of the following, and specially designed components therefor:
    1. "Instantaneous bandwidth" of 10 MHz or more; and
    2. Capable of finding a Line Of Bearing (LOB) to non-cooperating radio transmitters with a signal duration of less than 1 ms;
      - f. Mobile telecommunications interception or jamming equipment, and monitoring equipment therefor, as follows, and specially designed components therefor:
        1. Interception equipment designed for the extraction of voice or data, transmitted over the air interface;
        2. Interception equipment not specified in 5A001.f.i., designed for the extraction of client device or subscriber identifiers (e.g., IMSI, TIMSI or IMEI), signaling, or other metadata transmitted over the air interface;
        3. Jamming equipment specially designed or modified to intentionally and selectively interfere with, deny, inhibit, degrade or seduce mobile telecommunication services and performing any of the following:
          - a. Simulate the functions of Radio Access Network (RAN) equipment;
          - b. Detect and exploit specific characteristics of the mobile telecommunications protocol employed (e.g., GSM); or
          - c. Exploit specific characteristics of the mobile telecommunications protocol employed (e.g., GSM);

4. RF monitoring equipment designed or modified to identify the operation of items specified in 5A001.f.i., 5A001.f.ii. or 5A001.f.iii.;
  - g. Passive Coherent Location (PCL) systems or equipment, specially designed for detecting and tracking moving objects by measuring reflections of ambient radio frequency emissions, supplied by non-radar transmitters which may include commercial radio, television or cellular telecommunications base stations;
  - h. Counter Improvised Explosive Device (IED) equipment and related equipment, as follows:
    1. Radio Frequency (RF) transmitting equipment, not specified in 5A001.f., designed or modified for prematurely activating or preventing the initiation of Improvised Explosive Devices;
    2. Equipment using techniques designed to enable radio communications in the same frequency channels on which co-located equipment specified in 5A001.h.i. is transmitting;
      - i. Internet Protocol (IP) network communications surveillance systems or equipment, and specially designed components therefor, having all of the following:
        1. Performing all of the following on a carrier class Internet Protocol (IP) network (e.g., national grade IP backbone):
          - a. Analysis at the application layer (e.g., Layer 7 of Open Systems Interconnection (OSI) model (ISO/IEC 7498-1));
          - b. Extraction of selected metadata and application content (voice, video, messages, attachments); and
          - c. Indexing of extracted data; and
        2. Being specially designed to carry out all of the following:
          - a. Execution of searches on the basis of 'hard selectors' that are either data or set of data, related to an individual; and
          - b. Mapping of the relational network of an individual or of a group of people.

**5A101**

Telemetry and telecontrol equipment, including ground equipment, designed or modified for 'missiles' which include complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

***5B1 Test, Inspection and Production Equipment*****5B001**

Telecommunications test, inspection and production equipment, components and accessories, as follows:

- a. Equipment and specially designed components or accessories therefor, specially designed for the "development" or "production" of equipment, functions or features, specified in 5A001;
- b. Equipment and specially designed components or accessories therefor, specially designed for the "development" of any of the following telecommunication transmission or switching equipment:
  1. Equipment employing a "laser" and having any of the following:
    - a. Transmission wavelength exceeding 1,750 nm; or
    - b. Employing analogue techniques and having a bandwidth exceeding 2.5 GHz; or
    - c. Radio equipment employing Quadrature-Amplitude-Modulation (QAM) techniques above level 1,024;

***5C1 Materials***

None

***5D1 Software*****5D001**

"Software" as follows:

- a. "Software" specially designed or modified for the "development", "production" or "use" of equipment, functions or features, specified in 5A001;
- b. Specific "software" specially designed or modified to provide characteristics, functions or features of equipment, specified in 5A001 or 5B001;

- c. "Software" specially designed or modified for the "development" of any of the following telecommunication transmission or switching equipment;
  - 1. Equipment employing a "laser" and having any of the following:
    - a. A transmission wavelength exceeding 1,750 nm;  
or
    - b. Employing analogue techniques and having a bandwidth exceeding 2.5 GHz;
  - 2. Radio equipment employing Quadrature-Amplitude-Modulation (QAM) techniques above level 1,024.
- d. "Software", other than that specified in 5D001.a. or 5D001.b., specially designed or modified for monitoring or analysis for law enforcement purposes, providing all of the following:
  - 1. Execution of searches on the basis of "hard selectors" of either the content of communication or metadata acquired from a communications service provider using a 'handover interface'; and
  - 2. Mapping of the relational network or tracking the movement or location of targeted individuals based on the results of searches on content of communication or metadata or searches as described in 5D001.d.i

**5D101**

"Software" specially designed or modified for the "use" of equipment specified in 5A101.

**5E1 Technology**

**5E001**

"Technology" as follows:

- a. "Technology" according to the General Technology Note for the "development", "production" or "use" (excluding operation) of equipment, functions or features specified in 5A001 or "software" specified in 5D001.a. or 5D001.d;
- b. Specific "technology" as follows:
  - 1. "Technology" "required" for the "development" or "production" of telecommunications equipment specially designed to be used on board satellites;
  - 2. "Technology" for the "development" or "use" of "laser" communication techniques with the capability of

- automatically acquiring and tracking signals and maintaining communications through exoatmosphere or sub-surface (water) media;
3. "Technology" for the "development" of digital cellular radio base station receiving equipment whose reception capabilities that allow multi-band, multi-channel, multi-mode, multi-coding algorithm or multi-protocol operation can be modified by changes in "software";
  4. "Technology" for the "development" of "spread spectrum" techniques, including "frequency hopping" techniques;
- c. "Technology" according to the General Technology Note for the "development" or "production" of any of the following:
1. Equipment employing a "laser" and having any of the following:
    - a. A transmission wavelength exceeding 1,750 nm; or
    - b. Employing wavelength division multiplexing techniques of optical carriers at less than 100 GHz spacing; or
    - c. Employing analogue techniques and having a bandwidth exceeding 2.5 GHz;
  2. Equipment employing "optical switching" and having a switching time less than 1ms;
  3. Radio equipment having any of the following:
    - a. Quadrature-Amplitude-Modulation (QAM) techniques above level 1,024;
    - b. Operating at input or output frequencies exceeding 31.8 GHz; or
    - c. Operating in the 1.5 MHz to 87.5 MHz band and incorporating adaptive techniques providing more than 15 dB suppression of an interfering signal;
  4. Mobile equipment having all of the following:
    - a. Operating at an optical wavelength greater than or equal to 200 nm and less than or equal to 400 nm; and
    - b. Operating as a "local area network";
- d. "Technology" according to the General Technology Note for the "development" or "production" of "Monolithic Microwave Integrated Circuit" (MMIC) amplifiers specially designed for telecommunications and that are any of the following:

1. Rated for operation at frequencies exceeding 2.7 GHz up to and including 6.8 GHz with a “fractional bandwidth” greater than 15%, and having any of the following:
  - a. A peak saturated power output greater than 75 W (48.75 dBm) at any frequency exceeding 2.7 GHz up to and including 2.9 GHz;
  - b. A peak saturated power output greater than 55 W (47.4 dBm) at any frequency exceeding 2.9 GHz up to and including 3.2 GHz;
  - c. A peak saturated power output greater than 40 W (46 dBm) at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; or
  - d. A peak saturated power output also referred to as output power, saturated power output, maximum power output, peak power output, or peak envelope power output, greater than 20 W (43 dBm) at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;
2. Rated for operation at frequencies exceeding 6.8 GHz up to and including 16 GHz with a “fractional bandwidth” greater than 10%, and having any of the following:
  - a. A peak saturated power output greater than 10W (40 dBm) at any frequency exceeding 6.8 GHz up to and including 8.5 GHz; or
  - b. A peak saturated power output greater than 5W (37 dBm) at any frequency exceeding 8.5 GHz up to and including 16 GHz
3. Rated for operation with a peak saturated power output greater than 3 W (34.77 dBm) at any frequency exceeding 16 GHz up to and including 31.8 GHz, and with a “fractional bandwidth” of greater than 10%;
4. Rated for operation with a peak saturated power output greater than 0.1 nW (-70 dBm) at any frequency exceeding 31.8 GHz up to and including 37 GHz;
5. Rated for operation with a peak saturated power output greater than 1 W (30 dBm) at any frequency exceeding 37 GHz up to and including 43.5 GHz, and with a “fractional bandwidth” of greater than 10%;

6. Rated for operation with a peak saturated power output greater than 31.62 mW (15 dBm) at any frequency exceeding 43.5 GHz up to and including 75 GHz, and with a "fractional bandwidth" of greater than 10%;
  7. Rated for operation with a peak saturated power output greater than 10 mW (10 dBm) at any frequency exceeding 75 GHz up to and including 90 GHz, and with a "fractional bandwidth" of greater than 5%; or
  8. Rated for operation with a peak saturated power output greater than 0.1 nW (-70 dBm) at any frequency exceeding 90 GHz;
- e. "Technology" according to the General Technology Note for the "development" or "production" of electronic devices and circuits, specially designed for telecommunications and containing components manufactured from "superconductive" materials, specially designed for operation at temperatures below the "critical temperature" of at least one of the "superconductive" constituents and having any of the following:
1. Current switching for digital circuits using "superconductive" gates with a product of delay time per gate (in seconds) and power dissipation per gate (in watts) of less than  $10^{-14}$  J; or
  2. Frequency selection at all frequencies using resonant circuits with Q-values exceeding 10,000.

**5E101**

"Technology" according to the General Technology Note for the "development", "production" or "use" of equipment specified by 5A101.

**PART 2 - INFORMATION SECURITY****5A2 Systems, Equipment and Components****5A002**

"Information security" systems, equipment and components, as follows:

- a. Designed or modified to use 'cryptography for data confidentiality' having a 'described security algorithm', where that cryptographic function or capability is usable, has been activated, or can be

- activated by means of “cryptographic activation” not employing a secure mechanism, as follows:
1. Items having “information security” as a primary function;
  2. Digital communication or networking systems, equipment or components, not specified in 5A002. a.i.;
  3. Computers, other items having information storage or processing as a primary function, and components therefor, not specified in 5A002.a.i. or 5A002.a.ii.;
  4. Items, not specified in 5A002.a.i. to 5A002.a.iii., where the ‘cryptography for data confidentiality’ having a ‘described security algorithm’ meets all of the following:
    - i. It supports a non-primary function of the item;  
and
    - ii. It is performed by incorporated equipment or “software” that would, as a standalone item, be specified in Category 5, Part 2;
- b. Being a ‘cryptographic activation token’, an item designed or modified for any of the following:
1. Converting, by means of “cryptographic activation”, an item not specified in Category 5, Part 2 into an item specified in 5A002.a. or 5D002.c.i.; or
  2. Enabling, by means of “cryptographic activation”, additional functionality specified in 5A002.a. of an item already specified in Category 5, Part 2;
- c. Designed or modified to use or perform “quantum cryptography” also known as Quantum Key Distribution (QKD);
- d. Designed or modified to use cryptographic techniques to generate channelizing codes, scrambling codes or network identification codes, for systems using ultra-wideband modulation techniques and having any of the following:
1. A bandwidth exceeding 500 MHz; or
  2. A “fractional bandwidth” of 20% or more;
- e. Designed or modified to use cryptographic techniques to generate the spreading code for “spread spectrum” systems, other than those specified in 5A002.d., including the hopping code for “frequency hopping” systems.

**5A003**

**Systems, equipment and components, for non-cryptographic “information security”, as follows:**

- a. Communications cable systems and in particular, physical layer security (including Layer 1 of the Reference Model of Open Systems interconnection) designed or modified to use mechanical, electrical or electronic means to detect surreptitious intrusion;
- b. Specially designed or modified to reduce the compromising emanations of information-bearing signals beyond what is necessary for health, safety or electromagnetic interference standards.

**5A004**

**Systems, equipment and components for defeating, weakening or bypassing “information security” as follows:**

- a. Designed or modified to perform 'cryptanalytic functions' which are designed to defeat cryptographic mechanisms in order to derive confidential variables or sensitive data, comprising clear text, passwords or cryptographic keys, including systems or equipment by means of reverse engineering.
- b. Items, not specified in 4A005 or 5A004.a., designed to perform all of the following:
  1. 'Extract raw data' from a computing or communications device, meaning, to retrieve binary data from a storage medium (e.g., RAM, flash or hard disk) of the device without interpretation by the device's operating system or filesystem; and
  2. Circumvent “authentication” or authorisation controls of the device, in order to perform the function described in 5A004.b.i.

***5B2 Test, Inspection and Production Equipment*****5B002**

**“Information security” test, inspection and “production” equipment, as follows:**

- a. Equipment specially designed for the “development” or “production” of equipment specified in 5A002, 5A003, 5A004 or 5B002.b.;
- b. Measuring equipment specially designed to evaluate and validate the “information security” functions of the equipment specified

in 5A002, 5A003 or 5A004, or of “software” specified in 5D002.a. or 5D002.c.

**5C2 Materials**

None

**5D2 Software**

**5D002**

“Software” as follows:

- a. “Software” specially designed or modified for the “development”, “production” or “use” of any of the following:
  1. Equipment specified in 5A002 or “software” specified in 5D002.c.i.;
  2. Equipment specified in 5A003 or “software” specified in 5D002.c.ii.; or
  3. Equipment or “software”, as follows:
    - a. Equipment specified in 5A004.a. or “software” specified in 5D002.c.iii.a.
    - b. Equipment specified in 5A004.b. or “software” specified in 5D002.c.iii.b.
- b. “Software” having the characteristics of a ‘cryptographic activation token’ specified in 5A002.b.
- c. “Software” having the characteristics of, or performing or simulating the functions of, any of the following:
  1. Equipment specified in 5A002.a., 5A002.c., 5A002.d. or 5A002.e.;
  2. Equipment specified in 5A003; or
  3. Equipment, as follows:
    - a. Equipment specified in 5A004.a.;
    - b. Equipment specified in 5A004.b

**5E2 Technology**

**5E002**

“Technology” includes “information security” technical data resulting from procedures carried out to evaluate or determine the implementation of functions, features or techniques specified in

**Category 5, Part 2 as follows:**

- a. "Technology" according to the General Technology Note for the "development", "production" or "use" of equipment specified in SA002, SA003, SA004 or 5B002, or of "software" specified in 5D002.a. or 5D002.c.
- b. "Technology" having the characteristics of a 'cryptographic activation token' specified in 5A002.b

**CATEGORY 6: SENSORS AND LASERS**

**6A Systems, Equipment and Components**

**6A001 Acoustic systems, equipment and components, as follows:**

- a. Marine acoustic systems, equipment and specially designed components therefor, as follows:
  1. Active (transmitting or transmitting-and-receiving) systems, equipment and specially designed components therefor, as follows:
    - a. Acoustic seabed survey equipment as follows:
      1. Surface vessel survey equipment designed for seabed topographic mapping and having all of the following:
        - a. Designed to take measurements at an angle exceeding  $20^{\circ}$  from the vertical;
        - b. Designed to measure seabed topography at seabed depths exceeding 600 m;
        - c. 'Sounding resolution' less than 2; and
        - d. 'Enhancement' of the depth "accuracy" through compensation for all the following:
          1. Motion of the acoustic sensor;
          2. In-water propagation from sensor to the seabed and back; and
          3. Sound speed at the sensor;
      2. Underwater survey equipment, whose depth rating is determined by acoustic sensor /pressure, designed for seabed topographic mapping and having any of the following:
        - a. Having all of the following:
          1. Designed or modified to operate at depths exceeding 300 m; and

2. Sounding rate' greater than 3 800 m/s.
- b. Survey equipment, not specified in 6A001.a.1.a.2.a., having all of the following:
  1. Designed or modified to operate at depths exceeding 100m;
  2. Designed to take measurements at an angle exceeding 20 from the vertical;
  3. Having any of the following:
    - a. Operating frequency below 350 kHz; or
    - b. Designed to measure seabed topography at a range exceeding 200 m from the acoustic sensor; and
  4. 'Enhancement' of the depth "accuracy" through compensation of all of the following:
    - a. Motion of the acoustic sensor;
    - b. In-water propagation from sensor to the seabed and back; and
    - c. Sound speed at the sensor;
3. Side Scan Sonar (SSS) or Synthetic Aperture Sonar (SAS), designed for seabed imaging and having all of the following, and specially designed transmitting and receiving acoustic arrays therefor:
  - a. Designed or modified to operate at depths exceeding 500 m;

- b. An 'area coverage rate' which is twice the product of the sonar range and the maximum speed at which the sensor can operate at that range, of greater than  $570 \text{ m}^2/\text{s}$  while operating at the maximum range that it can operate with an 'along track resolution' for SSS only, being the product of azimuth (horizontal) beam width (degrees) and sonar range (m) and 0.873, of less than 15 cm; and
  - c. An 'across track resolution' which is 75 divided by the signal bandwidth (kHz) of less than 15 cm.
- b. Systems or transmitting and receiving arrays, designed for object detection or location, having any of the following:
- 1. A transmitting frequency below 10 kHz;
  - 2. Sound pressure level exceeding 224 dB (reference  $1 \mu\text{Pa}$  at 1 m) for equipment with an operating frequency in the band from 10 kHz to 24 kHz inclusive;
  - 3. Sound pressure level exceeding 235 dB (reference  $1 \mu\text{Pa}$  at 1 m) for equipment with an operating frequency in the band between 24 kHz and 30 kHz;
  - 4. Forming beams of less than  $1^\circ$  on any axis and having an operating frequency of less than 100 kHz;
  - 5. Designed to operate with an unambiguous display range exceeding 5,120 m; or
  - 6. Designed to withstand pressure during normal operation at depths exceeding 1,000 m and having transducers with any of the following:
    - a. Dynamic compensation for pressure; or

- b. Incorporating other than lead zirconate titanate as the transduction element.
- c. Acoustic projectors, (including transducers) specially designed for other equipment not specified in 6A001 is determined by the control status of the other equipment., incorporating piezoelectric (include those made from lead-magnesium-niobateilead- titanate, single crystals grown from solid solution or lead-indium-niobateilead-magnesium niobateilead-titanate, single crystals grown from solid solution), magnetostrictive, electrostrictive, electrodynamic or hydraulic elements operating individually or in a designed combination and having any of the following:
  1. Operating at frequencies below 10 kHz and having any of the following:
    - a. Not designed for continuous operation at 100% duty cycle and having a radiated 'free-field Source Level (SLRMS)' exceeding  $(10\log(f) + 169,77)$  dB (reference 1  $\mu$ Pa at 1 m) where f is the frequency in Hertz of maximum Transmitting Voltage Response (TVR) below 10kHz; or
    - b. Designed for continuous operation at 100% duty cycle and having a continuously radiated 'free-field Source Level (SLRMS)' defined along the maximum response axis and in the far field of the acoustic projector, at 100% duty cycle exceeding  $(10\log(f) + 159,77)$  dB (reference 1  $\mu$ Pa at 1 m) where f is the frequency in Hertz of maximum Transmitting Voltage Response (TVR) below 10kHz; or
  2. Side-lobe suppression exceeding 22 Db.
- d. Acoustic systems and equipment capable of automatically correcting speed-of- sound propagation errors for calculation of a point and using coherent "signal processing" between two or more beacons and the

hydrophone unit, designed to determine the position of surface vessels or submersible vehicles and having all the following, and specially designed components therefor:

1. Detection range exceeding 1,000 m; and
  2. Determined position error of less than 10 m rms (root mean square) when measured at a range of 1,000 m;
  3. Transmitted pulse signal bandwidth exceeding 3 kHz;
- e. Active individual sonars, specially designed or modified to detect and where multiple detection ranges are specified for various environments, the greatest detection range is used, locate and automatically classify swimmers or divers, having all of the following, and specially designed transmitting and receiving acoustic arrays therefor:
1. Detection range exceeding 530 m;
  2. Determined position error of less than 15 m rms (root mean square) when measured at a range of 530 m; and
  3. Transmitted pulse signal bandwidth exceeding 3 kHz;
2. Passive systems, equipment, receiving equipment, whether or not related in normal application to separate active equipment, and specially designed components therefor, as follows:
- a. Hydrophones, including underwater acoustic transducers designed to operate as passive receivers having any of the following:
1. Incorporating continuous flexible sensing elements;
  2. Incorporating flexible assemblies of discrete sensing elements with either a diameter or length less than 20 mm and with a separation between elements of less than 20 mm;
  3. Having any of the following sensing elements:

- a. Optical fibers;
  - b. 'Piezoelectric polymer films', sensing elements which consist of polarized polymer film that is stretched over and attached to a supporting frame or spool (mandrel), other than polyvinylidene-fluoride (PVDF) and its co-polymers {P(VDF-TrFE) and P(VDF-TFE)};
  - c. 'Flexible piezoelectric composites' which are sensing elements, consist of piezoelectric ceramic particles or fibers combined with an electrically insulating, acoustically transparent rubber, polymer or epoxy compound, where the compound is an integral part of the sensing elements;
  - d. Lead-magnesium-niobate/lead-titanate (i.e.,  $\text{Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3\text{-PbTiO}_3$ , or PMN-PT) piezoelectric single crystals grown from solid solution; or
  - e. Lead-indium-niobate/lead-magnesium niobate/lead-titanate (i.e.,  $\text{Pb}(\text{In}_{1/2}\text{Nb}_{1/2})\text{O}_3\text{-Pb}(\text{Mg}_{1/3}\text{Nb}_{2/3})\text{O}_3\text{-PbTiO}_3$ , or PIN-PMN-PT)
  - f. Piezoelectric single crystals grown from solid solution;
4. A 'hydrophone sensitivity' being twenty times the logarithm to the base 10 of the ratio of rms output voltage to a 1 V rms reference, when the hydrophone sensor, without a pre-amplifier, is placed in a plane wave acoustic field with an rms pressure of 1  $\mu\text{Pa}$ . and greater [better] than -180 dB at any depth with no acceleration compensation;
  5. Designed to operate at depths exceeding 35 m with acceleration compensation; or

6. Designed for operation at depths exceeding 1,000 m and having a 'hydrophone sensitivity' better than -230 dB below 4 kHz;
- b. Towed acoustic hydrophone arrays, consist of a number of hydrophones providing multiple acoustic output channels, having any of the following:
    1. Hydrophone group spacing of less than 12.5 m or 'able to be modified' to have hydrophone group spacing of less than 12.5 m;
    2. Designed or 'able to be modified' where there are provisions to allow a change of the wiring or interconnections to alter hydrophone group spacing to operate at depths exceeding 35 m;
    3. Heading sensors specified in 6A001.a.2.d.;
    4. Longitudinally reinforced array hoses;
    5. An assembled array of less than 40 mm in diameter;
    6. Hydrophone characteristics specified in 6A001.a.2.a.; or
    7. Accelerometer-based hydro-acoustic sensors specified in 6A001.a.2.g.;
  - c. Processing equipment, specially designed for towed acoustic hydrophone arrays, having "user-accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beam forming using Fast Fourier or other transforms or processes.
  - d. Heading sensors having all of the following:
    1. An "accuracy" of less (better) than 0.5°; and
    2. Designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m;
  - e. Bottom or bay-cable hydrophone arrays, having any

of the following:

1. Incorporating hydrophones specified in 6A001.a.2.a.;
  2. Incorporating multiplexed hydrophone group signal modules having all of the following characteristics:
    - a. Designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m; and
    - b. Capable of being operationally interchanged with towed acoustic hydrophone array modules; or
  3. Incorporating accelerometer-based hydro-acoustic sensors specified in 6A001.a.2.g.;
- f. Processing equipment, specially designed for bottom or bay cable systems, having "user-accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beam forming using Fast Fourier or other transforms or processes
- g. Accelerometer-based hydro-acoustic sensors or vector sensors having all of the following:
1. Composed of three accelerometers arranged along three distinct axes;
  2. Having an overall 'acceleration sensitivity' which is twenty times the logarithm to the base 10 of the ratio of rms output voltage to a 1 V rms reference, when the hydro-acoustic sensor, without a preamplifier, is placed in a plane wave acoustic field with an rms acceleration of 1 g, greater ['better] than 48 dB (reference 1,000 mV rms per 1g)
  3. Designed to operate at depths greater than 35 meters; and
  4. Operating frequency below 20 kHz.
- b. Correlation-velocity and Doppler-velocity sonar log equipment, designed to measure the horizontal speed of the equipment

carrier relative to the sea bed, as follows:

1. Correlation-velocity sonar log equipment having any of the following characteristics:
  - a. Designed to operate at distances between the carrier and the sea bed exceeding 500 m; or
  - b. Having speed “accuracy” better than 1% of speed;
2. Doppler-velocity sonar log equipment having speed “accuracy” less (better) than 1% of speed.

**6A002**

**Optical sensors or equipment and components therefor, as follows:**

- a. Optical detectors as follows:
  1. “Space-qualified” solid-state detectors including “focal plane arrays” as follows:
    - a. “Space-qualified” solid-state detectors having all of the following:
      1. A peak response in the wavelength range exceeding 10 nm but not exceeding 300 nm; and
      2. A response of less than 0.1% relative to the peak response at a wavelength exceeding 400 nm;
    - b. “Space-qualified” solid-state detectors having all of the following:
      1. A peak response in the wavelength range exceeding 900 nm but not exceeding 1,200 nm; and
      2. A response “time constant” of 95 ns or less;
    - c. “Space-qualified” solid-state detectors having a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm;
    - d. “Space-qualified” “focal plane arrays” having more than 2,048 elements per array and having a peak response in the wavelength range exceeding 300 nm but not exceeding 900 nm;

2. Image intensifier tubes and specially designed components therefor, as follows:
  1. Image intensifier tubes having all of the following:
    1. A peak response in the wavelength range exceeding 400 nm but not exceeding 1,050 nm;
    2. Electron image amplification using any of the following:
      - a. A microchannel plate with a hole pitch (center-to-center spacing) of 12  $\mu\text{m}$  or less; or
      - b. An electron sensing device with a non-binned pixel pitch of 500  $\mu\text{m}$  or less, specially designed or modified to achieve 'charge multiplication' other than by a microchannel plate; and
    3. Any of the following photocathodes:
      - a. Multi-alkali photocathodes having a luminous sensitivity exceeding 350  $\mu\text{A}/\text{lm}$ ;
      - b. GaAs or GaInAs photocathodes; or
      - c. Other "III/V compound" semiconductor photocathodes having a maximum "radiant sensitivity" exceeding 10 mA/W;
  2. Image intensifier tubes having all of the following:
    1. A peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,800 nm;
    2. Electron image amplification using any of the following:
      - a. A microchannel plate with a hole pitch (center-to-center spacing) of 12  $\mu\text{m}$  or less; or
      - b. An electron sensing device with a non-binned pixel pitch of 500  $\mu\text{m}$  or

less, specially designed or modified to achieve 'charge multiplication' other than by a microchannel plate; and

3. "III/V compound" semiconductor (e.g., GaAs or GaInAs) photocathodes and transferred electron photocathodes, having a maximum "radiant sensitivity" exceeding 15 mA/W;
3. Specially designed components as follows:
  1. Microchannel plates having a hole pitch (center-to-center spacing) of 12  $\mu\text{m}$  or less;
  2. An electron sensing device with a non-binned pixel pitch of 500  $\mu\text{m}$  or less, specially designed or modified to achieve 'charge multiplication' other than by a microchannel plate;
  3. "III/V compound" semiconductor photocathodes and transferred electron photocathodes;
3. Non-space-qualified focal plane arrays as follows:
  - a. Non- "space-qualified" "focal plane arrays" having all of the following:
    1. Individual elements with a peak response in the wavelength range exceeding 1 050 nm but not exceeding 1 200 nm; and
    2. Any of the following:
      - a. A response "time constant" of 95 ns or less; or
      - b. Specially designed or modified to achieve 'charge multiplication' and having a maximum "radiant sensitivity" exceeding 10 mA/W;
  - b. Non- "space-qualified| non-linear" focal plane arrays| having all of the following:
    1. Individual elements with a peak response

within the wavelength range exceeding 900nm but not exceeding 1,050nm; and

2. Any of the following:
  - a. A response "time constant" of less than 0.5 ns; or
  - b. Specially designed or modified to achieve 'charge multiplication' and having a maximum "radiant sensitivity" exceeding 10mA/W
- c. Non-"space-qualified" non-linear (2-dimensional) "focal plane arrays" having individual elements with a peak response in the wavelength range exceeding 1 200 nm but not exceeding 30 000 nm;
- d. Non-"space-qualified" linear (1-dimensional) "focal plane arrays" having all of the following:
  1. Individual elements with a peak response in the wavelength range exceeding 1,200 nm but not exceeding 3,000 nm; and
  2. Any of the following:
    - a. A ratio of 'scan direction' being the axis perpendicular to the linear array dimension of the detector element to the 'cross-scan direction' being axis parallel to linear array of dimension of the detector element of less than 3.8; or
    - b. Signal processing in the detector elements;
- e. Non-"space-qualified" linear (1-dimensional) "focal plane arrays" having individual elements with a peak response in the wavelength range exceeding 3,000 nm but not exceeding 30,000 nm;
- f. Non-"space-qualified" non-linear (2-dimensional) infrared "focal plane arrays" based on 'microbolometer' (a thermal imaging detector that, as a result of a temperature change in the detector caused by the absorption of infrared radiation, is used to generate any usable signal) material having individual elements with an unfiltered response in

- the wavelength range equal to or exceeding 8,000 nm but not exceeding 14,000 nm;
- g. Non-"space-qualified" "focal plane arrays" having all of the following:
    - 1. Individual detector elements with a peak response in the wavelength range exceeding 400 nm but not exceeding 900 nm;
    - 2. Specially designed or modified to achieve 'charge multiplication' and having a maximum "radiant sensitivity" exceeding 10 mA/W for wavelengths exceeding 760 nm; and
    - 3. Greater than 32 elements;
  - b. "Monospectral imaging sensors" and "multispectral imaging sensors", designed for remote sensing applications and having any of the following:
    - 1. An Instantaneous-Field-Of-View (IFOV) of less than 200  $\mu$ rad (microradians); or
    - 2. Specified for operation in the wavelength range exceeding 400 nm but not exceeding 30,000 nm and having all the following:
      - a. Providing output imaging data in digital format; and
      - b. Having any of the following characteristics:
        - 1. "Space-qualified"; or
        - 2. Designed for airborne operation, using other than silicon detectors, and having an IFOV of less than 2.5 mrad (milliradians);
  - c. 'Direct view' imaging equipment that presents a visual image to a human observer without converting the image into an electronic signal for television display, and that cannot record or store the image photographically, electronically or by any other means, incorporating any of the following:
    - 1. Image intensifier tubes specified in 6A002.a.2.a. or 6A002.a.2.b.;

2. "Focal plane arrays" specified in 6A002.a.3.; or
3. Solid state detectors specified in 6A002.a.1.;
- d. Special support components for optical sensors, as follows:
  1. "Space-qualified" cryocoolers;
  2. Non-"space-qualified" cryocoolers having a cooling source temperature below 218 K (-55°C), as follows:
    - a. Closed cycle type with a specified Mean-Time-To-Failure (MTTF) or Mean-Time-Between-Failures (MTBF), exceeding 2,500 hours;
    - b. Joule-Thomson (JT) self-regulating mini-coolers having bore (outside) diameters of less than 8 mm;
  3. Optical sensing fibers specially fabricated either compositionally or structurally, or modified by coating, to be acoustically, thermally, inertially, electromagnetically or nuclear radiation sensitive.
- e. 'Read-out integrated circuits' ('ROIC') is an integrated circuit designed to underlie and used to read-out signals produced by the detector elements specially designed for "focal plane arrays" specified in 6A002.a.3.

### **6A003**

#### **Cameras, systems or equipment, and components therefor, as follows:**

- a. Instrumentation cameras and specially designed components therefor, as follows:
  1. Electronic streak cameras having temporal resolution better than 50 ns;
  2. Electronic framing cameras having a speed exceeding 1,000,000 frames/s;
  3. Electronic cameras having all of the following:
    - a. An electronic shutter speed (gating capability) of less than 1  $\mu$ s per full frame; and
    - b. A read-out time allowing a framing rate of more than 125 full frames per second;
  4. Plug-ins having all of the following characteristics:
    - a. Specially designed for instrumentation cameras

which have modular structures and which are specified in 6A003.a.; and

- b. Enabling these cameras to meet the characteristics specified in 6A003.a.1., 6A003.a.2., or 6A003.a.3., according to the manufacturer's specifications
- b. Imaging cameras as follows:
1. Video cameras incorporating solid state sensors, having a peak response in the wavelength range exceeding 10 nm, but not exceeding 30,000 nm and having all of the following:
    - a. Having any of the following:
      1. More than 4 x 10<sup>6</sup> "active pixels" per solid state array for monochrome (black and white) cameras;
      2. More than 4 x 10<sup>6</sup> "active pixels" per solid state array for colour cameras incorporating three solid state arrays; or
      3. More than 12 x 10<sup>6</sup> "active pixels" for solid state array colour cameras incorporating one solid state array; and
    - b. Having any of the following:
      1. Optical mirrors specified in 6A004.a.;
      2. Optical control equipment specified in 6A004.d.; or
      3. The capability for annotating internally generated 'camera tracking data' being the information necessary to define camera line of sight orientation with respect to the earth;
  2. Scanning cameras and scanning camera systems, having all of the following:
    - a. A peak response in the wavelength range exceeding 10 nm, but not exceeding 30,000 nm;
    - b. Linear detector arrays with more than 8,192 elements per array; and
    - c. Mechanical scanning in one direction
  3. Imaging cameras incorporating image intensifier tubes specified in 6A002.a.2.a. or 6A002.a.2.b.;

4. Imaging cameras incorporating "focal plane arrays" combined with sufficient "signal processing" electronics, beyond the read out integrated circuit, to enable as a minimum the output of an analogue or digital signal once power is supplied, having any of the following:
  - a. Incorporating "focal plane arrays" specified in 6A002.a.3.a. to 6A002.a.3.e.;
  - b. Incorporating "focal plane arrays" specified in 6A002.a.3.f.; or
  - c. Incorporating "focal plane arrays" specified in 6A002.a.3.g.;
5. Imaging cameras incorporating solid-state detectors specified in 6A002.a.1.

#### **6A004**

##### **Optical equipment and components, as follows:**

- a. Optical mirrors (reflectors) incorporating Laser Induced Damage Threshold (LIDT) measured according to ISO 21254-1: 2011 as follows:
  1. Deformable mirrors' having an active optical aperture greater than 10mm and having any of the following, and specially designed component therefor;
    - a. Having all the following:
      1. A mechanical resonant frequency of 750 Hz or more; and
      2. More than 200 actuators; or
    - b. A Laser Induced Damage Threshold (LIDT) being any of the following:
      1. Greater than 1 kW/ cm<sup>2</sup> using a "CW laser"; or
      2. Greater than 2 J/ cm<sup>2</sup> using 20 ns "laser" pulses at 20 Hz repetition rate;
  2. Lightweight monolithic mirrors having an average "equivalent density" of less than 30 kg/m<sup>2</sup> and a total mass exceeding 10 kg;
  3. Lightweight "composite" or foam mirror structures having an average "equivalent density" of less than 30 kg/m<sup>2</sup> and a

total mass exceeding 2 kg;

4. Mirrors specially designed for beam steering mirror stages specified in 6A004.d.2.a. with a flatness of  $\lambda/10$  or better ( $\lambda$  is equal to 633 nm) and having any of the following:
  - a. Diameter or major axis length greater than or equal to 100 mm; or
  - b. Having all of the following:
    1. Diameter or major axis length greater than 50 mm but less than 100 mm; and
    2. A Laser Induced Damage Threshold (LIDT) being any of the following:
      - a. Greater than 10 kW/cm<sup>2</sup> using a “CW laser”; or
      - b. Greater than 20 J/cm<sup>2</sup> using 20 ns “laser” pulses at 20 Hz repetition rate;
- b. Optical components made from zinc selenide (ZnSe) or zinc sulphide (ZnS) with transmission in the wavelength range exceeding 3,000 nm but not exceeding 25,000 nm and having any of the following:
  1. Exceeding 100 cm<sup>3</sup> in volume; or
  2. Exceeding 80 mm in diameter or length of major axis and 20 mm in thickness (depth);
- c. “Space-qualified” components for optical systems, as follows:
  1. Components light-weighted to less than 20% “equivalent density” compared with a solid blank of the same aperture and thickness;
  2. Raw substrates, processed substrates having surface coatings (single-layer or multi-layer, metallic or dielectric, conducting, semiconducting or insulating) or having protective films;
  3. Segments or assemblies of mirrors designed to be assembled in space into an optical system with a collecting aperture equivalent to or larger than a single optic 1 m in diameter;
  4. Components manufactured from “composite” materials

having a coefficient of linear thermal expansion equal to or less than  $5 \times 10^{-6}$  in any coordinate direction;

- d. Optical control equipment as follows:
1. Equipment specially designed to maintain the surface figure or orientation of the "space-qualified" components specified in 6A004.c.1. or 6A004.c.3.;
  2. Steering, tracking, stabilization and resonator alignment equipment as follows:
    - a. Beam steering mirror stages designed to carry mirrors having diameter or major axis length greater than 50 mm and having all of the following, and specially designed electronic control equipment therefor:
      1. A maximum angular travel of  $\pm 26$  mrad or more;
      2. A mechanical resonant frequency of 500 Hz or more; and
      3. An angular "accuracy" of 10  $\mu$ rad (microradians) or less (better);
    - b. Resonator alignment equipment having bandwidths equal to or more than 100 Hz and an "accuracy" of 10  $\mu$ rad or less (better);
  3. Gimbals having all of the following:
    - a. A maximum slew exceeding  $5^\circ$ ;
    - b. A bandwidth of 100 Hz or more;
    - c. Angular pointing errors of 200  $\mu$ rad (microradians) or less; and
    - d. Having any of the following:
      1. Exceeding 0.15 m but not exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 2 rad; or
      2. Exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 0.5 rad;
    - e. Aspheric optical elements' used in an optical system whose imaging surface or surfaces are designed to depart from the shape of an ideal sphere having all of the following:

1. Largest dimension of the optical-aperture greater than 400 mm;
  2. Surface roughness where the optical element is designed or manufactured with the intent to meet, or exceed, the control parameter less than 1 nm (rms) for sampling lengths equal to or greater than 1 mm; and
  3. Coefficient of linear thermal expansion's absolute magnitude less than  $3 \times 10^{-6}/K$  at  $25^{\circ}C$ .
- f. Dynamic wavefront measuring equipment having all of the following:
1. 'Frame rates' being a frequency at which all —active pixelsl in the —focal plane arrayl are integrated for recording images protected by the wav-efront sensor optics, equal to or more than 1 kHz; and
  2. A wavefront accuracy equal to or less (better) than  $\lambda/20$  at the designed wavelength.
  - 3.

**6A005**

**"Lasers", other than those specified in 0B001.g.5. or 0B001.h.6., components and optical equipment, as follows:**

- a) Non-"tunable" continuous wave "(CW) lasers" having any of the following:
1. Output wavelength less than 150 nm and output power exceeding 1 W;
  2. Output wavelength of 150 nm or more but not exceeding 510 nm and output power exceeding 30W;
  3. Output wavelength exceeding 510 nm but not exceeding 540 nm and any of the following:
    - a) 'Single transverse mode' being a beam profile having an M2-factor of less than 1,3, output and output power exceeding 50 W; or
    - b) 'Multiple transverse mode' being "lasers" with a beam profile having an M2-factor of 1.3 or higher output and output power exceeding 150 W;

4. Output wavelength exceeding 540 nm but not exceeding 800 nm and output power exceeding 30 W;
5. Output wavelength exceeding 800 nm but not exceeding 975 nm and any of the following:
  - a) 'Single transverse mode' being a beam profile having an M2-factor of less than 1.3, output and output power exceeding 50 W; or
  - b) 'Multiple transverse mode' being "lasers" with a beam profile having an M2- factor of 1.3 or output and output power exceeding 80 W;
6. Output wavelength exceeding 975 nm but not exceeding 1,150 nm and any of the following:
  - a) 'Single transverse mode' output and any of the following:
    1. Output power exceeding 1,000 W; or
    2. Having all of the following:
      - a) Output power exceeding 500 W; and
      - b) Spectral bandwidth less than 40 GHz; or
  - b) 'Multiple transverse mode' output and any of the following:
    1. 'Wall-plug efficiency' being the ratio of "laser" output power (or average output power) to total electrical input power required to operate the "laser", including the power supply/conditioning and thermal conditioning/heat exchanger, exceeding 18% and output power exceeding 1,000 W; or
    2. Output power exceeding 2 kW;
7. Output wavelength exceeding 1,150 nm but not exceeding 1,555 nm and any of the following:
  - a) 'Single transverse mode' and output power exceeding 50 W; or
  - b) 'Multiple transverse mode' and output power exceeding 80 W;
8. Output wavelength exceeding 1,555 nm but not exceeding 1,850 nm and output power exceeding 1 W;

9. Output wavelength exceeding 1,850 nm but not exceeding 2,100 nm, and any of the following:
    - a) 'Single transverse mode' and output power exceeding 1 W; or
    - b) 'Multiple transverse mode' output and output power exceeding 120 W; or
  10. Output wavelength exceeding 2,100 nm and output power exceeding 1 W;
- b) Non-“tunable” “pulsed lasers” having any of the following:
1. Output wavelength less than 150 nm and any of the following:
    - a. Output energy exceeding 50 mJ per pulse and “peak power” exceeding 1 W; or
    - b. “Average output power” exceeding 1 W;
  2. Output wavelength of 150 nm or more but not exceeding 510 nm and any of the following:
    - a. Output energy exceeding 1.5 J per pulse and “peak power” exceeding 30 W; or
    - b. “Average output power” exceeding 30 W
  3. Output wavelength exceeding 510 nm but not exceeding 540 nm and any of the following:
    - a. 'Single transverse mode' output and any of the following:
      1. Output energy exceeding 1.5 J per pulse and “peak power” exceeding 50 W; or
      2. “Average output power” exceeding 50 W; or
    - b. 'Multiple transverse mode' output and any of the following:
      1. Output energy exceeding 1.5 J per pulse and “peak power” exceeding 150 W; or
      2. “Average output power” exceeding 150 W;
  4. Output wavelength exceeding 540 nm but not exceeding 800 nm and any of the following:
    - a. Pulse duration” less than 1 ps and any of the following:

1. Output energy exceeding 0.005 J per pulse and "peak power" exceeding 5 GW; or
    2. "Average output power" exceeding 20 W; or
  - b. "Pulse duration" equal to or exceeding 1 ps and any of the following:
    1. Output energy exceeding 1.5 J per pulse and "peak power" exceeding 30 W; or
    2. "Average output power" exceeding 30 W;
5. Output wavelength exceeding 800 nm but not exceeding 975 nm and any of the following:
  - a. "Pulse duration" less than 1 ps and any of the following:
    1. Output energy exceeding 0.005 J per pulse and "peak power" exceeding 5 GW; or
    2. 'Single transverse mode' output and "average output power" exceeding 20 W;
  - b. "Pulse duration" equal to or exceeding 1 ps and not exceeding 1  $\mu$ s and any of the following:
    1. Output energy exceeding 0.5 J per pulse and "peak power" exceeding 50 W;
    2. 'Single transverse mode' output and "average output power" exceeding 20 W; or
    3. 'Multiple transverse mode' output and "average output power" exceeding 50 W; or
  - c. "Pulse duration" exceeding 1  $\mu$ s and any of the following:
    1. Output energy exceeding 2 J per pulse and "peak power" exceeding 50 W;
    2. 'Single transverse mode' output and "average output power" exceeding 50 W; or
    - 'Multiple transverse mode' output and "average output power" exceeding 80 W
6. Output wavelength exceeding 975 nm but not exceeding 1,150 nm and any of the following:
  - a. "Pulse duration" of less than 1 ps, and any of the following:

1. Output "peak power" exceeding 2 GW per pulse;
2. "Average output power" exceeding 30 W; or
3. Output energy exceeding 0.002 J per pulse;
- b. "Pulse duration" equal to or exceeding 1 ps and less than 1 ns and any of the following:
  1. Output "peak power" exceeding 5 GW per pulse;
  2. "Average output power" exceeding 50 W; or
  3. Output energy exceeding 0.1 J per pulse;
- c. "Pulse duration" equal to or exceeding 1 ns but not exceeding 1  $\mu$ s, and any of the following;
- d. "Pulse duration" exceeding 1  $\mu$ s and any of the following:
  1. 'Single transverse mode' output and any of the following:
    - a. "Peak power" exceeding 500 kW;
    - b. 'Wall-plug efficiency' exceeding 12% and "average output power" exceeding 100 W; or
    - c. "Average output power" exceeding 150 W; or
  2. 'Multiple transverse mode' output and any of the following:
    - a. "Peak power" exceeding 1 MW;
    - b. 'Wall-plug efficiency' exceeding 18% and "average output power" exceeding 500 W; or
    - c. "Average output power" exceeding 2 kW;
7. Output wavelength exceeding 1,150 nm but not exceeding 1,555 nm, and any of the following:
  - a. "Pulse duration" not exceeding 1  $\mu$ s and any of the following:

1. Output energy exceeding 0.5 J per pulse and "peak power" exceeding 50 W;
    2. 'Single transverse mode' output and "average output power" exceeding 20 W; or
    3. 'Multiple transverse mode' output and "average output power" exceeding 50 W; or
  - b. "Pulse duration" exceeding 1  $\mu$ s and any of the following:
    1. Output energy exceeding 2 J per pulse and "peak power" exceeding 50 W;
    2. 'Single transverse mode' output and "average output power" exceeding 50 W; or
    3. 'Multiple transverse mode' output and "average output power" exceeding 80 W;
8. Output wavelength exceeding 1,555 nm but not exceeding 1,850 nm, and any of the following:
  - a. Output energy exceeding 100 mJ per pulse and "peak power" exceeding 1 W; or
  - b. "Average output power" exceeding 1 W;
9. Output wavelength exceeding 1,850 nm but not exceeding 2,100 nm, and any of the following:
  - a. 'Single transverse mode' and any of the following:
    1. Output energy exceeding 100 mJ per pulse and "peak power" exceeding 1 W; or
    2. "Average output power" exceeding 1 W; or
  - b. 'Multiple transverse mode' and any of the following:
    1. Output energy exceeding 100 mJ per pulse and "peak power" exceeding 10 kW; or
    2. "Average output power" exceeding 120 W; or
10. Output wavelength exceeding 2,100 nm and any of the following:
  - ii. Output energy exceeding 100 mJ per pulse and "peak power" exceeding 1 W; or

- iii. "Average output power" exceeding 1 W;
- c) "Tunable" "lasers" having any of the following:
  - 1. Output wavelength less than 600 nm and any of the following:
    - a. Output energy exceeding 50 mJ per pulse and "peak power" exceeding 1 W; or
    - b. Average or CW output power exceeding 1 W;
  - 2. Output wavelength of 600 nm or more but not exceeding 1,400 nm, and any of the following:
    - a. Output energy exceeding 1 J per pulse and "peak power" exceeding 20 W; or
    - b. Average or CW output power exceeding 20 W; or
  - 3. Output wavelength exceeding 1,400 nm and any of the following:
    - a. Output energy exceeding 50 mJ per pulse and "peak power" exceeding 1 W; or
    - b. Average or CW output power exceeding 1 W;
- d) Other "lasers", not specified in 6A005.a., 6A005.b. or 6A005.c. as follows:
  - 1. Semiconductor "lasers" having optical output connectors like, fiber optic pigtails as follows:
    - a. Individual single-transverse mode semiconductor "lasers" having any of the following:
      - 1. Wavelength equal to or less than 1,510 nm and average or CW output power, exceeding 1.5 W; or
      - 2. Wavelength greater than 1,510 nm and average or CW output power, exceeding 500 mW;
    - b. Individual multiple-transverse mode semiconductor "lasers" having any of the following:
      - 1. Wavelength of less than 1 400 nm and average or CW output power, exceeding 15W;
      - 2. Wavelength equal to or greater than 1,400 nm and less than 1,900 nm and average or CW output power, exceeding 2.5 W; or

3. Wavelength equal to or greater than 1,900 nm and average or CW output power, exceeding 1 W;
- c. Individual semiconductor "laser" 'bars', having any of the following:
  1. Wavelength of less than 1,400 nm and average or CW output power, exceeding 100 W;
  2. Wavelength equal to or greater than 1,400 nm and less than 1,900 nm and average or CW output power, exceeding 25 W; or
  3. Wavelength equal to or greater than 1,900 nm and average or CW output power, exceeding 10 W;
- d. Semiconductor "laser" 'stacked arrays' (two-dimensional arrays) having any of the following:
  1. Wavelength less than 1,400 nm and having any of the following:
    - a. Average or CW total output power less than 3 kW and having average or CW output 'power density' greater than 500 W/cm<sup>2</sup>;
    - b. Average or CW total output power equal to or exceeding 3 kW but less than or equal to 5 kW, and having average or CW output 'power density' greater than 350 W/cm<sup>2</sup>;
    - c. Average or CW total output power exceeding 5 kW;
    - d. Peak pulsed 'power density' exceeding 2,500 W/cm<sup>2</sup>; or
    - e. Spatially coherent average or CW total output power, greater than 150 W;
  2. Wavelength greater than or equal to 1,400 nm but less than 1,900 nm, and having any of the following:

- a. Average or CW total output power less than 250 W and average or CW output 'power density' greater than 150 W/cm<sup>2</sup>;
  - b. Average or CW total output power equal to or exceeding 250 W but less than or equal to 500 W, and having average or CW output 'power density' greater than 50 W/cm<sup>2</sup>;
  - c. Average or CW total output power exceeding 500 W;
  - d. Peak pulsed 'power density' exceeding 500 W/cm<sup>2</sup>; or
  - e. Spatially coherent average or CW total output power, exceeding 15 W;
3. Wavelength greater than or equal to 1,900 nm and having any of the following:
1. Average or CW output 'power density' greater than 50 W/cm<sup>2</sup>;
  2. Average or CW output power greater than 10 W; or
  3. Spatially coherent average or CW total output power, exceeding 1.5 W; or
4. At least one "laser" 'bar' specified in 6A005.d.1.c.
- e. Semiconductor "laser" or "laser" diode, 'stacked arrays', other than those specified in 6A005.d.1.d., having all of the following:
1. Specially designed or modified to be combined with other 'stacked arrays' to form a larger 'stacked array'; and
  2. Integrated connections, common for both electronics and cooling;
2. Carbon monoxide (CO) "lasers" having any of the following:
- a. Output energy exceeding 2 J per pulse and "peak

- power" exceeding 5 kW; or
- b. Average or CW output power exceeding 5 kW;
- 3. Carbon dioxide (CO<sub>2</sub>) "lasers" having any of the following:
  - a. CW output power exceeding 15 kW;
  - b. Pulsed output with a "pulse duration" exceeding 10  $\mu$ s and any of the following:
    - 1. "Average output power" exceeding 10 kW; or
    - 2. "Peak power" exceeding 100 kW; or
  - c. Pulsed output with a "pulse duration" equal to or less than 10  $\mu$ s and any of the following:
    - 1. Pulse energy exceeding 5 J per pulse; or
    - 2. "Average output power" exceeding 2.5 kW;
- 4. Excimer "lasers" having any of the following:
  - a. Output wavelength not exceeding 150 nm and any of the following:
    - 1. Output energy exceeding 50 mJ per pulse; or
    - 2. "Average output power" exceeding 1 W;
  - b. Output wavelength exceeding 150 nm but not exceeding 190 nm and any of the following:
    - 1. Output energy exceeding 1.5 J per pulse; or
    - 2. "Average output power" exceeding 120 W;
  - c. Output wavelength exceeding 190 nm but not exceeding 360 nm and any of the following:
    - 1. Output energy exceeding 10 J per pulse; or
    - 2. "Average output power" exceeding 500 W; or
  - d. Output wavelength exceeding 360 nm and any of the following:
    - 1. Output energy exceeding 1.5 J per pulse; or
    - 2. "Average output power" exceeding 30 W;
- 5. "Chemical lasers" as follows:
  - a. Hydrogen Fluoride (HF) "lasers";

- b. Deuterium Fluoride (DF) "lasers";
- c. 'Transfer lasers' being "lasers" in which the lasting species are excited through the transfer of energy by collision of a non-lasting atom or molecule with a lasting atom or molecule species, as follows:
  - 1. Oxygen Iodine (O2-I) "lasers";
  - 2. Deuterium Fluoride-Carbon dioxide (DF-CO2) "lasers";
- 6. 'Non-repetitive pulsed' being "lasers" that produce either a single output pulse or that have a time interval between pulses exceeding one minute, Nd: glass "lasers" having any of the following:
  - a. "Pulse duration" not exceeding 1  $\mu$ s and output energy exceeding 50 J per pulse; or
  - b. "Pulse duration" exceeding 1  $\mu$ s and output energy exceeding 100 J per pulse;
- e) Components as follows:
  - 1. Mirrors cooled either by 'active cooling' or by heat pipe cooling;
  - 2. Optical mirrors or transmissive or partially transmissive optical or electro-optical components, other than fused tapered fiber combiners and Multi-Layer Dielectric gratings (MLDs), specially designed for use with specified "lasers";
  - 3. Fiber "laser" components as follows:
    - a. Multimode to multimode fused tapered fiber combiners having all of the following:
      - 1. An insertion loss better (less) than or equal to 0.3 dB maintained at a rated total average or CW output power (excluding output power transmitted through the single mode core if present) exceeding 1,000 W; and
      - 2. Number of input fibers equal to or greater than 3;
    - b. Single mode to multimode fused tapered fiber combiners having all of the following:
      - 1. An insertion loss better (less) than 0.5 dB

- maintained at a rated total average or CW output power exceeding 4,600 W;
- 2. Number of input fibers equal to or greater than 3; and
- 3. Having any of the following:
  - a. A Beam Parameter Product (BPP) measured at the output not exceeding 1.5 mm mrad for a number of input fibers less than or equal to 5; or
  - b. A BPP measured at the output not exceeding 2.5 mm mrad for a number of input fibers greater than 5;
  - c. MLDs having all of the following:
    - 1. Designed for spectral or coherent beam combination of 5 or more fiber "lasers"; and
    - 2. CW "Laser" Induced Damage Threshold (LIDT) greater than or equal to 10 kW/cm<sup>2</sup>.
- f) Optical equipment as follows:
  - 1. "Laser" diagnostic equipment specially designed for dynamic measurement of "SHPL" system angular beam steering errors and having an angular "accuracy" of 10  $\mu$ rad (microradians) or less (better);
  - 2. Optical equipment and components, specially designed for coherent beam combination in a phased-array "SHPL" system and having any of the following:
    - a. An "accuracy" of 0.1  $\mu$ m or less, for wavelengths greater than 1  $\mu$ m; or
    - b. An "accuracy" of  $\lambda/10$  or less (better) at the designed wavelength, for wavelengths equal to or less than 1  $\mu$ m;
  - 3. Projection telescopes specially designed for use with "SHPL" systems;
- g) "Laser acoustic detection equipment"/"Laser" Microphone/Particle Flow Detection Microphone having all of the following:
  - 1. CW "laser" output power equal to or exceeding 20 mW;
  - 2. "Laser" frequency stability equal to or better (less) than 10 MHz;

3. "Laser" wavelengths equal to or exceeding 1,000 nm but not exceeding 2,000 nm;
4. Optical system resolution better (less) than 1 nm; and
5. Optical Signal to Noise ratio equal to or exceeding 103.

**6A006**

"Magnetometers", "magnetic gradiometers", "intrinsic magnetic gradiometers", underwater electric field sensors, "compensation systems", and specially designed components therefor, as follows:

- a. "Magnetometers and subsystems as follows:
  1. "Magnetometers" using "superconductive" (SQUID) "technology" and having any of the following:
    - a. SQUID systems designed for stationary operation, without specially designed subsystems designed to reduce in-motion noise, and having a 'sensitivity' equal to or lower (better) than 50 fT (rms) per square root Hz at a frequency of 1 Hz; or
    - b. SQUID systems having an in-motion-magnetometer 'sensitivity' lower (better) than 20 pT (rms) per square root Hz at a frequency of 1 Hz and specially designed to reduce in-motion noise;
  2. "Magnetometers" using optically pumped or nuclear precession (proton/Overhauser) "technology" having a 'sensitivity' lower (better) than 20 pT (rms) per square root Hz at a frequency of 1 Hz;
  3. "Magnetometers" using fluxgate "technology" having a 'sensitivity' equal to or lower (better) than 10 pT (rms) per square root Hz at a frequency of 1 Hz;
  4. Induction coil "magnetometers" having a 'sensitivity' lower (better) than any of the following:
    - a. 0.05nT (rms) per square root Hz at frequencies of less than 1 Hz;
    - b.  $1 \times 10^{-3}$  nT (rms) per square root Hz at frequencies of 1 Hz or more but not exceeding 10 Hz; or
    - c.  $1 \times 10^{-4}$  nT (rms) per square root Hz at frequencies exceeding 10 Hz; fiber optic "magnetometers" having a 'sensitivity' lower (better) than 1 nT (rms) per square root Hz;

5. Fibre optic "magnetometers" having a 'sensitivity' less(better) than 1 nT (rms) per square root Hz;
- b. Underwater electric field sensors having a 'sensitivity' (noise level) being the root mean square of the device-limited noise floor, lower (better) than 8 nanovolt per meter per square root Hz when measured at 1 Hz;
- c. "Magnetic gradiometers" as follows:
  1. "Magnetic gradiometers" using multiple "magnetometers" specified in 6A006.a.;
  2. Fiber optic "intrinsic magnetic gradiometers" having a magnetic gradient field 'sensitivity' lower (better) than 0.3 nT/m rms per square root Hz;
  3. "Intrinsic magnetic gradiometers", using "technology" other than fiber-optic "technology", having a magnetic gradient field 'sensitivity' lower (better) than 0.015 nT/m rms per square root Hz;
- d. "Compensation systems" for magnetic or underwater electric field sensors resulting in a performance equal to or better than the specified parameters of 6A006.a., 6A006.b. or 6A006.c.;
- e. Underwater electromagnetic receivers incorporating magnetic field sensors specified in 6A006.a. or underwater electric field sensors specified in 6A006.b.

**6A007****Gravity meters (gravimeters) and gravity gradiometers, as follows:**

- a. Gravity meters designed or modified for ground use and having a static "accuracy" of less (better) than 10  $\mu$ Gal;
- b. Gravity meters designed for mobile platforms and having all of the following:
  1. A static "accuracy" of less (better) than 0.7 mGal; and
  2. An in-service (operational) "accuracy" of less (better) than 0.7 mGal having a "time-to- steady-state registration" of less than 2 minutes under any combination of attendant corrective compensations and motional influences;
- c. Gravity gradiometers.

**6A008****Radar systems, equipment and assemblies, having any of the**

**following, and specially designed components therefor:**

- a. Operating at frequencies from 40 GHz to 230 GHz and having any of the following:
  1. An average output power exceeding 100 mW; or
  2. Locating "accuracy" of 1 m or less (better) in range and 0.2 degree or less (better) in azimuth;
- b. A tunable bandwidth exceeding  $\pm 6.25\%$  of the 'center operating frequency' which equal one half of the sum of the highest plus the lowest specified frequencies;
- c. Capable of operating simultaneously on more than two carrier frequencies;
- d. Capable of operating in synthetic aperture (SAR), inverse synthetic aperture (ISAR) radar mode, or side-looking airborne (SLAR) radar mode;
- e. Incorporating electronically scanned array antennae/electronically steerable array antennae;
- f. Capable of height finding non-cooperative targets;
- g. Specially designed for airborne (balloon or airframe mounted) operation and having Doppler "signal processing" for the detection of moving targets;
- h. Employing processing of radar signals and using any of the following:
  1. "Radar spread spectrum" techniques; or
  2. "Radar frequency agility" techniques;
- i. Providing ground-based operation with a maximum "instrumented range" exceeding 185 km;
- j. Being "laser" radar or Light Detection and Ranging (LIDAR) equipment and having any of the following:
  1. "Space-qualified";
  2. Employing coherent heterodyne or homodyne detection techniques and having an angular resolution of less (better) than 20  $\mu$ rad (microradians); or
  3. Designed for carrying out airborne bathymetric littoral surveys to International Hydrographic Organization (IHO) for Hydrographic Surveys or better, and using one or more "lasers" with a wavelength exceeding 400 nm but not exceeding 600 nm;

- k. Having "signal processing" sub-systems using "pulse compression" and having any of the following:
  1. A "pulse compression" ratio exceeding 150; or
  2. Compressed pulse width of less than 200 ns; or
- l. Having data processing sub-systems and having any of the following:
  1. 'Automatic target tracking' providing, at any antenna rotation, the predicted target position beyond the time of the next antenna beam passage; or
  2. Configured to provide superposition and correlation, or fusion, of target data within six seconds from two or more 'geographically dispersed' radar sensors to improve the aggregate performance beyond that of any single sensor specified in 6A008.f. or 6A008.i.

**6A102**

Radiation hardened 'detectors', 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 including devices that sense by one time operation or failure), other than those specified in 6A002, 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  $5 \times 10^5$  rads (silicon).

**6A107**

Gravity meters (gravimeters) and components for gravity meters and gravity gradiometers, as follows:

- a. Gravity meters, other than those specified in 6A007.b, designed or modified for airborne or marine use, and having a static or operational accuracy equal to or less (better) than 0.7 milligal (mgal), and having a time-to-steady-state registration of two minutes or less;
- b. Specially designed components for gravity meters specified in 6A007.b or 6A107.a. and gravity gradiometers specified in 6A007.c.

**6A108**

Radar systems, tracking systems and radomes, other than those specified in entry 6A008, as follows:

- a. Radar and laser radar systems designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104
- b. Precision tracking systems, usable for 'missiles' that complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km as follows:
  1. Tracking systems which use a code translator in conjunction with either surface or airborne references or navigation satellite systems to provide real-time measurements of in-flight position and velocity;
  2. Range instrumentation radars including associated optical/infrared trackers with all of the following capabilities:
    - a. Angular resolution better than 1.5 milliradians;
    - b. Range of 30 km or greater with a range resolution better than 10 m rms; and
    - c. Velocity resolution better than 3 m/s;
- c. Radomes designed to withstand a combined thermal shock greater than  $4,184 \times 10^6$  J/m<sup>2</sup> accompanied by a peak over pressure of greater than 50 kPa, and usable in "missiles" for protecting against nuclear effects (e.g. electromagnetic pulse (EMP), X-rays, combined blast and thermal effects).

#### 6A202

**Photomultiplier tubes having both of the following characteristics:**

1. Photocathode area of greater than 20 cm<sup>2</sup>; and
2. Anode pulse rise time of less than 1 ns.

#### 6A203

**Cameras and components, other than those specified in 6A003, as follows:**

- a. Streak cameras, and specially designed components therefor, as follows:
  1. Streak cameras with writing speeds greater than 0.5 mm/ $\mu$ s;
  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. or 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.;
- Framing cameras with recording rates greater than 225,000 frames per second;
- Framing cameras capable of 50 ns or less frame exposure time;
- 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.;
- 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.;
- 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.
- d. Radiation-hardened TV cameras, or lenses therefor, specially designed or rated as radiation hardened to withstand a total radiation dose greater than  $50 \times 10^3$  Gy(silicon) which is the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionizing radiation, ( $5 \times 10^6$  rad (silicon)) without operational degradation.

**6A205**

**“Lasers”, “laser” amplifiers and oscillators, other than those specified in 0B001.g.5., 0B001.h.6. and 6A005; 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;
- d. Pulsed carbon dioxide (CO<sub>2</sub>) “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;
- e. Para-hydrogen Raman shifters designed to operate at 16 μm output wavelength and at a repetition rate greater than 250 Hz;
- f. Neodymium-doped (other than glass) “lasers” with an output wavelength between 1,000 and 1 100 nm having either of the following:
  1. Pulse-excited and Q-switched with a pulse duration equal to or more than 1 ns, and having either of the following:
    - a. A single-transverse mode output with an average

- output power greater than 40W; or
- b. A multiple-transverse mode output having an average power greater than 50 W; or
- 2. Incorporating frequency doubling to give an output wavelength between 500 and 550 nm with an average output power of more than 40 W;
- g. Pulsed carbon monoxide (CO) "lasers", other than those specified in 6A005.d.2., having all of the following:
  - 1. Operating at wavelengths between 5,000 and 6,000 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.

**6A225**

Velocity interferometers such as Velocity Interferometer Systems for any Reflector, Doppler laser Interferometers and Photonic Doppler Velocimeters, also known as Heterodyne Velocimeters for measuring velocities exceeding 1 km/s during time intervals of less than 10 microseconds.

**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 fluoride / polyvinyl difluoride;
- b. Quartz pressure transducers for pressures greater than 10 GPa.

***6B Test, Inspection and Production Equipment*****6B002**

Masks and reticles, specially designed for optical sensors specified in 6A002.a.1.b. or 6A002.a.1.d.

**6B004**

Optical equipment as follows:

- a. Equipment for measuring absolute reflectance to an "accuracy" of equal to or better than 0.1% of the reflectance value;
- b. Equipment other than optical surface scattering measurement equipment, having an unobscured aperture of more than 10 cm, specially designed for the non-contact optical measurement of a non-planar optical surface figure (profile) to an "accuracy" of 2 nm

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or less (better) against the required profile.6B007 Equipment to produce, align and calibrate land-based gravity meters with a static “accuracy” of better than 0.1 mGal.

**6B007**

Equipment to produce, align and calibrate land-based gravity meters with a static "accuracy" of less (better) than 0,1 mGal.

**6B008**

Pulse radar cross-section measurement systems having transmit pulse widths of 100 ns or less, and specially designed components therefor.

**6B108**

Systems, other than those specified in 6B008, specially designed for radar cross section measurement usable for 'missiles', which complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km ' and their subsystems.

*6C Materials***6C002**

Optical sensor materials as follows:

- a. Elemental tellurium of purity levels of 999,995% or more;
- b. Single crystals (including epitaxial wafers) of any of the following:
  1. Cadmium zinc telluride, with zinc content of less than 6% by 'mole fraction' present in the crystal and;
  2. Cadmium telluride of any purity level; or
  3. Mercury cadmium telluride of any purity level.

**6C004**

Optical materials as follows:

- a. Zinc selenide and zinc sulphide —substrate blanks", produced by the chemical vapour deposition process and having any of the following:
  1. A volume greater than 100 cm<sup>3</sup>; or
  2. A diameter greater than 80 mm and a thickness of 20 mm or more;
- b. Electro-optic materials and non-linear optical materials, as follows:
  1. Potassium titanyl arsenate;
  2. Silver gallium selenide;
  3. Thallium arsenic selenide;

4. Zinc germanium phosphide, zinc germanium biphosphide or zinc germanium diphosphide); or
5. Gallium selenide;
- c. Non-linear optical materials, other than those specified in 6C004.b., having any of the following:
  1. Having all of the following:
    - a. Dynamic (also known as non-stationary) third order non-linear susceptibility or more; and
    - b. Response time of less than 1 ms; or
  2. Second order non-linear susceptibility or more;
- d. "Substrate blanks" of silicon carbide or beryllium beryllium (Be/Be) deposited materials, exceeding 300 mm in diameter or major axis length;
- e. Glass, including fused silica, phosphate glass, fluorophosphate glass, zirconium fluoride and hafnium fluoride and having all of the following:
  1. A hydroxyl ion (OH-) concentration of less than 5 ppm;
  2. Integrated metallic purity levels of less than 1 ppm; and
  3. High homogeneity (index of refraction variance) less than  $5 \times 10^{-6}$
- f. Synthetically produced diamond material with an absorption of less than  $10^{-5}$  cm<sup>-1</sup> for wavelengths exceeding 200 nm but not exceeding 1,000 nm.

**6C005**

**"Laser" materials as follows:**

- a. Synthetic crystalline "laser" host material in unfinished form made of 'Titanium doped sapphire'.
- b. Rare-earth-metal doped double-clad fibers having any of the following:
  1. Nominal "laser" wavelength of 975 nm to 1,150 nm and having all of the following:
    - a. Average core diameter equal to or greater than 25  $\mu$ m; and
    - b. Core 'Numerical Aperture' ('NA') includes fibers assembled with end caps, measured at the emission wavelengths of the fiber of less than 0.065; or

2. Nominal "laser" wavelength exceeding 1,530 nm and having all of the following:
  - a. Average core diameter equal to or greater than 20  $\mu\text{m}$ ; and
  - b. Core 'NA' less than 0.1.

**6D Software****6D001**

"Software" specially designed for the "development" or "production" of equipment specified in 6A004, 6A005, 6A008 or 6B008.

**6D002**

"Software" specially designed for the "use" of equipment specified in 6A002.b., 6A008 or 6B008.

**6D003**

**Other "software" as follows:**

- a. "Software" as follows:
  1. "Software" specially designed for acoustic beam forming for the "real-time processing" of acoustic data for passive reception using towed hydrophone arrays;
  2. "Source code" for the "real-time processing" of acoustic data for passive reception using towed hydrophone arrays;
  3. "Software" specially designed for acoustic beam forming for "real-time processing" of acoustic data for passive reception using bottom or bay cable systems;
  4. "Source code" for "real-time processing" of acoustic data for passive reception using bottom or bay cable systems;
  5. "Software" or "source code", specially designed for all of the following:
    - a. "Real-time processing" of acoustic data from sonar systems specified in 6A001.a.1.e.; and
    - b. Automatically detecting, classifying and determining the location of divers or swimmers;
- b. "Software" designed or modified for cameras incorporating "focal plane arrays" specified in 6A002.a.3.f. and designed or modified to remove a frame rate restriction and allow the camera to exceed the frame rate specified in 6A003.b.4.
- c. Software" specially designed to maintain the alignment and

phasing of segmented mirror systems consisting of mirror segments having a diameter or major axis length equal to or larger than 1 m;

d. "Software" as follows:

1. "Software" specially designed for magnetic and electric field "compensation systems" for magnetic sensors designed to operate on mobile platforms
2. "Software" specially designed for magnetic and electric field anomaly detection on mobile platforms;
3. "Software" specially designed for "real-time processing" of electromagnetic data using underwater electromagnetic receivers specified in 6A006.e.;
4. "Source code" for "real time processing" of electromagnetic data using underwater electromagnetic receivers specified in 6A006.e.;

e. "Software" specially designed to correct motional influences of gravity meters or gravity gradiometers;

f. "Software" as follows:

1. Air Traffic Control (ATC) "software" application "programs" designed to be hosted on general purpose computers located at Air Traffic Control centers and capable of accepting radar target data from more than four primary radars;
2. "Software" for the design or "production" of radomes having all of the following:
  - a. Specially designed to protect the electronically scanned array antennae specified in 6A008.e.; and
  - a. Resulting in an antenna pattern having an average side lobe level, measured over the array excluding the angular extent of the main beam and the first two side lobes on either side of the main beam, more than 40 dB below the peak of the main beam level.

**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’ that complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

**6D203**

“Software” specially designed to enhance or release the performance of cameras or imaging devices to meet the characteristics of 6A203.a. to 6A203.e.

*6E Technology***6E001**

“Technology” according to the General Technology Note for the “development” of equipment, materials or “software” specified in 6A, 6B, 6C or 6D.

**6E002**

“Technology” according to the General Technology Note for the “production” of equipment or materials specified in 6A, 6B or 6C.

**6E003**

Other “technology” as follows:

- a. A “Technology” as follows:
  1. “Technology” “required” for the coating and treatment of optical surfaces to achieve an ‘optical thickness’ uniformity of 99,5% or better for optical coatings 500 mm or more in diameter or major axis length and with a total loss (absorption and scatter) of less than  $5 \times 10^{-3}$ ;
  2. “Technology” for the fabrication of optics using single point diamond turning techniques to produce surface finish “accuracies” of better than 10 nm rms on non-planar surfaces exceeding 0.5 m<sup>2</sup>;
- b. “Technology” “required” for the “development”, “production” or “use” of specially designed diagnostic instruments or targets in test facilities for “SHPL” testing or testing or evaluation of materials irradiated by “SHPL” beams;

**6E101**

“Technology” according to the General Technology Note for the “use” of equipment or “software” specified in 6A002, 6A007.b. and c., if the items were designed for airborne applications and are usable in “missiles”, 6A008, 6A102, 6A107, 6A108, 6B108, 6D102 or 6D103.

**6E201**

“Technology” according to the General Technology Note for the “use” of equipment specified in 6A003 for cameras if they are also specified by any of the control parameters of 6A203, 6A005.a.2., 6A005.b.2., 6A005.b.3., 6A005.b.4., 6A005.b.6 for lasers that are neodymium-doped and specified by any of the control parameters of 6A205.f., 6A005.e.2., 6A005.d.3.c., 6A005.d.4.c., 6A202, 6A203, 6A205, 6A225 or 6A226.

**6E203**

“Technology”, in the form of codes or keys, to enhance or release the performance of cameras or imaging devices to meet the characteristics of 6A203.a. to 6A203.c.

**CATEGORY 8 – MARINE**

**8A Systems, Equipment and Components**

**8A001**

**Submersible vehicles and surface vessels, as follows:**

- a. Manned, tethered submersible vehicles designed to operate at depths exceeding 1 000m;
- b. Manned, untethered submersible vehicles having any of the following:
  1. Designed to ‘operate autonomously’ and having a lifting capacity of all of the following:
    - a. 10 % or more of their weight in air; and
    - b. 15 kN or more;
  2. Designed to operate at depths exceeding 1 000m; or
  3. Having all of the following:
    - a. Designed to continuously ‘operate autonomously’ for 10 hours or more; and
    - b. ‘Range’ of 25 nautical miles or more;
- c. Unmanned submersible vehicles, as follows:

1. Unmanned submersible vehicles having any of the following:
  - a. Designed for deciding a course relative to any geographical reference without real-time human assistance;
  - b. Acoustic data or command link; or
  - c. Wireless optical data or command link exceeding 1 000m;
2. Unmanned submersible vehicles, not specified in 8A001.c.1., having all of the following:
  - a. Designed to operate with a tether;
  - b. Designed to operate at depths exceeding 1 000m;
  - c. Having any of the following:
    1. Designed for self-propelled manoeuvre using propulsion motors or thrusters specified in 8A002.a.2.; or
    2. Fibre optic data link;
  - d. Ocean salvage systems with a lifting capacity exceeding 5 MN for salvaging objects from depths exceeding 250 m and having any of the following:
    1. Dynamic positioning systems capable of position keeping within 20 m of a given point provided by the navigation system; or
    2. Seafloor navigation and navigation integration systems, for depths exceeding 1 000m and with positioning "accuracies" to within 10 m of a predetermined point.

**8A002****Marine systems, equipment and components, as follows:**

- a. Systems, equipment and components, specially designed or modified for submersible vehicles and designed to operate at depths exceeding 1 000m, as follows:
  1. Pressure housings or pressure hulls with a maximum inside chamber diameter exceeding 1,5 m;
  2. Direct current propulsion motors or thrusters;

3. Umbilical cables, and connectors therefor, using optical fibre and having synthetic strength members;
4. Components manufactured from material specified in 8C001;
- b. Systems specially designed or modified for the automated control of the motion of submersible vehicles specified in 8A001, using navigation data, having closed loop servo-controls and having any of the following:
  1. Enabling a vehicle to move within 10 m of a predetermined point in the water column;
  2. Maintaining the position of the vehicle within 10 m of a predetermined point in the water column; or
  3. Maintaining the position of the vehicle within 10 m while following a cable on or under the seabed;
- c. Fibre optic pressure hull penetrators;
- d. Underwater vision systems having all of the following:
  1. Specially designed or modified for remote operation with a submersible vehicle; and
  2. Employing any of the following techniques to minimise the effects of back scatter:
    - a. Range-gated illuminators; or
    - b. Range-gated laser systems;
- e. Light systems specially designed or modified for underwater use, as follows:
  1. Stroboscopic light systems capable of a light output energy of more than 300 J per flash and a flash rate of more than 5 flashes per second;
  2. Argon arc light systems specially designed for use below 1 000m;
- f. "Robots" specially designed for underwater use, controlled by using a dedicated computer and having any of the following:
  1. Systems that control the "robot" using information from sensors which measure force or torque applied to an external object, distance to an external object, or tactile sense between the "robot" and an external object; or

2. The ability to exert a force of 250 N or more or a torque of 250 Nm or more and using titanium-based alloys or "composite" "fibrous or filamentary materials" in their structural members;
- g. Remotely controlled articulated manipulators specially designed or modified for use with submersible vehicles and having any of the following:
1. Systems which control the manipulator using information from sensors which measure any of the following:
    - a. Torque or force applied to an external object; or
    - b. Tactile sense between the manipulator and an external object; or
  2. Controlled by proportional master-slave techniques and having 5 degrees of 'freedom of movement' or more;
- h. Air independent power systems specially designed for underwater use, as follows:
1. Brayton or Rankine cycle engine air independent power systems having any of the following:
    - a. Chemical scrubber or absorber systems, specially designed to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;
    - b. Systems specially designed to use a monoatomic gas;
    - c. Devices or enclosures, specially designed for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; or
    - d. Systems having all of the following:
      1. Specially designed to pressurise the products of reaction or for fuel reformation;
      2. Specially designed to store the products of the reaction; and
      3. Specially designed to discharge the products of the reaction against a pressure of 100 kPa or more;
  2. Diesel cycle engine air independent systems having all of the following:

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- a. Chemical scrubber or absorber systems, specially designed to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;
  - b. Systems specially designed to use a monoatomic gas;
  - c. Devices or enclosures, specially designed for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; and
  - d. Specially designed exhaust systems that do not exhaust continuously the products of combustion;
3. "Fuel cell" air independent power systems with an output exceeding 2 kW and having any of the following:
    - a. Devices or enclosures, specially designed for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; or
    - b. Systems having all of the following:
      1. Specially designed to pressurise the products of reaction or for fuel reformation;
      2. Specially designed to store the products of the reaction; and
      3. Specially designed to discharge the products of the reaction against a pressure of 100 kPa or more;
  4. Stirling cycle engine air independent power systems having all of the following:
    - a. Devices or enclosures, specially designed for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; and
    - b. Specially designed exhaust systems which discharge the products of combustion against a pressure of 100 kPa or more;
- i. Propellers, power transmission systems, power generation systems and noise reduction systems and related equipment, as follows:
    1. Water-screw propeller, power generation systems or transmission systems, designed for use on vessels, as follows:
      - a. Controllable-pitch propellers and hub assemblies, rated at more than 30 MW;

- b. Internally liquid-cooled electric propulsion motors with a power output exceeding 2,5 MW;
  - c. "Superconductive" propulsion motors, with a power output exceeding 0,1 MW;
  - d. Power transmission systems incorporating "composite" shafts and designed to transmit power exceeding 10 MW;
  - e. Ventilated or base-ventilated propeller systems, rated at more than 2,5 MW;
2. Noise reduction systems and related equipment, designed for use on vessels of 1000tonnes displacement or more, as follows:
    - a. Systems that attenuate underwater noise at frequencies below 500 Hz and consist of compound acoustic mounts for the acoustic isolation of diesel engines, diesel generator sets, gas turbines, gas turbine generator sets, propulsion motors or propulsion reduction gears, specially designed for sound or vibration isolation and having an intermediate mass exceeding 30 % of the equipment to be mounted;
    - b. 'Active noise reduction or cancellation systems' or magnetic bearings, specially designed for power transmission systems;
  3. Permanent magnet electric propulsion motors specially designed for submersible vehicles, having a power output exceeding 0,1 MW.
- j. Pump jet propulsion systems having all of the following:
    1. Power output exceeding 2,5 MW; and
    2. Using divergent nozzle and flow conditioning vane techniques to improve propulsive efficiency or reduce propulsion-generated underwater-radiated noise;
  - k. Underwater swimming and diving equipment as follows:
    1. Closed circuit rebreathers;
    2. Semi-closed-circuit rebreathers;
  - l. Diver deterrent acoustic systems specially designed or modified to disrupt divers and having a sound pressure level equal to or exceeding 190 dB (reference 1  $\mu$ Pa at 1 m) at frequencies of 200 Hz and below.

### **8B Test, Inspection and Production Equipment**

**8B001** Water tunnels designed to have a background noise of less than 100 dB (reference 1  $\mu$ Pa, 1 Hz) within the frequency range exceeding 0 Hz but not exceeding 500 Hz and designed for measuring acoustic fields generated by a hydro-flow around propulsion system models.

### **8C Materials**

#### **8C001**

'Syntactic foam' designed for underwater use and having all of the following:

- a. Designed for marine depths exceeding 1 000m; and
- b. A density less than 561 kg/m<sup>3</sup>.

### **8D Software**

**8D001** "Software" specially designed or modified for the "development", "production" or "use" of equipment or materials, specified in 8A, 8B or 8C.

**8D002** Specific "software" specially designed or modified for the "development", "production", repair, overhaul or refurbishing (re-machining) of propellers specially designed for underwater noise reduction.

### **8E Technology**

**8E001** "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials, specified in 8A, 8B or 8C.

#### **8E002**

Other "technology" as follows:

- a. "Technology" for the "development", "production", repair, overhaul or refurbishing (re-machining) of propellers specially designed for underwater noise reduction;
- b. "Technology" for the overhaul or refurbishing of equipment specified in 8A001, 8A002.b., 8A002.j., 8A002.o. or 8A002.p.
- c. "Technology" according to the General Technology Note for the "development" or "production" of any of the following:
  1. Surface-effect vehicles (fully skirted variety) having all of the following:

- a. Maximum design speed, fully loaded, exceeding 30 knots in a significant wave height of 1,25 m or more;
  - b. Cushion pressure exceeding 3 830 Pa; and
  - c. Light-ship-to-full-load displacement ratio of less than 0,70;
2. Surface-effect vehicles (rigid sidewalls) with a maximum design speed, fully loaded, exceeding 40 knots in a significant wave height of 3,25 m or more;
  3. Hydrofoil vessels with active systems for automatically controlling foil systems, with a maximum design speed, fully loaded, of 40 knots or more in a significant wave height of 3,25 m or more; or
  4. 'Small waterplane area vessels' having any of the following:
    - a. Full load displacement exceeding 500 tonnes with a maximum design speed, fully loaded, exceeding 35 knots in a significant wave height of 3,25 m or more; or
    - b. Full load displacement exceeding 1 500 tonnes with a maximum design speed, fully loaded, exceeding 25 knots in a significant wave height of 4 m or more.

#### **PART XI**

#### **CATEGORY 9: AEROSPACE AND PROPULSION**

##### **9A Systems, Equipment and Components**

##### **9A001**

Aero gas turbine engines having any of the following:

- a. Incorporating any of the "technologies" specified in 9E003.a., 9E003.h. or 9E003.i.;

##### **9A002**

**Marine gas turbine engines' designed to use liquid fuel and having all of the following, and specially designed assemblies and components therefor:**

- a. Maximum continuous power when operating in "steady state mode" at standard reference conditions specified by ISO 3977-2:1997 (or national equivalent) of 24 245 kW or more; and
- b. 'Corrected specific fuel consumption' not exceeding 0,219 kg/kWh at 35% of the maximum continuous power when using liquid fuel.

##### **9A003**

Specially designed assemblies or components, incorporating any of the “technologies” specified in 9E003.a., 9E003.h. 9E003. i., or 9E003.k, for any of the following aero gas turbine engines:

- a. Specified in 9A001; or
- b. Whose design or production is unknown to the manufacturer.

#### **9A004**

Space launch vehicles, “spacecraft”, “spacecraft buses”, “spacecraft payloads”, “spacecraft” on-board systems or equipment, terrestrial equipment, air-launch platforms and “sub-orbital craft” as follows:

- a. a. Space launch vehicles;
- b. b. “Spacecraft”;
- c. c. “Spacecraft buses”;
- d. d. “Spacecraft payloads” incorporating items specified in 3A001.b.1.a.4., 3A002.g., 5A001.a.1., 5A001.b.3., 5A002.c., 5A002.e., 6A002.a.1., 6A002.a.2., 6A002.b., 6A002.d., 6A003.b., 6A004.c., 6A004.e., 6A008.d., 6A008.e., 6A008.k., 6A008.l. or 9A010.c.;
- e. e. On-board systems or equipment, specially designed for “spacecraft” and having any of the following functions:
  1. ‘Command and telemetry data handling’ including bus data management, storage, and processing
  2. ‘Payload data handling’ including payload data management, storage, and processing; or
  3. ‘Attitude and orbit control’ including sensing and actuation to determine and control the position and orientation of a “spacecraft”;
- f. Terrestrial equipment specially designed for “spacecraft”, as follows:
  1. Telemetry and telecommand equipment specially designed for any of the following data processing functions:
    - a. Telemetry data processing of frame synchronisation and error corrections, for monitoring of operational status (also known as health and safe status) of the “spacecraft bus”; or
    - b. Command data processing for formatting command data being sent to the “spacecraft” to control the “spacecraft bus”;

2. Simulators specially designed for 'verification of operational procedures' of "spacecraft";
- g. "Aircraft" specially designed or modified to be air-launch platforms for space launch vehicles or "sub-orbital craft";
  1. "Sub-orbital craft".

**9A005**

**Liquid rocket propulsion systems containing any of the systems or components, specified in 9A006.**

**9A006**

**Systems and components, specially designed for liquid rocket propulsion systems, as follows:**

- a. Cryogenic refrigerators, flightweight dewars, cryogenic heat pipes or cryogenic systems, designed to restrict cryogenic fluid losses to less than 30% per year;
- b. Cryogenic containers or closed-cycle refrigeration systems, designed to maintain or produce temperatures less than or equal to 100 K (-173,15°C);
- c. Slush hydrogen storage or transfer systems;
- d. High pressure (exceeding 17,5 MPa) turbo pumps, pump components or their associated gas generator or expander cycle turbine drive systems;
- e. High-pressure (exceeding 10,6 MPa) thrust chambers and nozzles therefor;
- f. Propellant storage systems using the principle of capillary containment or positive expulsion (i.e., with flexible bladders);
- g. Liquid propellant injectors with individual orifices of 0,381 mm or smaller in diameter (an area of  $1,14 \times 10^{-3}$  cm<sup>2</sup> or smaller for non-circular orifices) and specially designed for liquid rocket engines;
- h. One-piece carbon-carbon thrust chambers or one-piece carbon-carbon exit cones, with densities exceeding 1,4 g/cm<sup>3</sup> and tensile strengths exceeding 48 MPa.

**9A007**

**Solid rocket propulsion systems having any of the following:**

- a. Total impulse capacity exceeding 1,1 MNs;
- b. Specific impulse of 2,4 kNs/kg or more, when the nozzle flow is expanded to ambient sea level conditions for an adjusted chamber

- pressure of 7 MPa;
- c. Stage mass fractions exceeding 88% and propellant solid loadings exceeding 86%;
  - d. Components specified in 9A008; or
  - e. Insulation and propellant bonding systems, using direct-bonded motor designs to provide a 'strong mechanical bond' or a barrier to chemical migration between the solid propellant and case insulation material.

**9A008**

**Components specially designed for solid rocket propulsion systems, as follows:**

- a. Insulation and propellant bonding systems, using liners to provide a 'strong mechanical bond' or a barrier to chemical migration between the solid propellant and case insulation material;
- b. Filament-wound "composite" motor cases exceeding 0,61 m in diameter or having 'structural efficiency ratios (PV/W)' exceeding 25 km;
- c. Nozzles with thrust levels exceeding 45 kN or nozzle throat erosion rates of less than 0,075 mm/s;
- d. Movable nozzle or secondary fluid injection thrust vector control systems, capable of any of the following:
  1. Omni-axial movement exceeding  $\pm 5^\circ$ ;
  2. Angular vector rotations of  $20^\circ/\text{s}$  or more; or
  3. Angular vector accelerations of  $40^\circ/\text{s}^2$  or more.

**9A009**

**Hybrid rocket propulsion systems having any of the following:**

- a. Total impulse capacity exceeding 1,1 MNs; or
- b. Thrust levels exceeding 220 kN in vacuum exit conditions.

**9A010**

**Specially designed components, systems and structures, for launch vehicles, launch vehicle propulsion systems or "spacecraft", as follows:**

- a. Components and structures, each exceeding 10 kg and specially designed for launch vehicles manufactured using any of the following:
  1. "Composite" materials consisting of "fibrous or filamentary

- materials" specified in 1C010.e. and resins specified in 1C008 or 1C009.b.;
2. Metal "matrix" "composites" reinforced by any of the following:
    - a. Materials specified in 1C007;
    - b. "Fibrous or filamentary materials" specified in 1C010; or
    - c. Aluminides specified in 1C002.a.; or
  3. Ceramic "matrix" "composite" materials specified in 1C007;
- b. Components and structures, specially designed for launch vehicle propulsion systems specified in 9A005 to 9A009 manufactured using any of the following:
1. "Fibrous or filamentary materials" specified in 1C010.e. and resins specified in 1C008 or 1C009.b.;
  2. Metal "matrix" "composites" reinforced by any of the following:
    - a. Materials specified in 1C007;
    - b. "Fibrous or filamentary materials" specified in 1C010; or
    - c. Aluminides specified in 1C002.a.; or
  3. Ceramic "matrix" "composite" materials specified in 1C007;
- c. Structural components and isolation systems, specially designed to control actively the dynamic response or distortion of "spacecraft" structures;
- d. Pulsed liquid rocket engines with thrust-to-weight ratios equal to or more than 1 kN/kg and a 'response time' of less than 30 ms.

**9A011**

**Ramjet, scramjet or 'combined cycle engines', and specially designed components therefor.**

**9A012**

**"Unmanned aerial vehicles" ("UAVs"), unmanned "airships", related equipment and components, as follows:**

- a. "UAVs" or unmanned "airships", designed to have controlled

flight out of the direct 'natural vision' of the 'operator' and having any of the following:

1. Having all of the following:
    - a. A maximum 'endurance' greater than or equal to 30 minutes but less than 1 hour; and
    - b. Designed to take-off and have stable controlled flight in wind gusts equal to or exceeding 46,3 km/h (25 knots); or
  2. A maximum 'endurance' of 1 hour or greater;
- b. Related equipment and components, as follows:
1. Equipment or components, specially designed to convert a manned "aircraft" or manned "airship", to a "UAV" or unmanned "airship", specified in 9A012.a.;
  2. Air breathing reciprocating or rotary internal combustion type engines, specially designed or modified to propel "UAVs" or unmanned "airships", at altitudes above 15 240 metres (50 000 feet).

#### **9A101**

**Turbojet and turbofan engines, other than those specified in 9A001, as follows;**

- a. Engines having all of the following characteristics:
  1. 'Maximum thrust value' greater than 400 N excluding civil certified engines with a 'maximum thrust value' greater than 8 890 N;
  2. Specific fuel consumption of 0,15 kg N-1 h-1 or less;
  3. 'Dry weight' less than 750 kg; and 4.
  4. 'First-stage rotor diameter' less than 1 m;
- b. Engines designed or modified for use in "missiles" or unmanned aerial vehicles specified in 9A012 or 9A112.a.

#### **9A102**

**'Turboprop engine systems' specially designed for unmanned aerial vehicles specified in 9A012 or 9A112.a., and specially designed components therefor, having a 'maximum power' greater than 10 kW.**

#### **9A104**

**Sounding rockets, capable of a range of at least 300 km.**

**9A105**

**Liquid propellant rocket engines or gel propellant rocket motors, as follows:**

- a. Liquid propellant rocket engines or gel propellant rocket motors, usable in "missiles", other than those specified in 9A005, integrated, or designed or modified to be integrated, into a liquid propellant or gel propellant propulsion system which has a total impulse capacity equal to or greater than 1,1 MNs;
- b. Liquid propellant rocket engines or gel propellant rocket motors, usable in complete rocket systems or unmanned aerial vehicles, capable of a range of 300 km, other than those specified in 9A005 or 9A105.a., integrated, or designed or modified to be integrated, into a liquid propellant or gel propellant propulsion system which has a total impulse capacity equal to or greater than 0,841 MNs.

**9A106**

**Systems or components, other than those specified in 9A006 as follows, specially designed for liquid rocket propulsion or gel propellant rocket systems:**

- a. Thrust vector control sub-systems, usable in "missiles";
- b. Liquid, slurry and gel propellant (including oxidisers) control systems, and specially designed components therefor, usable in "missiles", designed or modified to operate in vibration environments greater than 10 g rms between 20 Hz and 2 kHz;
- c. Combustion chambers and nozzles for liquid propellant rocket engines or gel propellant rocket motors specified in 9A005 or 9A105.

**9A107**

**Solid propellant rocket motors, usable in complete rocket systems or unmanned aerial vehicles, capable of a range of 300 km, other than those specified in 9A007, having total impulse capacity equal to or greater than 0,841 MNs.**

**9A108**

**Components, other than those specified in 9A008, as follows, specially designed for solid and hybrid rocket propulsion systems:**

- a. Rocket motor cases and insulation components therefor, usable in subsystems specified in 9A007, 9A009, 9A107 or 9A109.a.;
- b. Rocket nozzles, usable in subsystems specified in 9A007,

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9A009, 9A107 or 9A109.a.;

- c. Thrust vector control sub-systems, usable in "missiles".

**9A109**

**Hybrid rocket motors and specially designed components as follows:**

- a. Hybrid rocket motors usable in complete rocket systems or unmanned aerial vehicles, capable of 300 km, other than those specified in 9A009, having a total impulse capacity equal to or greater than 0,841 MNs, and specially designed components therefor;
- b. Specially designed components for hybrid rocket motors specified in 9A009 that are usable in "missiles".

**9A110**

**Composite structures, laminates and manufactures thereof, other than those specified in 9A010, specially designed for use in 'missiles' or the subsystems specified in 9A005, 9A007, 9A105, 9A106.c., 9A107, 9A108.c., 9A116 or 9A119.**

**9A111**

**Pulse jet or detonation engines, usable in "missiles" or unmanned aerial vehicles specified in 9A012 or 9A112.a., and specially designed components therefor.**

**9A112**

**"Unmanned aerial vehicles" ("UAVs"), other than those specified in 9A012, as follows:**

- a. "Unmanned aerial vehicles" ("UAVs") capable of a range of 300 km;
- b. "Unmanned aerial vehicles" ("UAVs") having all of the following:
  1. Having any of the following:
    - a. An autonomous flight control and navigation capability; or
    - b. Capability of controlled flight out of the direct vision range involving a human operator; and having any of the following:
  2. Having any of the following:
    - a. Incorporating an aerosol dispensing system/mechanism with a capacity greater than 20 litres; or
    - b. Designed or modified to incorporate an aerosol dispensing system/mechanism with a capacity greater than 20 litres.

**9A115**

**Launch support equipment as follows:**

- a. Apparatus and devices for handling, control, activation or launching, designed or modified for space launch vehicles specified in 9A004, sounding rockets specified in 9A104 or 'missiles';
- b. Vehicles for transport, handling, control, activation or launching, designed or modified for space launch vehicles specified in 9A004, sounding rockets specified in 9A104 or "missiles".

**9A116**

**Reentry vehicles, usable in "missiles", and equipment designed or modified therefor, as follows:**

- a. Reentry vehicles;
- b. Heat shields and components therefor, fabricated of ceramic or ablative materials;
- c. Heat sinks and components therefor, fabricated of light-weight, high heat capacity materials;
- d. Electronic equipment specially designed for reentry vehicles.

**9A117**

**Staging mechanisms, separation mechanisms, and interstages, usable in "missiles".**

**9A118**

**Devices to regulate combustion usable in engines, which are usable in "missiles" or unmanned aerial vehicles specified in 9A012 or 9A112.a., specified in 9A011 or 9A111.**

**9A119**

**Individual rocket stages, usable in complete rocket systems or unmanned aerial vehicles, capable of a range of 300 km, other than those specified in 9A005, 9A007, 9A009, 9A105, 9A107 and 9A109.**

**9A120**

**Liquid or gel propellant tanks, other than those specified in 9A006, specially designed for propellants specified in 1C111 or 'other liquid or gel propellants' used in rocket systems capable of delivering at least a 500 kg payload to a range of at least 300 km.**

**9A121**

Umbilical and interstage electrical connectors specially designed for "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

#### **9A350**

**Spraying or fogging systems, specially designed or modified for fitting to aircraft, "lighter-than-air vehicles" or unmanned aerial vehicles, and specially designed components therefor, as follows:**

- a. Complete spraying or fogging systems capable of delivering, from a liquid suspension, an initial droplet 'VMD' of less than 50  $\mu\text{m}$  at a flow rate of greater than two litres per minute;
- b. Spray booms or arrays of aerosol generating units capable of delivering, from a liquid suspension, an initial droplet 'VMD' of less than 50  $\mu\text{m}$  at a flow rate of greater than two litres per minute;
- c. Aerosol generating units specially designed for fitting to systems specified in 9A350.a. and .b.

#### ***9B Test, Inspection and Production Equipment***

#### **9B001**

**Manufacturing equipment, tooling or fixtures, as follows:**

- a. Directional solidification or single crystal casting equipment designed for "superalloys";
- b. Casting tooling, specially designed for manufacturing gas turbine engine blades, vanes or "tip shrouds", manufactured from refractory metals or ceramics, as follows:
  1. Cores;
  2. Shells (moulds);
  3. Combined core and shell (mould) units;
- c. Directional-solidification or single-crystal additive-manufacturing equipment, designed for "superalloys".

#### **9B002**

**On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, having all of the following:**

- a. Specially designed for the "development" of gas turbine engines, assemblies or components; and
- b. Incorporating any of the "technologies" specified in 9E003.h. or 9E003.i.

**9B003**

Equipment specially designed for the "production" or test of gas turbine brush seals designed to operate at tip speeds exceeding 335 m/s and temperatures in excess of 773 K (500°C), and specially designed components or accessories therefor.

**9B004**

Tools, dies or fixtures, for the solid state joining of "superalloy", titanium or intermetallic aerofoil-to-disk combinations described in 9E003.a.3. or 9E003.a.6. for gas turbines.

**9B005**

On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, specially designed for use with any of the following:

- a. Wind tunnels designed for speeds of Mach 1,2 or more;
- b. Devices for simulating flow-environments at speeds exceeding Mach 5, including hot-shot tunnels, plasma arc tunnels, shock tubes, shock tunnels, gas tunnels and light gas guns; or
- c. Wind tunnels or devices, other than two-dimensional sections, capable of simulating Reynolds number flows exceeding  $25 \times 10^6$ .

**9B006**

Acoustic vibration test equipment capable of producing sound pressure levels of 160 dB or more (referenced to 20  $\mu$ Pa) with a rated output of 4 kW or more at a test cell temp

**9B007**

Equipment specially designed for inspecting the integrity of rocket motors and using Non-Destructive Test (NDT) techniques other than planar x-ray or basic physical or chemical analysis.

**9B008**

Direct measurement wall skin friction transducers specially designed to operate at a test flow total (stagnation) temperature exceeding 833 K (560°C).

**9B009**

Tooling specially designed for producing gas turbine engine powder metallurgy rotor components having all of the following:

- a. Designed to operate at stress levels of 60% of Ultimate Tensile Strength (UTS) or more measured at a temperature of 873 K (600°C); and

- b. Designed to operate at 873 K (600°C) or more.

**9B010**

Equipment specially designed for the "production" of items specified in 9A012.

**9B105**

Aerodynamic test facilities for speeds of Mach 0,9 or more, usable for 'missiles' and their subsystems.

**9B106**

Environmental chambers and anechoic chambers, as follows:

- a. Environmental chambers having all of the following:
  - 1. Capable of simulating any of the following flight conditions:
    - 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); and
  - 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;
- b. Environmental chambers capable of simulating the following flight conditions:
  - 1. Acoustic environments at an overall sound pressure level of 140 dB or greater (referenced to 20 µPa) or with a total rated acoustic power output of 4 kW or greater; and
  - 2. Altitude equal to or greater than 15 km; or
  - 3. Temperature range from below 223 K (-50°C) to above 398 K (125°C).

**9B107**

Aerothermodynamic test facilities, usable for 'missiles', 'missile' rocket propulsion systems, and reentry vehicles and equipment specified in 9A116, having any of the following characteristics:

- a. An electrical power supply equal to or greater than 5 MW; or
- b. A gas supply total pressure equal to or greater than 3 MPa.

**9B115**

Specially designed “production equipment” for the systems, sub-systems and components specified in 9A005 to 9A009, 9A011, 9A101, 9A102, 9A105 to 9A109, 9A111, 9A116 to 9A120.

**9B116**

Specially designed “production facilities” for the space launch vehicles specified in 9A004, or systems, sub-systems, and components specified in 9A005 to 9A009, 9A011, 9A101, 9A102, 9A104 to 9A109, 9A111, 9A116 to 9A120 or ‘missiles’.

**9B117**

Test benches or test stands for solid or liquid propellant rockets or rocket motors, having either of the following characteristics:

- a. The capacity to handle more than 68 kN of thrust; or
- b. Capable of simultaneously measuring the three axial thrust components.

*9C Materials*

**9C108**

Insulation material in bulk form and “interior lining”, other than those specified in 9A008, for rocket motor cases usable in “missiles” or specially designed for solid propellant rocket engines specified in 9A007 or 9A107.

**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.

*9D Software*

**9D001**

“Software”, not specified in 9D003 or 9D004, specially designed or modified for the “development” of equipment or “technology”, specified in 9A001 to 9A119, 9B or 9E003.

**9D002**

“Software”, not specified in 9D003 or 9D004, specially designed or modified for the “production” of equipment specified in 9A001 to

**9A119 or 9B.****9D003**

**“Software” incorporating “technology” specified in 9E003.h. and used in “FADEC Systems” for systems specified in 9A or equipment specified in 9B.**

**9D004**

**Other “software” as follows:**

- a. 2D or 3D viscous “software”, validated with wind tunnel or flight test data required for detailed engine flow modelling;
- b. “Software” for testing aero gas turbine engines, assemblies or components, having all of the following:
  1. Specially designed for testing any of the following:
    - a. Aero gas turbine engines, assemblies or components, incorporating “technology” specified in 9E003.a., 9E003.h. or 9E003.i.; or
    - b. Multi-stage compressors providing either bypass or core flow, specially designed for aero gas turbine engines incorporating “technology” specified in 9E003.a. or 9E003.h.; and
  2. Specially designed for all of the following:
    - a. Acquisition and processing of data, in real time; and
    - b. Feedback control of the test article or test conditions (e.g. temperature, pressure, flow rate) while the test is in progress;
- c. “Software” specially designed to control directional solidification or single crystal material growth in equipment specified in 9B001.a. or 9B001.c.;
- d. “Software” specially designed or modified for the operation of items specified in 9A012;
- e. “Software” specially designed to design the internal cooling passages of aero gas turbine blades, vans and “tip shrouds”;
- f. “Software” having all of the following:
  1. Specially designed to predict aero thermal, aeromechanical and combustion conditions in aero gas turbine engines; and
  2. Theoretical modelling predictions of the aero thermal, aeromechanical and combustion conditions, which have

been validated with actual aero gas turbine engine (experimental or production) performance data.

**9D005**

“Software” specially designed or modified for the operation of items specified in 9A004.e. or 9A004.f.

**9D101**

“Software” specially designed or modified for the “use” of goods specified in 9B105, 9B106, 9B116 or 9B117.

**9D103**

“Software” specially designed for modelling, simulation or design integration of the space launch vehicles specified in 9A004, sounding rockets specified in 9A104 or “missiles”, or the subsystems specified in 9A005, 9A007, 9A105, 9A106.c., 9A107, 9A108.c., 9A116 or 9A119.

**9D104**

“Software” as follows:

1. “Software” specially designed or modified for the “use” of goods specified in 9A001, 9A005, 9A006.d., 9A006.g., 9A007.a., 9A009.a., 9A010.d., 9A011, 9A101, 9A102, 9A105, 9A106.d., 9A107, 9A109, 9A111, 9A115.a., 9A117 or 9A118.
2. “Software” specially designed or modified for the operation or maintenance of subsystems or equipment specified in 9A008.d., 9A106.c., 9A108.c. or 9A116.d.

**9D105**

“Software” specially designed or modified to coordinate the function of more than onesubsystem, other than that specified in 9D004.e., in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104 or ‘missiles’.

*9E Technology*

**9E001**

“Technology” according to the General Technology Note for the “development” of equipment or “software”, specified in 9A004 to 9A012, 9A350, 9B or 9D.

**9E002**

“Technology” according to the General Technology Note for the “production” of equipment specified in 9A004 to 9A011, 9A350 or 9B.

**9E003****Other "technology" as follows:**

- a. "Technology" "required" for the "development" or "production" of any of the following gas turbine engine components or systems:
  1. Gas turbine blades, vanes or "tip shrouds", made from directionally solidified (DS) or single crystal (SC) alloys and having (in the 001 Miller Index Direction) a stress-rupture life exceeding 400 hours at 1 273 K (1 000°C) at a stress of 200 MPa, based on the average property values;
  2. Combustors having any of the following:
    - a. 'Thermally decoupled liners' designed to operate at 'combustor exit temperature' exceeding 1 883K (1 610°C);
    - b. Non-metallic liners;
    - c. Non-metallic shells;
    - d. Liners designed to operate at 'combustor exit temperature' exceeding 1 883 K (1 610°C) and having holes that meet the parameters specified in 9E003.c.; or
    - e. Utilising 'pressure gain combustion'; 9E003.a.2. continued
  3. Components that are any of the following:
    - a. Manufactured from organic "composite" materials designed to operate above 588 K (315°C);
    - b. Manufactured from any of the following:
      1. Metal "matrix" "composites" reinforced by any of the following:
        - a. Materials specified in 1C007;
        - b. "Fibrous or filamentary materials" specified in 1C010; or
        - c. Aluminides specified in 1C002.a.; or
      2. Ceramic "matrix" "composites" specified in 1C007.; or 9E003
    - c. Stators, vanes, blades, tip seals (shrouds), rotating blings, rotating blisks, or 'splitter ducts', that are all of the following:

1. Not specified in 9E003.a.3.a.;
2. Designed for compressors or fans; and
3. Manufactured from material specified in 1C010.e. with resins specified in 1C008;
4. Uncooled turbine blades, vanes or "tip shrouds", designed to operate at a 'gas path temperature' of 1 373 K (1 100°C) or more
5. Cooled turbine blades, vanes, "tip shrouds" other than those described in 9E003.a.1., designed to operate at a 'gas path temperature' of 1 693 K (1 420°C) or more;
6. Aerofoil-to-disk blade combinations using solid state joining;
7. 'Damage tolerant' gas turbine engine rotor components using powder metallurgy materials specified in 1C002.b.; or
8. Fan blades' having all of the following:
  - a. 20% or more of the total volume being one or more closed cavities containing vacuum or gas only; and
  - b. One or more closed cavities having a volume of 5 cm<sup>3</sup> or larger;
- b. "Technology" "required" for the "development" or "production" of any of the following:
  1. Wind tunnel aero-models equipped with non-intrusive sensors capable of transmitting data from the sensors to the data acquisition system; or
  2. "Composite" propeller blades or propfans, capable of absorbing more than 2 000 kW at flight speeds exceeding Mach 0,55;
- c. "Technology" "required" for manufacturing cooling holes in gas turbine engine components incorporating any of the "technologies" specified in 9E003.a.1., 9E003.a.2. or 9E003.a.5., and having any of the following:
  1. Having all of the following:
    - a. Minimum 'cross-sectional area' less than 0,45 mm<sup>2</sup>;
    - b. 'Hole shape ratio' greater than 4,52; and
    - c. 'Incidence angle' equal to or less than 25°; or

2. Having all of the following:
  - a. Minimum 'cross-sectional area' less than 0,12 mm<sup>2</sup>;
  - b. 'Hole shape ratio' greater than 5,65; and
  - c. 'Incidence angle' more than 25°;
- d. "Technology" "required" for the "development" or "production" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems;
- e. "Technology" for the "development" or "production" of reciprocating diesel engine ground vehicle propulsion systems having all of the following:
  1. 'Box volume' of 1,2 m<sup>3</sup> or less;
  2. An overall power output of more than 750 kW based on 80/1269/EEC, ISO 2534 or national equivalents; and
  3. Power density of more than 700 kW/m<sup>3</sup> of 'box volume';
- f. "Technology" "required" for the "production" of specially designed components for "high output diesel engines", as follows:
  1. "Technology" "required" for the "production" of engine systems having all of the following components employing ceramics materials specified in 1C007:
    - a. Cylinder liners;
    - b. Pistons;
    - c. Cylinder heads; and
    - d. One or more other components (including exhaust ports, turbochargers, valve guides, valve assemblies or insulated fuel injectors);
  2. "Technology" "required" for the "production" of turbocharger systems with single-stage compressors and having all of the following:
    - a. Operating at pressure ratios of 4:1 or higher;
    - b. Mass flow in the range from 30 to 130 kg per minute; and
    - c. Variable flow area capability within the compressor or turbine sections
  3. "Technology" "required" for the "production" of fuel injection systems with a specially designed multifuel (e.g., diesel or jet fuel) capability covering a viscosity range from

diesel fuel (2,5 cSt at 310,8 K (37,8°C)) down to gasoline fuel (0,5 cSt at 310,8 K (37,8°C)) and having all of the following:

- a. Injection amount in excess of 230 mm<sup>3</sup> per injection per cylinder; and
  - b. Electronic control features specially designed for switching governor characteristics automatically depending on fuel property to provide the same torque characteristics by using the appropriate sensors;
- g. "Technology" "required" for the "development" or "production" of "high output diesel engines" for solid, gas phase or liquid film (or combinations thereof) cylinder wall lubrication and permitting operation to temperatures exceeding 723 K (450°C), measured on the cylinder wall at the top limit of travel of the top ring of the piston;
- h. "Technology" for gas turbine engine "FADEC systems" as follows:
1. "Development" "technology" for deriving the functional requirements for the components necessary for the "FADEC system" to regulate engine thrust or shaft power (e.g., feedback sensor time constants and accuracies, fuel valve slew rate);
  2. "Development" or "production" "technology" for control and diagnostic components unique to the "FADEC system" and used to regulate engine thrust or shaft power;
  3. "Development" "technology" for the control law algorithms, including "source code", unique to the "FADEC system" and used to regulate engine thrust or shaft power;
- i. "Technology" for adjustable flow path systems designed to maintain engine stability for gas generator turbines, fan or power turbines, or propelling nozzles, as follows:
- a. "Development" "technology" for deriving the functional requirements for the components that maintain engine stability;
  - b. "Development" or "production" "technology" for components unique to the adjustable flow path system and that maintain engine stability;

- c. "Development" "technology" for the control law algorithms, including "source code", unique to the adjustable flow path system and that maintain engine stability.
- j. "Technology" "required" for the "development" of wing-folding systems designed for fixed-wing "aircraft" powered by gas turbine engines;
- k. "Technology", not specified in 9E003.a., 9E003.h., or 9E003.i., "required" for the "development" of any of the following components or systems, specially designed for aero gas turbine engines to enable "aircraft" to cruise at Mach 1 or greater for more than 30 minutes:
  - 1. Propulsion inlet systems;
  - 2. Propulsion exhaust systems;
  - 3. 'Reheat systems';
  - 4. 'Active thermal management systems' to condition fluids used to lubricate or cool 'engine rotor supports';
  - 5. Oil-free 'engine rotor supports'; or
  - 6. Systems to remove heat from 'compression system' core gas path flow.

**9E101****"Technology" as follows:**

- a. a. "Technology" according to the General Technology Note for the "development" of goods specified in 9A101, 9A102, 9A104 to 9A111, 9A112.a. or 9A115 to 9A121.
- b. b. "Technology" according to the General Technology Note for the "production" of 'UAV's specified in 9A012 or goods specified in 9A101, 9A102, 9A104 to 9A111, 9A112.a. or 9A115 to 9A121.

**9E102**

"Technology" according to the General Technology Note for the "use" of space launch vehicles specified in 9A004, goods specified in 9A005 to 9A011, 'UAV's specified in 9A012 or goods specified in 9A101, 9A102, 9A104 to 9A111, 9A112.a., 9A115 to 9A121, 9B105, 9B106, 9B115, 9B116, 9B117, 9D101 or 9D103.

## **MEMORANDUM OF OBJECTS AND REASONS**

### **Statement of the Objects and Reasons for the Bill**

The principal object of the Bill is to provide for the control of trade in strategic goods and related services, to prevent the proliferation of nuclear, chemical or biological weapons and their means of delivery.

The Bill is divided into six Parts consisting of 54 clauses.

**Part I (Clauses 1-4)** of the Bill provides for the preliminary matters, including the title, interpretation and application. Clause 3 provides for the Act to apply to any person who engages in strategic trade and a person who handles a strategic good. Clause 4 provides for the Cabinet Secretary to publish a National Control List which will specify the strategic goods that are subject to the provisions of the Act.

**Part II (Clauses 5-8)** of the Bill establishes the Strategic Goods Control Committee, sets out the functions of the Committee in relation to the management of trade in strategic goods and related services and puts in place a Secretariat of the Committee which shall be headed by a Director. The functions of the Committee include the oversight in the control of trade in strategic goods and related services, formulation and review of the National Control List, issuance, suspension or revocation of licences or a certificate issued under the Act and establishment and operation of end-use controls and compliance checks.

**Part III (Clauses 9-23)** of the Bill sets out the procedures related to registration and licensing under the Act. It provides for registration of persons intending to engage in strategic trade, a register of persons engaged in strategic trade, cancellation, suspension or restoration of registration, licencing and conditions for the issuance of the license among others. The Part also provides for end-use controls on strategic goods listed in the National Control List.

**Part IV (Clauses 24-37)** of the Bill provides for enforcement measures. It sets out the compliance requirements for persons engaged in strategic trade, the appointment of inspectors to ensure compliance with the Act as well as disposal and forfeiture of seized strategic goods. The Part also sets out offences which include fraudulent misrepresentation, obstruction of the Committee or its representatives, forgery of registration, licence or any other document issued under the Act, engagement in strategic trade or provision of related services without being duly registered and licenced by the Committee and use of strategic goods in a manner inconsistent with the registration certificate and licence issued by the Committee.

**PART V (Clauses 38-43)** of the Bill contains miscellaneous provisions that provide for the general penalty, confidentiality, voluntary disclosure and the power of the Cabinet Secretary to make regulations.

**PART VI (Clauses 44-54)** of the Bill contains consequential amendments to the Firearms Act, Cap. 114; the Pharmacy and Poisons Act, Cap. 244; the Fertilizers and Animal Foodstuffs Act, Cap. 345; the Pest Control Products Act, Cap. 346; the Nuclear Regulatory Act, Cap. 243; the Mining Act, Cap. 306 and the Explosives Act, Cap. 115.

The **Schedule** to the Bill provides for the National Control List which specifies the strategic goods that are subject to the provisions of the Bill.

**Statement on the delegation of legislative powers and limitation of fundamental rights and freedoms**

The Bill confers on the Cabinet Secretary the powers to make regulations under the Act for the purposes of operationalizing the Act in order to implement the objectives. The Bill does not limit any fundamental rights and freedoms.

**Statement of how the Bill concerns county governments**

The Bill does not concern county governments in terms of Article 110 of the Constitution as it does not contain provisions that affect the functions and powers of county governments as set out in the Fourth Schedule to the Constitution.

Paragraph 6 of Part 1 of the Fourth Schedule to Constitution provides that National defence and the use of the national defence services is a function of the National Government.

**Statement whether the Bill is a money Bill within the meaning of Article 114 of the Constitution**

The enactment of this Bill shall occasion additional expenditure of public funds which shall be provided for in the annual estimates.

Dated the 19th February, 2026.

KIMANI ICHUNG'WAH,  
*Leader of Majority Party.*