Council of the European Union

Brussels, 13 November 2020
(OR. en)

12798/20

Interinstitutional File:
2016/0295(COD)

LIMITE

COMER 165
CONOP 83
CFSP/PESC 981
ECO 51
UD 339
ATO 66
COARM 196
CODEC 1134

PUBLIC

'I' ITEM NOTE

From:	General Secretariat of the Council
To:	Permanent Representatives Committee (Part 2)
No. Cion doc.:	12785/16 + ADD 1 + ADD 2 + ADD 3
No. prev. doc.:	11747/20
Subject:	Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL setting up a Union regime for the control of exports, brokering, technical assistance, transit and transfer of dual-use items (recast) - Confirmation of the final compromise text with a view to agreement

1. On 30 September 2016, the Commission submitted to the European Parliament and the Council a Proposal for a Regulation of the European Parliament and of the Council setting up a Union regime for the control of exports, brokering, technical assistance, transit and transfer of dual-use items (recast)[1].

2. At its meeting on 5 June 2019, the Permanent Representatives Committee mandated the Presidency to start informal negotiations with the European Parliament, with a view to reaching a first reading agreement.

[1] doc. 12785/16.

3. At its Plenary session of 17 January 2018, the European Parliament endorsed the report by INTA Committee and mandated it to enter into negotiations with the Council with a view to a possible first reading agreement.[2] On 16 October 2019, the Conference of Presidents of the European Parliament took a decision to resume "unfinished business" and therefore confirmed the mandate of INTA Committee to start negotiations with the Council.

4. On the basis of these positions from the Council and the European Parliament, five informal trilogue meetings took place on the following dates: 21 October 2019, 13 November 2019, 13 February 2020, 22 September 2020 and 9 November 2020. At the last informal trilogue meeting held on 9 November 2020 a full provisional agreement was reached on the final compromise text, in line with the mandate[3] of 21 October 2020 by Coreper.

5. On 10 November 2020, the Presidency presented the results of the trilogue to members of the Working Party on Dual Use Goods, who welcomed the overall compromise reached.

6. The provisional agreement also includes a statement by the Commission regarding resource issues linked to the development of an EU capacity-building programme, which is envisaged to be published in the C-series of the Official Journal.

7. The Permanent Representatives' Committee is therefore invited:

   – to confirm the final compromise, as contained in the Annexes to this note; and

   – to authorise the Presidency to send a letter to the Chair of the European Parliament's INTA Committee confirming that, should the European Parliament adopt its position at first reading, in accordance with Article 294 paragraph 3 of the Treaty, in the form set out in the final compromise text contained in the Annex to the letter (subject to the revision by the lawyer-linguists of both institutions), the Council would, in accordance with Article 294 paragraph 4 of the Treaty, approve the European Parliament's position and the act shall be adopted in that wording.

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[2] doc. 5630/18
[3] doc. 11747/20

ANNEX I

PE-CONS No/YY - 2016/0295 (COD)

REGULATION (EU) 2020/...
OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of ...

setting up a Union regime for the control of exports, brokering, technical assistance transit and transfer of dual-use items (recast)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 207(2) thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee[1],

Acting in accordance with the ordinary legislative procedure,

Whereas:

(1) Council Regulation (EC) No 428/2009[2] has been substantially amended several times. Since further amendments are to be made, that Regulation should be recast in the interests of clarity, ***effectiveness and efficiency***.

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1 Opinion of ... (not yet published in the Official Journal).

2 Council Regulation (EC) No 428/2009 of 5 May 2009 setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items (OJ L 134, 29.5.2009, p. 1).

(1a) This Regulation aims to ensure that in the area of dual-use items, the Union and its Member States fully take into account all relevant considerations including international obligations and commitments, obligations under relevant sanctions as well as considerations for national foreign and security policy, including those contained in the Council Common Position of 8 December 2008[3] defining common rules governing control of exports of military technology and equipment, among them human rights, and considerations about intended end use and the risk of diversion. The European Union is committed to maintain robust legal requirements through this Regulation with regard to dual-use items, as well as to strengthen exchange of relevant information and greater transparency. With regard to cyber-surveillance items, the competent authorities of the Member States should in particular consider the risk of use in connection with internal repression or the commission of serious violations of international human rights and international humanitarian law.

(1b) This Regulation also aims at strengthening the guidance regarding responsible practices to be given to the exporters, especially to small and medium-sized enterprises (SMEs), while not impairing the global competitiveness of exporters of dual-use items or other associated industry or academia which are resident or established in the Member States of the European Union.

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[3] Council Common Position 2008/944/CFSP of 8 December 2008 defining common rules governing control of exports of military technology and equipment (OJ L 335, 13.12.2008, p. 99**).**

(2) United Nations Security Council Resolution 1540, adopted on 28 April 2004, decided that all States shall take and enforce effective measures to establish domestic controls to prevent the proliferation of nuclear, chemical or biological weapons and their means of delivery, including by establishing appropriate controls over related materials, ***equipment and technology*.** Controls are also required under relevant international agreements, such as the Convention on the Prohibition of the Development, Production, Stockpiling and use of Chemical Weapons and on their Destruction (the Chemical Weapons Convention or CWC) and the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and On Their Destruction (the Biological and Toxin Weapons Convention or BWC), and in line with commitments agreed upon in multilateral export control regimes.

(3) An effective common system of export controls on dual-use items is therefore necessary to ensure that the international commitments and responsibilities of the Member States and of the Union, especially regarding non-proliferation, ***regional peace, security and stability and respect for human rights and international humanitarian law*,** are complied with.

(4) The EU Strategy against proliferation of Weapons of Mass Destruction of 12 December 2003 (EU WMD Strategy) ***emphasises the Union's commitment to strong national and internationally-coordinated export controls***.

(4a) Contribution by exporters, brokers, suppliers of technical assistance or other relevant stakeholders to the overall aim of trade controls is crucial. In order for them to be able to act in conformity with this Regulation, the assessment of risks related to transactions concerned by this Regulation are to be approached by transaction screening measures, also referred to as the due diligence principle, as a part of Internal Compliance Programs (ICP). In this regard, especially the size and the organizational structure of exporters has to be taken into account when developing and implementing ICPs.

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(5) ▌ ***In order to address the risk*** that certain ***non listed*** cyber-surveillance ***items*** exported from the ***customs territory of the*** Union ***may be*** misused by persons complicit in or responsible for directing or committing serious violations of human rights or international humanitarian law ▌, it is appropriate to ***place*** the export of ***such items under control*** ▌***. Associated risks relate, in particular, to cases where cyber-surveillance items are specially designed to enable intrusion or deep packet inspection into information and telecommunications systems in order to conduct covert surveillance of natural persons by monitoring, extracting, collecting or analysing data, including biometrics data, from these systems. Items used for purely commercial applications such as billing, marketing, quality services, user satisfaction, network security etc. are considered to generally not entail such risks.***

(5a) With a view to strengthen the effective controls of exports of non-listed cyber-surveillance items it is essential to further harmonize the application of catch-all controls in this area. To this end, Member States are committed to support the controls by sharing information amongst each other and the Commission, in particular regarding technological developments of cyber-surveillance items, and by exercising vigilance in the application of such controls to promote an exchange on EU level.

(6) ***In order to enable the Union to react rapidly to serious misuse of existing technologies, or to new risks associated with emerging technologies, a mechanism should be introduced enabling Member States to coordinate their responses when a new risk is identified. Such coordination should be followed by initiatives to introduce equivalent controls at the multilateral level in order to broaden the response to the identified risk.***

(7) Transmission of dual-use software and technology by means of electronic media, fax or telephone to destinations outside the ***customs territory of the*** Union should also be controlled. In order to limit the administrative burden for exporters and the competent authorities of the Member States, ***facilitations in the form of general or global licenses or harmonised interpretation of provisions should be provided for certain transmissions, e.g. to a cloud***.

(7a) ***Considering the important role of customs authorities in the enforcement of export controls, the definitions of terms used should, to the extent possible, be consistent with the definitions in Regulation (EU) No 952/2013 of the European Parliament and of the Council[4] (the 'Union Customs Code').***

(8) Considering that various categories of persons may be involved in the export of dual-use items, including natural persons such as service providers, researchers, consultants and persons transmitting dual-use items electronically, ▌ ***it is essential they are aware of the risks associated with the export and technical assistance regarding sensitive items. In particular academic and research institutions face distinct challenges in export control due to, inter alia, their general commitment to the free exchange of ideas, the fact that their research work often involves cutting edge technologies, their organizational structures and the international nature of their scientific exchanges. The Member States and the Commission should, where necessary, raise awareness among the academic and research community and provide tailored guidance to them to address these distinct challenges. In alignment with the multilateral export control regimes and to the extent possible, the implementation of controls should provide for a common approach with respect to certain provisions, in particular regarding the academia related de-control notes "basic scientific research" and "public domain".***

(9) ▌

(10) The definition of broker should be revised to ***include legal persons and partnerships not resident or established in a Member State of the Union who carry out brokering services from the customs territory of the Union***.

(11) With the entry into force of the Lisbon Treaty, it has been clarified that the supply of technical assistance ▌ involving a cross-border movement falls under Union competence. It is therefore appropriate to clarify the controls applicable to technical assistance ▌, and to introduce a definition of those services. For reasons of effectiveness and consistency, controls on the supply of technical assistance ▌ should be harmonised ▌.

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[4] Regulation (EU) No 952/2013 of the European Parliament and of the Council of 9 October 2013 laying down the Union Customs Code (OJ L 269, 10.10.2013, p. 1).

(12) ***As in Dual-Use*** Regulation (EC) No 428/2009***, there should be*** a possibility for Member States' authorities **under certain circumstances** to prohibit ▌ the transit of non-Union dual-use items, where they, ***through intelligence or other sources,*** have reasonable grounds for suspecting ▌ that the items are or may be intended in their entirety or in part for proliferation of weapons of mass destruction or of their means of delivery ***or for a military end-use in a country subject to an arms embargo.*** ▌

(13) Licensing conditions and requirements ▌ should be harmonised***, where appropriate,*** in order to avoid distortions of competition and ensure the consistent and effective application of controls throughout the ***customs territory of the*** Union. To this effect, it is also necessary to ensure a clear determination of the competent authority ***of the Member State*** in all control situations. The responsibility for deciding on individual, global or national general export authorisations, on authorisations for brokering services and technical assistance, on transits of non-Union dual-use items ***and on authorisations for the transfer within the customs territory of the Union of the dual-use items listed in Annex IV***, lies with national authorities.

(14) ***Guidelines for*** "internal compliance programmes" ***(ICPs)*** should be introduced in order to contribute to the level-playing field between exporters and to enhance the effective application of controls. ***These guidelines should take into account the differences in sizes, resources, fields of activity and other features and conditions of exporters and subsidiaries such as intra-group compliance structures and standards, thus avoiding any 'one model for all' and helping each exporter to find its own solutions for compliance and competitiveness. Exporters using global export authorisations should implement an ICP unless that is considered unnecessary by the competent authority due to other circumstances it has taken into account when processing the application for a global export authorisation submitted by the exporter.***

(15) Additional Union general export authorisations should be introduced in order to reduce administrative burden on companies***, in particular SMEs,*** and authorities while ensuring an appropriate level of control of the relevant items to the relevant destinations. ***Where deemed necessary, Member States can provide guidance to exporters regarding the application of general authorisations. Member States can also introduce national general export authorisations for low-risk exports where they consider it necessary. An*** authorisation for large projects should also be introduced to adapt licensing conditions to the ***particular*** needs of industry.

(15a) The Commission, in close consultations with the Member States and stakeholders, should develop guidelines and/or recommendations for best practices to support practical applications of controls. In the preparation of the guidelines and/or recommendations for best practice, the information needs of SMEs should be duly taken into consideration.

(16) Common lists of dual-use items, destinations and guidelines are essential elements for an effective export control regime.

(16a) Member States establishing national control lists pursuant to this Regulation should inform the Commission and the other Member States of such lists. The Member States should also inform the Commission and the other Member States of all their decisions to refuse an authorisation for an export for which an authorisation is required on the basis of a national control list.

(17) ▌

(18) In order to allow for a swift Union response to changing circumstances as regards the assessment of the sensitivity of exports under Union general export authorisations as well as technological and commercial developments, the power to adopt acts in accordance with Article 290 of the Treaty on the Functioning of the European Union should be delegated to the Commission in respect of amending ▌ Annex I, Annex II ▌ and Annex IV to this Regulation. ***Decisions to update the common list of dual-use items subject to export controls in Annex I should be in conformity with the obligations and commitments that Member States or the Union have accepted as members of the relevant international non-proliferation agreements and multilateral export control regimes, or by ratification of relevant international treaties. Decisions to update the common list of dual-use items subject to export controls in Annex IV should be made in consideration of the public policy and public security interests of the Member States under Article 36 of the Treaty on the Functioning of the European Union. Decisions to update the common lists of items and destinations set out in Sections A to H of Annex II should be made in consideration of the assessment criteria set out in this Regulation.*** It is of particular importance that the Commission carry out appropriate consultations during its preparatory work, including at expert level and that those consultations be conducted in accordance with the principles laid down in the Interinstitutional Agreement on Better Law-Making of 13 April 2016. In particular, to ensure equal participation in the preparation of delegated acts, the European Parliament and the Council ▌ receive all documents at the same time as Member States' experts, and their experts systematically ▌ have access to meetings of Commission expert groups dealing with the preparation of delegated acts.

(18a) The Commission should publish in all EU languages the updates to Annex I through delegated acts.

(18b) The Commission should publish and keep updated in all EU languages a compilation of national control lists in force in the Member States.

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(19) National provisions and decisions affecting exports of dual-use items should be taken in the framework of the common commercial policy, and in particular Regulation (EU) 2015/479 of the European Parliament and of the Council[5]. Appropriate exchange of information and consultations on national provisions and decisions should ensure the effective and consistent application of controls throughout the ***customs territory of the*** Union.

(20) The existence of a common control system is a prerequisite for establishing the free movement of dual-use items inside the ***customs territory of the*** Union.

(21) Pursuant to and within the limits of Article 36 of the Treaty on the Functioning of the European Union and ***in view of international obligations undertaken***, Member States retain the right to carry out controls on transfers of certain dual-use items within the ***customs territory of the*** Union in order to safeguard public policy or public security. ▌ ***The*** list of items subject to intra-Union transfer controls in ▌ Annex IV should be periodically reviewed in light of ***the further evolution of the underlying international obligations, taking into account*** technological and commercial developments ▌ as regards the assessment of the sensitivity of transfers.

(22) On 22 September 1998 the Member States and the Commission signed Protocols additional to the respective safeguards agreements between the Member States, the European Atomic Energy Community and the International Atomic Energy Agency, which, among other measures, oblige the Member States to provide information on transfers of specified equipment and non-nuclear material. Intra-Union transfer controls should allow the Member States and the Union to fulfil their obligations under these agreements.

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5 Regulation (EU) 2015/479 of the European Parliament and of the Council on common rules for exports (OJ L83, 27.03.2015, p. 34).

(23) ***In order*** to achieve a uniform and consistent application of controls throughout the Union ▌, it is ▌ appropriate ▌ to broaden the scope of consultation and information exchange between the Member States and the Commission, and to introduce tools to support the development of a common export control network throughout the Union, such as electronic licensing procedures, technical expert groups and the setting up of an enforcement coordination mechanism. ***It is in particular important to ensure that exporters, brokers, suppliers of technical assistance and other relevant stakeholders concerned by this Regulation, including industry and civil society organisations, are consulted, where appropriate, by the Dual-Use Coordination Group and the technical expert groups.***

(23a) While customs authorities share certain information with other customs authorities using risk management system in accordance with Union customs rules, it is also appropriate to ensure close cooperation between licensing and customs authorities.

(24) It is appropriate to clarify that, to the extent that it concerns personal data, processing and exchange of information should comply with the applicable rules on ***the protection of natural persons with regard to the*** processing ▌ of personal data ***and on the free movement of such data*** in accordance with the rules laid down in ***Regulation (EU) 2016/679*** of the European Parliament and of the Council[6] ***(General Data Protection Regulation)*** and ***Regulation (EU) 2018/1725*** of the European Parliament and of the Council[7].

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[6] ***Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (OJ L 119, 4.5.2016, p. 1).***

[7] ***Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC (OJ L 295, 21.11.2018, p. 39).***

(24a) Member States and the Commission should take all necessary measures to ensure the protection of confidential information in compliance with, in particular, Commission Decision (EU, Euratom) 2015/443[8], Commission Decision (EU, Euratom) 2015/444[9] and the Agreement between the Member States of the European Union, meeting within the Council, regarding the protection of classified information exchanged in the interests of the European Union[10]. This includes, in particular, the obligation not to downgrade or declassify classified information without the prior written consent of the originator[11]. Any non-classified sensitive information or information which is provided on a confidential basis should be handled as such by the authorities.

(25) Outreach to the private sector, ***in particular to SMEs,*** and transparency are essential elements for an effective export control regime. It is therefore appropriate to provide for the continued development of ***guidelines, where necessary,*** to support the application of this Regulation and for the publication of an ***EU*** annual report on the implementation of controls [redacted] .

(25a) The annual report should include relevant information on the licensing and enforcement of controls under this Regulation, with due respect to the need to ensure the protection of the confidentiality of certain data, in particular where the publication of licensing data could affect national security concerns raised by Member States or jeopardise commercial confidentiality and allow non-EU suppliers to undercut restrictive licensing decisions by Member States.

(26) In order to ensure that this Regulation is properly applied, each Member State should take measures giving the competent authorities appropriate powers.

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8 ***Commission Decision (EU, Euratom) 2015/443 of 13 March 2015 on security in the Commission (OJ L 72, 17.3.2015, p. 41).***

9 ***Commission Decision (EU, Euratom) 2015/444 of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).***

10 ***OJ C 202, 8.7.2011, p. 13***

11 [redacted]

(27) Each Member State should ***in accordance with the EU WMD Strategy*** determine effective, proportionate and dissuasive penalties applicable in the event of breach of the provisions of this Regulation. It is also appropriate to introduce provisions to ▌ support effective enforcement of controls***, inter alia, through an Enforcement Coordination Mechanism***.

(28) ▌ ***The*** Union Customs Code ▌ lays down, among other things, provisions relating to the export and re-export of goods. Nothing in this Regulation constrains any powers under and pursuant to the Union Customs Code and its implementing provisions.

(29) Export controls ***contribute to*** international security and ***have an impact on*** trade with third countries and it is therefore appropriate to develop dialogue and cooperation with third countries in order to support a global level-playing field and enhance international security. ***In particular, Member States and the Commission should enhance their contribution to the activities of multilateral export control regimes and support their efforts in developing robust export controls as a model for international best practice and a global basis and an important tool for ensuring international peace and stability. Contributions should be made when a new risk has been identified by all Member States in the field of cyber surveillance items in order to ensure a multilateral level playing field.[12].***

(30) ▌ This Regulation ***applies*** without prejudice to the Commission Delegated Decision of 15 September 2015 supplementing Decision No 1104/2011/EU of the European Parliament and of the Council***[13]***, which establishes specific rules for the control of the export of items for the Public Regulated Service (PRS) under the Galileo Programme.

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12 The recital uses standard wording of MECRs "robust export controls as the model for international best practice" and "an important tool for ensuring international peace and stability".

13 ***Decision No 1104/2011/EU of the European Parliament and of the Council of 25 October 2011 on the rules for access to the public regulated service provided by the global navigation satellite system established under the Galileo programme (OJ L 287, 4.11.2011, p. 1).***

(31) This Regulation respects the fundamental rights and observes the principles recognised in particular by the Charter of Fundamental Rights of the European Union ▌,

HAVE ADOPTED THIS REGULATION:

CHAPTER I

SUBJECT AND DEFINITIONS

Article 1

This Regulation sets up a Union regime for the control of exports, brokering, technical assistance, transit and transfer of dual-use items.

Article 2

For the purposes of this Regulation:

1. ‘dual-use items’ ***means*** items, including software and technology, which can be used for both civil and military purposes, and shall include ▌ items which can be used for the design, development, production or use of nuclear, chemical ***or*** biological weapons ***or*** their means of delivery, including all ***items*** which can be used for both non-explosive uses and assisting in any way in the manufacture of nuclear weapons or other nuclear explosive devices;▌

2. ‘export’ ***means***:

   (a) an export procedure within the meaning of Article 269 of the Union Customs Code;

   (b) a re-export within the meaning of Article ***270*** of the Union Customs Code; ***a re-export also occurs if, during a transit through the customs territory of the Union according to Article 2(10), an exit summary declaration has to be lodged because the final destination of the items has been changed;***

   (c) ***an*** outward processing procedure within the meaning of Article 259 of the Union Customs Code; ***or***

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(d) transmission of software or technology by electronic media, including by fax, telephone, electronic mail or any other electronic means ***to a destination outside the customs territory of the Union; it includes making available in an electronic form such software and technology*** to legal ***or*** natural persons ***or*** partnerships outside the ***customs territory of the*** Union. ***Export also applies to oral transmission of technology when the technology is described over a voice transmission medium.***

3. 'exporter' ***means*** ▌:

(a) ***any natural or legal person or partnership*** ▌ who, at the time when the ***export declaration or the re-export declaration or an exit summary*** declaration is accepted, holds the contract with the consignee in the third country and has the power for determining the sending of the items out of the customs territory of the Union. If no export contract has been concluded ***or if the holder of the contract does not act on its own behalf,*** exporter ***means*** the person who has the power for determining the sending of the ***items*** out of the customs territory of the Union; ***or***

(b) ***any natural or legal person or partnership*** which decides to transmit ▌ software or technology by electronic media, including by fax, telephone, electronic mail or by any other electronic means to ***a destination*** ▌ outside the ***customs territory of the*** Union ***or to make available in an electronic form such software and technology to legal or natural persons or partnerships outside the customs territory of the Union***.

Where the benefit of a right to dispose of the dual-use item belongs to a person resident or established outside the ***customs territory of the*** Union pursuant to the contract on which the export is based, the exporter shall be considered to be the contracting party resident or established in the ***customs territory of the*** *Union.*

(c) ***if (a) or (b) are not applicable,*** ▌ any natural person carrying the ***dual use items*** to be exported where these ***dual use items*** are contained in the person's personal baggage within the meaning of ***point (a) of*** Article 1***(***19***)*** of ***Commission Delegated*** Regulation (EU) 2015/2446[14].

4. 'export declaration' ***means*** the act whereby ***any natural or legal*** person ***or partnership*** indicates in the prescribed form and manner the wish to ***place*** dual-use items specified in point 1 ***under an export procedure***;

5. 're-export declaration' ***means*** the act within the meaning of Article 5(13) of the Union Customs Code;

5a. ***'exit summary declaration' means the act within the meaning of Article 5(10) of the Union Customs Code;***

6. 'brokering services' ***means***:

(a) the negotiation or arrangement of transactions for the purchase, sale or supply of dual-use items from a third country to any other third country, or

(b) the selling or buying of dual-use items that are located in third countries for their transfer to another third country.

For the purposes of this Regulation the sole provision of ancillary services is excluded from this definition. Ancillary services are transportation, financial services, insurance or re-insurance, or general advertising or promotion;

7. 'broker' ***means*** any natural or legal person or partnership ▌ that carries out brokering services from the ***customs territory of the*** Union into the territory of a third country;

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14 ***Commission Delegated Regulation (EU) 2015/2446 of 28 July 2015 supplementing Regulation (EU) No 952/2013 of the European Parliament and of the Council as regards detailed rules concerning certain provisions of the Union Customs Code (OJ L 343, 29.12.2015, p. 1).***

8. 'technical assistance' ***means*** any technical support related to repairs, development, manufacture, assembly, testing, maintenance, or any other technical service, and may take forms such as instruction, advice, training, transmission of working knowledge or skills or consulting services, including ***by electronic means as well as by telephone or any other*** verbal forms of assistance;

9. 'supplier of technical assistance' means***:***

(a) any natural or legal person or partnership ▌ which supplies technical assistance from the ***customs territory of the*** Union into the territory of a third country;

(b) any natural or legal person or partnership resident or established in a Member State of the Union which supplies technical assistance within the territory of a third country; or

(c) any natural or legal person or partnership resident or established in a Member State of the Union which supplies technical assistance towards a resident of a third country temporarily present in the customs territory of the Union.

10. 'transit' ***means*** a transport of non-Union dual-use items entering and passing through the customs territory of the Union with a destination outside the ***customs territory of the*** Union. ***These are*** items:

(a) which are placed under ***an*** external transit procedure ***according to Article 226 of the Union Customs Code*** and only pass through the customs territory of the Union;

(b) which are trans-shipped within, or directly re-exported from, a free zone;

(c) which are in temporary storage and are directly re-exported from a temporary storage facility; ***or***

(d) which were brought into the customs territory of the Union on the same vessel or aircraft that will take them out of that territory without unloading;

11. ‘individual export authorisation’ ***means*** an authorisation granted to one specific exporter for one end user or consignee in a third country and covering one or more dual-use items;

12. ‘global export authorisation’ ***means*** an authorisation granted to one specific exporter in respect of a type or category of dual-use ***items*** which may be valid for exports to one or more specified end users ***and/or*** in one or more specified third countries;

13. 'large project authorisation' ***means an individual export authorisation*** **or** a global export authorisation granted to one specific exporter, in respect of a type or category of dual-use ***items*** which may be valid for exports to one or more specified end users in one or more specified third countries for the ***purpose*** of a specified ***large scale*** project ▌;

14. ‘Union general export authorisation’ ***means*** an export authorisation for exports to certain countries of destination available to all exporters who respect its conditions and requirements for use as listed in Sections A to ***H*** of Annex II;

15. ▌

16. ‘national general export authorisation’ ***means*** an export authorisation defined by national legislation in conformity with Article 10(6) and Section C of Annex III;

17. ‘customs territory of the Union’ ***means*** the territory within the meaning of Article 4 of the Union Customs Code;

18. ‘non-Union dual-use items’ ***means*** items that have the status of non-Union goods within the meaning of Article 5(24) of the Union Customs Code;

19. 'arms embargo' ***means*** an arms embargo imposed by a decision or a common position adopted by the Council or a decision of the Organisation for Security and Cooperation in Europe (OSCE) or an arms embargo imposed by a binding resolution of the Security Council of the United Nations;

20. ▌

21. ***'cyber-surveillance items' means dual-use items specially designed to enable the covert surveillance of natural persons by monitoring, extracting, collecting or analysing data from information and telecommunication systems;***

22. 'internal compliance programme' ***(ICP) means ongoing*** effective, appropriate and proportionate ***policies*** and procedures ▌ ***adopted*** by exporters to ***facilitate*** compliance with the provisions ***and objectives of this Regulation*** and with the terms and conditions of ***the*** authorisations ***implemented under*** this Regulation***, including, inter alia, due diligence measures assessing risks related to the export of the items to end users and end uses***;

23. ▌

24. ***'essentially identical transaction' means a transaction concerning items with essentially identical parameters or technical characteristics to the same end user or consignee as another transaction;***

CHAPTER II

SCOPE

Article 3

1. An authorisation shall be required for the export of the dual-use items listed in Annex I.

2. Pursuant to ***Articles*** 4, ***4a***, 8 or ***8a***, an authorisation may also be required for the export to all or certain destinations of certain dual-use items not listed in Annex I.

Article 4

1. An authorisation shall be required for the export of dual-use items not listed in Annex I if the exporter has been informed by the competent authority that the items in question are or may be intended, in their entirety or in part:

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(a) for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices or the development, production, maintenance or storage of missiles capable of delivering such weapons;

(b) for a military end-use if the purchasing country or country of destination is subject to an arms embargo. ***For the purposes of this subparagraph, 'military end-use' means***;

(i) incorporation into military items listed in the military list of Member States;

(ii) use of production, test or analytical equipment and components therefor, for the development, production or maintenance of military items listed in the abovementioned list; or

(iii) use of any unfinished products in a plant for the production of military items listed in the abovementioned list.

(c) for use as parts or components of military items listed in the national military list that have been exported from the territory of a Member State without authorisation or in violation of an authorisation prescribed by national legislation of that Member State;

(d) ▌

(e) ▌

2. If an exporter ▌ is aware that dual-use items which he proposes to export, not listed in Annex I, are intended, in their entirety or in part, for any of the uses referred to in paragraph 1, he ***shall*** notify the competent authority, which ***shall*** decide whether or not ▌ to make the export concerned subject to authorisation.

3. ***A Member State may adopt or maintain national legislation imposing an authorisation requirement on the export of dual-use items not listed in Annex I if the exporter has grounds for suspecting that those items are or may be intended, in their entirety or in part, for any of the uses referred to in paragraph 1***.

4. ***The*** Member State which imposes an authorisation requirement ***pursuant to*** paragraphs 1, 2, **or** 3 ▌ shall immediately inform ***its customs administration and other relevant national authorities and provide*** the other Member States and the Commission with relevant information ***on the authorisation requirement in question***, in particular ***as regards*** the items and end-users concerned***, unless it considers it not appropriate in light of the nature of the transaction or the sensitvity of the information concerned***.

5. The other Member States shall give all due consideration to this information ***received pursuant to paragraph 4*** and shall ▌ inform their customs administrations and other relevant national authorities ▌ .

6. ***In order to allow for an examination of all valid denials by the Member States, the*** provisions of Article 15(1), (2) and (5) to (7) shall apply to cases concerning dual-use items not listed in Annex I.

7. All information exchange required pursuant to this Article shall take place in accordance with the legal requirements concerning the protection of personal information, commercial sensitive information or protected defense, foreign policy or national security information. It shall be made via secure electronic means including the system referred to in Article 20(5).

8. This Regulation is without prejudice to the right of Member States to take national measures under Article 10 of Regulation (EU) 2015/479.

Article 4a

1. ***An authorisation shall be required for the export of cyber-surveillance items not listed in Annex I if the exporter has been informed by the competent authority that the items in question are or may be intended, in their entirety or in part, for use in connection with internal repression and/or the commission of serious violations of international human rights and international humanitarian law.***

2. ***If an exporter is aware according to its due diligence findings that cyber-surveillance items which it proposes to export, not listed in Annex I, are intended, in their entirety or in part, for any of the uses referred to in paragraph 1, it shall notify the competent authority, which shall decide whether or not to make the export concerned subject to authorisation. The Commission and the Council shall make available guidelines for exporters according to article 24(1).***

3. ***A Member State may adopt or maintain national legislation imposing an authorisation requirement on the export of cyber-surveillance items not listed in Annex I if the exporter has grounds for suspecting that those items are or may be intended, in their entirety or in part, for any of the uses referred to in paragraph 1.***

4. ***The Member State which imposes an authorisation requirement pursuant to paragraphs 1, 2 or 3 shall immediately inform its customs administration and other relevant national authorities and shall provide the other Member States and the Commission with relevant information on the authorisation requirement in question, in particular as regards the items and entities concerned, unless it considers it not appropriate in light of the nature of the transaction or the sensitivity of the information concerned.***

5. ***The other Member States shall give due consideration to the information received pursuant to paragraph 4 and shall review it in the light of the criteria set out in paragraph 1 within 30 working days as well as inform their customs administration and other relevant national authorities. In exceptional cases, any Member State may request the extension of the 30 day period. However, the extension may not exceed 30 working days.***

6. Where all Member States notify the other Member States and the Commission that an authorisation requirement should be imposed for essentially identical transactions, the Commission shall publish in the C series of the Official Journal of the European Union information regarding the cyber-surveillance items and, where appropriate, destinations subject to authorisation requirements as notified by the Member States for this purpose.

7. The Member States shall review the information published pursuant to paragraph 6 at least annually on the basis of relevant information and analyses provided by the Commission. Where all Member States notify the other Member States and the Commission that the publication of an authorisation requirement should be amended or renewed, the Commission shall promptly amend or renew accordingly the information published pursuant to paragraph 6 in the C series of the Official Journal of the European Union.

8. In order to allow for an examination of all valid denials by the Member States, the provisions of Article 15(1), (2) and (5) to (7) shall apply to cases concerning cyber-surveillance items not listed in Annex I.

9. All information exchange required pursuant to this Article shall take place in accordance with the legal requirements concerning the protection of personal information, commercial sensitive information or protected defense, foreign policy or national security information. It shall be made via secure electronic means including the system referred to in Article 20(5).

10. Member States shall consider supporting the inclusion of items published pursuant to paragraph 6 in the appropriate international non-proliferation regimes or export control arrangements with a view to extending controls. The Commission shall provide analyses of the relevant data gathered pursuant to Article 20(2) and to Article 24(2).

11. This Regulation is without prejudice to the right of Member States to take national measures under Article 10 of Regulation (EU) 2015/479.

Article 5

1. An authorisation shall be required for brokering services of dual-use items ***listed in Annex I*** if the broker has been informed by the competent authority that the items in question are or may be intended, in their entirety or in part, for any of the uses referred to in Article 4(1).

2. If a broker is aware that the dual-use items ***listed in Annex I*** for which he proposes brokering services are intended, in their entirety or in part, for any of the uses referred to in Article 4(1), he ***shall*** notify the competent authority which ***shall*** decide whether or not ▌ to make such brokering services subject to authorisation.

3. A Member State may extend the application of paragraph 1 to non-listed dual-use items.

4. A Member State may adopt or maintain national legislation imposing an authorisation requirement on the brokering of dual-use items, if the broker has grounds for suspecting that these items are or may be intended for any of the uses referred to in Article 4(1).

5. The provisions of Article 8(2), (3) and (4) shall apply to the national measures referred to in paragraphs 3 and 4 of this Article.

Article 6

1. The transit of non-Union dual-use items ***listed in Annex I*** may be prohibited at any time by the competent authority of the Member State where the items are situated if the items are or may be intended, in their entirety or in part, for uses referred to in Article 4(1).

2. Before deciding whether or not to prohibit a transit the competent authority may impose in individual cases an authorisation requirement for the specific transit of dual-use items ***listed in Annex I*** if the items are or may be intended, in their entirety or in part, for uses referred to in Article 4(1). ***In case the transit takes place through the territory of multiple Member States, the competent authority of each affected Member State shall be able to prohibit such transit through its territory.***

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The competent authority may impose the authorisation requirement on ***the natural or legal person or partnership who holds the contract with the consignee in the third country and has the power for determining the sending of the item passing through the customs territory of the Union.***

If the natural or legal person or partnership is not resident or established in the customs territory of the Union, the competent authority may impose the authorisation requirement on:

(a) the declarant within the meaning of Article 5(15) of the Union Customs Code;

(b) the carrier within the meaning of Article 5(40) of the Union Customs Code; ***or***

(c) the natural person carrying the ***dual use items in transit*** where these ***dual use items*** are contained in the personal baggage ***of this person***.

3. A Member State may extend the application of paragraph 1 to non-listed dual-use items.

4. The provisions of Article 8(2), (3) and (4) shall apply to the national measures referred to in paragraph 3 of this Article.

Article 7

1. An authorisation shall be required for the provision ▌ of technical assistance related to dual-use items ***listed in Annex I*** if the supplier of technical assistance has been informed by the competent authority that the items in question are or may be intended, in their entirety or in part, for any of the uses referred to in Article 4***(1)***.

2. If a supplier of technical assistance is aware that the dual-use items ***listed in Annex I*** for which he proposes to supply technical assistance are intended, in their entirety or in part, for any of the uses referred to in Article 4***(1)***, he ***shall*** notify the competent authority which ***shall*** decide whether or not ▌ to make such technical assistance subject to authorisation.

3. Paragraphs 1 and 2 shall not apply if the technical assistance:

(a) is supplied within or into the territory of a country listed in Part 2 of Section A of Annex II, or towards a resident of a country listed in Part 2 of Section A of Annex II;

(b) takes the form of transferring information that is in the public domain or basic scientific research within the meaning of the General Technology Note or of the Nuclear Technology Note of Annex I;

(c) is supplied by authorities or agencies of a Member State in the context of their official tasks;

(d) is supplied for the armed forces of a Member State on the basis of the tasks assigned to them;

(e) is supplied for a purpose which is cited in the exceptions for items of the Missile Technology Control Regime (MTCR technology) in Annex IV; or

(f) is the minimum necessary for the installation, operation, maintenance (checking) or repair of those items for which an export authorisation has been issued.

4. A Member State may extend the application of paragraph 1 to non-listed dual-use items.

5. A Member State may adopt or maintain national legislation imposing an authorisation requirement on the provision of technical assistance if the supplier of technical assistance has grounds for suspecting that the dual use items for which he proposes to supply technical assistance are or may be intended for any of the uses referred to in Article 4(1).

6. The provisions of Article 8(2), (3) and (4) shall apply to the national measures referred to in paragraphs 4 and 5 of this Article.

Article 8

1. A Member State may prohibit or impose an authorisation requirement on the export of dual-use items not listed in Annex I for reasons of public security***, including the prevention of acts of terrorism***, or for human rights considerations.

2. Member States shall notify the Commission and the other Member States of any measures adopted pursuant to paragraph 1 ***without delay*** after their adoption and indicate the precise reasons for the measures. ***If the measure is the establishment of a national control list, Member States shall also inform the Commission and the other Member States of the description of the controlled items.***

3. Member States shall also ***without delay*** notify the Commission and the other Member States of any modifications to measures adopted pursuant to paragraph 1***, including any modifications to the national control lists.***

4. The Commission shall publish the measures notified to it pursuant to paragraphs 2 and 3 in the C series of the *Official Journal of the European Union*. ***With regard to national control lists, the Commission shall publish separately and without delay in all EU languages a compilation of national control lists in force in the Member States. The Commission shall, upon notification by a Member State of any modifications to its national control list, without delay publish an update to the compilation of national control lists in force in the Member States.***

Article 8a

1. An authorisation shall be required for the export of dual use items not listed in Annex I if another Member State requires an authorisation for the export of these items on the basis of a national control list of items adopted by that Member State pursuant to Article 8 and published by the Commission pursuant to article 8(4), and if the exporter has been informed by the competent authority that the items in question are or may be intended, in their entirety or in part, for uses of concern with respect to public security, including the prevention of acts of terrorism, or to human rights considerations.

2. ***A Member State which refuses an authorisation required in accordance with paragraph 1 of this Article, shall also inform the Commission and other Member States of such decision.***

3. ***A Member State which imposes an authorisation requirement, in application of paragraph 1 on the export of a dual-use item not listed in Annex I, shall without delay inform its customs administration and other relevant national authorities about the authorisation requirement and, where appropriate, provide the other Member States and the Commission with the relevant information, in particular concerning the items and end-users concerned. The other Member States shall give all due consideration to this information and shall inform their customs administrations and other relevant national authorities.***

Article 9

1. An authorisation shall be required for intra-Union transfers of dual-use items listed in ▌Annex IV. ***Dual use items listed in Part 2 of Annex IV shall not be covered by a general authorisation***.

2. A Member State may impose an authorisation requirement for the transfer of other dual-use items from its territory to another Member State in cases where at the time of transfer:

   – the operator or the ***competent authority*** knows that the final destination of the items concerned is outside the ***customs territory of the*** Union, and

   – export of those items to that final destination is subject to an authorisation requirement pursuant to Articles 3, 4 or 8 in the Member State from which the items are to be transferred, and such export directly from its territory is not authorised by a general authorisation or a global authorisation, and

   – no processing or working as defined in Article 60(2) of the Union Customs Code is to be performed on the items in the Member State to which they are to be transferred.

3. The transfer authorisation shall be applied for in the Member State from which the dual-use items are to be transferred.

4. In cases where the subsequent export of the dual-use items has already been accepted, in the consultation procedures set out in Article 13, by the Member State from which the items are to be transferred, the transfer authorisation shall be issued to the operator immediately, unless the circumstances have substantially changed.

5. A Member State which adopts legislation imposing ***a*** requirement ***according to paragraph 2*** shall inform the Commission and the other Member States of the measures it has taken without delay. The Commission shall publish this information in the C series of the *Official Journal of the European Union*.

6. The measures pursuant to paragraphs 1 and 2 shall not involve the application of internal frontier controls within the ***customs territory of the*** Union, but solely controls which are performed as part of the normal control procedures applied in a non-discriminatory fashion throughout the ***customs*** territory of the Union.

7. Application of the measures pursuant to paragraphs 1 and 2 may in no case result in transfers from one Member State to another being subject to more restrictive conditions than those imposed for exports of the same items to third countries.

8. A Member State may, by national legislation, require that, for any intra-Union transfers from that Member State of items listed in Category 5, Part 2 ▌ of Annex I which are not listed in ▌ Annex IV, additional information concerning those items shall be provided to the competent authority of that Member State.

9. The relevant commercial documents relating to intra-Union transfers of dual-use items listed in Annex I shall indicate clearly that those items are subject to controls if exported from the ***customs territory of the*** Union. Relevant commercial documents include, in particular, any sales contract, order confirmation, invoice or dispatch note.

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CHAPTER III

EXPORT AUTHORISATION AND AUTHORISATION FOR BROKERING SERVICES AND TECHNICAL ASSISTANCE ▌

Article 10

1. The following ***types of*** authorisations for export ***may be issued or*** are established under this Regulation:

   (a) individual export authorisation;

   (b) global export authorisation ▌;

   (c) national general export authorisation;

   (d) Union general export authorisations for ***exports of certain items to certain destinations under specific conditions and requirements for use*** as set out in Sections A to ***H*** of Annex II.

   The authorisations shall be valid throughout the ***customs territory of the*** Union.

2. ***Individual and global export authorisations under this Regulation shall be granted by the competent authority of the Member State where the exporter is resident or established***.

   Without prejudice to Article 2(3), where the exporter is ***not*** resident or established on the ***customs*** territory of the Union***, individual export authorisations shall be granted under this Regulation by the competent authority of the Member State where the dual use items are located***. ▌

   All individual and global export authorisations shall be issued, whenever possible, by electronic means on forms containing at least all the elements and in the order set out in the models which appear in Section A of Annex III.

3. Individual export authorisations and global export authorisations shall be valid for ***up to two years, unless decided differently by the competent authority.***

Large project authorisations shall be valid for a duration to be determined by the competent authority***, but no longer than four years, except in duly justified circumstances based on the duration of the project***.

4. Exporters shall supply the competent authority with all relevant information required for their applications for individual and global export authorisation so as to provide complete information in particular on the end user, the country of destination and the end use of the item exported.

Individual export authorisations ***shall be*** subject ▌ to an end-use statement. ***The competent authority may exempt certain applications from the obligation of providing an end-use statement. Global export authorisations may be subject to an end-use statement if appropriate***.

Exporters using global export authorisations shall implement an ICP, unless that is considered unnecessary by the competent authority due to other information it has taken into account when processing the application for a global export authorisation submitted by the exporter.

Reporting and ICP requirements relating to the use of global export authorisations shall be defined by Member States. ▌

At the request of exporters, global export authorisations that contain quantitative limitations shall be split.

5. The competent authorities of the Member States shall process requests for individual or global authorisations within a period of time to be determined by national law or practice. ▌

6. National general export authorisations shall:

(a) exclude from their scope items listed in Section ***I*** of Annex II;

(b) be defined by national law or practice. They may be used by all exporters, established or resident in the Member State issuing these authorisations, if they meet the requirements set in this Regulation and in the complementary national legislation. They shall be issued in accordance with the indications set out in Section C of Annex III. ▌

(c) not be used if the exporter has been informed by the competent authority that the items in question are or may be intended, in their entirety or in part, for any of the uses referred to in Article 4***(1)***, or if the exporter is aware that the items are intended for the abovementioned uses.

National general export authorisations may also apply to items and destinations listed in Annex II Sections A to H.

Member States shall notify the Commission immediately of any national general export authorisations issued or modified. The Commission shall publish these notifications in the C series of the Official Journal of the European Union;

7. The competent ***authority*** of the Member State where the exporter is ***resident or*** established ***may*** prohibit the exporter from using ***Union general export authorisations*** if there is reasonable suspicion about his ability to comply with such authorisation or with a provision of the export control legislation.

The competent authorities of the Member States shall exchange information on exporters ***prohibited from using*** a Union general export authorisation, unless they determine that the exporter will not attempt to export dual-use items through another Member State. The system referred to in Article 20**(*5*)** shall be used for this purpose.

Article 11

1. Authorisations for brokering services and technical assistance under this Regulation shall be granted by the competent authority of the Member State where the broker or the supplier of technical assistance is resident or established. Where the broker or the supplier of technical assistance is not resident or established on the ***customs*** territory of the Union, authorisations for brokering services and technical assistance under this Regulation shall be granted ▌ by the competent authority of the Member State ▌ from where the brokering services or technical assistance will be supplied.

2. Authorisations for brokering services ▌ shall be granted for a set quantity of specific items. The location of the items in the originating third country, the end-user and its exact location ***shall*** be clearly identified.

Authorisations for technical assistance shall clearly identify the end-user and its exact location.

The authorisations shall be valid throughout the ***customs territory of the*** Union.

3. Brokers and suppliers of technical assistance shall supply the competent authority with all relevant information required for their application for authorisation under this Regulation, in particular details of the location of the dual-use items, a clear description of the items and the quantity involved, third parties involved in the transaction, the ▌ country of destination, the end-user in that country and its exact location.

4. The competent authorities of the Member States shall process requests for authorisations for brokering services and technical assistance within a period of time ***to be determined by national law or practice***.

5. All authorisations for brokering services and technical assistance shall be issued, whenever possible, by electronic means on forms containing at least all the elements and in the order set out in the models which appear in Section B of Annex III.

Article 12

▌

Article 13

1. If the dual-use items in respect of which an application has been made for an individual export authorisation to a destination not listed in ***Part 2 of*** Section A of Annex II or to any destination in the case of dual-use items listed in ▌ Annex IV are or will be located in one or more Member States other than the one where the application has been made, that fact shall be indicated in the application. The competent authority of the Member State to which the application for authorisation has been made shall immediately consult the competent authorities of the Member State or States in question and provide the relevant information. ***This consultation may be carried out using the electronic system mentioned in Article 20(5).*** The Member State or States consulted shall make known within 10 working days any objections it or they may have to the granting of such an authorisation, which shall bind the Member State in which the application has been made.

   If no objections are received within 10 working days, the Member State or States consulted shall be regarded as having no objection.

   In exceptional cases, any Member State consulted may request the extension of the 10-day period. However, the extension may not exceed 30 working days.

2. If an export might prejudice its essential security interests, a Member State may request another Member State not to grant an export authorisation or, if such authorisation has been granted, request its annulment, suspension, modification or revocation. The Member State receiving such a request shall immediately engage in consultations of a non-binding nature with the requesting Member State, to be terminated within 10 working days. In case the requested Member State decides to grant the authorisation, this should be notified to the Commission and other Member States using the electronic system mentioned in Article 20***(5)***.

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Article 14

1. In deciding whether or not to grant an ▌ authorisation ▌ or to prohibit a transit ***under this Regulation,*** ▌ the Member States shall take into account ***all relevant considerations including****:*

(a) Union and Member States' international obligations and commitments, in particular the obligations and commitments they have each accepted as members of the relevant international non-proliferation regimes and export control arrangements, or by ratification of relevant international treaties;

(b) their obligations under sanctions imposed by a decision or a common position adopted by the Council or by a decision of the OSCE or by a binding resolution of the Security Council of the United Nations; ▌

(c) considerations of national foreign and security policy, including ▌ ***those covered by Council Common Position 2008/944/CFSP of 8 December 2008 defining common rules governing control of exports of military technology and equipment;***

(d) considerations about intended end use and the risk of diversion▌ .

2. ***In addition to the criteria set in paragraph 1, when assessing an application for a global export authorisation Member States shall take into consideration the implementation by the exporter of an ICP.***

Article 15

1. The competent ***authority*** ▌ acting in accordance with this Regulation, may refuse to grant an export authorisation and may annul, suspend, modify or revoke an export authorisation which ***it has*** already granted. Where ***the competent authority refuses***, ***annuls***, ***suspends***, substantially ***limits*** or ***revokes*** an export authorisation or when ***it has*** determined that the intended export is not to be authorised, ***it*** shall notify the competent authorities of the other Member States and the Commission thereof and share the relevant information with them. In case the competent authority of a Member State has suspended an export authorisation, the final assessment shall be communicated to the competent authorities of the other Member States and the Commission at the end of the period of suspension.

2. The competent authorities of ***the*** Member States shall review denials of authorisations notified under paragraph 1 within three years of their notification and revoke them, amend them or renew them. The competent authorities of the Member States ***shall*** notify the results of the review to the competent authorities of the other Member States and the Commission as soon as possible. Denials which are not revoked shall remain valid ***and shall continue to be reviewed every three years. At the third review, the Member State concerned shall be required to explain the reasoning for maintaining such denial***.

3. The competent ***authority*** ▌ shall notify the ***competent authorities of the other*** Member States and the Commission of their decisions to prohibit a transit of dual-use items taken under Article 6 without delay. These notifications ***shall*** contain all relevant information including the classification of the item, its technical parameters, the country of destination and the end user.

4. Paragraphs 1 and 2 shall also apply to authorisations for brokering services and technical assistance ***referred to in Article 11***.

5. Before the competent authority of a Member State ▌ ***decides whether or not to grant an authorisation or to prohibit a transit under this Regulation***, it shall examine all valid denials or decisions to prohibit a transit of dual-use items listed in Annex I taken under this Regulation to ascertain whether an authorisation or a transit has been denied by the competent authorities of another Member State or States for an essentially identical transaction ▌. It shall first consult the competent authorities of the Member State or States which issued such denial(s) or decisions to prohibit the transit as provided for in paragraphs 1, 3 and ***4***.

The competent authorities of the Member State or States consulted shall make known within 10 working days whether or not they consider the transaction essentially identical. If no reaction has been received within 10 working days, the Member State or States consulted shall be regarded as not considering the transaction essentially identical.

If more information is required to correctly evaluate the transaction in question, the competent authorities of the Member States concerned shall agree on the extension of the 10-day period. However, the extension may not exceed 30 working days.

If following such consultation the competent authority ▌ decides to grant an authorisation or allow the transit, it shall notify the competent authorities of the other Member States and the Commission, providing all relevant information to explain the decision.

6. All notifications required pursuant to this Article shall be made via secure electronic means including the system referred to in Article 20***(5)***.

7. All information shared in accordance with the provisions of this Article shall be in compliance with the provisions of Article 20***(6)*** concerning the confidentiality of such information.

CHAPTER IV

AMENDMENT OF LISTS OF DUAL-USE ITEMS AND DESTINATIONS

Article 15a

1. ▌ The Commission ***is*** empowered to adopt delegated acts in ▌ ***accordance with Article 16 concerning the amendment of*** the lists of dual-use items set out in Annex I and ▌ Annex IV, as follows:

a) The list of dual-use items set out in ▌ Annex I shall be amended in conformity with the relevant obligations and commitments, and any modification thereof, that Member States and the Union have accepted as members of the international non-proliferation regimes and export control arrangements, or by ratification of relevant international treaties. Where the amendment of ▌ Annex I concerns dual-use items which are also listed in Annexes II ***or*** IV, ▌ those Annexes shall be amended accordingly. ▌

2. The Commission ***is*** empowered to adopt delegated acts ***in accordance with Article 16*** to amend Annex II by ▌ removing items ▌ ***and by adding or removing*** destinations from the scope of Union general export authorisations ▌ ***in consultation with the Dual-Use Coordination Group set up pursuant to Article 21 and taking into consideration obligations and commitments under the relevant non-proliferation regimes and export control arrangements, such as amendments to control lists, as well as relevant geopolitical developments***. Where imperative grounds of urgency require a removal of particular destinations from the scope of a Union general export authorisation, the procedure provided for in Article 17 shall apply to delegated acts adopted pursuant to this paragraph.

Article 16

1. The power to adopt delegated acts is conferred on the Commission subject to the conditions laid down in this Article.

2. The power to adopt delegated acts referred to in Article ***15a*** shall be conferred on the Commission for a period of five years from … [the date of entry into force of this Regulation]. The Commission shall draw up a report in respect of the delegation of power not later than nine months before the end of the five-year period. The delegation of power shall be tacitly extended for periods of an identical duration, unless the European Parliament or the Council opposes such extension not later than three months before the end of each period.

3. The delegation of power referred to in Article ***15a*** may be revoked at any time by the European Parliament or by the Council. A decision to revoke shall put an end to the delegation of the power specified in that decision. It shall take effect the day following the publication of the decision in the *Official Journal of the European Union* or at a later date specified therein. It shall not affect the validity of any delegated acts already in force.

4. Before adopting a delegated act, the Commission shall consult experts designated by each Member State in accordance with the principles laid down in the Inter-Institutional Agreement ***of 13 April 2016 on Better Law-Making***.

5. As soon as it adopts a delegated act, the Commission shall notify it simultaneously to the European Parliament and to the Council.

6. A delegated act adopted pursuant to Article ***15a*** shall enter into force only if no objection has been expressed either by the European Parliament or the Council within a period of two months of notification of that act to the European Parliament and the Council or if, before the expiry of that period, the European Parliament and the Council have both informed the Commission that they will not object. That period shall be extended by two months at the initiative of the European Parliament or of the Council.

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Article 17

1. Delegated acts adopted under this Article shall enter into force without delay and shall apply as long as no objection is expressed in accordance with paragraph 2. The notification of a delegated act to the European Parliament and to the Council shall state the reasons for the use of the urgency procedure.

2. Either the European Parliament or the Council may object to a delegated act in accordance with the procedure referred to in Article ***16(6)***. In such a case, the Commission shall repeal the act ***immediately*** following the notification of the decision to object by the European Parliament or by the Council.

Article 17a

The list of dual-use items set out in Annex IV, which is a subset of Annex I, shall be updated with regard to Article 36 of the Treaty on the Functioning of the European Union, namely the public policy and public security interests of the Member States.

CHAPTER V
CUSTOMS PROCEDURES

Article 18

1. When completing the formalities for the export of dual-use items at the customs office responsible for handling the export declaration, the exporter shall furnish proof that any necessary export authorisation has been obtained.

2. A translation of any documents furnished as proof into an official language of the Member State where the export declaration is presented may be required of the exporter.

3. Without prejudice to any powers conferred on it under, and pursuant to, the Union Customs Code, a Member State may also, for a period not exceeding the periods referred to in paragraph 4, suspend the process of export from its territory, or, if necessary, otherwise prevent the dual-use items ▌ which are ***or are not*** covered by a valid export authorisation from leaving the Union via its territory, where it:

a) ***has grounds for suspicion that***

(i) relevant information was not taken into account when the authorisation was granted, or

(ii) circumstances have materially changed since the grant of the authorisation, ***or***

(b) ***has relevant information regarding the potential application of measures under Article 4(1).***

4. In the ***cases*** referred to in paragraph 3, the competent authority of the Member State which granted the export authorisation ***or which may take action pursuant to Article 4(1)*** shall be consulted forthwith in order that they may take action pursuant to Article 15(1) ***or Article 4(1)***. If such competent authority decides to maintain the authorisation ***or not to take action pursuant to Article 4(1)*** it shall reply within 10 working days, which, at its request, may be extended to 30 working days in exceptional circumstances. In such case, or if no reply is received within 10 or 30 days, as the case may be, the dual-use items shall be released immediately. The competent authority of the Member State which granted the authorisation shall inform the competent authorities of the other Member States and the Commission.

5. The Commission, in cooperation with the Member States, ***may*** develop guidance to support interagency cooperation between licensing and customs authorities.

Article 19

1. Member States may provide that customs formalities for the export of dual-use items may be completed only at customs offices empowered to that end.

2. Member States availing themselves of the option set out in paragraph 1 shall inform the Commission of the duly empowered customs offices. The Commission shall publish the information in the C series of the *Official Journal of the European Union*.

CHAPTER VI

ADMINISTRATIVE COOPERATION, IMPLEMENTATION AND ENFORCEMENT

Article 20

1. Member States shall inform the Commission without delay of the laws, regulations and administrative provisions adopted in implementation of this Regulation, including:

   (a) a list of the ***competent*** authorities ***of the Member States*** empowered to:

      – grant export authorisations for dual-use items;

      – grant authorisations under this Regulation for the provision of brokering services and technical assistance ;

      – decide to prohibit the transit of non-Union dual-use items under this Regulation;

   (b) the measures referred to in Article 22***(1)***.

   The Commission shall forward the information to the other Member States and shall publish the information in the C series of the *Official Journal of the European Union*.

2. Member States, in cooperation with the Commission, shall take all appropriate measures to establish direct cooperation and exchange of information between the competent authorities with a view to enhance the efficiency of the Union export control regime and to ensure the consistent and effective implementation and enforcement of control throughout the ***customs territory of the Union. The*** information ***exchange may*** include:

   (a) ▌***relevant*** licensing data***, provided for each authorisation issued*** (***e.g.*** ▌value and types of licence and related destinations, number of users of general ▌authorisations▌)▌***;***

(b) ***additional*** information regarding the application of controls, including ***information on the application of criteria set out in Article 14(1), number of operators with ICPs and, where available, data on exports of dual-use items carried out in other Member States;***

(b1) information regarding the analysis underlying additions or planned additions to national control list pursuant to Article 8;

(c) information regarding the enforcement of controls, including ***risk-based audits,*** details of exporters deprived of the right to use the national or Union general export authorisations***, and, where available, number of*** violations, seizures and application of other penalties;

(d) data on sensitive end users, actors involved in suspicious procurement activities, and, where available, routes taken.

3. The exchange of licensing data shall take place at least annually in accordance with guidelines to be drawn up by the Dual Use Coordination Group established under Article 21 and with due consideration to legal requirements concerning the protection of personal information, commercially sensitive information or protected defense, foreign policy or national security information.

3a. Member States and the Commission shall regularly examine the implementation of Article 14 based on information submitted pursuant to this Regulation and analyses of such data. All participants of these exchanges shall respect the confidentiality of the discussions.

4. Council Regulation (EC) No 515/97[15], and in particular the provisions on the confidentiality of information, shall apply mutatis mutandis.

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15 ***Council Regulation (EC) No 515/97 of 13 March 1997 on mutual assistance between the administrative authorities of the Member States and cooperation between the latter and the Commission to ensure the correct application of the law on customs and agricultural matters (OJ L 82, 22.3.1997, p. 1).***

5. A secure and encrypted system shall be developed by the Commission, in consultation with the Dual-Use Coordination Group set up pursuant to Article 21, to support direct cooperation and exchange of information between the competent authorities of the Member States and***, where appropriate,*** the Commission. The system shall***, where feasible,*** be connected ***by the Commission*** to the electronic licensing systems of the competent authorities of the Member *States* ***to the extent necessary for the purpose of facilitating this direct cooperation and exchange of information***. The European Parliament shall be informed about the system's budget, development and functioning.

6. The processing of personal data shall be in accordance with the rules laid down in ▌***Regulation 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), as well as Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC.*** ▌

Article 21

1. A Dual-Use Coordination Group chaired by a representative of the Commission shall be set up. Each Member State shall appoint a representative to this Group. It shall examine any question concerning the application of this Regulation which may be raised either by the chair or by a representative of a Member State.

2. The ▌ Dual-Use Coordination Group shall, whenever it considers it to be necessary, consult exporters, brokers, ***suppliers of technical assistance*** and other relevant stakeholders concerned by this Regulation.

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3. The Dual-Use Coordination Group shall, where appropriate, set up technical expert groups composed of experts from Member States to examine specific issues relating to the implementation of controls, including issues relating to the updating of the Union control lists in Annex I. Technical expert groups shall, where appropriate, consult exporters, brokers, ***suppliers of technical assistance*** and other relevant stakeholders concerned by this Regulation.

4. The Commission shall support an EU licensing and enforcement capacity-building programme, including by developing, in consultation with the Dual-Use Coordination Group, common training programmes for officials of the Member States.

Article 22

1. Each Member State shall take appropriate measures to ensure proper enforcement of all the provisions of this Regulation. In particular, it shall lay down the penalties applicable to infringements of the provisions of this Regulation or of those adopted for its implementation. Those penalties ***shall*** be effective, proportionate and dissuasive.

2. The Dual-Use Coordination Group shall set up an Enforcement Coordination Mechanism ▌ ***to support exchange of information and direct cooperation*** between competent authorities and enforcement agencies ***of the Member States. Under the Enforcement Coordination Mechanism, the Member States and the Commission shall exchange relevant information, where available, including on the application, nature and effect of the measures, taken under paragraph 1, on enforcement of best practices and unauthorised exports of dual use items and/or infringements to this Regulation and/or relevant national legislation***.

Under the Enforcement Coordination Mechanism, the Member States and the Commission shall also exchange information on best practices of national enforcement authorities regarding risk-based audits, the detection and prosecution of unauthorised exports of dual use items and/or possible other infringements of this Regulation and/or relevant national legislation.

Exchange of information under the Enforcement Coordination Mechanism shall be confidential.

Article 23

▌

CHAPTER VII

TRANSPARENCY, OUTREACH, MONITORING, EVALUATION

Article 24

1. The Commission and the Council shall, where appropriate, make available ***guidelines*** and/or recommendations for best practices for the subjects referred to in this Regulation to ensure the efficiency of the Union export control regime and the consistency of its implementation. ▌ ***The provision of guidelines and/or recommendations for best practices to exporters, brokers and suppliers of technical assistance shall be the responsibility of the Member States where they are resident or established. In these guidelines and/or recommendations for best practices the information needs of small and medium-sized companies shall be especially taken into account.***

2. The Commission shall***, in consultation with the Dual-Use Coordination Group,*** submit an annual report to the European Parliament and the Council on the implementation ***of this Regulation,*** and on the activities, examinations and consultations of the Dual-Use Coordination Group. ▌ ***This*** annual report shall be public**.**

The annual report shall include information on authorisations (in particular number and value by types of items and by destinations at EU and Member State levels), denials and prohibitions under this Regulation, as well as on the administration (in particular staffing, compliance and outreach activities, dedicated licensing or classification tools), and on the enforcement of controls (in particular number of infringements and penalties).

With regard to cyber-surveillance items the annual report shall include dedicated information on authorisations, in particular on the number of applications received by items, the issuing Member State and the destinations concerned by these applications, and on the decisions taken on these applications.

The information contained in the annual report shall be presented in accordance with the principles set out in paragraph 3.

The Commission and the Council shall make available guidelines on the methodology for data gathering and processing for the preparation of the annual report, including the determination of the types of items and the availability of enforcement data.

3. ***Member States shall provide to the Commission all appropriate information for the preparation of the report with due consideration given to legal requirements concerning the protection of personal information, commercial sensitive information or protected defense, foreign policy or national security information. Regulation (EC) No 223/2009 of the European Parliament and of the Council[16] on European statistics applies to information exchanged or published under this Article.***

4. Between five and seven years after the date of application of this Regulation, the Commission shall carry out an evaluation of this Regulation and report on the main findings to the European Parliament, the Council and the European Economic and Social Committee. ▌ ***After three years after the date of application of this Regulation, the Commission shall carry out an evaluation of Article 4a and report on the main findings to the European Parliament, the Council and the European Economic and Social Committee.***

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16 ***Regulation (EC) No 223/2009 of the European Parliament and of the Council of 11 March 2009 on European statistics and repealing Regulation (EC, Euratom) No 1101/2008 of the European Parliament and of the Council on the transmission of data subject to statistical confidentiality to the Statistical Office of the European Communities, Council Regulation (EC) No 322/97 on Community Statistics, and Council Decision 89/382/EEC, Euratom establishing a Committee on the Statistical Programmes of the European Communities (OJ L 87, 31.3.2009, p. 164).***

CHAPTER VIII

CONTROL MEASURES

Article 25

1. Exporters of dual-use items shall keep detailed registers or records of their exports, in accordance with the national law or practice in force in the respective Member States. Such registers or records shall include in particular commercial documents such as invoices, manifests and transport and other dispatch documents containing sufficient information to allow the following to be identified:

   (a) the description of the dual-use items;

   (b) the quantity of the dual-use items;

   (c) the name and address of the exporter and of the consignee;

   (d) where known, the end-use and end-user of the dual-use items.

2. In accordance with national law or practice in force in the respective Member States, brokers and suppliers of technical assistance shall keep registers or records for brokering ***services*** or technical assistance so as to be able to prove, on request, the description of the dual-use items that were the subject of brokering ***services*** or technical assistance, the period during which the items were the subject of such services and their destination, and the countries concerned by those services.

3. The registers or records and the documents referred to in paragraphs 1 and 2 shall be kept for at least ***five*** years from the end of the calendar year in which the export took place or the brokering ***services*** or technical assistance were provided. They shall be produced, on request, to the competent authority.

4. Documents and records of intra-Union transfers of dual-use items listed in Annex I shall be kept for at least three years from the end of the calendar year in which a transfer took place and shall be produced***, on request,*** to the competent authority of the Member State from which these items were transferred.

Article 26

In order to ensure that this Regulation is properly applied, each Member State shall take ***all necessary measures*** to permit its competent authorities:

(a) to gather information on any order or transaction involving dual-use items;

(b) to establish that the export control measures are being properly applied, which may include in particular the power to enter the premises of persons with an interest in an export transaction or brokers involved in the supply of brokering services under circumstances set out in Article 5, or suppliers of technical assistance under the circumstances set out in Article 7.

CHAPTER IX

COOPERATION WITH THIRD COUNTRIES

Article 27

1. The Commission and ▌ the Member States shall, where appropriate, maintain ▌ ***dialogues*** with third countries***, with a view to promoting the global convergence of controls.***

The dialogues may support regular and reciprocal cooperation with third countries, including exchange of information and best practices, as well as capacity-building and outreach to third countries. The dialogues may also encourage the adherence of third countries to robust export controls developped by multilateral export control regimes as a model for international best practice.

2. Without prejudice to the provisions on mutual administrative assistance agreements or protocols in customs matters concluded between the Union and third countries, the Council may authorise the Commission to negotiate with third countries agreements providing for the mutual recognition of export controls of dual-use items covered by this Regulation. ▌

These negotiations shall be conducted in accordance with the procedures established in Article 207(3) of the Treaty on the Functioning of the European Union and the Treaty establishing the European Atomic Energy Community, as appropriate.

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CHAPTER X

FINAL PROVISIONS

Article 28

This Regulation ***applies*** without prejudice to the Commission Delegated Decision of 15 September 2015 supplementing Decision No 1104/2011/EU of the European Parliament and of the Council.

Article 29

Regulation (EC) No 428/2009 is repealed with effect from […].

However, for export authorisation applications made before […] , the relevant provisions of Regulation (EC) No 428/2009 shall continue to apply.

References to the repealed Regulation shall be construed as references to this Regulation and shall be read in accordance with the correlation table in Annex VI.

Article 30

This Regulation shall enter into force on the ninetieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

For the European Parliament	*For the Council*
The President	*The President*

ANNEXES

to the

Proposal for a Regulation of the European Parliament and of the Council

setting up a Union regime for the control of exports, transfer, brokering, technical assistance and transit of dual-use items (recast)

ANNEX I

- ***LIST OF DUAL-USE ITEMS (List referred to in Article 3 of this Regulation)***

This list implements internationally agreed dual-use controls including the Wassenaar Arrangement, the Missile Technology Control Regime (MTCR), the Nuclear Suppliers' Group (NSG), the Australia Group and the Chemical Weapons Convention (CWC).

CONTENTS

Notes

Acronyms and abbreviations

Definitions

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

GENERAL NOTES TO ANNEX I

1. For control of goods which are designed or modified for military use, see the relevant list(s) of controls on military goods maintained by individual Member States.

References in this Annex that state "SEE ALSO MILITARY GOODS CONTROLS" refer to the same lists.

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

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

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

4. In some instances chemicals are listed by name and CAS number. The list applies to chemicals of the same structural formula (including hydrates) regardless of name or CAS number. CAS numbers are shown to assist in identifying a particular chemical or mixture, irrespective of nomenclature. CAS numbers cannot be used as unique identifiers because some forms of the listed chemical have different CAS numbers, and mixtures containing a listed chemical may also have different CAS numbers.

NUCLEAR TECHNOLOGY NOTE (NTN)

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

The "technology" directly associated with any goods controlled in Category 0 is controlled according to the provisions of Category 0.

"Technology" for the "development", "production" or "use" of goods under control remains under control even when applicable to non-controlled goods.

The approval of goods for export also authorizes the export to the same end-user of the minimum "technology" required for the installation, operation, maintenance and repair of the goods.

Controls on "technology" transfer do not apply to information "in the public domain" or to "basic scientific research".

GENERAL TECHNOLOGY NOTE (GTN)

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

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

"Technology" "required" for the "development", "production" or "use" of goods under control remains under control even when applicable to non-controlled goods.

Controls do not apply to that "technology" which is the minimum necessary for the installation, operation, maintenance (checking) or repair of those goods which are not controlled or whose export has been authorised.

N.B.: This does not release such "technology" specified in 1E002.e., 1E002.f., 8E002.a. and 8E002.b.

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

GENERAL SOFTWARE NOTE (GSN)

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

Categories 0 to 9 of this list do not control "software" which is any of the following:

a. Generally available to the public by being:

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

a. Over-the-counter transactions;

b. Mail order transactions;

c. Electronic transactions; *or*

d. Telephone call transactions; *and*

2. Designed for installation by the user without further substantial support by the supplier;

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

b. "In the public domain"; *or*

c. The minimum necessary "object code" for the installation, operation, maintenance (checking) or repair of those items whose export has been authorised.

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

EDITORIAL PRACTICES IN THE *OFFICIAL JOURNAL OF THE EUROPEAN UNION*

In accordance with the rules set out in paragraph 6.5 on page 108 of the Interinstitutional style guide (2015 edition), for texts in English published in the *Official Journal of the European Union*:

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

– whole numbers are presented in series of three, each series being separated by a thin space. The text reproduced in this annex follows the above-described practice.

ACRONYMS AND ABBREVIATIONS USED IN THIS ANNEX

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

Acronym or meaning abbreviation	
ABEC	Annular Bearing Engineers Committee
AGMA	American Gear Manufacturers' Association
AHRS	attitude and heading reference systems
AISI	American Iron and Steel Institute
ALU	arithmetic logic unit
ANSI	American National Standards Institute
ASTM	the American Society for Testing and Materials
ATC	air traffic control
AVLIS	atomic vapour laser isotope separation
CAD	computer-aided-design
CAS	Chemical Abstracts Service
CDU	control and display unit
CEP	circular error probable
CNTD	controlled nucleation thermal deposition
CPU	Central processing unit
CVD	chemical vapour deposition
CW	chemical warfare
CW (for lasers)	continuous wave
DME	distance measuring equipment
DS	directionally solidified
EB-PVD	electron beam physical vapour deposition

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EBU	European Broadcasting Union
ECM	electro-chemical machining
ECR	electron cyclotron resonance
EDM	electrical discharge machines
EEPROMS	electrically erasable programmable read only memory
EIA	Electronic Industries Association
EMC	electromagnetic compatibility
ETSI	European Telecommunications Standards Institute
FFT	Fast Fourier Transform
GLONASS	global navigation satellite system
GPS	global positioning system
HBT	hetero-bipolar transistors
HDDR	high density digital recording
HEMT	high electron mobility transistors
ICAO	International Civil Aviation Organisation
IEC	International Electro-technical Commission
IEEE	Institute of Electrical and Electronic Engineers
IFOV	instantaneous-field-of-view
ILS	instrument landing system
IRIG	inter-range instrumentation group
ISA	international standard atmosphere
ISAR	inverse synthetic aperture radar
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JIS	Japanese Industrial Standard

JT	Joule-Thomson
LIDAR	light detection and ranging
LRU	line replaceable unit
MAC	message authentication code
Mach	ratio of speed of an object to speed of sound (after Ernst Mach)
MLIS	molecular laser isotopic separation
MLS	microwave landing systems
MOCVD	metal organic chemical vapour deposition
MRI	magnetic resonance imaging
MTBF	mean-time-between-failures
Mtops	million theoretical operations per second
MTTF	mean-time-to-failure
NBC	Nuclear, Biological and Chemical
NDT	non-destructive test
PAR	precision approach radar
PIN	personal identification number
ppm	parts per million
PSD	power spectral density
QAM	quadrature-amplitude-modulation
RF	radio frequency
SACMA	Suppliers of Advanced Composite Materials Association
SAR	synthetic aperture radar
SC	single crystal
SLAR	sidelooking airborne radar
SMPTE	Society of Motion Picture and Television Engineers

SRA	shop replaceable assembly
SRAM	static random access memory
SRM	SACMA Recommended Methods
SSB	single sideband
SSR	secondary surveillance radar
TCSEC	trusted computer system evaluation criteria
TIR	total indicated reading
UV	Ultraviolet
UTS	ultimate tensile strength
VOR	very high frequency omni-directional range
YAG	yttrium/aluminium garnet

DEFINITIONS OF TERMS USED IN THIS ANNEX

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

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

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

"Accuracy" (2 6), 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 8) is a minimum (single) element of the solid state array which has a photoelectric transfer function when exposed to light (electromagnetic) radiation.

"Adapted for use in war" (1) means any modification or selection (such as altering purity, shelf life, virulence, dissemination characteristics, or resistance to UV radiation) designed to increase the effectiveness in producing casualties in humans or animals, degrading equipment or damaging crops or the environment.

"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.

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

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

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

"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.

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

"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.

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

"Automatic target tracking" (6) means a processing technique that automatically determines and provides as output an extrapolated value of the most probable position of the target in real time.

"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.

"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'.

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

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

a. The common hardware and software architecture;

b. The common design and process technology; and

c. The common basic characteristics.

"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 1×10^{-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).

"Camming" (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).

"Carbon fibre preforms" (1) means an ordered arrangement of uncoated or coated fibres intended to constitute a framework of a part before the "matrix" is introduced to form a "composite".

"CEP" (circle of equal probability) (7) is a measure of accuracy; the radius of the circle centred at the target, at a specific range, in which 50 % of the payloads impact.

"Chemical laser" (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

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Member States or Wassenaar Arrangement Participating States to fly commercial civil internal and external routes or for legitimate civil, private or business use.

N.B.: See also "aircraft".

"Commingled" (1) means filament to filament blending of thermoplastic fibres and reinforcement fibres in order to produce a fibre reinforcement "matrix" mix in total fibre form.

"Comminution" (1) means a process to reduce a material to particles by crushing or grinding.

"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 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.

"Compound rotary table" (2) means a table allowing the workpiece to rotate and tilt about two non-parallel axes, which can be coordinated simultaneously for "contouring control".

"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 activates or enables cryptographic capability of an item, by means of a secure mechanism implemented by the manufacturer of the item, where this mechanism is uniquely bound to any of the following:

1. A single instance of the item; *or*

2. One customer, for multiple instances of the item.

Technical Notes

1. "Cryptographic activation" techniques and mechanisms may be implemented as hardware, "software" or "technology".

2. Mechanisms for "cryptographic activation" can, for example, be serial number-based licence keys or authentication instruments such as digitally signed certificates.

"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 unauthorized use. "Cryptography" is limited to the transformation of information using one or more 'secret parameters' (e.g., crypto variables) or associated key management.

Note: "Cryptography" does not include "fixed" data compression or coding techniques.

Technical Note:

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

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

"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.

"Deformable mirrors" (6) (also known as adaptive optic mirrors) means mirrors having:

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

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

"Depleted uranium" (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 9) 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.

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

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

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

"Direct-acting hydraulic pressing" (2) means a deformation process which uses a fluid-filled flexible bladder in direct contact with the workpiece.

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

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

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

"Electronically steerable phased array antenna" (5 6) means an antenna which forms a beam by means of phase coupling, i.e., the beam direction is controlled by the complex excitation coefficients of the radiating elements and the direction of that beam can be varied in azimuth or in elevation, or both, by application, both in transmission and reception, of an electrical signal.

"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.

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

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

"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" (7 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) 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".

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

"Fixed" (5) means that the coding or compression algorithm cannot accept externally supplied parameters (e.g., cryptographic or key variables) and cannot be modified by the user.

"Flight control optical sensor array" (7) is a network of distributed optical sensors, using "laser" beams, to provide real-time flight control data for on-board processing.

"Flight path optimisation" (7) is a procedure that minimizes deviations from a four-dimensional (space and time) desired trajectory based on maximizing performance or effectiveness for mission tasks.

"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.

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

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

"Frequency hopping" (5) 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 mask trigger" (3) for "signal analysers" is a mechanism where the trigger function is able to select a frequency range to be triggered on as a subset of the acquisition bandwidth while ignoring other signals that may also be present within the same acquisition bandwidth. A "frequency mask trigger" may contain more than one independent set of limits.

"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 ± 0,05 % of a final specified output frequency. Items having a specified frequency range of less than ± 0,05 % around their centre frequency are defined to be incapable of frequency switching.

"Frequency synthesiser" (3) means any kind of frequency source, regardless of the actual technique used, providing a multiplicity of simultaneous or alternative output frequencies, from one or more outputs, controlled by, derived from or disciplined by a lesser number of standard (or master) frequencies.

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"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).

"Gas Atomisation" (1) means a process to reduce a molten stream of metal alloy to droplets of 500 micrometre diameter or less by a high pressure gas stream.

"Geographically dispersed" (6) is where each location is distant from any other more than 1500 m in any direction. Mobile sensors are always considered "geographically dispersed".

"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.

"Hot isostatic densification" (2) means the process of pressurising a casting at temperatures exceeding 375 K (102 °C) in a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal force in all directions to reduce or eliminate internal voids in the casting.

"Hybrid 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.

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

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

"Image enhancement" (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" (4 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.

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

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

"Instrumented range" (6) means the specified unambiguous display range of a radar.

"Insulation" (9) is applied to the components of a rocket motor, i.e. the case, nozzle, inlets, case closures, and includes cured or semi-cured compounded rubber sheet stock containing an insulating or refractory material. It may also be incorporated as stress relief boots or flaps.

"Interior lining" (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.

"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.

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

"Intrusion software" (4) 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.

Notes:

1. "Intrusion software" does not include any of the following:

a. Hypervisors, debuggers or Software Reverse Engineering (SRE) tools;

b. Digital Rights Management (DRM) "software"; or

c. "Software" designed to be installed by manufacturers, administrators or users, for the purposes of asset tracking or recovery.

2. Network-capable devices include mobile devices and smart meters.

Technical Notes:

1. 'Monitoring tools': "software" or hardware devices, that monitor system behaviours or processes running on a device. This includes antivirus (AV) products, end point security products, Personal Security Products (PSP), Intrusion Detection Systems (IDS), Intrusion Prevention Systems (IPS) or firewalls.

2. 'Protective countermeasures': techniques designed to ensure the safe execution of code, such as Data Execution Prevention (DEP), Address Space Layout Randomisation (ASLR) or sandboxing.

"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 2 3 5 6 7 8 9) is an assembly of components which produce both spatially and temporally coherent light that is amplified by stimulated emission of radiation.

N.B.: See also

"Chemical laser"

"Super High Power Laser";

"Transfer laser".

"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).

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

"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.

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

"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.

"Main storage" (4) means the primary storage for data or instructions for rapid access by a central processing unit. It consists of the internal storage of a "digital computer" and any hierarchical extension thereto, such as cache storage or non-sequentially accessed extended storage.

"Materials resistant to corrosion by UF_6" (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).

"Mechanical Alloying" (1) means an alloying process resulting from the bonding, fracturing and rebonding of elemental and master alloy powders by mechanical impact. Non-metallic particles may be incorporated in the alloy by addition of the appropriate powders.

"Melt Extraction" (1) means a process to 'solidify rapidly' and extract a ribbon-like alloy product by the insertion of a short segment of a rotating chilled block into a bath of a molten metal alloy.

N.B.: 'Solidify rapidly': solidification of molten material at cooling rates exceeding 1000 K/s.

"Melt Spinning" (1) means a process to 'solidify rapidly' a molten metal stream impinging upon a rotating chilled block, forming a flake, ribbon or rod-like product.

N.B.: 'Solidify rapidly': solidification of molten material at cooling rates exceeding 1000 K/s.

"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.

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

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

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

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

"Missiles" (1 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.

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

"Monospectral imaging sensors" (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".

"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

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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.

"Neural computer" (4) means a computational device designed or modified to mimic the behaviour of a neuron or a collection of neurons, i.e., a computational device which is distinguished by its hardware capability to modulate the weights and numbers of the interconnections of a multiplicity of computational components based on previous data.

"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).

"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:

    1. Accounts or privileges of users or administrators;

    2. Settings of an item; *or*

    3. Authentication data in support of the tasks described in paragraphs a.1. or a.2.;

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.

Note: "OAM" does not include any of the following tasks or their associated key management functions:

a. Provisioning or upgrading any cryptographic functionality that is not directly related to establishing or managing authentication data in support of the tasks described in paragraphs a.1. or a.2. above; or

b. Performing any cryptographic functionality on the forwarding or data plane of an item.

"Optical amplification" (5), in optical communications, means an amplification technique that introduces a gain of optical signals that have been generated by a separate optical source, without conversion to electrical signals, i.e., using semiconductor optical amplifiers, optical fibre luminescent amplifiers.

"Optical computer" (4) means a computer designed or modified to use light to represent data and whose computational logic elements are based on directly coupled optical devices.

"Optical integrated circuit" (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 (see www.wassenaar.org

"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 vicinity of an individual person or device controller (e.g., single room, office, or automobile, and their nearby surrounding spaces).

Technical Note:

'Data device' means equipment capable of transmitting or receiving sequences of digital information.

"Plasma atomisation" (1) means a process to reduce a molten stream or solid metal to droplets of 500 μm diameter or less, using plasma torches in an inert gas environment.

"Power management" (7) means changing the transmitted power of the altimeter signal so that received power at the "aircraft" altitude is always at the minimum necessary to determine the altitude.

"Previously separated" (0 1) means the application of any process intended to increase the concentration of the controlled isotope.

"Primary flight control" (7) means an "aircraft" stability or manoeuvering control using force/moment generators, i.e., aerodynamic control surfaces or propulsive thrust vectoring.

"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".

"Programme" (2 6) 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 Radiant sensitivity (mA/W) = 0,807 × (wavelength in nm) × Quantum Efficiency (QE).

Technical Note:

QE is usually expressed as a percentage; however, for the purposes of this formula QE is expressed as a decimal number less than one, e.g., 78 % is 0,78.

"Real-time bandwidth" (3) for "signal analysers" is the widest frequency range for which the analyser can continuously transform time-domain data entirely into frequency-domain results, using a Fourier or other discrete time transformation that processes every incoming time point without gaps or windowing effects that causes a reduction of measured amplitude of more than 3 dB below the actual signal amplitude, while outputting or displaying the transformed data.

"Real time processing" (2 6 7) 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 1-9), 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.

"Resolution" (2) means the least increment of a measuring device; on digital instruments, the least significant bit (ref. ANSI B-89.1.12).

"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.

Technical Note:

Tear gases are a subset of "riot control agents".

"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.

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

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

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

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

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

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

"Rotary atomisation" (1) means a process to reduce a stream or pool of molten metal to droplets to a diameter of 500 micrometre or less by centrifugal force.

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

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

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"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).

"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.

"Settling time" (3) means the time required for the output to come within one-half bit of the final value when switching between any two levels of the converter.

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

"Signal analysers" (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 "programmes" or 'microprogrammes' fixed in any tangible medium of expression.

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

"Source code" (or source language) (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" (7 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.

N.B.: A determination that a specific item is "Space-qualified" by virtue of testing does not mean that other items in the same production run or model series are "Space-qualified" if not individually tested.

"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 ± 2) K ((23 ± 2) °C) and a relative humidity of (50 ± 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 ± 2) K ((23 ± 2) °C) and a relative humidity of (50 ± 5) %.

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

"Splat Quenching" (1) means a process to 'solidify rapidly' a molten metal stream impinging upon a chilled block, forming a flake-like product.

N.B.: 'Solidify rapidly' solidification of molten material at cooling rates exceeding 1000 K/s.

"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)

"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.

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

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

"Substrate blanks" (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 strengths superior to any alloys in the AISI 300 series at temperatures over 922 K (649 °C) under severe environmental and operating conditions.

"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.

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

"Super High Power Laser" ("SHPL") (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.

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

"System tracks" (6) means processed, correlated (fusion of radar target data to flight plan position) and updated aircraft flight position report available to the Air Traffic Control centre controllers.

"Systolic array computer" (4) means a computer where the flow and modification of the data is dynamically controllable at the logic gate level by the user.

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

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

"Technology" (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'.

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

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

"Three dimensional integrated circuit" (3) means a collection of semiconductor die, integrated together, and having vias passing completely through at least one die to establish interconnections between die.

"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).

"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.

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

"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".

"Transfer laser" (6) means a "laser" in which the lasing species is excited through the transfer of energy by collision of a non-lasing atom or molecule with a lasing atom or molecule species.

"Tunable" (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↑ and R↓ (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 "programmes" by means other than:

a. A physical change in wiring or interconnections; *or*

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

"Vaccine" (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 Atomisation" (1) means a process to reduce a molten stream of metal to droplets of a diameter of 500 micrometre or less by the rapid evolution of a dissolved gas upon exposure to a vacuum.

"Variable geometry airfoils" (7) means the use of trailing edge flaps or tabs, or leading edge slats or pivoted nose droop, the position of which can be controlled in flight.

"Yarn" (1) is a bundle of twisted 'strands'.

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

CATEGORY 0 — NUCLEAR MATERIALS, FACILITIES, AND EQUIPMENT

1. *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;

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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 assembles of tubes) specially designed or prepared for use as fuel cladding in a "nuclear reactor", and in quantities exceeding 10 kg;

N.B.: 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;

Technical Note:

In 0A001.h. 'nuclear reactor internals' means any major structure within a reactor vessel which has one or more functions such as supporting the core, maintaining fuel alignment, directing primary coolant flow, providing radiation shields for the reactor vessel, and guiding in-core instrumentation.

i. Heat exchangers as follows:

1. Steam generators specially designed or prepared for 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";

Note: 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.

Technical Note:

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

2. *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", and "special fissile materials", as follows:

1. Gas centrifuge separation plant;

2. Gaseous diffusion separation plant;

3. Aerodynamic separation plant;

4. Chemical exchange separation plant;

5. Ion-exchange separation plant;

6. Atomic vapour "laser" isotope separation 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:

Technical Note:

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 UF_6" containing a damping medium and having the magnet coupling with a pole piece or second magnet fitted to the top cap of the rotor;

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

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/recipients to contain the rotor tube assembly of a gas centrifuge, consisting of a rigid cylinder of wall thickness up to 30 mm with precision machined ends that are parallel to each other and perpendicular to the cylinder's longitudinal axis to within 0,05 degrees or less;

12. Scoops consisting of specially designed or prepared tubes for the extraction of UF_6 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_6 gaseous streams of an individual gas centrifuge;

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

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

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

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

3. Compressors or gas blowers with a suction volume capacity of 1 m^3/min or more of UF_6, 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 UF_6";

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

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

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 UF_6, 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 UF_6" and with one or more tangential inlets;

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

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

5. Separation element housings, made of or protected by "materials resistant to corrosion by UF_6" 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 UF_6", with a diameter of 40 mm or more;

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

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

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

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

d. UF_6 cold traps capable of freezing out UF_6;

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 fibres, with diameters of 0,2 mm or less, resistant to concentrated hydrochloric acid and designed to have an exchange rate half-time of less than 10 seconds and capable of operating at temperatures in the range of 373 K (100 °C) to 473 K (200 °C);

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

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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;

N.B.: SEE ALSO 2A225.

3. Product and tails collector assemblies for 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 stabilisation for operation over extended periods of time;

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

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_6 and carrier gas to 150 K (–123 °C) or less and made from "materials resistant to corrosion by UF_6";

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_6";

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

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

5. Process systems for separating UF_6 from carrier gas (e.g. nitrogen, 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_6 cold traps capable of freezing out UF_6;

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

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

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

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

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

3. Uranium plasma generation systems;

4. Not used;

5. 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;

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

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

1. Ion sources, single or multiple, consisting of a vapour source, ioniser, and beam accelerator made of suitable non-magnetic materials (e.g. graphite, stainless steel, or copper) and capable of providing a total ion beam current of 50 mA or greater;

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

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

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

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

   a. Capable of continuous operation;

   b. Output voltage of 20000 V or greater;

   c. Output current of 1 A or greater; *and*

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

      N.B.: SEE ALSO 3A227.

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

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

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

      N.B.: SEE ALSO 3A226.

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

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

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

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

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

e. Piping systems and header systems specially designed or prepared for handling UF_6 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^3/minute or more;

   2. Vacuum pumps specially designed for use in UF_6 bearing atmospheres made of, or protected by, "materials resistant to corrosion by UF_6"; *or*

   3. Vacuum systems consisting of vacuum manifolds, vacuum headers and vacuum pumps, and designed for service in UF_6-bearing atmospheres;

g. UF_6 mass spectrometers/ion sources capable of taking on-line samples from UF_6 gas streams and having all of the following:

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

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

3. Electron bombardment ionisation sources; *and*

4. Having a collector system suitable for isotopic analysis.

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

a. Systems for the conversion of uranium ore concentrates to UO_3;

b. Systems for the conversion of UO_3 to UF_6;

c. Systems for the conversion of UO_3 to UO_2;

d. Systems for the conversion of UO_2 to UF_4;

e. Systems for the conversion of UF_4 to UF_6;

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

g. Systems for the conversion of UF_6 to UO_2;

h. Systems for the conversion of UF_6 to UF_4;

i. Systems for the conversion of UO_2 to UCl_4.

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

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

1. Water-hydrogen sulphide exchange plants;

2. Ammonia-hydrogen exchange plants;

b. Equipment and components, as follows:

1. Water-hydrogen sulphide exchange towers with diameters of 1,5 m or 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 % H_2S) with a throughput capacity greater than or equal to 56 m^3/second when operating at pressures greater than or equal to 1,8 MPa suction and having seals designed for wet H_2S service;

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

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

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

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

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

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

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

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

Technical Note:

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.

Note: 0B006 includes:

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

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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";

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

Technical Note:

Holding or storage vessels may have the following features:

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

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

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

f. Neutron measurement systems specially designed or prepared for integration and use with automated process control systems in a plant for the reprocessing of irradiated "natural uranium", "depleted uranium" or "special fissile materials".

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

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

b. Systems for plutonium metal production.

3. *0C Materials*

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

Note: 0C001 does not control the following:

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

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

1. Shielding;

2. Packaging;

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

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

c. Alloys containing less than 5 % thorium;

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

0C002 "Special fissile materials"

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

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

0C004 Graphite having a purity level better than 5 parts per million 'boron equivalent' and with a density greater than 1,50 g/cm^3 for use in a "nuclear reactor", in quantities exceeding 1 kg.

N.B.: SEE ALSO 1C107

Note 1: For the purpose of export control, the competent authorities of the Member State in which the exporter is established will determine whether or not the exports of graphite meeting the above specifications are for "nuclear reactor" use.

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

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

$$\text{where CF is the conversion factor} = \frac{\sigma_Z A_B}{\sigma_B A_Z}$$

and σ_B and σ_Z are the thermal neutron capture cross sections (in barns) for naturally occurring boron and element Z respectively; and A_B and A_Z are the atomic masses of naturally occurring boron and element Z respectively.

0C005 Specially prepared compounds or powders for the manufacture of gaseous diffusion barriers, resistant to corrosion by UF_6 (e.g. nickel or alloy containing 60 weight per cent or more nickel, aluminium oxide and fully fluorinated hydrocarbon polymers), having a purity of 99,9 % 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.

4. *0D Software*

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

5. *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

6. *1A Systems, Equipment and Components*

1A001 Components made from fluorinated compounds, as follows:

a. 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.;

b. Piezoelectric polymers and copolymers, made from vinylidene fluoride (CAS 75-38-7) materials, specified in 1C009.a., having all of the following:

1. In sheet or film form; *and*

2. With a thickness exceeding 200 μm;

c. Seals, gaskets, valve seats, bladders or diaphragms, having all of the following:

1. Made from fluoroelastomers containing at least one vinylether group as a constitutional unit; *and*

2. Specially designed for "aircraft", aerospace or 'missile' use.

Note: In 1A001.c., 'missile' means complete rocket systems and unmanned aerial vehicle systems.

1A002 "Composite" structures or laminates, having any of the following:

N.B: SEE ALSO 1A202, 9A010 and 9A110

a. Consisting of an organic "matrix" and materials specified in 1C010.c., 1C010.d. or 1C010.e.; *or*

b. Consisting of 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.

Note 1: 1A002 does not control composite structures or laminates made from epoxy resin impregnated carbon "fibrous or filamentary materials" for the repair of "civil aircraft" structures or laminates, having all of the following:

a. An area not exceeding 1 m^2;

b. A length not exceeding 2,5 m; and

c. A width exceeding 15 mm.

Note 2: 1A002 does not control semi-finished items, specially designed for purely civilian applications as follows:

a. Sporting goods;

b. Automotive industry;

c. Machine tool industry;

d. Medical applications.

Note 3: 1A002.b.1. does not control semi-finished items containing a maximum of two dimensions of interwoven filaments and specially designed for applications as follows:

a. Metal heat-treatment furnaces for tempering metals;

b. Silicon boule production equipment.

Note 4: 1A002 does not control finished items specially designed for a specific application.

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.

Note: 1A003 does not control manufactures when coated or laminated with copper and designed for the production of electronic printed circuit boards.

N.B.: For "fusible" aromatic polyimides in any form, see 1C008.a.3.

1A004 Protective and detection equipment and components not specially designed for military use, as follows:

N.B.: SEE ALSO MILITARY GOODS CONTROLS, 2B351 AND 2B352.

a. Full face masks, filter canisters and decontamination equipment therefor, designed or modified for defence against any of the following, and specially designed components therefor:

Note: 1A004.a. includes Powered Air Purifying Respirators (PAPR) that are designed or modified for defence against agents or materials, listed in 1A004.a.

Technical Note:

For the purposes of 1A004.a.:

1. Full face masks are also known as gas masks.

2. Filter canisters include filter cartridges.

1. Biological agents "adapted for use in war";

2. Radioactive materials "adapted for use in war";

3. Chemical warfare (CW) agents; *or*

4. "Riot control agents", including:

   a. α-Bromobenzeneacetonitrile, (Bromobenzyl cyanide) (CA) (CAS 5798-79-8);

   b. [(2-chlorophenyl) methylene] propanedinitrile, (o-Chlorobenzylidenemalononitrile) (CS) (CAS 2698-41-1);

   c. 2-Chloro-1-phenylethanone, Phenylacyl chloride (ω-chloroacetophenone) (CN) (CAS 532-27-4);

   d. Dibenz-(b,f)-1,4-oxazephine (CR) (CAS 257-07-8);

   e. 10-Chloro-5,10-dihydrophenarsazine, (Phenarsazine chloride), (Adamsite), (DM) (CAS 578-94-9);

   f. N-Nonanoylmorpholine, (MPA) (CAS 5299-64-9);

b. Protective suits, gloves and shoes, specially designed or modified for defence against any of the following:

   1. Biological agents "adapted for use in war";

   2. Radioactive materials "adapted for use in war"; *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 "adapted for use in war";

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2. Radioactive materials "adapted for use in war"; *or*

3. Chemical warfare (CW) agents.

d. Electronic equipment designed for automatically detecting or identifying the presence of "explosives" residues and utilising 'trace detection' techniques (e.g., surface acoustic wave, ion mobility spectrometry, differential mobility spectrometry, mass spectrometry).

Technical Note:

'Trace detection' is defined as the capability to detect less than 1 ppm vapour, or 1 mg solid or liquid.

Note 1: 1A004.d. does not control equipment specially designed for laboratory use.

Note 2: 1A004.d. does not control non-contact walk-through security portals.

Note: 1A004 does not control:

a. Personal radiation monitoring dosimeters;

b. Occupational health or safety equipment limited by design or function to protect against hazards specific to residential safety or civil industries, including:

1. mining;

2. quarrying;

3. agriculture;

4. pharmaceutical;

5. medical;

6. veterinary;

7. environmental;

8. waste management;

9. food industry.

Technical Notes:

1. 1A004 includes equipment and components that have been identified, successfully tested to national standards or otherwise proven effective, for the detection of or defence against radioactive materials "adapted for use in war", biological agents "adapted for use in war", chemical warfare agents, 'simulants' or "riot control agents", even if such equipment or components are used in civil industries such as mining, quarrying, agriculture,

pharmaceuticals, medical, veterinary, environmental, waste management, or the food industry.

2. 'Simulant' is a substance or material that is used in place of toxic agent (chemical or biological) in training, research, testing or evaluation.

1A005 Body armour and components therefor, as follows:

N.B.: SEE ALSO MILITARY GOODS CONTROLS.

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 IIIA (NIJ 0101.06, July 2008) or national equivalents.

N.B.: For "fibrous or filamentary materials" used in the manufacture of body armour, see 1C010.

Note 1: 1A005 does not control body armour when accompanying its user for the user's own personal protection.

Note 2: 1A005 does not control body armour designed to provide frontal protection only from both fragment and blast from non-military explosive devices.

Note 3: 1A005 does not 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:

N.B.: SEE ALSO MILITARY GOODS CONTROLS.

a. Remotely operated vehicles;

b. 'Disruptors'.

Technical Note:

'Disruptors' are devices specially designed for the purpose of preventing the operation of an explosive device by projecting a liquid, solid or frangible projectile.

Note: 1A006 does not control equipment when accompanying its operator.

1A007 Equipment and devices, specially designed to initiate charges and devices containing "energetic materials", by electrical means, as follows:

N.B.: SEE ALSO MILITARY GOODS CONTROLS, 3A229 AND 3A232.

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).

Technical Notes:

1. The word initiator or igniter is sometimes used in place of the word detonator.

2. For the purpose of 1A007.b. the detonators of concern all utilise a small electrical conductor (bridge, bridge wire, or foil) that explosively vaporises when a fast, high-current electrical pulse is passed through it. In non-slapper types, the exploding conductor starts a chemical detonation in a contacting high explosive material such as PETN (pentaerythritoltetranitrate). In slapper detonators, the explosive vaporization of the electrical conductor drives a flyer or slapper across a gap, and the impact of the slapper on an explosive starts a chemical detonation. The slapper in some designs is driven by magnetic force. The term exploding foil detonator may refer to either an EB or a slapper-type detonator.

1A008 Charges, devices and components, as follows:

a. 'Shaped charges' 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.

Technical Note:

'Shaped charges' are explosive charges shaped to focus the effects of the explosive blast.

1A102 Resaturated pyrolized 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:

N.B.: SEE ALSO 9A010 AND 9A110.

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

b. Made with any of the "fibrous or filamentary materials" specified in 1C010.a. or b. or 1C210.a. or with carbon prepreg materials specified in 1C210.c.

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

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

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

b. Designed to be used in vacuum distillation towers.

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

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

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

c. A thickness of 100 mm or greater.

Technical Note:

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

7. *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:

N.B.: SEE ALSO 1B101 AND 1B201.

a. Filament winding machines, of which the motions for positioning, wrapping and winding fibres 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', 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 'missile' structures;

Note: In 1B001.b. 'missile' means complete rocket systems and unmanned aerial vehicle systems.

Technical Note:

For the purposes of 1B001.b., 'tape-laying machines' have the ability to lay one or more 'filament bands' limited to widths greater than 25 mm and less than or equal to 305 mm, and to cut and restart individual 'filament band' courses during the laying process.

c. Multidirectional, multidimensional weaving machines or interlacing machines, including adapters and modification kits, specially designed or modified for weaving, interlacing or braiding fibres, for "composite" structures;

Technical Note:

For the purposes of 1B001.c., the technique of interlacing includes knitting.

d. Equipment specially designed or adapted for the production of reinforcement fibres, as follows:

1. Equipment for converting polymeric fibres (such as polyacrylonitrile, rayon, pitch or polycarbosilane) into carbon fibres or silicon carbide fibres, including special equipment to strain the fibre during heating;

2. Equipment for the chemical vapour deposition of elements or compounds, on heated filamentary substrates, to manufacture silicon carbide fibres;

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

4. Equipment for converting aluminium containing precursor fibres into alumina fibres by heat treatment;

e. Equipment for producing prepregs specified in 1C010.e. 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;

g. 'Tow-placement machines', 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.

Technical Note:

For the purposes of 1B001.g., 'tow-placement machines' have the ability to place one or more 'filament bands' having widths less than or equal to 25 mm, and to cut and restart individual 'filament band' courses during the placement process.

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Technical Note:

1. For the purpose of 1B001, 'primary servo positioning' axes control, under computer program direction, the position of the end effector (i.e., head) in space relative to the work piece at the correct orientation and direction to achieve the desired process.

2. For the purposes of 1B001., a 'filament band' is a single continuous width of fully or partially resin-impregnated tape, tow or fibre.

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.

N.B.: SEE ALSO 1B102.

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:

N.B.: SEE ALSO 1B201.

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

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

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

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

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

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

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

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

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

1B102 Metal powder "production equipment", other than that specified in 1B002, and components as follows:

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

a. Metal powder "production equipment" usable for the "production", in a controlled environment, of spherical, spheroidal or atomised materials specified in 1C011.a., 1C011.b., 1C111.a.1., 1C111.a.2. or in the Military Goods Controls.

b. Specially designed components for "production equipment" specified in 1B002 or 1B102.a.

Note: 1B102 includes:

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

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

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

1B115 Equipment, other than that specified in 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.

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

Note 1: For equipment specially designed for the production of military goods, see the Military Goods Controls.

Note 2: 1B115 does not control equipment for the "production", handling and acceptance testing of boron carbide.

1B116 Specially designed nozzles for producing pyrolitically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1573 K (1300 °C) to 3173 K (2900 °C) temperature range at pressures of 130 Pa to 20 kPa.

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

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

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

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

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

a. Two or more mixing/kneading shafts; *or*

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

1B119 Fluid energy mills usable for grinding or milling substances specified in 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 fibres coordinated and programmed in two or more axes;

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

   3. Capable of winding cylindrical tubes with an internal diameter between 75 and 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.

Note: 1B226 includes separators:

a. Capable of enriching stable isotopes;

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

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

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

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

c. Constructed of either:

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

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

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

Technical Note:

In 1B228 'effective length' means the active height of packing material in a packed-type column, or the active height of internal contactor plates in a plate-type column.

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

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

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

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

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

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

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

Technical Note:

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

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

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

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

c. Either of the following characteristics:

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

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

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

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

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

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

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

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

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

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

1B233 Lithium isotope separation facilities or plants, and 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;

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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:

N.B.: SEE ALSO MILITARY GOODS CONTROLS.

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

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

8. *1C Materials*

Technical Note:

Metals and alloys:

Unless provision to the contrary is made, the words 'metals' and 'alloys' in 1C001 to 1C012 cover crude and semi-fabricated forms, as follows:

Crude forms:

Anodes, balls, bars (including notched bars and wire bars), billets, blocks, blooms, brickets, cakes, cathodes, crystals, cubes, dice, grains, granules, ingots, lumps, pellets, pigs, powder, rondelles, shot, slabs, slugs, sponge, sticks;

Semi-fabricated forms (whether or not coated, plated, drilled or punched):

a. Wrought or worked materials fabricated by rolling, drawing, extruding, forging, impact extruding, pressing, graining, atomising, and grinding, i.e.: angles, channels, circles, discs, dust, flakes, foils and leaf, forging, plate, powder, pressings and stampings, ribbons, rings, rods (including bare welding rods, wire rods, and rolled wire), sections, shapes, sheets, strip, pipe and tubes (including tube rounds, squares, and hollows), drawn or extruded wire;

b. Cast material produced by casting in sand, die, metal, plaster or other types of moulds, including high pressure castings, sintered forms, and forms made by powder metallurgy.

The object of the control should not be defeated by the export of non-listed forms alleged to be finished products but representing in reality crude forms or semi-fabricated forms.

1C001 Materials specially designed for use as absorbers of electromagnetic waves, or intrinsically conductive polymers, as follows:

N.B. SEE ALSO 1C101.

a. Materials for absorbing frequencies exceeding 2×10^8 Hz but less than 3×10^{12} Hz;

Note 1: 1C001.a. does not control:

a. Hair type absorbers, constructed of natural or synthetic fibres, with non-magnetic loading to provide absorption;

b. Absorbers having no magnetic loss and whose incident surface is non-planar in shape, including pyramids, cones, wedges and convoluted surfaces;

c. 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 ± 15 % of the centre frequency of the incident energy, and not capable of withstanding temperatures exceeding 450 K (177 °C); or

b. Ceramic materials providing more than 20 % echo compared with metal over a bandwidth exceeding ± 15 % of the centre frequency of the incident energy, and not capable of withstanding temperatures exceeding 800 K (527 °C);

Technical Note:

Absorption test samples for 1C001.a. Note: 1.c.1. should be a square at least 5 wavelengths of the centre frequency on a side and positioned in the far field of the radiating element.

2. Tensile strength less than 7×10^6 N/m^2; and

3. Compressive strength less than 14×10^6 N/m^2;

d. Planar absorbers made of sintered ferrite, having all of the following:

1. A specific gravity exceeding 4.4; and

2. A maximum operating temperature of 548 K (275 °C).

Note 2: Nothing in Note 1 to 1C001.a. releases magnetic materials to provide absorption when contained in paint.

b. Materials for absorbing frequencies exceeding $1,5 \times 10^{14}$ Hz but less than 3.7×10^{14} Hz and not transparent to visible light;

Note: 1C001.b. does not control materials, specially designed or formulated for any of the following applications:

a. Laser marking of polymers; or

b. Laser welding of polymers.

c. Intrinsically conductive polymeric materials with a 'bulk electrical conductivity' exceeding 10000 S/m (Siemens per metre) 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.

Note: 1C001.c. does not control materials in a liquid form.

Technical Note:

'Bulk electrical conductivity' and 'sheet (surface) resistivity' should be determined using ASTM D-257 or national equivalents.

1C002 Metal alloys, metal alloy powder and alloyed materials, as follows:

N.B.: SEE ALSO 1C202.

Note: 1C002 does not control metal alloys, metal alloy powder and alloyed materials for coating substrates.

Technical Notes:

1. The metal alloys in 1C002 are 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.

a. 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;

b. Metal alloys, as follows, made from the powder or particulate material specified in 1C002.c.:

1. Nickel alloys having any of the following:

a. A 'stress-rupture life' of 10000 hours or longer at 923 K (650 °C) at a stress of 676 MPa; *or*

b. A 'low cycle fatigue life' of 10000 cycles or more at 823 K (550 °C) at a maximum stress of 1095 MPa;

2. Niobium alloys having any of the following:

a. A 'stress-rupture life' of 10000 hours or longer at 1073 K (800 °C) at a stress of 400 MPa; *or*

b. A 'low cycle fatigue life' of 10000 cycles or more at 973 K (700 °C) at a maximum stress of 700 MPa;

3. Titanium alloys having any of the following:

a. A 'stress-rupture life' of 10000 hours or longer at 723 K (450 °C) at a stress of 200 MPa; *or*

b. A 'low cycle fatigue life' of 10000 cycles or more at 723 K (450 °C) at a maximum stress of 400 MPa;

4. Aluminium alloys having any of the following:

a. A tensile strength of 240 MPa or more at 473 K (200 °C); *or*

b. A tensile strength of 415 MPa or more at 298 K (25 °C);

5. 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;

c. Metal alloy powder or particulate material, having all of the following:

1. Made from any of the following composition systems:

Technical Note:

X in the following equals one or more alloying elements.

a. 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 10^9 alloy particles;

b. Niobium alloys (Nb-Al-X or Nb-X-Al, Nb-Si-X or Nb-X-Si, Nb-Ti-X or Nb-X-Ti);

c. Titanium alloys (Ti-Al-X or Ti-X-Al);

d. Aluminium alloys (Al-Mg-X or Al-X-Mg, Al-Zn-X or Al-X-Zn, Al-Fe-X or Al-X-Fe); *or*

e. Magnesium alloys (Mg-Al-X or Mg-X-Al);

2. Made in a controlled environment by any of the following processes:

a. "Vacuum atomisation";

b. "Gas atomisation";

c. "Rotary atomisation";

d. "Splat quenching";

e. "Melt spinning" and "comminution";

f. "Melt extraction" and "comminution";

g. "Mechanical alloying"; or

h. "Plasma atomisation", and

3. Capable of forming materials specified in 1C002.a. or 1C002.b.;

d. Alloyed materials having all of the following:

1. Made from any of the composition systems specified in 1C002.c.1.;

2. In the form of uncomminuted flakes, ribbons or thin rods; *and*

3. Produced in a controlled environment by any of the following:

a. "Splat quenching";

b. "Melt spinning"; *or*

c. "Melt extraction".

1C003 Magnetic metals, of all types and of whatever form, having any of the following:

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a. Initial relative permeability of 120000 or more and a thickness of 0,05 mm or less;

Technical Note:

Measurement of initial relative permeability must be performed on fully annealed materials.

b. Magnetostrictive alloys having any of the following:

1. A saturation magnetostriction of more than 5×10^{-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 saturation magnetic induction (B_s) of 1,6 T or more; *and*

3. Any of the following:

a. A strip thickness of 0,02 mm or less; *or*

b. An electrical resistivity of 2×10^{-4} ohm cm or more.

Technical Note:

'Nanocrystalline' materials in 1C003.c. are those materials having a crystal grain size of 50 nm or less, as determined by X-ray diffraction.

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 g/cm^3;

b. An elastic limit exceeding 880 MPa;

c. An ultimate tensile strength exceeding 1270 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 '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 $0,28 \times 10^{-4}$ mm^2 (6 μm 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 °C); *and*

2. Remaining in the "superconductive" state at a temperature of 4,2 K (–268,96 °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 1750 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 °C).

Technical Note:

For the purpose of 1C005 'filaments' may be in wire, cylinder, film, tape or ribbon form.

1C006 Fluids and lubricating materials, as follows:

a. Hydraulic fluids containing, as their principal ingredients, any of the following:

1. Synthetic 'silahydrocarbon oils' having all of the following:

Technical Note:

For the purpose of 1C006.a.1., 'silahydrocarbon oils' contain exclusively silicon, hydrogen and carbon.

a. A 'flash point' exceeding 477 K (204 °C);

b. A 'pour point' at 239 K (–34 °C) or less;

c. A 'viscosity index' of 75 or more; *and*

d. A 'thermal stability' at 616 K (343 °C); *or*

2. 'Chlorofluorocarbons' having all of the following:

Technical Note:

For the purpose of 1C006.a.2., 'chlorofluorocarbons' contain exclusively carbon, fluorine and chlorine.

a. No 'flash point';

b. An 'autogenous ignition temperature' exceeding 977 K (704 °C);

c. A 'pour point' at 219 K (–54 °C) or less;

d. A 'viscosity index' of 80 or more; *and*

e. A boiling point at 473 K (200 °C) or higher;

b. Lubricating materials containing, as their principal ingredients, any of the following:

1. Phenylene or alkylphenylene ethers or thio-ethers, or their mixtures, containing more than two ether or thio-ether functions or mixtures thereof; *or*

2. Fluorinated silicone fluids with a kinematic viscosity of less than 5000 mm^2/s (5000 centistokes) measured at 298 K (25 °C);

c. Damping or flotation fluids having all of the following:

1. Purity exceeding 99,8 %;

2. Containing less than 25 particles of 200 μm 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;

d. 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. Monomeric forms of perfluoropolyalkylether-triazines or 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.

Note: 1C006.d. does not control materials specified and packaged as medical products.

Technical Note:

For the purpose of 1C006:

1. 'Flash point' is determined using the Cleveland Open Cup Method described in ASTM D-92 or national equivalents;

2. 'Pour point' is determined using the method described in ASTM D-97 or national equivalents;

3. 'Viscosity index' is determined using the method described in ASTM D-2270 or national equivalents;

4. 'Thermal stability' is determined by the following test procedure or national equivalents:

Twenty ml of the fluid under test is placed in a 46 ml type 317 stainless steel chamber containing one each of 12,5 mm (nominal) diameter balls of M-10 tool steel, 52100 steel and naval bronze (60 % Cu, 39 % Zn, 0,75 % Sn);

The chamber is purged with nitrogen, sealed at atmospheric pressure and the temperature raised to and maintained at 644 ± 6 K (371 ± 6 °C) for six hours;

The specimen will be considered thermally stable if, on completion of the above procedure, all of the following conditions are met:

a. The loss in weight of each ball is less than 10 mg/mm^2 of ball surface;

b. The change in original viscosity as determined at 311 K (38 °C) is less than 25 %; and

c. The total acid or base number is less than 0,40;

5. 'Autogenous ignition' temperature is determined using the method described in ASTM E-659 or national equivalents.

1C007 1 Ceramic powders, non-"composite" ceramic materials, ceramic-"matrix" "composite" materials and precursor materials, as follows:

N.B.: SEE ALSO 1C107.

a. Ceramic powders of single or complex borides of titanium, having total metallic impurities, excluding intentional additions, of less than 5000 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. Non-"composite" ceramic materials in crude or semi-fabricated form, composed of borides of titanium with a density of 98 % or more of the theoretical density;

Note: 1C007.b. does not control abrasives.

c. Ceramic-ceramic "composite" materials with a glass or oxide-"matrix" and reinforced with fibres having all of the following:

1. Made from any of the following materials:

a. Si-N;

b. Si-C;

c. Si-Al-O-N; *or*

d. Si-O-N; *and*

2. Having a "specific tensile strength" exceeding $12,7 \times 10^3$ m;

d. Ceramic-ceramic "composite" materials, with or without a continuous metallic phase, incorporating particles, whiskers or fibres, where carbides or nitrides of silicon, zirconium or boron form the "matrix";

e. Precursor materials (i.e., special purpose polymeric or metallo-organic materials) for producing any phase or phases of the materials specified in 1C007.c., as follows:

1. Polydiorganosilanes (for producing silicon carbide);

2. Polysilazanes (for producing silicon nitride);

3. Polycarbosilazanes (for producing ceramics with silicon, carbon and nitrogen components);

f. Ceramic-ceramic "composite" materials with an oxide or glass "matrix" reinforced with continuous fibres from any of the following systems:

1. Al_2O_3 (CAS 1344-28-1); *or*

2. Si-C-N.

Note: 1C007.f. does not control "composites" containing fibres from these systems with a fibre tensile strength of less than 700 MPa at 1273 K (1000 °C) or fibre tensile creep resistance of more than 1 % creep strain at 100 MPa load and 1273 K (1000 °C) for 100 hours.

1C008 Non-fluorinated polymeric substances as follows:

a. Imides, as follows:

1. Bismaleimides;

2. Aromatic polyamide-imides (PAI) having a 'glass transition temperature (T_g)' exceeding 563 K (290 °C);

3. Aromatic polyimides having a 'glass transition temperature (Tg)' exceeding 505 K (232 °C);

4. Aromatic polyetherimides having a 'glass transition temperature (T_g)' exceeding 563 K (290 °C);

Note: 1C008.a. controls substances in liquid or solid "fusible" form, including resin, powder, pellet, film, sheet, tape or ribbon.

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N.B. For non-"fusible" aromatic polyimides in film, sheet, tape or ribbon form, see 1A003.

b. Not used;

c. Not used;

d. Polyarylene ketones;

e. Polyarylene sulphides, where the arylene group is biphenylene, triphenylene or combinations thereof;

f. Polybiphenylenethersulphone having a 'glass transition temperature (T_g)' exceeding 563 K (290 °C).

Technical Note:

1. The 'glass transition temperature (T_g)' for 1C008.a.2. thermoplastic materials and 1C008.a.4. materials is determined using the method described in ISO 11357-2 (1999) or national equivalents

2. The 'glass transition temperature (T_g)' for 1C008.a.2. thermosetting materials and 1C008.a.3. materials is determined using the 3-point bend method described in ASTM D 7028-07 or equivalent national standard. The test is to be performed using a dry test specimen which has attained a minimum of 90 % degree of cure as specified by ASTM E 2160-04 or equivalent national standard, and was cured using the combination of standard- and post-cure processes that yield the highest Tg.

1C009 Unprocessed fluorinated compounds as follows:

a. Copolymers of vinylidene fluoride having 75 % or more beta crystalline structure without stretching;

b. Fluorinated polyimides containing 10 % by weight or more of combined fluorine;

c. Fluorinated phosphazene elastomers containing 30 % by weight or more of combined fluorine.

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

N.B.: SEE ALSO 1C210 AND 9C110.

Technical Note:

1. For the purpose of calculating "specific tensile strength", "specific modulus" or specific weight of "fibrous or filamentary materials" in 1C010.a., 1C010.b., 1C010.c. or 1C010.e.1.b., the tensile strength and modulus should be determined by using Method A described in ISO 10618 (2004) or national equivalents.

2. Assessing the "specific tensile strength", "specific modulus" or specific weight of non-unidirectional "fibrous or filamentary materials" (e.g., fabrics, random mats or braids) in 1C010 is to be based on the mechanical properties of the constituent

unidirectional monofilaments (e.g., monofilaments, yarns, rovings or tows) prior to processing into the non-unidirectional "fibrous or filamentary materials".

a. Organic "fibrous or filamentary materials", having all of the following:

1. "Specific modulus" exceeding $12,7 \times 10^6$ m; *and*

2. "Specific tensile strength" exceeding $23,5 \times 10^4$ m;

Note: 1C010.a. does not control polyethylene.

b. Carbon "fibrous or filamentary materials", having all of the following:

1. "Specific modulus" exceeding $14,65 \times 10^6$ m; *and*

2. "Specific tensile strength" exceeding $26,82 \times 10^4$ m;

Note: 1C010.b. does not control:

a. "Fibrous or filamentary materials", for the repair of "civil aircraft" structures or laminates, having all of the following:

1. An area not exceeding 1 m^2;

2. A length not exceeding 2,5 m; and

3. A width exceeding 15 mm.

b. Mechanically chopped, milled or cut carbon "fibrous or filamentary materials" 25,0 mm or less in length.

c. Inorganic "fibrous or filamentary materials", having all of the following:

1. "Specific modulus" exceeding $2,54 \times 10^6$ m; *and*

2. Melting, softening, decomposition or sublimation point exceeding 1922 K (1649 °C) in an inert environment;

Note: 1C010.c. does not control:

a. Discontinuous, multiphase, polycrystalline alumina fibres in chopped fibre or random mat form, containing 3 % by weight or more silica, with a "specific modulus" of less than 10×10^6 m;

b. Molybdenum and molybdenum alloy fibres;

c. Boron fibres;

d. Discontinuous ceramic fibres with a melting, softening, decomposition or sublimation point lower than 2043 K (1770 °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.; *or*

   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 fibres 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 fibre 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; *and*

      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 T_g)' equal to or exceeding 453 K (180 °C) and having a phenolic resin; or

   c. 'Dynamic Mechanical Analysis glass transition temperature (DMA T_g)' 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;

Note 1: Metal or carbon-coated "fibrous or filamentary materials" (preforms) or "carbon fibre preforms", not impregnated with resin or pitch, are specified by "fibrous or filamentary materials" in 1C010.a., 1C010.b. or 1C010.c.

Note 2: 1C010.e. does not control:

a. Epoxy resin "matrix" impregnated carbon "fibrous or filamentary materials" (prepregs) for the repair of "civil aircraft" structures or laminates, having all the following;

1. An area not exceeding 1 m^2;

2. A length not exceeding 2,5 m; and

3. A width exceeding 15 mm.

b. Fully or partially resin-impregnated or pitch-impregnated mechanically chopped, milled or cut carbon "fibrous or filamentary materials" 25,0 mm or less in length when using a resin or pitch other than those specified by 1C008 or 1C009.b.

Technical Note:

The 'Dynamic Mechanical Analysis glass transition temperature (DMA T_g)' for materials specified by 1C010.e. is determined using the method described in ASTM D 7028-07, or equivalent national standard, on a dry test specimen. In the case of thermoset materials, degree of cure of a dry test specimen shall be a minimum of 90 % as defined by ASTM E 2160-04 or equivalent national standard.

1C011 Metals and compounds, as follows:

N.B.: SEE ALSO MILITARY GOODS CONTROLS and 1C111.

a. Metals in particle sizes of less than 60 μm whether spherical, atomised, spheroidal, flaked or ground, manufactured from material consisting of 99 % or more of zirconium, magnesium and alloys thereof;

Technical Note:

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

Note: The metals or alloys specified in 1C011.a. are controlled whether or not the metals or alloys are encapsulated in aluminium, magnesium, zirconium or beryllium.

b. Boron or boron alloys, with a particle size of 60 μm 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;

Note: The metals or alloys specified in 1C011.b. are controlled whether or not the metals or alloys are encapsulated in aluminium, magnesium, zirconium or beryllium.

c. Guanidine nitrate (CAS 506-93-4);

d. Nitroguanidine (NQ) (CAS 556-88-7).

N.B.: See also Military Goods Controls for metal powders mixed with other substances to form a mixture formulated for military purposes.

1C012 Materials as follows:

Technical Note:

These materials are typically used for nuclear heat sources.

a. Plutonium in any form with a plutonium isotopic assay of plutonium-238 of more than 50 % by weight;

Note: 1C012.a. does not control:

a. Shipments with a plutonium content of 1 g or less;

b. Shipments of 3 "effective grammes" or less when contained in a sensing component in instruments.

b. "Previously separated" neptunium-237 in any form.

Note: 1C012.b. does not control shipments with a neptunium-237 content of 1 g or less.

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.

Note 1: 1C101 includes:

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

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

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

Technical Note:

In 1C101 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

1C102 Resaturated pyrolized 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 g/cm^3 or greater, measured at 288 K (15 °C), and having a grain size of 100 μm 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;

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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 × 120 mm × 50 mm or greater;

N.B.: See also 0C004

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;

N.B.: See also 0C004

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.

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 μm, according to ISO 2591-1:1988 or national equivalents;

Technical Note:

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

2. Metal 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 μm (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;

Technical Note:

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

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 μm (determined by measurement techniques such as using a sieve, laser diffraction or optical scanning), whether spherical, atomised, spheroidal, flaked or ground;

Note: 1C111a.2.a. and 1C111a.2.b. controls powder mixtures with a multimodal particle distribution (e.g. mixtures of different grain sizes) if one or more modes are controlled.

3. Oxidiser 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 10544-72-6);

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

d. Mixed Oxides of Nitrogen (MON);

Technical Note:

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

e. SEE MILITARY GOODS CONTROLS for Inhibited Red Fuming Nitric Acid (IRFNA);

f. SEE MILITARY GOODS CONTROLS AND 1C238 for compounds composed of fluorine and one or more of other halogens, oxygen or nitrogen.

4. Hydrazine derivatives as follows:

N.B.: SEE ALSO MILITARY GOODS CONTROLS.

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;

f. Monomethylhydrazine dinitrate;

g. Unsymmetrical dimethylhydrazine nitrate;

h. Hydrazinium azide (CAS 14546-44-2);

i. Dimethylhydrazinium azide;

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. Diethylhydrazine nitrate (DEHN);

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 40×10^6 J/kg or greater;

b. Other high energy density fuels and fuel additives (e.g., cubane, ionic solutions, JP-10) having a volume-based energy density of $37{,}5 \times 10^9$ J/m^3 or greater, measured at 20 °C and one atmosphere (101,325 kPa) pressure;

Note: 1C111.a.5.b. does not control fossil refined fuels and biofuels produced from vegetables, including fuels for engines certified for use in civil aviation, unless specially formulated for 'missiles' or unmanned aerial vehicles specified in 9A012 or 9A112.a..

Technical Note:

In 1C111.a.5. 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

6. Hydrazine replacement fuels as follows:

1,2-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), other than that specified in the Military Goods Controls;

3. Polybutadiene-acrylic acid (PBAA);

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

5. Polytetrahydrofuran polyethylene glycol (TPEG);

Technical Note:

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

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. Triethylene glycol dinitrate (TEGDN) (CAS 111-22-8);

3. 2-Nitrodiphenylamine (CAS 119-75-5);

4. Trimethylolethane 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;

b. See Military Goods Controls for Ethyl ferrocene;

c. See Military Goods Controls for Propyl ferrocene;

d. See Military Goods Controls for n-butyl ferrocene;

e. See Military Goods Controls for Pentyl ferrocene (CAS 1274-00-6);

f. See Military Goods Controls for Dicyclopentyl ferrocene;

g. See Military Goods Controls for Dicyclohexyl ferrocene;

h. See Military Goods Controls for Diethyl ferrocene

i. See Military Goods Controls for Dipropyl ferrocene;

j. See Military Goods Controls for Dibutyl ferrocene

k. See Military Goods Controls for Dihexyl ferrocene

l. See Military Goods Controls for Acetyl ferrocene (CAS 1271-55-2) / 1,1′-diacetyl ferrocene

m. See Military Goods Controls for ferrocene Carboxylic acids;

n. See Military Goods Controls for butacene;

o. Other ferrocene derivatives usable as rocket propellant burning rate modifiers, other than those specified in the Military Goods Controls.

Note: 1C111.c.6.o. does not control ferrocene derivatives that contain a six carbon aromatic functional group attached to the ferrocene molecule.

7. 4,5 diazidomethyl-2-methyl-1,2,3-triazole (iso- DAMTR), other than that specified in the Military Goods Controls.

Note: For propellants and constituent chemicals for propellants not specified in 1C111, see the Military Goods Controls.

1C116 Maraging steels, useable in 'missiles', having all of the following:

N.B.: SEE ALSO 1C216.

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.

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Nutzen Sie unsere gespeicherten **Erfahrungen aus 26 Jahren Complianceberatung.** Wir vermeiden die Haftung für Organisationsverschulden von Führungskräften. Sie müssen organisatorisch dafür sorgen, dass sie sich selbst und dass sich alle Mitarbeiter des Unternehmens legal verhalten. Dazu lassen sich alle Risiken und Pflichten eines Unternehmens mit unserem System ermitteln, delegieren, monatlich aktualisieren, erfüllen, kontrollieren, digital speichern und für alle jederzeit verfügbar halten. Die Verantwortlichen können digital abfragen, wer, welche Pflicht, an welchem Betriebsteil, wie zu erfüllen hat. Führungskräfte können auf einer Oberaufsichtsmaske mit einem Blick kontrollieren, ob alle Pflichten im Unternehmen erfüllt sind. **Systematisch senken wir den Complianceaufwand durch Standardisierung um 60 %.** Sachverhalte im Unternehmen wiederholen sich, verursachen gleiche Risiken und lösen gleiche Rechtspflichten zur Risikoabwehr aus. Rechtspflichten werden nur einmal geprüft, verlinkt, gespeichert und immer wieder mehrfach genutzt. Wir sind Rechtsanwälte mit eigenen Informatikern und bieten eine Softwarelösung mit Inhalten und präventiver Rechtsberatung aus einer Hand. Auf Anregungen aus den Unternehmen passen unsere EDV-Spezialisten die Software unseres Compliance-Management-Systems an. Der aktuelle Inhalt unserer Datenbank: 18.000 Rechtsvorschriften von EU, Bund, Ländern und Berufsgenossenschaften, 7.500 Gerichtsurteile, standardisierte Pflichtenkataloge für 45 Branchen und 57.000 vorformulierte Betriebspflichten. **44.000 Unternehmensrisiken sind mit 59.000 Rechtspflichten drei Millionen Mal verlinkt und gespeichert.** Auf die Inhalte kommt es an. Je umfangreicher die Datenbank umso geringer ist das Risiko eine Unternehmenspflicht zu übersehen.

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Maraging steels are iron alloy:

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

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

Technical Note 2:

In 1C116 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

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 50×10^{-6} m (50 μm) or less;

b. Molybdenum and alloys in particulate form with a molybdenum content of 97 % by weight or more and a particle size of 50×10^{-6} m (50 μm) 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 ot 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.

Technical Note:

In 1C117 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

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

a. Having all of the following characteristics:

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

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

3. A ferritic-austenitic microstructure (also referred to as a two-phase microstructure) of which at least 10 percent is austenite by volume (according to ASTM E-1181-87 or national equivalents); *and*

b. Having any of the following forms:

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

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

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

1C202 Alloys, other than those specified in 1C002.b.3. or.b.4., as follows:

a. Aluminium alloys having both of the following characteristics:

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

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

b. Titanium alloys having both of the following characteristics:

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

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

Technical Note:

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

1C210 'Fibrous or filamentary materials' or prepregs, 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 235×10^4 m or greater;

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

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

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

2. A "specific tensile strength" of $7{,}62 \times 10^4$ 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.

Technical Note:

The resin forms the matrix of the composite.

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

1C216 Maraging steel, other than that specified in 1C116, 'capable of' an ultimate tensile strength of 1950 MPa or more, at 293 K (20 °C).

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

Technical Note:

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

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

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

Technical Note:

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

1C226 Tungsten, tungsten carbide, and alloys containing more than 90 % tungsten by weight, other than that specified by 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.

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

1C227 Calcium having both of the following characteristics:

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

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

1C228 Magnesium having both of the following characteristics:

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

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

1C229 Bismuth having both of the following characteristics:

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

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

1C230 Beryllium metal, alloys containing more than 50 % beryllium by weight, beryllium compounds, manufactures thereof, and waste or scrap of any of the foregoing, other than that specified in the Military Goods Controls.

N.B.: SEE ALSO MILITARY GOODS CONTROLS.

Note: 1C230 does not control the following:

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

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

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

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

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

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

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

Note: 1C233 does not control thermoluminescent dosimeters.

Technical Note:

The natural isotopic abundance of lithium-6 is approximately 6,5 weight per cent (7.5 atom per cent).

1C234 Zirconium with a hafnium content of less than 1 part hafnium to 500 parts zirconium by weight, as follows: metal, alloys containing more than 50 % zirconium by weight, compounds, manufactures thereof, waste or scrap of any of the foregoing, other than those specified in 0A001.f.

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

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

Note: 1C235 does not control a product or device containing less than 1.48 × 10^3 GBq (40 Ci) of tritium.

1C236 'Radionuclides' appropriate for making neutron sources based on alpha-n reaction, 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 3 GBq/kg (1 Ci/kg) or greater;

d. Products or devices containing any of the foregoing.

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

Technical Note:

In 1C236 'radionuclides' are any of the following:

– Actinium-225 (Ac-225)

– Actinium-227 (Ac-227)

– Californium-253 (Cf-253)

– Curium-240 (Cm-240)

– Curium-241 (Cm-241)

– Curium-242 (Cm-242)

– Curium-243 (Cm-243)

– Curium-244 (Cm-244)

– Einsteinium-253 (Es-253)

– Einsteinium-254 (Es-254)

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– Gadolinium-148 (Gd-148)

– Plutonium-236 (Pu-236)

– Plutonium-238 (Pu-238)

– Polonium-208 (Po-208)

– Polonium-209 (Po-209)

– Polonium-210 (Po-210)

– Radium-223 (Ra-223)

– Thorium-227 (Th-227)

– Thorium-228 (Th-228)

– Uranium-230 (U-230)

– Uranium-232 (U-232)

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

Note: 1C237 does not control the following:

a. Medical applicators;

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

1C238 Chlorine trifluoride (ClF_3).

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^3 and having a detonation velocity greater than 8000 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.

Note: 1C240 does not control the following:

a. Filamentary nickel powders;

b. Single porous nickel sheets with an area of 1000 cm^2 per sheet or less.

Technical Note:

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

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

N.B.: SEE ALSO MILITARY GOODS CONTROLS AND 1C450.

1. Thiodiglycol (111-48-8);

2. Phosphorus oxychloride (10025-87-3);

3. Dimethyl methylphosphonate (756-79-6);

4. SEE MILITARY GOODS CONTROLS for Methyl phosphonyl difluoride (676-99-3);

5. Methyl phosphonyl dichloride (676-97-1);

6. Dimethyl phosphite (DMP) (868-85-9);

7. Phosphorus trichloride (7719-12-2);

8. Trimethyl phosphite (TMP) (121-45-9);

9. Thionyl chloride (7719-09-7);

10. 3-Hydroxy-1-methylpiperidine (3554-74-3);

11. N,N-Diisopropyl-(beta)-aminoethyl chloride (96-79-7);

12. N,N-Diisopropyl-(beta)-aminoethane thiol (5842-07-9);

13. 3-Quinuclidinol (1619-34-7);

14. Potassium fluoride (7789-23-3);

15. 2-Chloroethanol (107-07-3);

16. Dimethylamine (124-40-3);

17. Diethyl ethylphosphonate (78-38-6);

18. Diethyl N,N-dimethylphosphoramidate (2404-03-7);

19. Diethyl phosphite (762-04-9);

20. Dimethylamine hydrochloride (506-59-2);

21. Ethyl phosphinyl dichloride (1498-40-4);

22. Ethyl phosphonyl dichloride (1066-50-8);

23. SEE MILITARY GOODS CONTROLS for Ethyl phosphonyl difluoride (753-98-0);

24. Hydrogen fluoride (7664-39-3);

25. Methyl benzilate (76-89-1);

26. Methyl phosphinyl dichloride (676-83-5);

27. N,N-Diisopropyl-(beta)-amino ethanol (96-80-0);

28. Pinacolyl alcohol (464-07-3);

29. SEE MILITARY GOODS CONTROLS for O-Ethyl-O-2-diisopropylaminoethyl methyl phosphonite (QL) (57856-11-8);

30. Triethyl phosphite (122-52-1);

31. Arsenic trichloride (7784-34-1);

32. Benzilic acid (76-93-7);

33. Diethyl methylphosphonite (15715-41-0);

34. Dimethyl ethylphosphonate (6163-75-3);

35. Ethyl phosphinyl difluoride (430-78-4);

36. Methyl phosphinyl difluoride (753-59-3);

37. 3-Quinuclidone (3731-38-2);

38. Phosphorus pentachloride (10026-13-8);

39. Pinacolone (75-97-8);

40. Potassium cyanide (151-50-8);

41. Potassium bifluoride (7789-29-9);

42. Ammonium hydrogen fluoride or ammonium bifluoride (1341-49-7);

43. Sodium fluoride (7681-49-4);

44. Sodium bifluoride (1333-83-1);

45. Sodium cyanide (143-33-9);

46. Triethanolamine (102-71-6);

47. Phosphorus pentasulphide (1314-80-3);

48. Di-isopropylamine (108-18-9);

49. Diethylaminoethanol (100-37-8);

50. Sodium sulphide (1313-82-2);

51. Sulphur monochloride (10025-67-9);

52. Sulphur dichloride (10545-99-0);

53. Triethanolamine hydrochloride (637-39-8);

54. N,N-Diisopropyl-(Beta)-aminoethyl chloride hydrochloride (4261-68-1);

55. Methylphosphonic acid (993-13-5);

56. Diethyl methylphosphonate (683-08-9);

57. N,N-Dimethylaminophosphoryl dichloride (677-43-0);

58. Triisopropyl phosphite (116-17-6);

59. Ethyldiethanolamine (139-87-7);

60. O,O-Diethyl phosphorothioate (2465-65-8);

61. O,O-Diethyl phosphorodithioate (298-06-6);

62. Sodium hexafluorosilicate (16893-85-9);

63. Methylphosphonothioic dichloride (676-98-2).

Note 1: For exports to "States not Party to the Chemical Weapons Convention", 1C350 does not control "chemical mixtures" containing one or more of the chemicals specified in entries 1C350.1, .3, .5, .11, .12, .13, .17, .18, .21, .22, .26, .27, .28, .31, .32, .33, .34, .35, .36, .54, .55, .56, .57 and .63 in which no individually specified chemical constitutes more than 10 % by the weight of the mixture.

Note 2: For exports to "States Party to the Chemical Weapons Convention", 1C350 does not control "chemical mixtures" containing one or more of the chemicals specified in entries 1C350.1, .3, .5, .11, .12, .13, .17, .18, .21, .22, .26, .27, .28, .31, .32, .33, .34,

.35, .36, .54, .55, .56, .57 and .63 in which no individually specified chemical constitutes more than 30 % by the weight of the mixture.

Note 3: 1C350 does not control "chemical mixtures" containing one or more of the chemicals specified in entries 1C350.2, .6, .7, .8, .9, .10, .14, .15, .16, .19, .20, .24, .25, .30, .37, .38, .39, .40, .41, .42, .43, .44, .45, .46, .47, .48, .49, .50, .51, .52, .53, .58, .59, .60, .61 and .62 in which no individually specified chemical constitutes more than 30 % by the weight of the mixture.

Note 4: 1C350 does not control products identified as consumer goods packaged for retail sale for personal use or packaged for individual use.

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. Uncharacterised; *or*

b. Defined in Annex I(2) EC Directive 2005/94/EC (OJ L 10 14.1.2006 p. 16) as having high pathogenicity, as follows:

1. Type A viruses with an IVPI (intravenous pathogenicity index) in 6 Week old chickens of greater than 1,2; *or*

2. Type A viruses 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 HPAI 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. Congo-Crimean haemorrhagic fever virus;

10. Dengue fever virus;

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11. Dobrava-Belgrade virus;
12. Eastern equine encephalitis virus;
13. Ebola virus;
14. Foot and mouth disease virus;
15. Goat pox virus;
16. Guanarito virus;
17. Hantaan virus;
18. Hendra virus (Equine morbillivirus);
19. Herpes virus (Aujeszky's disease);
20. Hog cholera virus (swine fever virus);
21. Japanese encephalitis virus;
22. Junin virus;
23. Kyasanur Forest virus;
24. Laguna Negra virus;
25. Lassa fever virus;
26. Louping ill virus;
27. Lujo virus;
28. Lumpy skin disease virus;
29. Lymphocytic choriomeningitis virus;
30. Machupo virus;
31. Marburg virus;
32. Monkey pox virus;
33. Murray Valley encephalitis virus;
34. Newcastle disease virus;
35. Nipah virus;
36. Omsk haemorrhagic fever virus;
37. Oropouche virus;

38. Peste des petits ruminants virus;

39. Porcine enterovirus type 9 (swine vesicular disease virus);

40. Powassan virus;

41. Rabies virus and all other members of the Lyssavirus genus;

42. Rift Valley fever virus;

43. Rinderpest virus;

44. Rocio virus;

45. Sabia virus;

46. Seoul virus;

47. Sheep pox virus;

48. Sin nombre virus;

49. St Louis encephalitis virus;

50. Teschen disease virus;

51. Tick-borne encephalitis virus (Russian Spring-Summer encephalitis virus);

52. Variola virus;

53. Venezuelan equine encephalitis virus;

54. Vesicular stomatitis virus;

55. Western equine encephalitis virus;

56. Yellow fever virus;

b. Not used;

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

1. Bacillus anthracis;

2. Brucella abortus;

3. Brucella melitensis;

4. Brucella suis;

5. Burkholderia mallei (Pseudomonas mallei);

6. Burkholderia pseudomallei (Pseudomonas pseudomallei);

7. Chlamydophila psittaci (formerly known as Chlamydia 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 prowasecki;

18. Salmonella typhi;

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

Technical Note:

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

20. Shigella dysenteriae;

21. Vibrio cholerae;

22. Yersinia pestis;

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

1. Botulinum toxins;

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

3. Conotoxin;

4. Ricin;

5. Saxitoxin;

6. Shiga toxin;

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

8. Tetrodotoxin;

9. Verotoxin and shiga-like ribosome inactivating proteins;

10. Microcystin (Cyanginosin);

11. Aflatoxins;

12. Abrin;

13. Cholera toxin;

14. Diacetoxyscirpenol toxin;

15. T-2 toxin;

16. HT-2 toxin;

17. Modeccin;

18. Volkensin;

19. Viscum album Lectin 1 (Viscumin);

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

1. Are pharmaceutical formulations designed for human administration in the treatment of medical conditions;

2. Are pre-packaged for distribution as medical products;

3. Are authorised by a state authority to be marketed as medical products.

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

1. Coccidioides immitis;

2. Coccidioides posadasii.

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

1C352 Not used

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

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

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

Technical Notes:

1. Genetically-modified organisms includes organisms in which the genetic material (nucleic acid sequences) has been altered in a way that does not occur naturally by mating and/or natural recombination, and encompasses those produced artificially in whole or in part.

2. Genetic elements include inter alia chromosomes, genomes, plasmids, transposons, and vectors whether genetically modified or unmodified, or chemically synthesized in whole or in part.

3. Nucleic acid sequences associated with the pathogenicity of any of the micro-organisms specified in 1C351.a., 1C351.c., 1C351.e. or 1C354 means any sequence specific to the specified micro-organism that:

a. In itself or through its transcribed or translated products represents a significant hazard to human, animal or plant health; or

b. Is known to enhance the ability of a specified micro-organism, or any other organism into which it may be inserted or otherwise integrated, to cause serious harm to humans, animals or plant health.

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

1C354 Plant pathogens, as follows:

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

1. 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];

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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 endobioticium;

10. Tilletia indica;

11. Thecaphora solani.

1C450 Toxic chemicals and toxic chemical precursors, as follows, and "chemical mixtures" containing one or more thereof:

N.B.: SEE ALSO ENTRY 1C350, 1C351.d. AND MILITARY GOODS CONTROLS.

a. Toxic chemicals, as follows:

1. Amiton: O,O-Diethyl S-[2-(diethylamino)ethyl] phosphorothiolate (78-53-5) and corresponding alkylated or protonated salts;

2. PFIB: 1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene (382-21-8);

3. SEE MILITARY GOODS CONTROLS for BZ: 3-Quinuclidinyl benzilate (6581-06-2);

4. Phosgene: Carbonyl dichloride (75-44-5);

5. Cyanogen chloride (506-77-4);

6. Hydrogen cyanide (74-90-8);

7. Chloropicrin: Trichloronitromethane (76-06-2);

Note 1: For exports to "States not Party to the Chemical Weapons Convention", 1C450 does not control "chemical mixtures" containing one or more of the chemicals specified in entries 1C450.a.1. and .a.2. in which no individually specified chemical constitutes more than 1 % by the weight of the mixture.

Note 2: For exports to "States Party to the Chemical Weapons Convention", 1C450 does not control "chemical mixtures" containing one or more of the chemicals specified in entries 1C450.a.1. and .a.2. in which no individually specified chemical constitutes more than 30 % by the weight of the mixture.

Note 3: 1C450 does not control "chemical mixtures" containing one or more of the chemicals specified in entries 1C450.a.4., .a.5., .a.6. and .a.7. in which no individually specified chemical constitutes more than 30 % by the weight of the mixture.

Note 4: 1C450 does not control products identified as consumer goods packaged for retail sale for personal use or packaged for individual use.

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;

Note: 1C450.b.1 does not control Fonofos: O-Ethyl S-phenyl ethylphosphonothiolothionate (944-22-9);

2. N,N-Dialkyl [methyl, ethyl or propyl (normal or iso)] phosphoramidic dihalides, other than N,N-Dimethylaminophosphoryl dichloride;

N.B.: See 1C350.57. for 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. 1 N,N-Dialkyl [methyl, ethyl or propyl (normal or iso)] aminoethane-2-ols and corresponding protonated salts, other than N,N-Diisopropyl-(beta)-aminoethanol (96-80-0) and N,N-Diethylaminoethanol (100-37-8) which are specified in 1C350;

Note: 1C450.b.5. does not control the following:

a. N,N-Dimethylaminoethanol (108-01-0) and corresponding protonated salts;

b. Protonated salts of N,N-Diethylaminoethanol (100-37-8);

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 which is specified in 1C350;

7. See 1C350 for ethyldiethanolamine (139-87-7);

8. Methyldiethanolamine (105-59-9).

Note 1: For exports to "States not Party to the Chemical Weapons Convention", 1C450 does not control "chemical mixtures" containing one or more of the chemicals specified in entries 1C450.b.1., .b.2., .b.3., .b.4., .b.5. and .b.6. in which no individually specified chemical constitutes more than 10 % by the weight of the mixture.

Note 2: For exports to "States Party to the Chemical Weapons Convention", 1C450 does not control "chemical mixtures" containing one or more of the chemicals specified in entries 1C450.b.1., .b.2., .b.3., .b.4., .b.5. and .b.6. in which no individually specified chemical constitutes more than 30 % by the weight of the mixture.

Note 3: 1C450 does not control "chemical mixtures" containing one or more of the chemicals specified in entry 1C450.b.8. in which no individually specified chemical constitutes more than 30 % by the weight of the mixture.

Note 4: 1C450 does not control products identified as consumer goods packaged for retail sale for personal use or packaged for individual use.

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.

10. *1E Technology*

1E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials specified in 1A001.b., 1A001.c., 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 vinylether 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 1000 ppm for single oxides or carbides; *or*

2. Less than 5000 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 μm and no more than 10 % of the particles larger than 5 μm or

2. Other ceramic powders with an average particle size equal to or less than 5 μm and no more than 10 % of the particles larger than 10 μm; *or*

2. Non-"composite" ceramic materials composed of the materials specified in 1E002.c.1;

Note: 1E002.c.2. does not control "technology" for the design or production of abrasives.

d. Not used.

e. "Technology" for the installation, maintenance or repair of materials specified in 1C001;

f. "Technology" for the repair of "composite" structures, laminates or materials specified in 1A002, 1C007.c. or 1C007.d.;

Note: 1E002.f. does not control "technology" for the repair of "civil aircraft" structures using carbon "fibrous or filamentary materials" and epoxy resins, contained in aircraft manufacturers' manuals.

g. "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" relating to the "production" of pyrolytically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1573 K (1300 °C) to 3173 K (2900 °C) temperature range at pressures of 130 Pa to 20 kPa.

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

1E201 "Technology" according to the General Technology Note for the "use" of goods specified in 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

11. *2A Systems, Equipment and Components*

N.B.: For quiet running bearings, see the Military Goods Controls.

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

N.B.: SEE ALSO 2A101.

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

a. Ball bearings and solid roller bearings, having all tolerances specified by the manufacturer in accordance with ISO 492 Tolerance Class 4 (or national equivalents), or better, and having both rings and rolling elements (ISO 5593), made from monel or beryllium;

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

b. Not used;

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

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

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

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

2A101 Radial ball bearings, other than those specified in 2A001, having all tolerances specified in accordance with ISO 492 Tolerance Class 2 (or ANSI/ABMA Std 20 Tolerance Class ABEC-9 or other national equivalents), or better and having all the following characteristics:

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

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

c. A width between 10 mm and 20 mm.

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

a. Crucibles having both of the following characteristics:

1. A volume of between 150 cm^3 and 8000 cm^3; *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_2);

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

c. Cerium sulphide (Ce_2S_3);

d. Erbium oxide (erbia) (Er_2O_3);

e. Hafnium oxide (hafnia) (HfO_2);

f. Magnesium oxide (MgO);

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

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

i. Zirconium oxide (zirconia) (ZrO_2);

b. Crucibles having both of the following characteristics:

1. A volume of between 50 cm^3 and 2000 cm^3; *and*

2. Made of or lined with tantalum, having a purity of 99,9 % or greater by weight;

c. Crucibles having all of the following characteristics:

1. A volume of between 50 cm^3 and 2000 cm^3;

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

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

2A226 Valves having all of the following characteristics:

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

b. Having a bellows seal; *and*

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

Technical Note:

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

12. *2B Test, Inspection and Production Equipment*

Technical Notes:

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

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

a. Wheel-dressing systems in grinding machines;

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

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

3. Axis nomenclature shall be in accordance with International Standard ISO 8412001, Industrial automation systems and integration - Numerical Control –of machines Coordinate system and Motion nomenclature'.

4. For the purposes of 2B001 to 2B009 a "tilting spindle" is counted as a rotary axis.

5. 'Stated "unidirectional positioning repeatability"' may be used for each machine tool model as an alternative to individual machine tests and is determined as follows:

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

b. Measure the linear axis repeatability (R↑,R↓) according to ISO 2302:2014 and evaluate "unidirectional positioning repeatability" for each axis of each of the five machines;

c. Determine the arithmetic mean value of the "unidirectional positioning repeatability"-values for each axis of all five machines together. These arithmetic mean values of "unidirectional positioning repeatability" (UPR) become the stated value of each axis for the model (UPR_x,UPR_y, ...);

d. Since the Category 2 list refers to each linear axis there will be as many 'stated "unidirectional positioning repeatability" values as there are linear axes;

e. If any axis of a machine model not controlled by 2B001.a. to 2B001.c. has a 'stated "unidirectional positioning repeatability" equal to or less than the specified "unidirectional positioning repeatability" of each machine tool model plus 0,7 μm, the builder should be required to reaffirm the accuracy level once every eighteen months.

6. For the purposes of 2B001.a. to 2B001.c., measurement uncertainty for the "unidirectional positioning repeatability" of machine tools, as defined in the International Standard ISO 230/2:2014 or national equivalents, shall not be considered.

7. For the purpose of 2.B001.a. to 2B001.c.., the measurement of axes shall be made according to test procedures in 5.3.2. of ISO 230-2:2014. Tests for axes longer than 2 meters shall be made over 2 m segments. Axes longer than 4 m require multiple tests (e.g., two tests for axes longer than 4 m and up to 8 m, three tests for axes longer than 8 m and up to 12 m), each over 2 m segments and distributed in equal intervals over the axis length. Test segments are equally spaced along the full axis length, with any excess length equally divided at the beginning, in between, and at the end of the test segments. The smallest "unidirectional positioning repeatability"-value of all test segments is to be reported.

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:

N.B.: SEE ALSO 2B201.

Note 1: 2B001 does not control special purpose machine tools limited to the manufacture of gears. For such machines see 2B003.

Note 2: 2B001 does not control special purpose machine tools limited to the manufacture of any of the following:

a. Crankshafts or camshafts;

b. Tools or cutters;

c. Extruder worms;

d. Engraved or facetted jewellery parts; or

e. Dental prostheses.

Note 3: A machine tool having at least two of the three turning, milling or grinding capabilities (e.g., a turning machine with milling capability), must be evaluated against each applicable entry 2B001.a., b. or c.

N.B.: For optical finishing machines, see 2B002.

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

1. "Unidirectional positioning repeatability" equal to or less (better) than 1,1 μm along one or more linear axis; *and*

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

Note: 2B001.a. does not control turning machines specially designed for producing contact lenses, having all of the following:

a. Machine controller limited to using ophthalmic based software for part programming data input; and

b. No vacuum chucking.

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

1. Having all of the following:

a. "Unidirectional positioning repeatability" equal to or less (better) than 1,1 μm along one or more linear axis; *and*

b. Three linear axes plus one rotary axis which can be coordinated simultaneously for "contouring control";

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

N.B.: 'Parallel mechanism machine tools' are specified in 2B001.b.2.d.

a. "Unidirectional positioning repeatability" equal to or less (better) than 1,1 μm 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 μm along one or more linear axis with a travel length equal to or greater than 1 m and less than 4 m;

c. "Unidirectional positioning repeatability" equal to or less (better) than 6,0 μm (along one or more linear axis with a travel length equal to or greater than 4 m; *or*

d. Being a 'parallel mechanism machine tool';

Technical Note:

A 'parallel mechanism machine tool' is a machine tool having multiple rods which are linked with a platform and actuators; each of the actuators operates the respective rod simultaneously and independently.

3. A "unidirectional positioning repeatability" for jig boring machines, equal to or less (better) than 1,1 μm 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 μm along one or more linear axis; *and*

b. Three or more 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 μm along one or more linear axis with a travel length less than 1 m;

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b. "Unidirectional positioning repeatability" equal to or less (better) than 1.4 μm 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 μm along one or more linear axis with a travel length equal to or greater than 4 m.

Note: 2B001.c. does not control grinding machine as follows:

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

1. Limited to cylindrical grinding; and

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

b. Machines designed specifically as jig grinders that do not have a z-axis or a w-axis, with a "unidirectional positioning repeatability" less (better) than 1,1 μm

c. Surface grinders.

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 5 m.

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 μm;

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*

d. 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'.

Technical Notes:

For the purposes of 2B002:

1. 'MRF' is a material removal process using an abrasive magnetic fluid whose viscosity is controlled by a magnetic field.

2. 'ERF' is a removal process using an abrasive fluid whose viscosity is controlled by an electric field.

3. 'Energetic particle beam finishing' uses Reactive Atom Plasmas (RAP) or ion-beams to selectively remove material.

4. 'Inflatable membrane tool finishing' is a process that uses a pressurized membrane that deforms to contact the workpiece over a small area.

5. 'Fluid jet finishing' makes use of a fluid stream for material removal.

2B003 "Numerically controlled" or manual machine tools, and specially designed components, controls and accessories therefor, specially designed for the shaving, finishing, grinding or honing of hardened (Rc = 40 or more) spur, helical and double-helical gears with a pitch diameter exceeding 1,250 mm and a face width of 15 % of pitch diameter or larger finished to a 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:

N.B.: SEE ALSO 2B104 and 2B204.

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 1773 K (1500 °C); *or*

3. A facility for hydrocarbon impregnation and removal of resultant gaseous degradation products.

Technical Note:

The inside chamber dimension is that of the chamber in which both the working temperature and the working pressure are achieved and does not include fixtures. That dimension will be the smaller of either the inside diameter of the pressure chamber or the inside diameter of the insulated furnace chamber, depending on which of the two chambers is located inside the other.

N.B.: For specially designed dies, moulds and tooling see 1B003, 9B009 and the Military Goods Controls.

2B005 Equipment specially designed for the deposition, processing and in-process control of inorganic overlays, coatings and surface modifications, as follows, for non-electronic substrates, by processes shown in the Table and associated Notes 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:

N.B.: SEE ALSO 2B105.

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^2 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.

Note: 2B005 does not control chemical vapour deposition, cathodic arc, sputter deposition, ion plating or ion implantation equipment, specially designed for cutting or machining tools.

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

a. Computer controlled or "numerically controlled" Coordinate Measuring Machines (CMM), having a three dimensional (volumetric) maximum permissible error of length measurement (E_0, 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/1000) μm (L is the measured length in mm), according to ISO 10360-2 (2009);

Technical Note:

The E_0, MPE of the most accurate configuration of the CMM specified by the manufacturer (e.g., best of the following: probe, stylus length, motion parameters, environment) and with "all compensations available" shall be compared to the 1,7 + L/1000 μm threshold.

N.B.: SEE ALSO 2B206.

b. Linear and angular displacement measuring instruments, as follows:

1. 'Linear displacement' measuring instruments having any of the following:

Note: Displacement measuring "laser" interferometers are only controlled in 2B006.b.1.c.

Technical Note:

For the purpose of 2B006.b.1. 'linear displacement' means the change of distance between the measuring probe and the measured object.

a. Non-contact type measuring systems with a "resolution" equal to or less (better) than 0,2 μm within a measuring range up to 0,2 mm;

b. Linear Variable Differential Transformer (LVDT) systems having all of the following:

1. Having any of the following:

a. "Linearity" equal to or less (better) than 0,1 % measured from 0 to the 'full operating range', for LVDTs with a 'full operating range' up to and including ± 5 mm; *or*

b. "Linearity" equal to or less (better) than 0,1 % measured from 0 to 5mm for LVDTs with a 'full operating range' greater than ± 5 mm; *and*

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

Technical Note:

For the purposes of 2B006.b.1.b., 'full operating range' is half of the total possible linear displacement of the LVDT. For example, LVDTs with a 'full operating range' up to and including ± 5 mm can measure a total possible linear displacement of 10 mm..

c. Measuring systems having all of the following:

1. Containing a "laser"; *and*

2. Maintaining, for at least 12 hours, at a temperature of 20 ± 1 °C, all of the following:

a. A "resolution" over their full scale of 0,1 μm or less (better); *and*

b. Capable of achieving a "measurement uncertainty" equal to or less (better) than (0,2 + L/2000) μm (L is the measured length in mm) at any point within a measuring range, when compensated for the refractive index of air; *or*

d. "Electronic assemblies" specially designed to provide feedback capability in systems specified in 2B006.b.1.c.;

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Note: 2B006.b.1. does not control measuring interferometer systems, with an automatic control system that is designed to use no feedback techniques, containing a "laser" to measure slide movement errors of machine-tools, dimensional inspection machines or similar equipment.

2. Angular displacement measuring instruments having an angular position "accuracy" equal to or less (better) than 0,00025 °;

Note: 2B006.b.2. does not control optical instruments, such as autocollimators, using collimated light (e.g., laser light) to detect angular displacement of a mirror.

c. Equipment for measuring surface roughness (including surface defects), by measuring optical scatter with a sensitivity of 0,5 nm or less (better).

Note: 2B006 includes machine tools, other than those specified by 2B001, that can be used as measuring machines if they meet or exceed the criteria specified for the measuring machine function.

2B007 "Robots" having any of the following characteristics and specially designed controllers and "end-effectors" therefor:

N.B.: SEE ALSO 2B207.

a. Capable in real time of full three-dimensional image processing or full three-dimensional 'scene analysis' to generate or modify "programmes" or to generate or modify numerical programme data;

Technical Note:

The scene analysis limitation does not include approximation of the third dimension by viewing at a given angle, or limited grey scale interpretation for the perception of depth or texture for the approved tasks (2 1/2 D).

b. Specially designed to comply with national safety standards applicable to potentially explosive munitions environments;

Note: 2B007.b. does not control "robots" specially designed for paint-spraying booths.

c. Specially designed or rated as radiation-hardened to withstand a total radiation dose greater than 5×10^3 Gy (silicon) without operational degradation; *or*

Technical Note:

The term Gy(silicon) refers to the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionising radiation.

d. Specially designed to operate at altitudes exceeding 30000 m.

2B008 Assemblies or units, specially designed for machine tools, or dimensional inspection or measuring systems and equipment, as follows:

a. Linear position feedback units having an overall "accuracy" less (better) than (800 + (600 × L/1000)) nm (L equals the effective length in mm);

N.B.: For "laser" systems see also Note to 2B006.b.1.c. and d.

b. Rotary position feedback units having an "accuracy" less (better) than 0,00025 °;

N.B.: For "laser" systems see also Note to 2B006.b.2.

Note: 2B008.a. and 2B008.b. control units, which are designed to determine the positioning information for feedback control, such as inductive type devices, graduated scales, infrared systems or "laser" systems.

c. "Compound rotary tables" and "tilting spindles", capable of upgrading, according to the manufacturer's specifications, machine tools to or above the levels specified in 2B.

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:

N.B.: SEE ALSO 2B109 AND 2B209.

a. Three or more axes which can be coordinated simultaneously for "contouring control"; *and*

b. A roller force more than 60 kN.

Technical Note:

For the purpose of 2B009, machines combining the function of spin-forming and flow-forming are regarded as flow-forming machines.

2B104 "Isostatic presses", other than those specified in 2B004, having all of the following:

N.B.: SEE ALSO 2B204.

a. Maximum working pressure of 69 MPa or greater;

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

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

2B105 Chemical vapour deposition (CVD) furnaces, 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, and specially designed components as follows:

N.B.: SEE ALSO 2B209.

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

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

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

b. Specially designed components for flow-forming machines specified in 2B009 or 2B109.a.

Note: 2B109 does not control machines that are not usable in the production of propulsion components and equipment (e.g. motor cases) for systems specified in 9A005, 9A007.a. or 9A105.a.

Technical Note:

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

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

a. 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.;

Technical Note:

In 2B116.b., 'real-time control bandwidth' means the maximum rate at which a controller can execute complete cycles of sampling, processing data and transmitting control signals.

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 2B116.a.

Technical Note:

In 2B116, 'bare table' means a flat table, or surface, with no fixture or fittings.

2B117 Equipment and process controls, other than those specified in 2B004, 2B005.a., 2B104 or 2B105, designed or modified for densification and pyrolysis of structural composite rocket nozzles and reentry vehicle nose tips.

2B119 Balancing machines and related equipment, as follows:

N.B.: SEE ALSO 2B219.

a. Balancing machines having all the following characteristics:

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

2. Capable of balancing rotors/assemblies at speeds greater than 12500 rpm;

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

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

Note: 2B119.a. does not control balancing machines designed or modified for dental or other medical equipment.

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

Technical Note:

Indicator heads are sometimes known as balancing instrumentation.

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

a. Two axes or more;

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

c. Having any of the following characteristics:

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

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

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

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

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

Note 1: 2B120 does not control rotary tables designed or modified for machine tools or for medical equipment. For controls on machine tool rotary tables see 2B008.

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

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

a. Two axes or more; *and*

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

Note: 2B121 does not control rotary tables designed or modified for machine tools or for medical equipment. For controls on machine tool rotary tables see 2B008.

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

Note: Centrifuges specified in 2B122 remain controlled whether or not slip rings or integrated non-contact devices are fitted at time of export.

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:

Technical Note:

Stated 'positioning accuracy' levels derived under the following procedures from measurements made according to ISO 230/2 (1988)[17] *or national equivalents may be used for each machine tool model if provided to, and accepted by, national authorities instead of individual machine tests. Determination of 'Stated' positioning accuracy:*

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

b. Measure the linear axis accuracies according to ISO 230/2 (1988[18]*);*

c. Determine the accuracy values (A) for each axis of each machine. The method of calculating the accuracy value is described in the ISO 230/2 (1988)[19]*1 standard;*

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17 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.

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d. Determine the average accuracy value of each axis. This average value becomes the stated 'positioning accuracy' of each axis for the model (Âx Ây…);

e. Since Item 2B201 refers to each linear axis, there will be as many stated 'positioning accuracy' values as there are linear axes;

f. If any axis of a machine tool not controlled by 2B201.a., 2B201.b. or 2B201.c.. has a stated 'positioning accuracy' of 6 µm or better (less) for grinding machines, and 8 µm or better (less) for milling and turning machines, both according to ISO 230/2 (1988)[20], then the builder should be required to reaffirm the accuracy level once every eighteen months.

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 µm according to ISO 230/2 (1988)[21] 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";

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

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

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

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 µm according to ISO 230/2 (1988)[22] or national equivalents along any linear axis;

2. Two or more contouring rotary axes; or

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19 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.

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

Note: 2B201.b. does not control grinding machines as follows:

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

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

2. Axes limited to x, z and c;

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

c. Machine tools for turning, that have 'positioning accuracies' with "all compensations available" better (less) than 6 µm according to ISO 230/2 (1988) along any linear axis (overall positioning) for machines capable of machining diameters greater than 35 mm;

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

Note 1: 2B201 does not control special purpose machine tools limited to the manufacture of any of the following parts:

a. Gears;

b. Crankshafts or camshafts;

c. Tools or cutters;

d. Extruder worms.

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

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.

Technical Note:

In 2B204 the inside chamber dimension is that of the chamber in which both the working temperature and the working pressure are achieved and does not include fixtures. That dimension will be the smaller of either the inside diameter of the pressure chamber or the inside diameter of the insulated furnace chamber, depending on which of the two chambers is located inside the other.

2B206 Dimensional inspection machines, instruments or systems, 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/1000) µm (where L is the measured length in mm) at any point within the operating range of the machine (i.e., within the length of the axis), according to ISO 10360-2(2009); *or*

2. Three or more axes and having a three dimensional (volumetric) maximum permissible error of length measurement (E_0,MPE) equal to or less (better) than (1,7 + L/800) µm (where L is the measured length in mm) at any point within the operating range of the machine (i.e., within the length of the axis), according to ISO 10360-2(2009);

Technical Note:

The E_0,MPE of the most accurate configuration of the CMM specified according to ISO 10360-2(2009) by the manufacturer (e.g., best of the following: probe, stylus, length, motion parameters, environments) and with all compensations available shall be compared to the 1,7 + L/800 µm threshold.

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 µm per 5 mm; *and*

2. "Angular position deviation" equal to or less than 0,02 °.

Note 1: Machine tools that can be used as measuring machines are controlled if they meet or exceed the criteria specified for the machine tool function or the measuring machine function.

Note 2: A machine specified in 2B206 is controlled if it exceeds the control threshold anywhere within its operating range.

Technical Notes:

All parameters of measurement values in 2B206 represent plus/minus i.e., not total band.

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); *and*

2. Which, according to the manufacturer's technical specification, can be equipped with "numerical control" units or a computer control;

b. Rotor-forming mandrels designed to form cylindrical rotors of inside diameter between 75 mm and 400 mm.

Note: 2B209.a. includes machines which have only a single roller designed to deform metal plus two auxiliary rollers which support the mandrel, but do not participate directly in the deformation process.

2B219 Centrifugal multiplane balancing machines, fixed or portable, horizontal or vertical, as follows:

a. Centrifugal balancing machines designed for balancing flexible rotors having a length of 600 mm or more and having all of the following characteristics:

1. Swing or journal diameter greater than 75 mm;

2. Mass capability of from 0,9 to 23 kg; *and*

3. Capable of balancing speed of revolution greater than 5000 r.p.m.;

b. Centrifugal balancing machines designed for balancing hollow cylindrical rotor components and having all of the following characteristics:

1. Journal diameter greater than 75 mm;

2. Mass capability of from 0,9 to 23 kg;

3. Capable of balancing to a residual imbalance equal to or less than 0,01 kg ×mm/kg per plane; *and*

4. Belt drive type.

2B225 Remote manipulators that can be used to provide remote actions in radiochemical separation operations or hot cells, having either of the following characteristics:

a. A capability of penetrating 0,6 m or more of hot cell wall (through-the-wall operation); *or*

b. A capability of bridging over the top of a hot cell wall with a thickness of 0,6 m or more (over-the-wall operation).

Technical Note:

Remote manipulators provide translation of human operator actions to a remote operating arm and terminal fixture. They may be of 'master/slave' type or operated by joystick or keypad.

2B226 Controlled atmosphere (vacuum or inert gas) induction furnaces, and power supplies therefor, as follows:

N.B: SEE ALSO 3B.

a. Furnaces having all of the following characteristics:

1. Capable of operation above 1,123 K (850 °C);

2. Induction coils 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.

Note: 2B226.a. does not control furnaces designed for the processing of semiconductor wafers.

2B227 Vacuum or other controlled atmosphere metallurgical melting and casting furnaces and related equipment as follows:

a. Arc remelt and casting furnaces having both of the following characteristics:

1. Consumable electrode capacities between 1000 cm^3 and 20000 cm^3; *and*

2. Capable of operating with melting temperatures above 1973 K (1700 °C);

b. Electron beam melting furnaces and plasma atomization and melting furnaces, having both of the following characteristics:

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1. A power of 50 kW or greater; *and*

2. Capable of operating with melting temperatures above 1473 K (1,200 °C).

c. Computer control and monitoring systems specially configured for any of the furnaces specified in 2B227.a. or b.

2B228 Rotor fabrication or assembly equipment, rotor straightening equipment, bellows-forming mandrels and dies, as follows:

a. Rotor assembly equipment for assembly of gas centrifuge rotor tube sections, baffles, and end caps;

Note: 2B228.a. includes precision mandrels, clamps, and shrink fit machines.

b. Rotor straightening equipment for alignment of gas centrifuge rotor tube sections to a common axis;

Technical Note:

In 2B228.b. such equipment normally consists of precision measuring probes linked to a computer that subsequently controls the action of, for example, pneumatic rams used for aligning the rotor tube sections.

c. Bellows-forming mandrels and dies for producing single-convolution bellows.

Technical Note:

In 2B228.c. the bellows have all of the following characteristics:

1. Inside diameter between 75 mm and 400 mm;

2. Length equal to or greater than 12,7 mm;

3. Single convolution depth greater than 2 mm; and

4. Made of high-strength aluminium alloys, maraging steel or high strength "fibrous or filamentary materials".

2B230 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*

c. Having either of the following characteristics:

1. A full scale of less than 13 kPa and an 'accuracy' of better than ± 1 % of full-scale; *or*

2. A full scale of 13 kPa or greater and an 'accuracy' of better than ± 130 Pa when measured at 13 kPa.

Technical Notes:

1. In 2B230 'pressure transducer' means a device that converts a pressure measurement into a signal.

2. For the purposes of 2B230, 'accuracy' includes non-linearity, hysteresis and repeatability at ambient temperature.

2B231 Vacuum pumps having all of the following characteristics:

a. Input throat size equal to or greater than 380 mm;

b. Pumping speed equal to or greater than 15 m^3/s; *and*

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

Technical Notes:

1. The pumping speed is determined at the measurement point with nitrogen gas or air.

2. The ultimate vacuum is determined at the input of the pump with the input of the pump blocked off.

2B232 High-velocity gun systems (propellant, gas, coil, electromagnetic, and electrothermal types, and other advanced systems) capable of accelerating projectiles to 1,5 km/s or greater.

N.B.: SEE ALSO MILTARY GOODS CONTROLS.

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

N.B.: SEE ALSO 2B350.i.

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

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

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

1. Aluminium or aluminium alloy;

2. Aluminium oxide;

3. Stainless steel;

4. Nickel or nickel alloy;

5. Phosphor bronze; *or*

6. Fluoropolymers.

2B350 Chemical manufacturing facilities, equipment and components, as follows:

a. Reaction vessels or reactors, with or without agitators, with total internal (geometric) volume greater than 0,1 m^3 (100 litres) and less than 20 m^3 (20000 litres), where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:

1. 'Alloys' with more than 25 % nickel and 20 % chromium by weight;

2. Fluoropolymers (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^3 (100 litres) where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from any of the following materials:

1. 'Alloys' with more than 25 % nickel and 20 % chromium by weight;

2. Fluoropolymers (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^2, and less than 20 m^2; and tubes, plates, coils or blocks (cores) designed for such heat exchangers or condensers, where all surfaces that come in direct contact with the chemical(s) being processed are made from any of the following materials:

1. 'Alloys' with more than 25 % nickel and 20 % chromium by weight;

2. Fluoropolymers (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 10 mm (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 25,4 mm (1″) and equal to or less than 101,6 mm (4″);

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';

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

a. Casings (valve bodies);

b. Preformed casing liners;

Technical Notes:

1. For the purposes of 2B350.g., 'corrosion resistant materials' means any of the following materials:

a. Nickel or alloys with more than 40 % nickel by weight;

b. Alloys with more than 25 % nickel and 20 % chromium by weight;

c. Fluoropolymers (polymeric or elastomeric materials with more than 35 % fluorine by weight);

d. Glass or glass-lined (including vitrified or enamelled coating);

e. Tantalum or tantalum alloys;

f. Titanium or titanium alloys;

g. Zirconium or zirconium alloys;

h. Niobium (columbium) or niobium alloys; or

i. Ceramic materials as follows:

1. Silicon carbide with a purity of 80 % or more by weight;

2. Aluminium oxide (alumina) with a purity of 99.9 % or more by weight;

3. Zirconium oxide (zirconia).

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

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^3/hour, or vacuum pumps with manufacturer's specified maximum flow-rate greater than 5 m^3/hour (under standard temperature (273 K (0 °C)) and pressure (101,3 kPa) conditions), 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';

Technical Notes:

In 2B350.i., the term seal refers to only those seals that come into direct contact with the chemical(s) being processed (or are designed to), and provide a sealing function where a rotary or reciprocating drive shaft passes through a pump body.

j. Incinerators designed to destroy chemicals specified in entry 1C350, having specially designed waste supply systems, special handling facilities and an average combustion chamber temperature greater than 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.

Note: For the purposes of 2B350, the materials used for gaskets, packing, seals, screws, washers or other materials performing a sealing function do not determine the status of control, provided that such components are designed to be interchangeable.

Technical Notes:

1. 'Carbon graphite' is a composition consisting of amorphous carbon and graphite, in which the graphite content is eight percent or more by weight.

2. For the listed materials in the above entries, the term 'alloy' when not accompanied by a specific elemental concentration is understood as identifying those alloys where the identified metal is present in a higher percentage by weight than any other element.

2B351 Toxic gas 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^3; *or*

b. Designed for the detection of cholinesterase-inhibiting activity.

2B352 Equipment capable of use in handling biological materials, as follows:

a. Complete biological containment facilities at P3, P4 containment level;

Technical Note:

P3 or P4 (BL3, BL4, L3, L4) containment levels are as specified in the WHO Laboratory Biosafety manual (3rd edition Geneva 2004).

b. Fermenters and components as follows:

1. Fermenters capable of cultivation of pathogenic "microorganisms" or of live cells for the production of pathogenic viruses or toxins, without the propagation of aerosols, having a total capacity of 20 litres or more;

2. Components designed for fermenters in 2B352.b.1. as follows:

a. Cultivation chambers designed to be sterilised 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);

Technical Note:

For the purposes of 2B352.b. fermenters include bioreactors, single-use (disposable) bioreactors, chemostats and continuous-flow systems.

c. Centrifugal separators, capable of continuous separation without the propagation of aerosols, having all the following characteristics:

1. Flow rate exceeding 100 litres per hour;

2. Components of polished stainless steel or titanium;

3. One or more sealing joints within the steam containment area; and

4. Capable of in-situ steam sterilisation in a closed state;

Technical Note:

Centrifugal separators include decanters.

d. Cross (tangential) flow filtration equipment and components as follows:

1. Cross (tangential) flow filtration equipment capable of separation of pathogenic micro-organisms, viruses, toxins or cell cultures having all of the following characteristics:

a. A total filtration area equal to or greater than 1 m^2; and

b. Having any of the following characteristics:

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

2. Using disposable or single-use filtration components;

Technical Note:

In 2B352.d.1.b. sterlised denotes the elimination of all viable microbes from the equipment through the use of either physical (e.g. steam) or chemical agents. Disinfected denotes the destruction of potential microbial infectivity in the equipment through the use of chemical agents with a germicidal effect. Disinfection and sterilisation are distinct from sanitisation, the latter referring to cleaning procedures designed to lower the microbial content of equipment without necessarily achieving elimination of all microbial infectivity or viability.

Note: 2B352.d. does not control reverse osmosis equipment, as specified by the manufacturer.

2. Cross (tangential) flow filtration components (e.g. modules, elements, cassettes, cartridges, units or plates) with filtration area equal to or greater than 0,2 m^2 for each component and designed for use in cross (tangential) flow filtration equipment specified in 2B352.d.;

e. Steam sterilisable freeze drying equipment with a condenser capacity exceeding 10 kg of ice in 24 hours and less than 1000 kg of ice in 24 hours;

f. Protective and containment equipment, as follows:

1. Protective full or half suits, or hoods dependent upon a tethered external air supply and operating under positive pressure;

Note: 2B352.f.1. does not control suits designed to be worn with self-contained breathing apparatus.

2. Class III biological safety cabinets or isolators with similar performance standards;

Note: In 2B352.f.2., isolators include flexible isolators, dry boxes, anaerobic chambers, glove boxes and laminar flow hoods (closed with vertical flow).

g. Chambers designed for aerosol challenge testing with "microorganisms", viruses or "toxins" and having a capacity of 1 m^3 or greater;

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

1. A water evaporation capacity of ≥ 0,4 kg/h and ≤ 400 kg/h;

2. The ability to generate a typical mean product particle size of ≤10 μm 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 sterilised or disinfected in situ.

13. *2C Materials*

None.

14. *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

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

Note: 2D001 does not control part programming "software" that generates "numerical control" codes for machining various parts.

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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-ordinating simultaneously more than four axes for "contouring control".

Note 1: 2D002 does not control "software" specially designed or modified for the operation of items not specified in Category 2.

Note 2: 2D002 does not control "software" for items specified in 2B002. See 2D001 and 2D003 for "software" for items specified in 2B002.

Note 3: 2D002 does not control "software" that is exported with, and the minimum necessary for the operation of, items not specified by Category 2.

2D003 "Software", designed or modified for the operation of equipment specified in 2B002, that converts optical design, workpiece measurements and material removal functions into "numerical control" commands to achieve the desired workpiece form.

2D101 "Software" specially designed or modified for the "use" of equipment specified in 2B104, 2B105, 2B109, 2B116, 2B117 or 2B119 to 2B122.

N.B.: SEE ALSO 9D004.

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

2D202 "Software" specially designed or modified for the "development", "production" or "use" of equipment specified in 2B201.

Note: 2D202 does not control part programming "software" that generates "numerical control" command codes but does not allow direct use of equipment for machining various parts.

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

15. *2E Technology*

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

Note: 2E001 includes "technology" for the integration of probe systems into coordinate measurement machines specified in 2B006.a.

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 the "development" of interactive graphics as an integrated part in "numerical control" units for preparation or modification of part programmes;

b. "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";

2. Technical data consisting of process methods or parameters as listed below used to control:

   a. "Superplastic forming" of aluminium alloys, titanium alloys or "superalloys":

      1. Surface preparation;

      2. Strain rate;

      3. Temperature;

      4. Pressure;

   b. "Diffusion bonding" of "superalloys" or titanium alloys:

      1. Surface preparation;

      2. Temperature;

      3. Pressure;

   c. "Direct-acting hydraulic pressing" of aluminium alloys or titanium alloys:

      1. Pressure;

      2. Cycle time;

   d. "Hot isostatic densification" of titanium alloys, aluminium alloys or "superalloys":

      1. Temperature;

      2. Pressure;

      3. Cycle time;

c. "Technology" for the "development" or "production" of hydraulic stretch-forming machines and dies therefor, for the manufacture of airframe structures;

d. "Technology" for the "development" of generators of machine tool instructions (e.g., part programmes) from design data residing inside "numerical control" units;

e. "Technology" for the "development" of integration "software" for incorporation of expert systems for advanced decision support of shop floor operations into "numerical control" units;

f. "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 and defined in the Technical Note.

Note: The table and Technical Note appear after entry 2E301.

N.B. This table should be read to specify the technology of a particular Coating Process only when the Resultant Coating in column 3 is in a paragraph directly across from the relevant Substrate under column 2. For example, Chemical Vapour Deposition (CVD) coating process technical data are included for the application of silicides to carbon-carbon, ceramic and metal "matrix" "composites" substrates, but are not included for the application of silicides to 'cemented tungsten carbide' (16), 'silicon carbide' (18) substrates. In the second case, the resultant coating is not listed in the paragraph under column 3 directly across from the paragraph under column 2 listing 'cemented tungsten carbide' (16), 'silicon carbide' (18).

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 (1)[23]	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

[23] The numbers in parenthesis refer to the Notes following this Table.

		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 (9)	Dielectric layers (15) Diamond Diamond-like carbon (17)
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 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) Borides Beryllium
	Sensor window materials (9)	Dielectric layers (15)
	Titanium alloys (13)	Borides Nitrides
B.2. Ion assisted resistive	Ceramics (19) and Low-	Dielectric layers (15)

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heating Physical Vapour Deposition (PVD) (Ion Plating)	expansion glasses	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.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
B.4. Physical Vapour Deposition (PVD): Cathodic Arc Discharge	"Superalloys"	Alloyed silicides Alloyed aluminides (2) MCrAlX (5)
	Polymers (11) and Organic "matrix"	Borides

	"composites"	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)
	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	MCrAlX (5)

	(7)	Modified zirconia (12) Mixtures thereof (4)
	Titanium alloys (13)	Carbides Aluminides 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) Dielectic layers (15)

		Diamond-like carbon (17)
	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
	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
	Sensor window materials (9)	Dielectric layers (15) Diamond-like carbon (17)
	Refractory metals and	Aluminides

	alloys (8)	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

TABLE — DEPOSITION TECHNIQUES — NOTES

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;

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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. "Technology" for single-step pack cementation of solid airfoils is not controlled by Category 2.

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 1×10^{-7} K^{-1} 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" specially designed to deposit 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.

TABLE — DEPOSITION TECHNIQUES — TECHNICAL NOTE

Processes specified in Column 1 of the Table are defined as follows:

a. Chemical Vapour Deposition (CVD) is an overlay coating or surface modification coating process wherein a metal, alloy, "composite", dielectric or ceramic is deposited upon a heated substrate. Gaseous reactants are decomposed or combined in the vicinity of a substrate resulting in the deposition of the desired elemental, alloy or compound material on the substrate. Energy for this decomposition or chemical reaction process may be provided by the heat of the substrate, a glow discharge plasma, or "laser" irradiation.

N.B. 1 CVD includes the following processes: directed gas flow out-of-pack deposition, pulsating CVD, controlled nucleation thermal deposition (CNTD), plasma enhanced or plasma assisted CVD processes.

N.B. 2 Pack denotes a substrate immersed in a powder mixture.

N.B. 3 The gaseous reactants used in the out-of-pack process are produced using the same basic reactions and parameters as the pack cementation process, except that the substrate to be coated is not in contact with the powder mixture.

b. Thermal Evaporation-Physical Vapour Deposition (TE-PVD) is an overlay coating process conducted in a vacuum with a pressure less than 0,1 Pa wherein a source of thermal energy is used to vaporize the coating material. This process results in the condensation, or deposition, of the evaporated species onto appropriately positioned substrates.

The addition of gases to the vacuum chamber during the coating process to synthesize compound coatings is an ordinary modification of the process.

The use of ion or electron beams, or plasma, to activate or assist the coating's deposition is also a common modification in this technique. The use of monitors to provide in-process measurement of optical characteristics and thickness of coatings can be a feature of these processes.

Specific TE-PVD processes are as follows:

1. Electron Beam PVD uses an electron beam to heat and evaporate the material which forms the coating;

2. Ion Assisted Resistive Heating PVD employs electrically resistive heating sources in combination with impinging ion beam(s) to produce a controlled and uniform flux of evaporated coating species;

3. "Laser" Vaporization uses either pulsed or continuous wave "laser" beams to vaporize the material which forms the coating;

4. Cathodic Arc Deposition employs a consumable cathode of the material which forms the coating and has an arc discharge established on the surface by a momentary contact of a ground trigger. Controlled motion of arcing erodes the cathode surface creating a highly ionized plasma. The anode can be either a cone attached to the periphery of the cathode, through an insulator, or the chamber. Substrate biasing is used for non line-of-sight deposition.

   N.B. This definition does not include random cathodic arc deposition with non-biased substrates.

5. Ion Plating is a special modification of a general TE-PVD process in which a plasma or an ion source is used to ionize the species to be deposited, and a negative bias is applied to the substrate in order to facilitate the extraction of the species from the plasma. The introduction of reactive species, evaporation of solids within the process chamber, and the use of monitors to provide in-process measurement of optical characteristics and thicknesses of coatings are ordinary modifications of the process.

c. Pack Cementation is a surface modification coating or overlay coating process wherein a substrate is immersed in a powder mixture (a pack), that consists of:

   1. The metallic powders that are to be deposited (usually aluminium, chromium, silicon or combinations thereof);

   2. An activator (normally a halide salt); and

   3. An inert powder, most frequently alumina.

   The substrate and powder mixture is contained within a retort which is heated to between 1030 K (757 °C) and 1375 K (1,102 °C) for sufficient time to deposit the coating.

d. Plasma Spraying is an overlay coating process wherein a gun (spray torch) which produces and controls a plasma accepts powder or wire coating materials, melts them and propels them towards a substrate, whereon an integrally bonded coating is formed. Plasma spraying constitutes either low pressure plasma spraying or high velocity plasma spraying.

   N.B. 1 Low pressure means less than ambient atmospheric pressure.

N.B. 2 High velocity refers to nozzle-exit gas velocity exceeding 750 m/s calculated at 293 K (20 °C) at 0,1 MPa.

e. Slurry Deposition is a surface modification coating or overlay coating process wherein a metallic or ceramic powder with an organic binder is suspended in a liquid and is applied to a substrate by either spraying, dipping or painting, subsequent air or oven drying, and heat treatment to obtain the desired coating.

f. Sputter Deposition is an overlay coating process based on a momentum transfer phenomenon, wherein positive ions are accelerated by an electric field towards the surface of a target (coating material). The kinetic energy of the impacting ions is sufficient to cause target surface atoms to be released and deposited on an appropriately positioned substrate.

N.B. 1 The Table refers only to triode, magnetron or reactive sputter deposition which is used to increase adhesion of the coating and rate of deposition and to radio frequency (RF) augmented sputter deposition used to permit vaporisation of non-metallic coating materials.

N.B. 2 Low-energy ion beams (less than 5 keV) can be used to activate the deposition.

g. Ion Implantation is a surface modification coating process in which the element to be alloyed is ionized, accelerated through a potential gradient and implanted into the surface region of the substrate. This includes processes in which ion implantation is performed simultaneously with electron beam physical vapour deposition or sputter deposition.

CATEGORY 3 — ELECTRONICS

16. *3A Systems, Equipment and Components*

Note 1: The control status of equipment and components described in 3A001 or 3A002, other than those described in 3A001.a.3. to 3A001.a.10., 3A001.a.12. or 3A001.a.13, which are specially designed for or which have the same functional characteristics as other equipment is determined by the control status of the other equipment.

Note 2: The control status of integrated circuits described in 3A001.a.3. to 3A001.a.9., 3A001.a.12. or 3A001.a.13 Which are unalterably programmed or designed for a specific function for another equipment is determined by the control status of the other equipment.

N.B.: When the manufacturer or applicant cannot determine the control status of the other equipment, the control status of the integrated circuits is determined in 3A001.a.3. to 3A001.a.9., 3A001.a.12 and 3A001.a.13.

3A001 Electronic components and specially designed components therefor, as follows:

a. General purpose integrated circuits, as follows:

Note 1: The control status of wafers (finished or unfinished), in which the function has been determined, is to be evaluated against the parameters of 3A001.a.

Note 2: Integrated circuits include the following types:

– *"Monolithic integrated circuits";*

– *"Hybrid integrated circuits";*

– *"Multichip integrated circuits";*

– *"Film type integrated circuits", including silicon-on-sapphire integrated circuits;*

– *"Optical integrated circuits";*

– *"Three dimensional integrated circuits".*

1. Integrated circuits designed or rated as radiation hardened to withstand any of the following:

   a. A total dose of 5×10^3 Gy (silicon) or higher;

   b. A dose rate upset of 5×10^6 Gy (silicon)/s or higher; *or*

   c. A fluence (integrated flux) of neutrons (1 MeV equivalent) of 5×10^{13} n/cm^2 or higher on silicon, or its equivalent for other materials;

      Note: 3A001.a.1.c. does not control Metal Insulator Semiconductors (MIS).

2. "Microprocessor microcircuits", "microcomputer microcircuits", microcontroller microcircuits, storage integrated circuits manufactured from a compound semiconductor, analogue-to-digital converters, 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, electrical erasable programmable read-only memories (EEPROMs), flash memories or static random-access memories (SRAMs), 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);

      Note: 3A001.a.2. does not control integrated circuits for civil automobiles or railway train applications.

3. "Microprocessor microcircuits", "microcomputer microcircuits" and microcontroller microcircuits, manufactured from a compound semiconductor and operating at a clock frequency exceeding 40 MHz;

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Note: 3A001.a.3. includes digital signal processors, digital array processors and digital coprocessors.

4. Not used;

5. Analogue-to-Digital Converter (ADC) and Digital-to-Analogue Converter (DAC) integrated circuits, as follows:

   a. ADCs having any of the following:

      N.B.: SEE ALSO 3A101

      1. A resolution of 8 bit or more, but less than 10 bit, with an output rate greater than 1,000 million words per second;

      2. A resolution of 10 bit or more, but less than 12 bit, with an output rate greater than 300 million words per second;

      3. A resolution of 12 bit with an output rate greater than 200 million words per second;

      4. A resolution of more than 12 bit, but equal to or less than 14 bit, with an output rate greater than 125 million words per second; *or*

      5. A resolution of more than 14 bit with an output rate greater than 20 million words per second;

Technical Notes:

1. A resolution of n bit corresponds to a quantisation of 2^n levels.

2. The number of bits in the output word is equal to the resolution of the ADC.

3. The output rate is the maximum output rate of the converter, regardless of the architecture or oversampling.

4. For 'multiple channel ADCs', the outputs are not aggregated and the output rate is the maximum output rate of any single channel.

5. For 'interleaved ADCs' or for 'multiple channel ADCs' that are specified to have an interleaved mode of operation, the outputs are aggregated and the output rate is the maximum combined total output rate of all of the outputs.

6. Vendors may also refer to the output rate as sampling rate, conversion rate or throughput rate. It is often specified in megahertz (MHz) or mega samples per second (MSPS).

7. For the purpose of measuring output rate, one output word per second is equivalent to one Hertz or one sample per second.

8. 'Multiple channel ADCs' are defined as devices which integrate more than one ADC, designed so that each ADC has a separate analogue input.

9. 'Interleaved ADCs' are defined as devices which 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.

b. Digital-to-Analogue Converters (DAC) having any of the following:

1. A resolution of 10 bit or more with an 'adjusted update rate' of greater than 3500 MSPS; *or*

2. 1 A resolution of 12 bit or more with an 'adjusted update rate' of greater than 1250 MSPS and having any of the following:

a. A settling time less than 9 ns to 0,024 % of full scale from a full scale step; *or*

b. A 'Spurious Free Dynamic Range' (SFDR) greater than 68 dBc (carrier) when synthesising a full scale analogue signal of 100 MHz or the highest full scale analogue signal frequency specified below 100 MHz.

Technical Notes:

1. 'Spurious Free Dynamic Range' (SFDR) is defined as the ratio of the RMS value of the carrier frequency (maximum signal component) at the input of the DAC to the RMS value of the next largest noise or harmonic distortion component at its output.

2. SFDR is determined directly from the specification table or from the characterisation plots of SFDR versus frequency.

3. A signal is defined to be full scale when its amplitude is greater than – 3 dBfs (full scale).

4. 'Adjusted update rate' for DACs:

a. For conventional (non-interpolating) DACs, the 'adjusted update rate' is the rate at which the digital signal is converted to an analogue signal and the output analogue values are changed by the DAC. For DACs where the interpolation mode may be bypassed (interpolation factor of one), the DAC should be considered as a conventional (non-interpolating) DAC.

b. For interpolating DACs (oversampling DACs), the 'adjusted update rate' is defined as the DAC update rate divided by the smallest interpolating factor. For interpolating DACs, the 'adjusted update rate' may be referred to by different terms including:

– *input data rate*

– *input word rate*

– *input sample rate*

– *maximum total input bus rate*

– *maximum DAC clock rate for DAC clock input.*

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;

   Note: 3A001.a.7. includes:

   – *Simple Programmable Logic Devices (SPLDs)*

   – *Complex Programmable Logic Devices (CPLDs)*

   – *Field Programmable Gate Arrays (FPGAs)*

   – *Field Programmable Logic Arrays (FPLAs)*

   – *Field Programmable Interconnects (FPICs)*

   Technical Notes:

   1. Maximum number of digital input/outputs in 3A001.a.7.a. is also referred to as the maximum user input/outputs or maximum available input/outputs, whether the integrated circuit is packaged or bare die.

   2. 'Aggregate one-way peak serial transceiver data rate' is the product of the peak serial one-way transceiver data rate times the number of transceivers on the FPGA.

8. Not used;

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 1500 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 3000 (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 $(N \log_2 N)$ /20480 ms, where N is the number of points;

Technical Note:

When N is equal to 1,024 points, the formula in 3A001.a.12. gives an execution time of 500 µs.

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;

Technical Note:

The DAC clock frequency may be specified as the master clock frequency or the input clock frequency

b. Microwave or millimetre wave components, as follows:

Technical Note:

For purposes of 3A001.b., the parameter peak saturated power output may also be referred to on product data sheets as output power, saturated power output, maximum power output, peak power output, or peak envelope power output.

1. Electronic vacuum tubes and cathodes, as follows:

Note 1: 3A001.b.1. does not control tubes designed or rated for operation in any frequency band and having all of the following:

a. Does not exceed 31,8 GHz; and

b. Is "allocated by the ITU" for radio-communications services, but not for radio-determination.

Note 2: 3A001.b.1. does not control non-"space-qualified" tubes having all of the following:

a. An average output power equal to or less than 50 W; and

b. Designed or rated for operation in any frequency band and having all of the following:

1. Exceeds 31,8 GHz but does not exceed 43,5 GHz; and

2. Is "allocated by the ITU" for radio-communications services, but not for radio-determination.

a. Travelling wave tubes, pulsed or continuous wave, as follows:

1. Tubes operating at frequencies exceeding 31,8 GHz;

2. Tubes having a cathode heater element with a turn on time to rated RF power of less than 3 seconds;

3. Coupled cavity tubes, or derivatives thereof, with a "fractional bandwidth" of more than 7 % or a peak power exceeding 2,5 kW;

4. Helix tubes, 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; *or*

c. Being "space-qualified";

b. Crossed-field amplifier tubes with a gain of more than 17 dB;

c. Impregnated cathodes designed for electronic tubes producing a continuous emission current density at rated operating conditions exceeding 5 A/cm^2;

2. Microwave "Monolithic Integrated Circuits" (MMIC) power amplifiers that are any of the following:

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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;

Note 1: Not used.

Note 2: The control status of the MMIC whose rated operating frequency includes frequencies listed in more than one frequency range, as defined by 3A001.b.2.a. to 3A001.b.2.h., is determined by the lowest peak saturated power output threshold.

Note 3: Notes 1 and 2 in 3A mean that 3A001.b.2. does not control MMICs if they are specially designed for other applications, e.g., telecommunications, radar, automobiles.

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;

Note 1: The control status of a transistor whose rated operating frequency includes frequencies listed in more than one frequency range, as defined by 3A001.b.3.a. to 3A001.b.3.e., is determined by the lowest peak saturated power output threshold.

Note 2: 3A001.b.3. includes bare dice, dice mounted on carriers, or dice mounted in packages. Some discrete transistors may also be referred to as power amplifiers, but the status of these discrete transistors is determined by 3A001.b.3.

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; *or*

f. Rated for operation at frequencies above 2,7 GHz and having all of the following:

1. A peak saturation power (in watts), P_{sat}, greater than 400 divided by the maximum operating frequency (in GHz) squared [P_{sat} >400 W*GHz^2/f_{GHz}^2];

2. A "fractional bandwidth" of 5 % or greater; *and*

3. Any two sides perpendicular to one another with either length d (in cm) equal to or less than 15 divided by the lowest operating frequency in GHz [$d \leq 15$ cm*GHz/ f_{GHz}];

Technical Note:

*2.7 GHz should be used as the lowest operating frequency (f_{GHz}) in the formula in 3A001.b.4.f.3., for amplifiers that have a rated operating range extending downward to 2.7 GHz and below [$d \leq 15$ cm*GHz/2,7 GHz]*.

N.B.: MMIC power amplifiers should be evaluated against the criteria in 3A001.b.2.

Note 1: Not used.

Note 2: The control status of an item whose rated operating frequency includes frequencies listed in more than one frequency range, as defined by 3A001.b.4.a. to 3A001.b.4.e., is determined by the lowest peak saturation output threshold.

Note 3: 3A001.b.4. includes transmit/receive modules and transmit modules.

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 μs and having any of the following:

a. A band-pass bandwidth of more than 0,5 % of centre frequency; *or*

b. A band-stop bandwidth of less than 0,5 % of centre frequency;

6. Not used;

7. Converters and harmonic mixers that are any of the following:

a. Designed to extend the frequency range of "signal analysers" beyond 90 GHz;

b. Designed to extend the operating range of signal generators as follows:

1. Beyond 90 GHz;

2. To an output power greater than 100 mW (20 dBm) anywhere within the frequency range exceeding 43.5 GHz but not exceeding 90 GHz;

c. Designed to extend the operating range of network analysers as follows:

1. Beyond 110 GHz;

2. To an output power greater than 31.62 mW (15 dBm) anywhere within the frequency range exceeding 43.5 GHz but not exceeding 90 GHz;

3. To an output power greater than 1 mW (0 dBm) anywhere within the frequency range exceeding 90 GHz but not exceeding 110 GHz; *or*

d. Designed to extend the frequency range of microwave test receivers beyond 110 GHz;

8. Microwave power amplifiers containing tubes specified in 3A001.b.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^3;

Note: 3A001.b.8. does not control equipment designed or rated for operation in any frequency band which is "allocated by the ITU" for radio-communications services, but not for radio-determination.

9. Microwave power modules (MPM) consisting of, at least, a travelling wave tube, a microwave "monolithic integrated circuit" 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;

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b. A volume less than the maximum rated power in Watts multiplied by 10 cm^3/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;

Technical Notes:

1. To calculate the volume in 3A001.b.9.b., the following example is provided: for a maximum rated power of 20 W, the volume would be: 20 W × 10 cm^3/W = 200 cm^3.

2. The 'turn-on time' in 3A001.b.9.a. refers to the time from fully-off to fully operational, i.e., it includes the warm-up time of the MPM.

10. Oscillators or oscillator assemblies, specified to operate with a single sideband (SSB) phase noise, in dBc/Hz, less (better) than $-(126 + 20\log_{10}F - 20\log_{10}f)$ anywhere within the range of 10 Hz ≤ F ≤ 10 kHz;

Technical Note:

In 3A001.b.10., F is the offset from the operating frequency in Hz and f is the operating frequency in MHz.

11. "Frequency synthesiser" "electronic assemblies" having a "frequency switching time" as specified by any of the following:

a. Less than 156 ps;

b. Less than 100 μs for any frequency change exceeding 1,6 GHz within the synthesised frequency range exceeding 4,8 GHz but not exceeding 10,6 GHz;

c. Less than 250 μs for any frequency change exceeding 550 MHz within the synthesised frequency range exceeding 10,6 GHz but not exceeding 31,8 GHz;

d. Less than 500 μs for any frequency change exceeding 550 MHz within the synthesised frequency range exceeding 31,8 GHz but not exceeding 43,5 GHz;

e. Less than 1 ms for any frequency change exceeding 550 MHz within the synthesised frequency range exceeding 43,5 GHz but not exceeding 56 GHz;

f. Less than 1 ms for any frequency change exceeding 2,2 GHz within the synthesized frequency range exceeding 56 GHz but not exceeding 90 GHz; or

g. Less than 1 ms within the synthesized frequency range exceeding 90 GHz;

N.B.: For general purpose "signal analysers", signal generators, network analysers and microwave test receivers, see 3A002.c., 3A002.d., 3A002.e. and 3A002.f., respectively.

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 μs and bandwidth in MHz) of more than 100;

3. A bandwidth greater than 250 MHz; *or*

4. A dispersive delay of more than 10 μs; *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 μs and bandwidth in MHz) of more than 100;

2. A dispersive delay of more than 10 μs; *or*

3. A 'frequency side-lobe rejection' exceeding 65 dB and a bandwidth greater than 100 MHz;

Technical Note:

'Frequency side-lobe rejection' is the maximum rejection value specified in data sheet.

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;

Note: 3A001.c. does not control acoustic wave devices that are limited to a single band pass, low pass, high pass or notch filtering, or resonating function.

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 10000;

e. High energy devices as follows:

1. 'Cells' as follows:

a. 'Primary cells' having an 'energy density' exceeding 550 Wh/kg at 20 °C;

b. 'Secondary cells' having an 'energy density' exceeding 300 Wh/kg at 20 °C;

Technical Notes:

1. For the purpose of 3A001.e.1.,'energy density' (Wh/kg) is calculated from the nominal voltage multiplied by the nominal capacity in ampere-hours (Ah) divided by the mass in kilograms. If the nominal capacity is not stated, energy density is calculated from the nominal voltage squared then multiplied by the discharge duration in hours divided by the discharge load in ohms and the mass in kilograms.

2. For the purpose of 3A001.e.1., a 'cell' is defined as an electrochemical device, which has positive and negative electrodes, an electrolyte, and is a source of electrical energy. It is the basic building block of a battery.

3. For the purpose of 3A001.e.1.a., a 'primary cell' is a 'cell' that is not designed to be charged by any other source.

4. For the purpose of 3A001.e.1.b., a 'secondary cell' is a 'cell' that is designed to be charged by an external electrical source.

Note: 3A001.e.1. does not control batteries, including single-cell batteries.

2. High energy storage capacitors as follows:

N.B SEE ALSO 3A201.a. and the Military Goods Controls.

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 10000;

3. "Superconductive" electromagnets and solenoids, specially designed to be fully charged or discharged in less than one second and having all of the following:

N.B. SEE ALSO 3A201.b.

Note: 3A001.e.3. does not control "superconductive" electromagnets or solenoids specially designed for Magnetic Resonance Imaging (MRI) medical equipment.

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^2;

4. Solar cells, cell-interconnect-coverglass (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 'AM0' illumination with an irradiance of 1367 watts per square metre (W/m^2);

Technical Note:

'AM0', or 'Air Mass Zero', refers to the spectral irradiance of sun light in the earth's outer atmosphere when the distance between the earth and sun is one astronomical unit (AU).

f. Rotary input type absolute position encoders having an accuracy equal to or less (better) than ± 1,0 second of arc;

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 30000 A/µs and off-state voltage greater than 1100 V; *or*

2. A maximum turn-on current rate of rise (di/dt) greater than 2000 A/µs and having all of the following:

   a. An off-state peak voltage equal to or greater than 3000 V; *and*

   b. A peak (surge) current equal to or greater than 3000 A.

Note 1: 3A001.g. includes:

– *Silicon Controlled Rectifiers (SCRs)*

– *Electrical Triggering Thyristors (ETTs)*

– *Light Triggering Thyristors (LTTs)*

– *Integrated Gate Commutated Thyristors (IGCTs)*

– *Gate Turn-off Thyristors (GTOs)*

– *MOS Controlled Thyristors (MCTs)*

– *Solidtrons*

Note 2: 3A001.g. does not control thyristor devices and 'thyristor modules' incorporated into equipment designed for civil railway or "civil aircraft" applications.

Technical Note:

For the purposes of 3A001.g., a 'thyristor module' contains one or more thyristor devices.

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 (blocking voltage) exceeding 300 V; *and*

3. Continuous current greater than 1 A.

Note 1: Repetitive peak off-state voltage in 3A001.h. includes drain to source voltage, collector to emitter voltage, repetitive peak reverse voltage and peak repetitive off-state blocking voltage.

Note 2: 3A001.h. includes:

– *Junction Field Effect Transistors (JFETs)*

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– *Vertical Junction Field Effect Transistors (VJFETs)*

– *Metal Oxide Semiconductor Field effect Transistors (MOSFETs)*

– *Double Diffused Metal Oxide Semiconductor Field Effect Transistor (DMOSFET)*

– *Insulated Gate Bipolar Transistor (IGBT)*

– *High Electron Mobility Transistors (HEMTs)*

– *Bipolar Junction Transistors (BJTs)*

– *Thyristors and Silicon Controlled Rectifiers (SCRs)*

– *Gate Turn-Off Thyristors (GTOs)*

– *Emitter Turn-Off Thyristors (ETOs)*

– *PiN Diodes*

– *Schottky Diodes*

Note 3: 3A001.h. does not control switches, diodes, or 'modules', incorporated into equipment designed for civil automobile, civil railway or "civil aircraft" applications.

Technical Note:

For the purposes of 3A001.h., 'modules' contain one or more solid-state power semiconductor switches or diodes.

3A002 General purpose electronic equipment as follows:

a. Recording equipment and oscilloscopes as follows:

1. Not used;

2. Not used;

3. Not used;

4. Not used;

5. Waveform digitisers and transient recorders, having all of the following:

a. Digitising rate equal to or more than200 million samples per second and a resolution of 10 bit or more;

b. A 'continuous throughput' of 2 Gbit/s or more; and

c. Triggered acquisition of transients or aperiodic signals

Technical Notes:

1. For those instruments with a parallel bus architecture, the 'continuous throughput' rate is the highest word rate multiplied by the number of bits in a word.

2. 'Continuous throughput' is the fastest data rate the instrument can output to mass storage without the loss of any information whilst sustaining the sampling rate and analogue-to-digital conversion.

3. For the purposes of 3A002.a.5.c., acquisition can be triggered internally or externally.

6. Digital instrumentation data recorder systems using magnetic disk storage technique and having all of the following, and specially designed digital recorders therefor:

   a. Digitised instrumentation data rate equal to or more than 100 million samples per second at a resolution of 8 bit or more; *and*

   b. A 'continuous throughput' of 1 Gbit/s or more;

Technical Note:

Digital instrumentation data recorder systems can be configured either with a digitiser integrated within or outside the digital recorder.

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;

Note: 3A002.a.7. does not control equivalent-time sampling oscilloscopes

b. Not used;

c. "Signal analysers" as follows:

1. "Signal analysers" having a 3 dB resolution bandwidth (RBW) exceeding 10 MHz anywhere within the frequency range exceeding 31,8 GHz but not exceeding 37 GHz;

2. "Signal analysers" having Displayed Average Noise Level (DANL) less (better) than -150 dBm/Hz anywhere within the frequency range exceeding 43,5 GHz but not exceeding 90 GHz;

3. "Signal analysers" having a frequency exceeding 90 GHz;

4. "Signal analysers" having all of the following:

   a. "Real-time bandwidth" exceeding 170 MHz; *and*

b. 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 15 μs or less;

Technical Notes:

1. Probability of discovery in 3A002.c.4.b. is also referred to as probability of intercept or probability of capture.

2. For the purposes of 3A002.c.4.b., the duration for 100 % probability of discovery is equivalent to the minimum signal duration necessary for the specified level measurement uncertainty.

Note: 3A002.c.4. does not control those "signal analysers" using only constant percentage bandwidth filters (also known as octave or fractional octave filters).

5. "Signal analysers" having a "frequency mask trigger" function with 100 % probability of trigger (capture) for signals having a duration of 15μs or less;

d. Signal 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 90 GHz;

3. A "frequency switching time" as specified by any of the following:

a. Not used;

b. Less than 100 μs for any frequency change exceeding 2,2GHz within the frequency range exceeding 4,8 GHz but not exceeding 31,8 GHz;

c. Not used.

d. Less than 500 μs for any frequency change exceeding 550 MHz within the frequency range exceeding 31,8 GHz but not exceeding 37 GHz;

e. Less than 100 μs for any frequency change exceeding 2,2 GHz within the frequency range exceeding 37 GHz but not exceeding 90 GHz; *or*

f. Not used

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 Hz < F < 10 kHz anywhere within the frequency range exceeding 3,2 GHz but not exceeding 90 GHz; *or*

b. Less (better) than $-(206 - 20\log_{10}f)$ anywhere within the range of 10 kHz < F≤ 100 kHz anywhere within the frequency range exceeding 3,2 GHz but not exceeding 90 GHz; *or*

Technical Note:

In 3A002.d.4., F is the offset from the operating frequency in Hz and f is the operating frequency in MHz;

5. A maximum frequency exceeding 90 GHz;

Note 1.: For the purpose of 3A002.d., signal generators include arbitrary waveform and function generators.

Note 2.: 3A002.d. does not control equipment in which the output frequency is either produced by the addition or subtraction of two or more crystal oscillator frequencies, or by an addition or subtraction followed by a multiplication of the result.

Technical Notes:

1. The maximum frequency of an arbitrary waveform or function generator is calculated by dividing the sample rate, in samples/second, by a factor of 2,5.

2. For the purposes of 3A002.d.1.a, 'pulse duration' is defined as the time interval from the point on the leading edge that is 50 % of the pulse amplitude to the point on the trailing edge that is 50 % of the pulse amplitude.

e. Network analysers having any of the following:

1. An output power exceeding 31,62 mW (15 dBm) anywhere within the operating frequency range exceeding 43,5 GHz but not exceeding 90 GHz;

2. An output power exceeding 1 mW (0 dBm) anywhere within the operating frequency range exceeding 90 GHz but not exceeding 110 GHz;

3. 'Nonlinear vector measurement functionality' at frequencies exceeding 50 GHz but not exceeding 110 GHz; *or*

Technical Note:

'Nonlinear vector measurement functionality' is an instrument's ability to analyse the test results of devices driven into the large-signal domain or the non-linear distortion range.

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 1×10^{-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 1×10^{-11}/month; *and*

c. Total power consumption of less than 1 W.

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.

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

3A102 'Thermal batteries' designed or modified for 'missiles'.

Technical Notes:

1. In 3A102 'thermal batteries' are single use batteries that contain a solid non-conducting inorganic salt as the electrolyte. These batteries incorporate a pyrolytic material that, when ignited, melts the electrolyte and activates the battery.

2. In 3A102 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

3A201 Electronic components, other than those specified in 3A001, as follows;

a. Capacitors having either of the following sets of characteristics:

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1.

a. Voltage rating greater than 1,4 kV;

b. Energy storage greater than 10 J;

c. Capacitance greater than 0,5 μF; *and*

d. Series inductance less than 50 nH; *or*

2.

a. Voltage rating greater than 750 V;

b. Capacitance greater than 0,25 μF; *and*

c. Series inductance less than 10 nH;

b. Superconducting solenoidal electromagnets having all of the following characteristics:

1. Capable of creating magnetic fields greater than 2 T;

2. A ratio of length to inner diameter greater than 2;

3. Inner diameter greater than 300 mm; *and*

4. Magnetic field uniform to better than 1 % over the central 50 % of the inner volume;

Note: 3A201.b. does not control magnets specially designed for and exported 'as parts of' medical nuclear magnetic resonance (NMR) imaging systems. The phrase 'as part of' does not necessarily mean physical part in the same shipment; separate shipments from different sources are allowed, provided the related export documents clearly specify that the shipments are dispatched 'as part of' the imaging systems.

c. Flash X-ray generators or pulsed electron accelerators having either of the following sets of characteristics:

1.

a. An accelerator peak electron energy of 500 keV or greater but less than 25 MeV ; *and*

b. With a 'figure of merit' (K) of 0,25 or greater; *or*

2.

a. An accelerator peak electron energy of 25 MeV or greater; *and*

b. A 'peak power' greater than 50 MW.

Note: 3A201.c. does not control accelerators that are component parts of devices designed for purposes other than electron beam or X-ray radiation (electron microscopy, for example) nor those designed for medical purposes:

Technical Notes:

1. The 'figure of merit' K is defined as:

$K = 1,7 \times 10^3 V^{2.65} Q$

V is the peak electron energy in million electron volts.

If the accelerator beam pulse duration is less than or equal to 1 μs, then Q is the total accelerated charge in Coulombs. If the accelerator beam pulse duration is greater than 1 μs, then Q is the maximum accelerated charge in 1 μs.

Q equals the integral of i with respect to t, over the lesser of 1 μs or the time duration of the beam pulse ($Q = \int idt$), where i is beam current in amperes and t is time in seconds.

2. 'Peak power' = (peak potential in volts) × (peak beam current in amperes).

3. In machines based on microwave accelerating cavities, the time duration of the beam pulse is the lesser of 1 μs or the duration of the bunched beam packet resulting from one microwave modulator pulse.

4. In machines based on microwave accelerating cavities, the peak beam current is the average current in the time duration of a bunched beam packet.

3A225 Frequency changers or generators, other than those specified in 0B001.b.13., usable as a variable or fixed frequency motor drive, having all of the following characteristics:

N.B. 1: "Software" specially designed to enhance or release the performance of a frequency changer or generator to meet the characteristics of 3A225 is specified in 3D225.

N.B. 2: "Technology" in the form of codes or keys to enhance or release the performance of a frequency changer or generator to meet the characteristics of 3A225 is specified in 3E225.

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 %.

Note: 3A225 does not control frequency changers or generators if they have hardware, "software" or "technology" constraints that limit the performance to less than that specified above, provided they meet any of the following:

1. They need to be returned to the original manufacturer to make the enhancements or release the constraints;

2. *They require "software" as specified in 3D225 to enhance or release the performance to meet the characteristics of 3A225; or*

3. *They require "technology" in the form of keys or codes as specified in 3E225 to enhance or release the performance to meet the characteristics of 3A225.*

Technical Notes:

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

2. *Frequency changers in 3A225 may be marketed as Generators, Electronic Test Equipment, AC Power Supplies, Variable Speed Motors Drives, Variable Speed Drives (VSDs), Variable Frequency Drives (VFDs), Adjustable Frequency Drives (AFDs), or Adjustable Speed Drives (ASDs).*

3A226 High-power direct current power supplies, 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, as follows:

a. Cold-cathode tubes, whether gas filled or not, operating similarly to a spark gap, having all of the following characteristics:

1. Containing three or more electrodes;

2. Anode peak voltage rating of 2,5 kV or more;

3. Anode peak current rating of 100 A or more; *and*

4. Anode delay time of 10 μs or less;

Note: 3A228 includes gas krytron tubes and vacuum sprytron tubes.

b. Triggered spark-gaps having both of the following characteristics:

1. An anode delay time of 15 μs or less; *and*

2. Rated for a peak current of 500 A or more;

c. Modules or assemblies with a fast switching function, 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 μs or less.

3A229 High-current pulse generators as follows:

N.B.: SEE ALSO MILITARY GOODS CONTROLS.

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 μs 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.

Note: 3A229.b. includes xenon flash-lamp drivers.

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.

Technical Notes:

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

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

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

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

b. 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 3×10^9 neutrons/s or greater.

3A232 Multipoint initiation systems, other than those specified in 1A007, as follows:

N.B.: SEE ALSO MILITARY GOODS CONTROLS.

N.B.: See 1A007.b. for detonators.

a. Not used;

b. Arrangements using single or multiple detonators designed to nearly simultaneously initiate an explosive surface over greater than 5,000 mm^2 from a single firing signal with an initiation timing spread over the surface of less than 2,5 µs.

Note: 3A232 does not control detonators using only primary explosives, such as lead azide.

3A233 Mass spectrometers, other than those specified in 0B002.g., capable of measuring ions of 230 atomic mass units or greater and having a resolution of better than 2 parts in 230, as follows, and ion sources therefor:

a. Inductively coupled plasma mass spectrometers (ICP/MS);

b. Glow discharge mass spectrometers (GDMS);

c. Thermal ionization mass spectrometers (TIMS);

d. Electron bombardment mass spectrometers having both of the following features:

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

2. One or more 'cold traps' that can be cooled to a temperature of 193 K (–80 °C);

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e. Not used;

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

Technical Notes:

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

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

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

a. Voltage rating greater than 2 kV; *and*

b. Inductance of less than 20 nH.

17. *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 capable of producing a layer of any material other than silicon with a thickness uniform to less than ± 2,5 % across a distance of 75 mm or more;

Note: 3B001.a.1. includes 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. Not used;

2. 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;

3. Direct write capability;

4. 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*

5. 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;

c. Anisotropic plasma dry etching equipment having all of the following:

1. Designed or optimised to produce critical dimensions of 65 nm or less; *and*

2. Within-wafer non-uniformity equal to or less than 10 % 3σ measured with an edge exclusion of 2 mm or less;

d. Not used;

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., 3B001.b. or 3B001.c. are designed to be connected; *and*

2. Designed to form an integrated system in a vacuum environment for 'sequential multiple wafer processing';

Note: 3B001.e. does not control automatic robotic wafer handling systems specially designed for parallel wafer processing.

Technical Notes:

1. For the purpose of 3B001.e., 'semiconductor process tools' refers to modular tools that provide physical processes for semiconductor production that are functionally different, such as deposition, etch, implant or thermal processing.

2. For the purpose of 3B001.e., 'sequential multiple wafer processing' means the capability to process each wafer in different 'semiconductor process tools', such as by transferring each wafer from one tool to a second tool and on to a third tool with the automatic loading multi-chamber central wafer handling systems.

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;

Technical Note:

The 'Minimum Resolvable Feature size' (MRF) is calculated by the following formula:

$$MRF = \frac{\text{(an exposure light source wavelength in nm) x (K factor)}}{\text{numerical aperture}}$$

where the K factor = 0,35

2. Imprint lithography equipment capable of producing features of 45 nm or less;

   Note: 3B001.f.2. includes:

   – *Micro contact printing tools*

   – *Hot embossing tools*

   – *Nano-imprint lithography tools*

   – *Step and flash imprint lithography (S-FIL) tools*

3. Equipment specially designed for mask making or semiconductor device processing using direct writing methods, having all of the following:

   a. Using deflected focussed electron beam, ion beam or "laser" beam; *and*

   b. Having any of the following:

      1. A spot size smaller than 0,2 μm;

      2. Being capable of producing a pattern with a feature size of less than 1 μm; *or*

      3. An overlay accuracy of better than ± 0,20 μm (3 sigma);

g. Masks and reticles, designed for integrated circuits specified in 3A001;

h. Multi-layer masks with a phase shift layer not specified by 3B001.g. and having any of the following:

   1. Made on a mask "substrate blank" from glass specified as having less than 7 nm/cm birefringence; *or*

   2. Designed to be used by lithography equipment having a light source wavelength less than 245 nm;

   Note: 3B001.h. does not control multi-layer masks with a phase shift layer designed for the fabrication of memory devices not controlled by 3A001.

i. Imprint lithography templates designed for integrated circuits specified in 3A001.

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 transistor devices at frequencies exceeding 31,8 GHz;

b. Not used;

c. For testing microwave integrated circuits specified in 3A001.b.2.

18. *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); *or*

d. "III/V compounds" of gallium or indium.

Note: 3C001.d. does not control a "substrate" having one or more P-type epitaxial layers of GaN, InGaN, AlGaN, InAlN, InAlGaN, GaP, InGaP, AlInP or InGaAlP, independent of the sequence of the elements, except if the P-type epitaxial layer is between N-type layers.

3C002 Resist materials as follows and "substrates" coated with the following resists:

a. Resists designed for semiconductor lithography as follows:

1. Positive resists adjusted (optimised) for use at wavelengths less than 245 nm but equal to or greater than 15 nm;

2. Resists adjusted (optimised) 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 μcoulomb/mm^2 or better;

c. Not used;

d. All resists optimised for surface imaging technologies;

e. All resists designed or optimised 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 %.

Note: 3C003 only controls compounds whose metallic, partly metallic or non-metallic element is directly linked to carbon in the organic part of the molecule.

3C004 Hydrides of phosphorus, arsenic or antimony, having a purity better than 99,999 %, even diluted in inert gases or hydrogen.

Note: 3C004 does not control hydrides containing 20 % molar or more of inert gases or hydrogen.

3C005 Silicon carbide (SiC), gallium nitride (GaN), aluminium nitride (AlN) or aluminium gallium nitride (AlGaN) semiconductor "substrates", or ingots, boules, or other preforms of those materials, having resistivities greater than 10000 ohm-cm at 20 °C.

3C006 "Substrates" specified in 3C005 With at least one epitaxial layer of silicon carbide, gallium nitride, aluminium nitride or aluminium gallium nitride.

19. *3D Software*

3D001 "Software" specially designed for the "development" or "production" of equipment specified in 3A001.b. to 3A002.g. 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.

Technical Note:

'Physics-based' in 3D003 means using computations to determine a sequence of physical cause and effect events based on physical properties (e.g., temperature, pressure, diffusion constants and semiconductor materials properties).

Note: Libraries, design attributes or associated data for the design of semiconductor devices or integrated circuits are considered as "technology".

3D004 "Software" specially designed for the "development" of the equipment specified in 3A003.

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.

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20. *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;

Note 1: 3E001 does not control "technology" for the "production" of equipment or components controlled by 3A003.

Note 2: 3E001 does not control "technology" for the "development" or "production" of integrated circuits specified in 3A001.a.3. to 3A001.a.12., having all of the following:

a. Using "technology" at or above 0.130 µm; and

b. Incorporating multi-layer structures with three or fewer metal layers.

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, 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;

Technical Note:

A 'vector processor unit' is a processor element with built-in instructions that perform multiple calculations on floating-point vectors (one-dimensional arrays of 32-bit or larger numbers) simultaneously, having at least one vector arithmetic logic unit.

b. Designed to perform more than four 64-bit or larger floating-point operation results per cycle; *or*

c. Designed to perform more than four 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").

Note: 3E002.c. does not control "technology" for multimedia extensions.

Note 1: 3E002 does not control "technology" for the "development" or "production" of micro-processor cores, having all of the following:

a. Using "technology" at or above 0.130 µm; and

b. Incorporating multi-layer structures with five or fewer metal layers.

Note 2: 3E002 includes "technology" for digital signal processors and digital array processors.

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;

Note: 3E003.b. does not control "technology" for high electron mobility transistors (HEMT) operating at frequencies lower than 31,8 GHz and hetero-junction bipolar transistors (HBT) operating at frequencies lower than 31,8 GHz.

c. "Superconductive" electronic devices;

d. Substrates of films 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. Electronic vacuum tubes operating at frequencies of 31,8 GHz or higher.

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

Note 1: Computers, related equipment and "software" performing telecommunications or "local area network" functions must also be evaluated against the performance characteristics of Category 5, Part 1 (Telecommunications).

Note 2: Control units which directly interconnect the buses or channels of central processing units, "main storage" or disk controllers are not regarded as telecommunications equipment described in Category 5, Part 1 (Telecommunications).

N.B.: For the control status of "software" specially designed for packet switching, see 5D001.

Note 3: Computers, related equipment and "software" performing cryptographic, cryptanalytic, certifiable multi-level security or certifiable user isolation functions, or which limit electromagnetic compatibility (EMC), must also be evaluated against the performance characteristics in Category 5, Part 2 ("Information Security").

21. *4A Systems, Equipment and Components*

4A001 Electronic computers and related equipment, having any of the following and "electronic assemblies" and specially designed components therefor:

N.B.: SEE ALSO 4A101.

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*

Note: 4A001.a.1. does not control computers specially designed for civil automobile, railway train or "civil aircraft" applications.

2. Radiation hardened to exceed any of the following specifications:

a.	Total Dose		5×10^3 Gy (silicon);
b.	Dose Rate Upset		5×10^6 Gy (silicon)/s; *or*
c.	Single Event Upset		1×10^{-8} Error/bit/day;

Note: 4A001.a.2. does not control computers specially designed for "civil aircraft" applications.

b. Not used.

4A003 "Digital computers", "electronic assemblies", and related equipment therefor, as follows and specially designed components therefor:

Note 1: 4A003 includes the following:

– *'Vector processors';*

– *Array processors;*

– *Digital signal processors;*

– *Logic processors;*

– *Equipment designed for "image enhancement";*

– *Equipment designed for "signal processing".*

Note 2: The control status of the "digital computers" and related equipment described in 4A003 is determined by the control status of other equipment or systems provided:

a. The "digital computers" or related equipment are essential for the operation of the other equipment or systems;

b. The "digital computers" or related equipment are not a "principal element" of the other equipment or systems; and

N.B. 1: The control status of "signal processing" or "image enhancement" equipment specially designed for other equipment with functions limited to those required for the other equipment is determined by the control status of the other equipment even if it exceeds the "principal element" criterion.

N.B. 2: For the control status of "digital computers" or related equipment for telecommunications equipment, see Category 5, Part 1 (Telecommunications).

c. The "technology" for the "digital computers" and related equipment is determined by 4E.

a. Not used;

b. "Digital computers" having an "Adjusted Peak Performance" ("APP") exceeding 8.0 weighted TeraFLOPS (WT);

c. "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.;

Note 1: 4A003.c. controls only "electronic assemblies" and programmable interconnections not exceeding the limit specified in 4A003.b. when shipped as unintegrated "electronic assemblies". It does not control "electronic assemblies" inherently limited by nature of their design for use as related equipment specified in 4A003.e.

Note 2: 4A003.c. does not control "electronic assemblies" specially designed for a product or family of products whose maximum configuration does not exceed the limit specified in 4A003.b.

d. Not used;

e. Equipment performing analogue-to-digital conversions exceeding the limits specified in 3A001.a.5.;

f. Not used;

g. 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.

Note: 4A003.g. does not control internal interconnection equipment (e.g. backplanes, buses), passive interconnection equipment, "network access controllers" or "communications channel controllers".

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, operation or delivery of, or communication with, "intrusion software".

4A101 Analogue computers, "digital computers" or digital differential analysers, other than those specified in 4A001.a.1., 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 modelling, simulation or design integration of space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

Note: This control only applies when the equipment is supplied with "software" specified in 7D103 or 9D103.

22. *4B Test, Inspection and Production Equipment*

None.

23. *4C Materials*

None.

24. *4D Software*

Note: The control status of "software" for equipment described in other Categories is dealt with in the appropriate Category.

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 1,0 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.1.

4D002 Not used

4D003 Not used.

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4D004 "Software" specially designed or modified for the generation, operation or delivery of, or communication with, "intrusion software".

25. *4E Technology*

4E001

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", other than that specified in 4E001.a., specially designed or modified for the "development" or "production" of equipment as follows:

1. "Digital computers" having an "Adjusted Peak Performance" ("APP") exceeding 1,0 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.1.

c. "Technology" for the "development" of "intrusion software".

26. TECHNICAL NOTE ON "ADJUSTED PEAK PERFORMANCE" ("APP")

"APP" is an adjusted peak rate at which "digital computers" perform 64-bit or larger floating point additions and multiplications.

"APP" is expressed in Weighted TeraFLOPS (WT), in units of 10^{12} adjusted floating point operations per second

27. *Abbreviations used in this Technical Note*

n		number of processors in the "digital computer"
i		processor number (i,…n)
t_i		processor cycle time ($t_i = 1/F_i$)
F_i		processor frequency
R_i		peak floating point calculating rate
W_i		architecture adjustment factor

28. *Outline of "APP" calculation method*

1. For each processor i, determine the peak number of 64-bit or larger floating point operations, FPO_i, performed per cycle for each processor in the "digital computer".

Note In determining FPO, include only 64-bit or larger floating point additions and/or multiplications. All floating point operations must be expressed in operations per processor

cycle; operations requiring multiple cycles may be expressed in fractional results per cycle. For processors not capable of performing calculations on floating point operands of 64-bit or more, the effective calculating rate R is zero.

2. Calculate the floating point rate R for each processor $R_i = FPO_i/t_i$.

3. Calculate "APP" as "APP" = $W_1 \times R_1 + W_2 \times R_2 + \ldots + W_n \times R_n$.

4. For 'vector processors', $W_i = 0,9$. For non-'vector processors', $W_i = 0,3$.

Note 1 For processors that perform compound operations in a cycle, such as addition and multiplication, each operation is counted.

Note 2 For a pipelined processor the effective calculating rate R is the faster of the pipelined rate, once the pipeline is full, or the non-pipelined rate.

Note 3 The calculating rate R of each contributing processor is to be calculated at its maximum value theoretically possible before the "APP" of the combination is derived. Simultaneous operations are assumed to exist when the computer manufacturer claims concurrent, parallel, or simultaneous operation or execution in a manual or brochure for the computer.

Note 4 Do not include processors that are limited to input/output and peripheral functions (e.g., disk drive, communication and video display) when calculating "APP".

Note 5 "APP" values are not to be calculated for processor combinations (inter)connected by "Local Area Networks", Wide Area Networks, I/O shared connections/devices, I/O controllers and any communication interconnection implemented by "software".

Note 6 "APP" values must be calculated for processor combinations containing processors specially designed to enhance performance by aggregation, operating simultaneously and sharing memory;

Technical Note:

1. Aggregate all processors and accelerators operating simultaneously and located on the same die.

2. Processor combinations share memory when any processor is capable of accessing any memory location in the system through the hardware transmission of cache lines or memory words, without the involvement of any software mechanism, which may be achieved using "electronic assemblies" specified in 4A003.c.

Note 7 A 'vector processor' is defined as a processor with built-in instructions that perform multiple calculations on floating-point vectors (one-dimensional arrays of 64-bit or larger numbers) simultaneously, having at least 2 vector functional units and at least 8 vector registers of at least 64 elements each.

CATEGORY 5 — TELECOMMUNICATIONS AND "INFORMATION SECURITY"

29. *PART 1 — TELECOMMUNICATIONS*

Note 1: The control status of components, "lasers", test and "production" equipment and "software", therefor which are specially designed for telecommunications equipment or systems is determined in Category 5, Part 1.

N.B. 1: For "lasers" specially designed for telecommunications equipment or systems, see 6A005.

N.B. 2: See also Category 5, Part 2 for equipment, components, and "software", performing or incorporating "information security" functions.

Note 2: "Digital computers", related equipment or "software", when essential for the operation and support of telecommunications equipment described in this Category, are regarded as specially designed components, provided they are the standard models customarily supplied by the manufacturer. This includes operation, administration, maintenance, engineering or billing computer systems.

30. *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; *or*

3. Specially designed to operate outside the temperature range from 218 K (–55 °C) to 397 K (124 °C);

Note: 5A001.a.3. applies only to electronic equipment.

Note: 5A001.a.2. and 5A001.a.3. do not control equipment designed or modified for use on board satellites.

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 optimise 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.4. 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;

      Note: 5A001.b.3.b. does not control radio equipment specially designed for use with any of the following:

      a. Civil cellular radio-communications systems; or

      b. Fixed or mobile satellite earth stations for commercial civil telecommunications.

   Note: 5A001.b.3 does not control equipment designed to operate at an output power of 1 W or less.

4. Being radio equipment employing ultra-wideband modulation techniques, having user programmable channelising 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 1000 channels;

   b. A 'channel switching time' 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*

Note: 5A001.b.5. does not control radio equipment specially designed for use with civil cellular radio-communications systems.

Technical Notes:

'Channel switching time' means the time (i.e., delay) to change from one receiving frequency to another, to arrive at or within ± 0,05 % of the final specified receiving frequency. Items having a specified frequency range of less than ± 0.05 % around their centre frequency are defined to be incapable of channel frequency switching.

6. Employing functions of digital "signal processing" to provide 'voice coding' output at rates of less than 2400 bit/s.

Technical Notes:

1. For variable rate 'voice coding', 5A001.b.6. applies to the 'voice coding' output of continuous speech.

2. For the purposes of 5A001.b.6., 'voice coding' is defined as 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.

c. Optical fibres of more than 500 m in length and specified by the manufacturer as being capable of withstanding a 'proof test' tensile stress of 2×10^9 N/m^2 or more;

N.B.: For underwater umbilical cables, see 8A002.a.3.

Technical Note:

'Proof Test': on-line or off-line production screen testing that dynamically applies a prescribed tensile stress over a 0,5 to 3 m length of fibre at a running rate of 2 to 5 m/s while passing between capstans approximately 150 mm in diameter. The ambient temperature is a nominal 293 K (20 °C) and relative humidity 40 %. Equivalent national standards may be used for executing the proof test.

d. "Electronically steerable phased array antennae" operating above 31,8 GHz;

Note: 5A001.d. does not control "electronically steerable phased array antennae" for landing systems with instruments meeting ICAO standards covering Microwave Landing Systems (MLS).

e. Radio direction finding equipment operating at frequencies above 30 MHz and having all of the following, and specially designed components therefor:

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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.1., designed for the extraction of client device or subscriber identifiers (e.g., IMSI, TIMSI or IMEI), signalling, 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.1., 5A001.f.2. or 5A001.f.3.;

Note: 5A001.f.1. and 5A001.f.2. do not control any of the following:

a. Equipment specially designed for the interception of analogue Private Mobile Radio (PMR), IEEE 802.11 WLAN;

b. Equipment designed for mobile telecommunications network operators; or

c. Equipment designed for the "development" or "production" of mobile telecommunications equipment or systems.

N.B. 1.: See also MILITARY GOODS CONTROLS.

N.B. 2.: For radio receivers see 5A001.b.5.

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;

Technical Note:

Non-radar transmitters may include commercial radio, television or cellular telecommunications base stations.

Note: 5A001.g. does not control any of the following:

a. Radio-astronomical equipment; or

b. Systems or equipment, that require any radio transmission from the target.

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.1. is transmitting.

N.B.: See also MILITARY GOODS CONTROLS.

i. Not used;

j. 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 (e.g., 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'; *and*

b. Mapping of the relational network of an individual or of a group of people.

Note: 5A001.j. does not control systems or equipment, specially designed for any of the following:

a. Marketing purpose;

b. Network Quality of Service (QoS); or

c. Quality of Experience (QoE).

Technical Note:

'Hard selectors' 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).

5A101 Telemetry and telecontrol equipment, including ground equipment, designed or modified for 'missiles'.

Technical Note:

In 5A101 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

Note: 5A101 does not control:

a. Equipment designed or modified for manned aircraft or satellites;

b. Ground based equipment designed or modified for terrestrial or marine applications;

c. Equipment designed for commercial, civil or 'Safety of Life' (e.g. data integrity, flight safety) GNSS services;

31. *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;

Note: 5B001.a. does not control optical fibre characterization equipment.

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. Not used;

2. Equipment employing a "laser" and having any of the following:

a. A transmission wavelength exceeding 1750 nm;

b. Performing "optical amplification" using praseodymium-doped fluoride fibre amplifiers (PDFFA);

c. Employing coherent optical transmission or coherent optical detection techniques; *or*

Note: 5B001.b.2.c. controls equipment specially designed for the "development" of systems using an optical local oscillator in the receiving side to synchronise with a carrier "laser".

Technical Note:

For the purpose of 5B001.b.2.c., these techniques include optical heterodyne, homodyne or intradyne techniques.

d. Employing analogue techniques and having a bandwidth exceeding 2,5 GHz; *or*

Note: 5B001.b.2.d. does not control equipment specially designed for the "development" of commercial TV systems.

3. Not used;

4. Radio equipment employing Quadrature-Amplitude-Modulation (QAM) techniques above level 256;

5. Not used.

32. *5C1Materials*

None

33. *5D1Software*

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. Not used;

c. Specific "software" specially designed or modified to provide characteristics, functions or features of equipment, specified in 5A001 or 5B001;

d. "Software" specially designed or modified for the "development" of any of the following telecommunication transmission or switching equipment:

1. Not used;

2. Equipment employing a "laser" and having any of the following:

a. A transmission wavelength exceeding 1750 nm; *or*

b. Employing analogue techniques and having a bandwidth exceeding 2,5 GHz; *or*

Note: 5D001.d.2.b. does not control "software" specially designed or modified for the "development" of commercial TV systems.

3. Not used;

4. Radio equipment employing Quadrature-Amplitude-Modulation (QAM) techniques above level 256.

5D101 "Software" specially designed or modified for the "use" of equipment specified in 5A101.

34. *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.;

b. Specific "technology" as follows:

1. "Required" "technology" 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;

Note: 5E001.b.4. does not control "technology" for the "development" of any of the following:

a. Civil cellular radio-communications systems; or

b. Fixed or mobile satellite earth stations for commercial civil telecommunications.

c. "Technology" according to the General Technology Note for the "development" or "production" of any of the following:

1. Equipment employing digital techniques designed to operate at a "total digital transfer rate" exceeding 560 Gbit/s;

Technical Note:

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For telecommunication switching equipment the "total digital transfer rate" is the unidirectional speed of a single interface, measured at the highest speed port or line.

2. Equipment employing a "laser" and having any of the following:

   a. A transmission wavelength exceeding 1750 nm;

   b. Performing "optical amplification" using Praseodymium-Doped Fluoride Fibre Amplifiers (PDFFA);

   c. Employing coherent optical transmission or coherent optical detection techniques;

      Note: 5E001.c.2.c. controls "technology" for the "development" or "production" of systems using an optical local oscillator in the receiving side to synchronize with a carrier "laser".

      Technical Note:

      For the purpose of 5E001.c.2.c., these techniques include optical heterodyne, homodyne or intradyne techniques.

   d. Employing wavelength division multiplexing techniques of optical carriers at less than 100 GHz spacing; *or*

   e. Employing analogue techniques and having a bandwidth exceeding 2,5 GHz;

      Note: 5E001.c.2.e. does not control "technology" for the "development" or "production" of commercial TV systems.

      N.B.: For "technology" for the "development" or "production" of non-telecommunications equipment employing a laser, see 6E.

3. Equipment employing "optical switching" and having a switching time less than 1 ms;

4. Radio equipment having any of the following:

   a. Quadrature-Amplitude-Modulation (QAM) techniques above level 256;

   b. Operating at input or output frequencies exceeding 31,8 GHz; *or*

      Note: 5E001.c.4.b. does not control "technology" for the "development" or "production" of equipment designed or modified for operation in any frequency band which is "allocated by the ITU" for radio-communications services, but not for radio-determination.

   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; or

5. Not used;

6. 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 Microwave Monolithic Integrated Circuit (MMIC) power amplifiers specially designed for telecommunications and that are any of the following:

Technical Note:

For purposes of 5E001.d., the parameter peak saturated power output may also be referred to on product data sheets as output power, saturated power output, maximum power output, peak power output, or peak envelope power output.

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 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 10 W (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 5 W (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 10000.

5E101 "Technology" according to the General Technology Note for the "development", "production" or "use" of equipment specified in 5A101.

35. *PART 2 — "INFORMATION SECURITY"*

Note 1: The control status of "information security" items or functions is determined in Category 5, Part 2 even if they are components, "software" or functions of other systems or equipment.

Note 2: Category 5 – Part 2 does not control products when accompanying their user for the user's personal use.

Note 3: Cryptography Note 5A002 and 5D002 do not control items as follows:

a. Items that meet all of the following:

1. Generally available to the public by being sold, without restriction, from stock at retail selling points by means of any of the following:

a. Over-the-counter transactions;

b. Mail order transactions;

c. Electronic transactions; or

d. Telephone call transactions;

2. The cryptographic functionality cannot easily be changed by the user;

3. Designed for installation by the user without further substantial support by the supplier; and

4. When necessary, details of the goods are accessible and will be provided, upon request, to the competent authorities of the Member State in which the exporter is established in order to ascertain compliance with conditions described in paragraphs 1. to 3. above;

b. Hardware components or 'executable software', of existing items described in paragraph a. of this Note, that have been designed for these existing items, meeting all of the following:

1. "Information security" is not the primary function or set of functions of the component or 'executable software';

2. The component or 'executable software' does not change any cryptographic functionality of the existing items, or add new cryptographic functionality to the existing items;

3. The feature set of the component or 'executable software' is fixed and is not designed or modified to customer specification; and

4. When necessary as determined by the competent authorities of the Member State in which the exporter is established, details of the component or 'executable software' and details of relevant end-items are accessible and will be provided to the competent authority upon request, in order to ascertain compliance with conditions described above.

Technical Note:

For the purpose of the Cryptography Note, 'executable software' means "software" in executable form, from an existing hardware component excluded from 5A002 by the Cryptography Note.

Note: 'Executable software' does not include complete binary images of the "software" running on an end-item.

Note to the Cryptography Note:

1. To meet paragraph a. of Note 3, all of the following must apply:

a. The item is of potential interest to a wide range of individuals and businesses; and

b. The price and information about the main functionality of the item are available before purchase without the need to consult the vendor or supplier.

2. In determining eligibility of paragraph a. of Note 3, competent authorities may take into account relevant factors such as quantity, price, required technical skill, existing sales channels, typical customers, typical use or any exclusionary practices of the supplier.

Note 4: Category 5 – Part 2 does not control items incorporating or using "cryptography" and meeting all of the following:

a. The primary function or set of functions is not any of the following:

1. "Information security";

2. A computer, including operating systems, parts and components therefor;

3. Sending, receiving or storing information (except in support of entertainment, mass commercial broadcasts, digital rights management or medical records management); or

4. Networking (includes operation, administration, management and provisioning);

b. The cryptographic functionality is limited to supporting their primary function or set of functions; and

c. When necessary, details of the items are accessible and will be provided, upon request, to the competent authorities of the Member State in which the exporter is established in order to ascertain compliance with conditions described in paragraphs a. and b. above.

36. *5A2 Systems, Equipment and Components*

5A002 "Information security" systems, equipment and components therefor, as follows:

a. Systems, equipment and components for "information security", as follows,

N.B.: For the control of Global Navigation Satellite Systems (GNSS) receiving equipment containing or employing decryption, see 7A005 and for related decryption "software" and "technology" see 7D005 and 7E001.

1. Designed or modified to use "cryptography" employing digital techniques performing any cryptographic function other than authentication, digital signature or the execution of copy-protected "software", and having any of the following:

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1. Functions for authentication, digital signature and the execution of copy-protected "software" include their associated key management function.

2. Authentication includes 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.

a. A "symmetric algorithm" employing a key length in excess of 56 bits; *or*

Technical Note:

In Category 5 - Part 2, parity bits are not included in the key length.

b. An "asymmetric algorithm" where the security of the algorithm is based on any of the following:

1. Factorisation of integers in excess of 512 bits (e.g., RSA);

2. Computation of discrete logarithms in a multiplicative group of a finite field of size greater than 512 bits (e.g., Diffie-Hellman over Z/pZ); *or*

3. Discrete logarithms in a group other than mentioned in 5A002.a.1.b.2. in excess of 112 bits (e.g., Diffie-Hellman over an elliptic curve);

2. Designed or modified to perform 'cryptanalytic functions';

Note: 5A002.a.2. includes systems or equipment, designed or modified to perform 'cryptanalytic functions' by means of reverse engineering.

Technical Note:

'Cryptanalytic functions' are functions designed to defeat cryptographic mechanisms in order to derive confidential variables or sensitive data, including clear text, passwords or cryptographic keys.

3. Not used;

4. Specially designed or modified to reduce the compromising emanations of information-bearing signals beyond what is necessary for health, safety or electromagnetic interference standards;

5. Designed or modified to use cryptographic techniques to generate the spreading code for "spread spectrum" systems, other than those specified in 5A002.a.6., including the hopping code for "frequency hopping" systems;

6. Designed or modified to use cryptographic techniques to generate channelising codes, scrambling codes or network identification codes, for systems using ultra-wideband modulation techniques and having any of the following:

a. A bandwidth exceeding 500 MHz; *or*

b. A "fractional bandwidth" of 20 % or more;

7. Non-cryptographic information and communications technology (ICT) security systems and devices that have been evaluated and certified by a national authority to exceed class EAL-6 (evaluation assurance level) of the Common Criteria (CC) or equivalent;

8. Communications cable systems designed or modified using mechanical, electrical or electronic means to detect surreptitious intrusion;

Note: 5A002.a.8. only controls physical layer security.

9. Designed or modified to use or perform "quantum cryptography".

Technical Note:

"Quantum cryptography" is also known as Quantum Key Distribution (QKD).

b. Systems, equipment, and components, designed or modified to enable, by means of "cryptographic activation" an item to achieve or exceed the controlled performance levels for functionality specified by 5A002.a. that would not otherwise be enabled.

Note: 5A002 does not control any of the following:

a. Smart cards and smart card 'readers/writers' as follows:

1. A smart card or an electronically readable personal document (e.g., token coin, e-passport) that meets any of the following:

a. The cryptographic capability is restricted for use in equipment or systems excluded from 5A002 by Note 4 in Category 5 – Part 2 or entries b. to i. of this Note, and cannot be reprogrammed for any other use; or

b. Having all of the following:

1. It is specially designed and limited to allow protection of 'personal data' stored within;

2. Has been, or can only be, personalized for public or commercial transactions or individual identification; and

3. Where the cryptographic capability is not user-accessible;

Technical Note:

'Personal data' includes any data specific to a particular person or entity, such as the amount of money stored and data necessary for authentication.

2. 'Readers/writers' specially designed or modified, and limited, for items specified by a.1. of this Note.

Technical Note:

'Readers/writers' include equipment that communicates with smart cards or electronically readable documents through a network.

b. Not used;

c. Not used;

d. Cryptographic equipment specially designed and limited for banking use or 'money transactions';

Technical Note:

'Money transactions' in 5A002 Note d. includes the collection and settlement of fares or credit functions.

e. Portable or mobile radiotelephones for civil use (e.g., for use with commercial civil cellular radio communication systems) that are not capable of transmitting encrypted data directly to another radiotelephone or equipment (other than Radio Access Network (RAN) equipment), nor of passing encrypted data through RAN equipment (e.g., Radio Network Controller (RNC) or Base Station Controller (BSC));

f. Cordless telephone equipment not capable of end-to-end encryption where the maximum effective range of unboosted cordless operation (i.e. a single, unrelayed hop between terminal and home base station) is less than 400 metres according to the manufacturer's specifications;

g. Portable or mobile radiotelephones and similar client wireless devices for civil use, that implement only published or commercial cryptographic standards (except for anti-piracy functions, which may be non-published) and also meet the provisions of paragraphs a.2. to a.4. of the Cryptography Note (Note 3 in Category 5, Part 2), that have been customised for a specific civil industry application with features that do not affect the cryptographic functionality of these original non-customised devices;

h. Not used;

i. Wireless "personal area network" equipment that implement only published or commercial cryptographic standards and where the cryptographic capability is limited to a nominal operating range not exceeding 30 metres according to the manufacturer's specifications, or not exceeding 100 metres according to the manufacturer's specifications for equipment that cannot interconnect with more than seven devices;

j. Equipment, having no functionality specified by 5A002.a.2., 5A002.a.4., 5A002.a.7.,5A002.a.8 or 5A002.b. meeting all of the following:

1. *All cryptographic capability specified by 5A002.a. meets any of the following:*

   a. *It cannot be used; or*

   b. *It can only be made useable by means of "cryptographic activation", and*

2. *When necessary as determined by the competent authorities of the Member State in which the exporter is established, details of the equipment are accessible and will be provided to the authority upon request, in order to ascertain compliance with conditions described above;*

   N.B. 1: See 5A002.a. for equipment that has undergone "cryptographic activation".

   N.B. 2: See also 5A002.b., 5D002.d. and 5E002.b.

k. Mobile telecommunications Radio Access Network (RAN) equipment designed for civil use, which also meet the provisions of paragraphs a.2. to a.4. of the Cryptography Note (Note 3 in Category 5, Part 2), having an RF output power limited to 0,1 W (20 dBm) or less, and supporting 16 or fewer concurrent users.

l. Routers, switches or relays, where the "information security" functionality is limited to the tasks of "Operations, Administration or Maintenance" ("OAM") implementing only published or commercial cryptographic standards; or

m. General purpose computing equipment or servers, where the "information security" functionality meets all of the following:

1. *Uses only published or commercial cryptographic standards; and*

2. *Is any of the following:*

   a. *Integral to a CPU that meets the provisions of Note 3 to Category 5–Part 2;*

   b. *Integral to an operating system that is not specified by 5D002.; or*

   c. *Limited to "OAM" of the equipment.*

37. *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 or 5B002.b.;

b. Measuring equipment specially designed to evaluate and validate the "information security" functions of the equipment specified in 5A002 or "software" specified in 5D002.a. or 5D002.c.

38. *5C2Materials*

None.

39. *5D2Software*

5D002 "Software" as follows:

a. "Software" specially designed or modified for the "development", "production" or "use" of equipment specified in 5A002 or "software" specified in 5D002.c.;

b. "Software" specially designed or modified to support "technology" specified in 5E002;

c. Specific "software", as follows:

1. "Software" having the characteristics, or performing or simulating the functions of the equipment, specified in 5A002;

2. "Software" to certify "software" specified in 5D002.c.1.

Note: 5D002.c. does not control "software" limited to the tasks of "OAM" implementing only published or commercial cryptographic standards.

d. "Software" designed or modified to enable, by means of "cryptographic activation", an item to achieve or exceed the controlled performance levels for functionality specified by 5A002.a. that would not otherwise be enabled.

40. *5E2Technology*

5E002 "Technology" as follows:

a. "Technology" according to the General Technology Note for the "development", "production" or "use" of equipment specified in 5A002, 5B002 or "software" specified in 5D002.a. or 5D002.c.

b. "Technology" to enable, by means of "cryptographic activation", an item to achieve or exceed the controlled performance levels for functionality specified by 5A002.a. that would not otherwise be enabled.

Note: 5E002 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.

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CATEGORY 6 — SENSORS AND LASERS

41. *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:

Note: 6A001.a.1. does not control equipment as follows:

a. Depth sounders operating vertically below the apparatus, not including a scanning function exceeding ± 20°, and limited to measuring the depth of water, the distance of submerged or buried objects or fish finding;

b. Acoustic beacons, as follows:

1. Acoustic emergency beacons;

2. Pingers specially designed for relocating or returning to an underwater position.

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° 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) 1. Motion of the acoustic sensor;

(2) 2. In-water propagation from sensor to the seabed and back;

(3) 3. Sound speed at the sensor;

Technical Notes

1. Sounding resolution' is the swath width (degrees) divided by the maximum number of soundings per swath.

2. 'Enhancement' includes the ability to compensate by external means.

2. Underwater survey equipment designed for seabed topographic mapping and having any of the following:

Technical Note:

The acoustic sensor pressure rating determines the depth rating of the equipment specified in 6A001.a.1.a.2.

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; *or*

Technical Note:

'Sounding rate' is the product of the maximum speed (m/s) at which the sensor can operate and the maximum number of soundings per swath assuming 100 % coverage. For systems that produce soundings in two directions (3D sonars), the maximum of the 'sounding rate' in either direction should be used

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 100 m;

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' of greater than 570 m2/s while operating at the maximum range that it can operate with an 'along track resolution' of less than 15 cm; *and*

c. An 'across track resolution' of less than 15 cm;

Technical Notes

1. 'Area coverage rate' (m^2/s) is twice the product of the sonar range (m) and the maximum speed (m/s) at which the sensor can operate at that range.

2. 'Along track resolution' (cm), for SSS only, is the product of azimuth (horizontal) beamwidth (degrees) and sonar range (m) and 0,873.

3. 'Across track resolution' (cm) is 75 divided by the signal bandwidth (kHz).

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 μPa 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 μPa 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° 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 1000 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, incorporating piezoelectric, magnetostrictive, electrostrictive, electrodynamic or hydraulic elements operating individually or in a designed combination and having any of the following:

Note 1: The control status of acoustic projectors, including transducers, specially designed for other equipment not specified in 6A001 is determined by the control status of the other equipment.

Note 2: 6A001.a.1.c. does not control electronic sources which direct the sound vertically only, or mechanical (e.g., air gun or vapour-shock gun) or chemical (e.g., explosive) sources.

Note 3: Piezoelectric elements specified in 6A001.a.1.c. include those made from lead-magnesium-niobate/lead-titanate ($Pb(Mg_{1/3}Nb_{2/3})O_3$-$PbTiO_3$, or PMN-PT) single crystals grown from solid solution or lead-indium-niobate/lead-magnesium niobate/lead-titanate ($Pb(In_{1/2}Nb_{1/2})O_3$–$Pb(Mg_{1/3}Nb_{2/3})O_3$–$PbTiO_3$, or PIN-PMN-PT) single crystals grown from solid solution.

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 (SL_{RMS})' exceeding (10log(f) + 169,77) dB (reference 1 µPa at 1 m) where f is the frequency in Hertz of maximum Transmitting Voltage Response (TVR) below 10 kHz; *or*

   b. Designed for continuous operation at 100 % duty cycle and having a continuously radiated 'free-field Source Level (SL_{RMS})' at 100 % duty cycle exceeding (10log(f) + 159,77) dB (reference 1 µPa at 1 m) where f is the frequency in Hertz of maximum Transmitting Voltage Response (TVR) below 10 kHz; *or*

Technical Note:

The 'free-field Source Level (SL_{RMS}' is defined along the maximum response axis and in the far field of the acoustic projector. It can be obtained from the Transmitting Voltage Response using the following equation: $SL_{RMS} = (TVR + 20\log V_{RMS})$ dB (ref 1µPa at 1 m), where SL_{RMS} is the source level, TVR is the Transmitting Voltage Response and V_{RMS} is the Driving Voltage of the Projector.

2. Not used

3. Side-lobe suppression exceeding 22 dB;

d. Acoustic systems and equipment, designed to determine the position of surface vessels or underwater vehicles and having all the following, and specially designed components therefor:

1. Detection range exceeding 1000 m; *and*

2. Positioning accuracy of less than 10 m rms (root mean square) when measured at a range of 1000 m;

Note: 6A001.a.1.d. includes:

a. Equipment using coherent "signal processing" between two or more beacons and the hydrophone unit carried by the surface vessel or underwater vehicle;

b. Equipment capable of automatically correcting speed-of-sound propagation errors for calculation of a point.

e. Active individual sonars, specially designed or modified to detect, 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. Positioning accuracy 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;

N.B:. For diver detection systems specially designed or modified for military use, see the Military Goods Controls.

Note: For 6A001.a.1.e., where multiple detection ranges are specified for various environments, the greatest detection range is used.

2. Passive systems, equipment and specially designed components therefor, as follows:

a. Hydrophones having any of the following:

Note: The control status of hydrophones specially designed for other equipment is determined by the control status of the other equipment.

Technical Note:

Hydrophones consist of one or more sensing elements producing a single acoustic output channel. Those that contain multiple elements can be referred to as a hydrophone group.

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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 fibres;

   b. 'Piezoelectric polymer films' other than polyvinylidene-fluoride (PVDF) and its co-polymers {}{P(VDF-TrFE) and P(VDF-TFE)}};

   c. 'Flexible piezoelectric composites';

   d. Lead-magnesium-niobate/lead-titanate (i.e., $Pb(Mg_{1/3}Nb_{2/3})O3\text{-}PbTiO_3$, or PMN-PT) piezoelectric single crystals grown from solid solution; *or*

   e. Lead-indium-niobate/lead-magnesium niobate/lead-titanate (i.e., $Pb(In_{1/2}Nb_{1/2})O_3–Pb(Mg_{1/3}Nb_{2/3})O3–PbTiO_3$, or PIN-PMN-PT) piezoelectric single crystals grown from solid solution;

4. A 'hydrophone sensitivity' 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 1000 m;

Technical Notes:

1. 'Piezoelectric polymer film' sensing elements consist of polarised polymer film that is stretched over and attached to a supporting frame or spool (mandrel).

2. 'Flexible piezoelectric composite' sensing elements consist of piezoelectric ceramic particles or fibres combined with an electrically insulating, acoustically transparent rubber, polymer or epoxy compound, where the compound is an integral part of the sensing elements.

3. 'Hydrophone sensitivity' is defined as 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 µPa. For example, a hydrophone of – 160 dB (reference 1 V per µPa) would yield an output voltage of 10^{-8} V in such a field, while

one of – 180 dB sensitivity would yield only 10^{-9} V output. Thus, – 160 dB is better than – 180 dB.

b. Towed acoustic hydrophone arrays having any of the following:

Technical Note:

Hydrophone arrays consist of a number of hydrophones providing multiple acoustic output channels.

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' to operate at depths exceeding 35 m;

Technical Note:

'Able to be modified' in 6A001.a.2.b.1. and 2. means having provisions to allow a change of the wiring or interconnections to alter hydrophone group spacing or operating depth limits. These provisions are: spare wiring exceeding 10 % of the number of wires, hydrophone group spacing adjustment blocks or internal depth limiting devices that are adjustable or that control more than one hydrophone group.

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. Not used;

7. Hydrophone characteristics specified in 6A001.a.2.a.; *or*

8. 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 beamforming using Fast Fourier or other transforms or processes;

d. Heading sensors having all of the following:

1. An accuracy of 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; *o*

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 beamforming using Fast Fourier or other transforms or processes;

g. Accelerometer-based hydro-acoustic sensors having all of the following:

1. Composed of three accelerometers arranged along three distinct axes;

2. Having an overall 'acceleration sensitivity' better than 48 dB (reference 1,000 mV rms per 1 g);

3. Designed to operate at depths greater than 35 meters; *and*

4. Operating frequency below 20 kHz.

Note: 6A001.a.2.g. does not control particle velocity sensors or geophones.

Technical Notes:

1. Accelerometer-based hydro-acoustic sensors are also known as vector sensors.

2. 'Acceleration sensitivity' is defined as 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 (i.e., 9,81 m/s^2).

Note: 6A001.a.2. also controls receiving equipment, whether or not related in normal application to separate active equipment, and specially designed components therefor.

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 better than 1 % of speed.

Note 1: 6A001.b. does not control depth sounders limited to any of the following:

a. Measuring the depth of water;

b. Measuring the distance of submerged or buried objects; or

c. Fish finding.

Note 2: 6A001.b. does not control equipment specially designed for installation on surface vessels.

c. Not used.

6A002 Optical sensors or equipment and components therefor, as follows:

N.B.: SEE ALSO 6A102.

a. Optical detectors as follows:

1. "Space-qualified" solid-state detectors as follows:

Note: For the purpose of 6A002.a.1., solid-state detectors include "focal plane arrays".

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 1200 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 1200 nm but not exceeding 30000 nm;

d. "Space-qualified" "focal plane arrays" having more than 2048 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:

Note: 6A002.a.2. does not control non-imaging photomultiplier tubes having an electron sensing device in the vacuum space limited solely to any of the following:

a. A single metal anode; or

b. Metal anodes with a centre to centre spacing greater than 500 µm.

Technical Note:

'Charge multiplication' is a form of electronic image amplification and is defined as the generation of charge carriers as a result of an impact ionization gain process. 'Charge multiplication' sensors may take the form of an image intensifier tube, solid state detector or "focal plane array".

a. Image intensifier tubes having all of the following:

1. A peak response in the wavelength range exceeding 400 nm but not exceeding 1050 nm;

2. Electron image amplification using any of the following:

a. 1 A microchannel plate with a hole pitch (centre-to-centre spacing) of 12 µm or less; or

b. An electron sensing device with a non-binned pixel pitch of 500 µm or less, specially designed or modified to achieve 'charge multiplication' other than by a microchannel plate; *and*

3. Any of the following photocathodes:

a. Multialkali photocathodes (e.g., S-20 and S-25) having a luminous sensitivity exceeding 350 µA/lm;

b. GaAs or GaInAs photocathodes; *or*

c. Other "III/V compound" semiconductor photocathodes having a maximum "radiant sensitivity" exceeding 10 mA/W;

b. Image intensifier tubes having all of the following:

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1. A peak response in the wavelength range exceeding 1050 nm but not exceeding 1800 nm;

2. Electron image amplification using any of the following:

a. A microchannel plate with a hole pitch (centre-to-centre spacing) of 12 μm or less; *or*

b. An electron sensing device with a non-binned pixel pitch of 500 μm 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;

c. Specially designed components as follows:

1. Microchannel plates having a hole pitch (centre-to-centre spacing) of 12 μm or less;

2. An electron sensing device with a non-binned pixel pitch of 500 μm or less, specially designed or modified to achieve 'charge multiplication' other than by a microchannel plate;

3. "III/V compound" semiconductor (e.g., GaAs or GaInAs) photocathodes and transferred electron photocathodes;

Note: 6A002.a.2.c.3. does not control compound semiconductor photocathodes designed to achieve a maximum "radiant sensitivity" of any of the following:

a. 10 mA/W or less at the peak response in the wavelength range exceeding 400 nm but not exceeding 1 050 nm; or

b. 15 mA/W or less at the peak response in the wavelength range exceeding 1050 nm but not exceeding 1800 nm.

3. Non-"space-qualified" "focal plane arrays" as follows:

N.B.: 'Microbolometer' non-"space-qualified" "focal plane arrays" are only specified in 6A002.a.3.f.

Technical Note:

Linear or two-dimensional multi-element detector arrays are referred to as "focal plane arrays";

Note 1: 6A002.a.3. includes photoconductive arrays and photovoltaic arrays.

Note 2: 6A002.a.3. does not control:

a. Multi-element (not to exceed 16 elements) encapsulated photoconductive cells using either lead sulphide or lead selenide;

b. Pyroelectric detectors using any of the following:

1. Triglycine sulphate and variants;

2. Lead-lanthanum-zirconium titanate and variants;

3. Lithium tantalate;

4. Polyvinylidene fluoride and variants; or

5. Strontium barium niobate and variants;

c. "Focal plane arrays" specially designed or modified to achieve 'charge multiplication' and limited by design to have a maximum "radiant sensitivity" of 10 mA/W or less for wavelengths exceeding 760 nm, having all of the following:

1. Incorporating a response limiting mechanism designed not to be removed or modified; and

2. Any of the following:

(4) a. The response limiting mechanism is integral to or combined with the detector element; or

(5) *b. The "focal plane array" is only operable with the response limiting mechanism in place.*

Technical Note:

A response limiting mechanism integral to the detector element is designed not to be removed or modified without rendering the detector inoperable.

Technical Note:

'Charge multiplication' is a form of electronic image amplification and is defined as the generation of charge carriers as a result of an impact ionization gain process. 'Charge multiplication' sensors may take the form of an image intensifier tube, solid state detector or "focal plane array".

a. Non-"space-qualified" "focal plane arrays" having all of the following:

1. Individual elements with a peak response within the wavelength range exceeding 900 nm but not exceeding 1050 nm; *and*

2. Any of the following:

(6) a. A response "time constant" of less than 0,5 ns; *or*

(7) b. Specially designed or modified to achieve 'charge multiplication' and having a maximum "radiant sensitivity" exceeding 10 mA/W;

b. Non-"space-qualified" "focal plane arrays" having all of the following:

1. Individual elements with a peak response in the wavelength range exceeding 1050 nm but not exceeding 1200 nm; *and*

2. Any of the following:

(8) a. A response "time constant" of 95 ns or less; *or*

(9) b. Specially designed or modified to achieve 'charge multiplication' and having a maximum "radiant sensitivity" exceeding 10 mA/W;

c. Non-"space-qualified" non-linear (2-dimensional) "focal plane arrays" having individual elements with a peak response in the wavelength range exceeding 1200 nm but not exceeding 30000 nm;

N.B.: Silicon and other material based 'microbolometer' non-"space-qualified" "focal plane arrays" are only specified in 6A002.a.3.f.

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 1200 nm but not exceeding 3000 nm; *and*

2. Any of the following:

(10) a. A ratio of 'scan direction' dimension of the detector element to the 'cross-scan direction' dimension of the detector element of less than 3,8; *or*

(11) b. Signal processing in the detector elements;

(12) *Note: 6A002.a.3.d. does not control "focal plane arrays" (not to exceed 32 elements) having detector elements limited solely to germanium material.*

Technical Note:

For the purposes of 6A002.a.3.d., 'cross-scan direction' is defined as the axis parallel to the linear array of detector elements and the

'scan direction' is defined as the axis perpendicular to the linear array of detector elements.

e. Non-"space-qualified" linear (1-dimensional) "focal plane arrays" having individual elements with a peak response in the wavelength range exceeding 3000 nm but not exceeding 30000 nm;

f. Non-"space-qualified" non-linear (2-dimensional) infrared "focal plane arrays" based on 'microbolometer' material having individual elements with an unfiltered response in the wavelength range equal to or exceeding 8000 nm but not exceeding 14000 nm;

Technical Note:

For the purposes of 6A002.a.3.f., 'microbolometer' is defined as 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.

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 μrad (microradians); *or*

2. Specified for operation in the wavelength range exceeding 400 nm but not exceeding 30000 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);

Note: 6A002.b.1. does not control "monospectral imaging sensors" with a peak response in the wavelength range exceeding 300 nm but not exceeding 900 nm and only incorporating any of the following non–"space-qualified" detectors or non–"space-qualified" "focal plane arrays":

1. Charge Coupled Devices (CCD) not designed or modified to achieve 'charge multiplication'; or

2. Complementary Metal Oxide Semiconductor (CMOS) devices not designed or modified to achieve 'charge multiplication'.

c. 'Direct view' imaging equipment 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.;

Technical Note:

'Direct view' refers to 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.

Note: 6A002.c. does not control equipment as follows, when incorporating other than GaAs or GaInAs photocathodes:

a. Industrial or civilian intrusion alarm, traffic or industrial movement control or counting systems;

b. Medical equipment;

c. Industrial equipment used for inspection, sorting or analysis of the properties of materials;

d. Flame detectors for industrial furnaces;

e. Equipment specially designed for laboratory use.

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 2500 hours;

b. Joule-Thomson (JT) self-regulating minicoolers having bore (outside) diameters of less than 8 mm;

3. Optical sensing fibres specially fabricated either compositionally or structurally, or modified by coating, to be acoustically, thermally, inertially, electromagnetically or nuclear radiation sensitive;

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Note: 6A002.d.3. does not control encapsulated optical sensing fibres specially designed for bore hole sensing applications.

e. Not used.

6A003 Cameras, systems or equipment, and components therefor, as follows:

N.B.: SEE ALSO 6A203.

N.B.: For television and film-based photographic still cameras specially designed or modified for underwater use, see 8A002.d.1. and 8A002.e.

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

Note: Instrumentation cameras, specified in 6A003.a.3. to 6A003.a.5., with modular structures should be evaluated by their maximum capability, using plug-ins available according to the camera manufacturer's specifications.

1. High-speed cinema recording cameras using any film format from 8 mm to 16 mm inclusive, in which the film is continuously advanced throughout the recording period, and that are capable of recording at framing rates exceeding 13150 frames/s;

   Note: 6A003.a.1. does not control cinema recording cameras designed for civil purposes.

2. Mechanical high speed cameras, in which the film does not move, capable of recording at rates exceeding 1000000 frames/s for the full framing height of 35 mm film, or at proportionately higher rates for lesser frame heights, or at proportionately lower rates for greater frame heights;

3. Mechanical or electronic streak cameras, as follows:

   a. Mechanical streak cameras having writing speeds exceeding 10 mm/μs;

   b. Electronic streak cameras having temporal resolution better than 50 ns;

4. Electronic framing cameras having a speed exceeding 1000000 frames/s;

5. Electronic cameras having all of the following:

   a. An electronic shutter speed (gating capability) of less than 1 μs per full frame; *and*

   b. A read out time allowing a framing rate of more than 125 full frames per second;

6. 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.3., 6A003.a.4., or 6A003.a.5., according to the manufacturer's specifications;

b. Imaging cameras as follows:

Note: 6A003.b. does not control television or video cameras, specially designed for television broadcasting.

1. Video cameras incorporating solid state sensors, having a peak response in the wavelength range exceeding 10 nm, but not exceeding 30000 nm and having all of the following:

a. Having any of the following:

1. More than 4×10^6 "active pixels" per solid state array for monochrome (black and white) cameras;

2. More than 4×10^6 "active pixels" per solid state array for colour cameras incorporating three solid state arrays; *or*

3. More than 12×10^6 "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';

Technical Note:

1. For the purpose of this entry, digital video cameras should be evaluated by the maximum number of "active pixels" used for capturing moving images.

2. For the purpose of this entry, 'camera tracking data' is the information necessary to define camera line of sight orientation with respect to the earth. This includes: 1) the horizontal angle the camera line of sight makes with respect to the earth's magnetic field direction and; 2) the vertical angle between the camera line of sight and the earth's horizon.

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 30000 nm;

b. Linear detector arrays with more than 8192 elements per array; *and*

c. Mechanical scanning in one direction;

Note: 6A003.b.2. does not control scanning cameras and scanning camera systems, specially designed for any of the following:

a. Industrial or civilian photocopiers;

b. Image scanners specially designed for civil, stationary, close proximity scanning applications (e.g., reproduction of images or print contained in documents, artwork or photographs); or

c. Medical equipment.

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" 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.;

Note 1: Imaging cameras specified in 6A003.b.4. include "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.

Note 2: 6A003.b.4.a. does not control imaging cameras incorporating linear "focal plane arrays" with 12 elements or fewer, not employing time-delay-and-integration within the element and designed for any of the following:

a. Industrial or civilian intrusion alarm, traffic or industrial movement control or counting systems;

b. Industrial equipment used for inspection or monitoring of heat flows in buildings, equipment or industrial processes;

c. Industrial equipment used for inspection, sorting or analysis of the properties of materials;

d. Equipment specially designed for laboratory use; or

e. Medical equipment.

Note 3: 6A003.b.4.b. does not control imaging cameras having any of the following:

a. A maximum frame rate equal to or less than 9 Hz;

b. Having all of the following:

1. Having a minimum horizontal or vertical 'Instantaneous-Field-of-View (IFOV)' of at least 10 mrad/pixel (milliradians/pixel);

2. Incorporating a fixed focal-length lens that is not designed to be removed;

3. Not incorporating a 'direct view' display, and

4. Having any of the following:

(13) a. No facility to obtain a viewable image of the detected field-of-view, or

(14) *b. The camera is designed for a single kind of application and designed not to be user modified; or*

(15) *c. The camera is specially designed for installation into a civilian passenger land vehicle and having all of the following:*

1. The placement and configuration of the camera within the vehicle are solely to assist the driver in the safe operation of the vehicle;

2. Is only operable when installed in any of the following:

a. The civilian passenger land vehicle for which it was intended and the vehicle weighs less than 4,500 kg (gross vehicle weight); or

b. A specially designed, authorized maintenance test facility; and

3. Incorporates an active mechanism that forces the camera not to function when it is removed from the vehicle for which it was intended.

Technical Notes:

1. 'Instantaneous Field of View (IFOV)' specified in 6A003.b.4. Note 3.b. is the lesser figure of the 'Horizontal IFOV' or the 'Vertical IFOV'.

'Horizontal IFOV' = horizontal Field of View (FOV) / number of horizontal detector elements

'Vertical IFOV' = vertical Field of View (FOV) / number of vertical detector elements.

2. 'Direct view' in 6A003.b.4. Note 3.b. refers to an imaging camera operating in the infrared spectrum that presents a visual image to a human observer using a near-to-eye micro display incorporating any light-security mechanism.

Note 4: 6A003.b.4.c. does not control imaging cameras having any of the following:

a. Having all of the following:

1. Where the camera is specially designed for installation as an integrated component into indoor and wall-plug-operated systems or equipment, limited by design for a single kind of application, as follows;

(16) a. Industrial process monitoring, quality control, or analysis of the properties of materials;

(17) *b. Laboratory equipment specially designed for scientific research;*

(18) *c. Medical equipment;*

(19) *d. Financial fraud detection equipment; and*

2. Is only operable when installed in any of the following:

(20) *a. The system(s) or equipment for which it was intended; or*

(21) *b. A specially designed, authorised maintenance facility; and*

3. Incorporates an active mechanism that forces the camera not to function when it is removed from the system(s) or equipment for which it was intended;

b. Where the camera is specially designed for installation into a civilian passenger land vehicle or passenger and vehicle ferries, and having all of the following:

1. The placement and configuration of the camera within the vehicle or ferry is solely to assist the driver or operator in the safe operation of the vehicle or ferry;

2. Is only operable when installed in any of the following:

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(22) *a. The civilian passenger land vehicle for which it was intended; and the vehicle weighs less than 4,500 kg (gross vehicle weight);*

(23) *b. The passenger and vehicle ferry for which it was intended and having a length overall (LOA) 65 m or greater; or*

(24) *c. A specially designed, authorised maintenance test facility; and*

3. Incorporates an active mechanism that forces the camera not to function when it is removed from the vehicle for which it was intended;

c. Limited by design to have a maximum "radiant sensitivity" of 10 mA/W or less for wavelengths exceeding 760 nm, having all of the following:

1. Incorporating a response limiting mechanism designed not to be removed or modified;

2. Incorporates an active mechanism that forces the camera not to function when the response limiting mechanism is removed; and

3. Not specially designed or modified for underwater use: or

d. Having all of the following:

1. Not incorporating a 'direct view' or electronic image display;

2. Has no facility to output a viewable image of the detected field of view;

3. The "focal plane array" is only operable when installed in the camera for which it was intended; and

4. The "focal plane array" incorporates an active mechanism that forces it to be permanently inoperable when removed from the camera for which it was intended

5. Imaging cameras incorporating solid-state detectors specified in 6A002.a.1.

6A004 Optical equipment and components, as follows:

a. Optical mirrors (reflectors) as follows:

Technical Note:

For the purpose of 6A004.a., Laser Induced Damage Threshold (LIDT) is measured according to ISO 21254-1:2011.

N.B.: For optical mirrors specially designed for lithography equipment, see 3B001.

1. "Deformable mirrors" having an active optical aperture greater than 10 mm and having any of the following, and specially designed components 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^2 using a "CW laser"; or

        2. Greater than 2 J/ cm^2 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^2 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^2 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 (λ 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^2 using a "CW laser"; or

        b. Greater than 20 J/cm^2 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 3000 nm but not exceeding 25000 nm and having any of the following:

    1. Exceeding 100 cm^3 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 lightweighted 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 5×10^{-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, stabilisation 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 ± 26 mrad or more;

2. A mechanical resonant frequency of 500 Hz or more; and

3. An angular accuracy of 10 μrad (microradians) or less;

b. Resonator alignment equipment having bandwidths equal to or more than 100 Hz and an accuracy of 10 μrad or less;

3. Gimbals having all of the following:

a. A maximum slew exceeding 5 °;

b. A bandwidth of 100 Hz or more;

c. Angular pointing errors of 200 μrad (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 (radians)/s^2; *or*

2. Exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 0,5 rad (radians)/s^2;

4. Not used

e. 'Aspheric optical elements' having all of the following:

1. Largest dimension of the optical-aperture greater than 400 mm;

2. Surface roughness 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 3×10^{-6}/K at 25 °C.

Technical Notes:

1. An 'aspheric optical element' is any element used in an optical system whose imaging surface or surfaces are designed to depart from the shape of an ideal sphere.

2. Manufacturers are not required to measure the surface roughness listed in 6A004.e.2. unless the optical element was designed or manufactured with the intent to meet, or exceed, the control parameter.

Note 6A004.e. does not control 'aspheric optical elements' having any of the following:

a. Largest optical-aperture dimension less than 1 m and focal length to aperture ratio equal to or greater than 4,5:1;

b. Largest optical-aperture dimension equal to or greater than 1 m and focal length to aperture ratio equal to or greater than 7:1;

c. Designed as Fresnel, flyeye, stripe, prism or diffractive optical elements;

d. Fabricated from borosilicate glass having a coefficient of linear thermal expansion greater than $2,5 \times 10^{-6}$ /K at 25 °C; or

e. An x-ray optical element having inner mirror capabilities (e.g., tube-type mirrors).

N.B. For 'aspheric optical elements' specially designed for lithography equipment, see 3B001.

6A005 "Lasers", other than those specified in 0B001.g.5. or 0B001.h.6., components and optical equipment, as follows:

N.B.: SEE ALSO 6A205.

Note 1: Pulsed "lasers" include those that run in a continuous wave (CW) mode with pulses superimposed.

Note 2: Excimer, semiconductor, chemical, CO, CO_2, and 'non-repetitive pulsed' Nd:glass "lasers" are only specified in 6A005.d.

Technical Note:

'Non-repetitive pulsed' refers to "lasers" that produce either a single output pulse or that have a time interval between pulses exceeding one minute.

Note 3: 6A005 includes fibre "lasers".

Note 4: The control status of "lasers" incorporating frequency conversion (i.e., wavelength change) by means other than one "laser" pumping another "laser" is determined by applying the control parameters for both the output of the source "laser" and the frequency-converted optical output.

Note 5: 6A005 does not control "lasers" as follows:

a. Ruby with output energy below 20 J;

b. Nitrogen;

c. Krypton.

Technical Note:

In 6A005 'Wall-plug efficiency' is defined as 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.

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 30 W;

Note: 6A005.a.2. does not control Argon "lasers" having an output power equal to or less than 50 W.

3. Output wavelength exceeding 510 nm but not exceeding 540 nm and any of the following:

a. Single transverse mode output and output power exceeding 50 W; *or*

b. Multiple transverse mode 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 output and output power exceeding 50 W; *or*

b. Multiple transverse mode output and output power exceeding 80 W;

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6. Output wavelength exceeding 975 nm but not exceeding 1150 nm and any of the following:

   a. Single transverse mode and output power exceeding 200 W; *or*

   b. Multiple transverse mode output and any of the following:

      1. 'Wall-plug efficiency' exceeding 18 % and output power exceeding 500 W; *or*

      2. Output power exceeding 2 kW;

   Note 1: 6A005.a.6.b. does not control multiple transverse mode, industrial "lasers" with output power exceeding 2 kW and not exceeding 6 kW with a total mass greater than 1200 kg. For the purpose of this note, total mass includes all components required to operate the "laser", e.g., "laser", power supply, heat exchanger, but excludes external optics for beam conditioning and/or delivery.

   Note 2: 6A005.a.6.b. does not control multiple transverse mode, industrial "lasers" having any of the following:

   a. Output power exceeding 500 W but not exceeding 1 kW and having all of the following:

      1. Beam Parameter Product (BPP) exceeding 0,7 mm•mrad; and

      2. 'Brightness' not exceeding 1024 W/(mm•mrad)^2;

   b. Output power exceeding 1 kW but not exceeding 1.6 kW and having a BPP exceeding 1,25 mm•mrad

   c. Output power exceeding 1,6 kW but not exceeding 2,5 kW and having a BPP exceeding 1,7 mm•mrad;

   d. Output power exceeding 2,5 kW but not exceeding 3,3 kW and having a BPP exceeding 2,5 mm•mrad;

   e. Output power exceeding 3,3 kW but not exceeding 4 kW and having a BPP exceeding 3,5 mm•mrad;

   f. Output power exceeding 4 kW but not exceeding 5 kW and having a BPP exceeding 5 mm•mrad;

   g. Output power exceeding 5 kW but not exceeding 6 kW and having a BPP exceeding 7,2 mm•mrad;

   h. Output power exceeding 6 kW but not exceeding 8 kW and having a BPP exceeding 12 mm•mrad; or

   i. Output power exceeding 8 kW but not exceeding 10 kW and having a BPP exceeding 24 mm•mrad.

Technical Note:

For the purpose of 6A005.a.6.b. Note 2.a., 'brightness' is defined as the output power of the "laser" divided by the squared Beam Parameter Product (BPP), i.e., (output power)/BPP^2.

7. Output wavelength exceeding 1150 nm but not exceeding 1555 nm and of the following:

   a. Single transverse mode and output power exceeding 50 W; *or*

   b. Multiple transverse mode and output power exceeding 80 W; *or*

8. Output wavelength exceeding 1555 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;

   Note: 6A005.b.2.b. does not control Argon "lasers" having an "average output power" equal to or less than 50 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 μs 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 μs 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;

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 following:

1. Output "peak power" exceeding 2 GW per pulse;

2. "Average output power" exceeding 10 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 10 W; or

3. Output energy exceeding 0,1 J per pulse;

c. "Pulse duration" equal to or exceeding 1 ns but not exceeding 1 μs, and any of the following:

1. Single transverse mode output and any of the following:

a. "Peak power" exceeding 100 MW;

b. "Average output power" exceeding 20 W limited by design to a maximum pulse repetition frequency less than or equal to 1 kHz;

c. 'Wall-plug efficiency' exceeding 12 %, "average output power" exceeding 100 W and capable of operating at a pulse repetition frequency greater than 1 kHz;

d. "Average output power" exceeding 150 W and capable of operating at a pulse repetition frequency greater than 1 kHz; *or*

e. Output energy exceeding 2 J per pulse; *or*

2. Multiple transverse mode output and any of the following:

a. "Peak power" exceeding 400 MW;

b. 'Wall-plug efficiency' exceeding 18 % and "average output power" exceeding 500 W;

c. "Average output power" exceeding 2 kW; *or*

d. Output energy exceeding 4 J per pulse; *or*

d. "Pulse duration" exceeding 1 μs 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 1150 nm but not exceeding 1555 nm, and any of the following:

a. "Pulse duration" not exceeding 1 μs 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 μs 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; *or*

8. Output wavelength exceeding 1555 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;

c. "Tunable" "lasers" having any of the following:

1. Output wavelength less than 600 nm and any of the following:

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a. Output energy exceeding 50 mJ per pulse and "peak power" exceeding 1 W; *or*

b. Average or CW output power exceeding 1 W;

Note: 6A005.c.1. does not control dye lasers or other liquid lasers, having a multimode output and a wavelength of 150 nm or more but not exceeding 600 nm and all of the following:

1. Output energy less than 1,5 J per pulse or a "peak power" less than 20 W; and

2. Average or CW output power less than 20 W.

2. Output wavelength of 600 nm or more but not exceeding 1400 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 1400 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" as follows:

Note 1: 6A005.d.1. includes semiconductor "lasers" having optical output connectors (e.g., fibre optic pigtails).

Note 2: The control status of semiconductor "lasers" specially designed for other equipment is determined by the control status of the other equipment.

a. Individual single-transverse mode semiconductor "lasers" having any of the following:

1. Wavelength equal to or less than 1510 nm and average or CW output power, exceeding 1,5 W; *or*

2. Wavelength greater than 1510 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 1400 nm and average or CW output power, exceeding 15 W;

2. Wavelength equal to or greater than 1400 nm and less than 1900 nm and average or CW output power, exceeding 2,5 W; *or*

3. Wavelength equal to or greater than 1900 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 1400 nm and average or CW output power, exceeding 100 W;

2. Wavelength equal to or greater than 1400 nm and less than 1900 nm and average or CW output power, exceeding 25 W; *or*

3. Wavelength equal to or greater than 1900 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 1400 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^2;

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^2;

c. Average or CW total output power exceeding 5 kW;

d. Peak pulsed 'power density' exceeding 2500 W/cm^2; *or*

e. Spatially coherent average or CW total output power, greater than 150 W;

2. Wavelength greater than or equal to 1400 nm but less than 1900 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^2;

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^2;

c. Average or CW total output power exceeding 500 W;

d. Peak pulsed 'power density' exceeding 500 W/cm^2; *or*

e. Spatially coherent average or CW total output power, exceeding 15 W

3. Wavelength greater than or equal to 1900 nm and having any of the following:

a. Average or CW output 'power density' greater than 50 W/cm^2;

b. Average or CW output power greater than 10 W; *or*

c. 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.;

Technical Note:

For the purposes of 6A005.d.1.d., 'power density' means the total "laser" output power divided by the emitter surface area of the 'stacked array'.

e. Semiconductor "laser" '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;

Note 1: 'Stacked arrays', formed by combining semiconductor "laser" 'stacked arrays' specified by 6A005.d.1.e., that are not designed to be further combined or modified are specified by 6A005.d.1.d.

Note 2: 'Stacked arrays', formed by combining semiconductor "laser" 'stacked arrays' specified by 6A005.d.1.e., that are designed to be further combined or modified are specified by 6A005.d.1.e.

Note 3: 6A005.d.1.e. does not control modular assemblies of single 'bars' designed to be fabricated into end-to-end stacked linear arrays.

Technical Notes:

1. Semiconductor "lasers" are commonly called "laser" diodes.

2. A 'bar' (also called a semiconductor "laser" 'bar', a "laser" diode 'bar' or diode 'bar') consists of multiple semiconductor "lasers" in a one-dimensional array.

3. A 'stacked array' consists of multiple 'bars' forming a two-dimensional array of semiconductor "lasers".

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_2) "lasers" having any of the following:

   a. CW output power exceeding 15 kW;

   b. Pulsed output with a "pulse duration" exceeding 10 μs 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 μs 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;

N.B.: For excimer "lasers" specially designed for lithography equipment, see 3B001.

5. "Chemical lasers" as follows:

a. Hydrogen Fluoride (HF) "lasers";

b. Deuterium Fluoride (DF) "lasers";

c. "Transfer lasers" as follows:

1. Oxygen Iodine (O_2-I) "lasers";

2. Deuterium Fluoride-Carbon dioxide (DF-CO_2) "lasers";

6. 'Non-repetitive pulsed' Nd: glass "lasers" having any of the following:

a. "Pulse duration" not exceeding 1 μs and output energy exceeding 50 J per pulse; or

b. "Pulse duration" exceeding 1 μs and output energy exceeding 100 J per pulse;

Note: 'Non-repetitive pulsed' refers to "lasers" that produce either a single output pulse or that have a time interval between pulses exceeding one minute.

e. Components as follows:

1. Mirrors cooled either by 'active cooling' or by heat pipe cooling;

Technical Note:

'Active cooling' is a cooling technique for optical components using flowing fluids within the subsurface (nominally less than 1 mm below the optical surface) of the optical component to remove heat from the optic.

2. Optical mirrors or transmissive or partially transmissive optical or electro-optical components, other than fused tapered fibre combiners and Multi-Layer Dielectric gratings (MLDs), specially designed for use with specified "lasers";

Note: Fibre combiners and MLDs are specified in 6A005.e.3.

3. Fibre laser components as follows:

a. Multimode to multimode fused tapered fibre 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 1000 W; and

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2. Number of input fibres equal to or greater than 3;

b. Single mode to multimode fused tapered fibre 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 4600 W;

2. Number of input fibres 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 fibres 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 fibres greater than 5;

c. MLDs having all of the following:

(25) 1. Designed for spectral or coherent beam combination of 5 or more fibre lasers; and

(26) 2. CW Laser Induced Damage Threshold (LIDT) greater than or equal to 10 kW/cm^2.

f. Optical equipment as follows:

N.B.: For shared aperture optical elements, capable of operating in "Super-High Power Laser" ("SHPL") applications, see the Military Goods Controls.

1. Dynamic wavefront (phase) measuring equipment capable of mapping at least 50 positions on a beam wavefront and any of the following:

a. Frame rates equal to or more than 100 Hz and phase discrimination of at least 5 % of the beam's wavelength; or

b. Frame rates equal to or more than 1000 Hz and phase discrimination of at least 20 % of the beam's wavelength;

2. "Laser" diagnostic equipment capable of measuring "SHPL" system angular beam steering errors of equal to or less than 10 μrad;

3. Optical equipment and components, specially designed for a phased-array "SHPL" system for coherent beam combination to an accuracy of λ/10 at the designed wavelength, or 0,1 μm, whichever is the smaller;

4. Projection telescopes specially designed for use with "SHPL" systems;

g. 'Laser acoustic detection equipment' 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 1000 nm but not exceeding 2000 nm;

4. Optical system resolution better (less) than 1 nm; and

5. Optical Signal to Noise ratio equal to or exceeding 10^3.

Technical Note:

'Laser acoustic detection equipment' is sometimes referred to as a LaserMicrophone or Particle Flow Detection Microphone.

6A006 "Magnetometers", "magnetic gradiometers", "intrinsic magnetic gradiometers", underwater electric field sensors, "compensation systems", and specially designed components therefor, as follows:

N.B.: SEE ALSO 7A103.d.

Note: 6A006 does not control instruments specially designed for fishery applications or biomagnetic measurements for medical diagnostics.

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. 0,05 nT (rms) per square root Hz at frequencies of less than 1 Hz;

b. 1×10^{-3} nT (rms) per square root Hz at frequencies of 1 Hz or more but not exceeding 10 Hz; *or*

c. 1×10^{-4} nT (rms) per square root Hz at frequencies exceeding 10 Hz;

5. Fibre optic "magnetometers" having a 'sensitivity' lower (better) than 1 nT (rms) per square root Hz;

b. Underwater electric field sensors having a 'sensitivity' lower (better) than 8 nanovolt per metre 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. Fibre 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 fibre-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 by 6A006.a. or underwater electric field sensors specified by 6A006.b.

Technical Note:

For the purposes of 6A006., 'sensitivity' (noise level) is the root mean square of the device-limited noise floor which is the lowest signal that can be measured.

6A007 Gravity meters (gravimeters) and gravity gradiometers, as follows:

N.B.: SEE ALSO 6A107.

a. Gravity meters designed or modified for ground use and having a static accuracy of less (better) than 10 μGal;

Note: 6A007.a. does not control ground gravity meters of the quartz element (Worden) type.

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;

Technical Note:

For the purposes of 6A007.b., 'time-to-steady-state registration' (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.

c. Gravity gradiometers.

6A008 Radar systems, equipment and assemblies, having any of the following, and specially designed components therefor:

N.B.: SEE ALSO 6A108.

Note: 6A008 does not control:

– *Secondary surveillance radar (SSR);*

– *Civil Automotive Radar;*

– *Displays or monitors used for air traffic control (ATC);*

– *Meteorological (weather) radar;*

– *Precision approach radar (PAR) equipment conforming to ICAO standards and employing electronically steerable linear (1-dimensional) arrays or mechanically positioned passive antennae.*

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 ± 6,25 % of the 'centre operating frequency';

Technical Note:

The 'centre operating frequency' equals one half of the sum of the highest plus the lowest specified operating 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 sidelooking airborne (SLAR) radar mode;

e. Incorporating electronically steerable array antennae;

f. Capable of heightfinding 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;

Note: 6A008.i. does not control:

a. Fishing ground surveillance radar;

b. Ground radar equipment specially designed for enroute air traffic control and having all the following:

1. A maximum "instrumented range" of 500 km or less;

2. Configured so that radar target data can be transmitted only one way from the radar site to one or more civil ATC centres;

3. Contains no provisions for remote control of the radar scan rate from the enroute ATC centre; and

4. Permanently installed;

c. Weather balloon tracking radars.

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 μrad (microradians); or

3. Designed for carrying out airborne bathymetric littoral surveys to International Hydrographic Organization (IHO) Order 1a Standard (5th Edition February 2008) for Hydrographic Surveys or better, and using one or more lasers with a wavelength exceeding 400 nm but not exceeding 600 nm;

Note 1: LIDAR equipment specially designed for surveying is only specified in 6A008.j.3.

Note 2: 6A008.j. does not control LIDAR equipment specially designed for meteorological observation.

Note 3: Parameters in the IHO Order 1a Standard 5th Edition February 2008 are summarized as follows:

– *Horizontal Accuracy (95 % Confidence Level) = 5 m + 5 % of depth.*

– *Depth Accuracy for Reduced Depths (95 % confidence level) $=\pm\sqrt{a^2+(b*d)^2}$, where*:

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a	=	*0,5 m = constant depth error, i.e. the sum of all constant depth errors*
b	=	*0,013 = factor of depth dependent error*
b*d	=	*depth dependent error, i.e. the sum of all depth dependent errors*
d	=	*depth*

– *Feature Detection = Cubic features > 2 m in depths up to 40 m;10 % of depth beyond 40 m.*

k. Having "signal processing" sub-systems using "pulse compression" and having any of the following:

1. A "pulse compression" ratio exceeding 150; or

2. A compressed pulse width of less than 200 ns; *or*

Note: 6A008.k.2. does not control two dimensional 'marine radar' or 'vessel traffic service' radar, having all of the following;

a. "Pulse compression" ratio not exceeding 150;

b. Compressed pulse width of greater than 30 ns;

c. Single and rotating mechanically scanned antenna;

d. Peak output power not exceeding 250 W; and

e. Not capable of "frequency hopping".

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*

Note: 6A008.l.1. does not control conflict alert capability in ATC systems, or 'marine radar'.

2. Not used;

3. Not used;

4. 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 by 6A008.f. or 6A008.i.

N.B. See also Military Goods Controls.

Note: 6A008.l.4. does not control systems, equipment and assemblies used for 'vessel traffic service'.

Technical Notes:

1. For the purposes of 6A008, 'marine radar' is a radar that is used to navigate safely at sea, inland waterways or near-shore environments.

2. For the purposes of 6A008, 'vessel traffic service' is a vessel traffic monitoring and control service similar to air traffic control for aircraft.

6A102 Radiation hardened 'detectors', 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 5×10^5 rads (silicon).

Technical Note:

In 6A102, a 'detector' is defined as a mechanical, electrical, optical or chemical device that automatically identifies and records, or registers a stimulus such as an environmental change in pressure or temperature, an electrical or electromagnetic signal or radiation from a radioactive material. This includes devices that sense by one time operation or failure.

6A107 Gravity meters (gravimeters) 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 and tracking systems, 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;

Note: 6A108.a. includes the following:

a. Terrain contour mapping equipment;

b. Imaging sensor equipment;

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

d. Doppler navigation radar equipment.

b. Precision tracking systems, usable for 'missiles', as follows:

1. Tracking systems which use a code translator in conjunction with either surface or airborne references or navigation satellite systems to provide real-time measurements of in-flight position and velocity;

2. Range instrumentation radars including associated optical/infrared trackers with all of the following capabilities:

   a. Angular resolution better than 1,5 milliradians;

   b. Range of 30 km or greater with a range resolution better than 10 m rms;

   c. Velocity resolution better than 3 m/s.

Technical Note:

In 6A108.b. 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

6A202 Photomultiplier tubes having both of the following characteristics:

a. Photocathode area of greater than 20 cm^2; *and*

b. Anode pulse rise time of less than 1 ns.

6A203 Cameras and components, other than those specified in 6A003, as follows:

N.B. 1: "Software" specially designed to enhance or release the performance of a camera or imaging device to meet the characteristics of 6A203.a., 6A203.b. or 6A203.c. is specified in 6D203.

N.B. 2: "Technology" in the form of codes or keys to enhance or release the performance of a camera or imaging device to meet the characteristics of 6A203.a., 6A203.b. or 6A203.c is specified in 6E203.

Note: 6A203.a. to 6A203.c. does not control cameras or imaging devices if they have hardware, "software" or "technology" constraints that limit the performance to less than that specified above, provided they meet any of the following:

1. They need to be returned to the original manufacturer to make the enhancements or release the constraints;

2. They require "software" as specified in 6D203 to enhance or release the performance to meet the characteristics of 6A203; or

3. They require "technology" in the form of keys or codes as specified in 6E203 to enhance or release the performance to meet the characteristics of 6A203.

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

   1. Streak cameras with writing speeds greater than 0,5 mm/μs;

   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:

1. Framing cameras with recording rates greater than 225000 frames per second;

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

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

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

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

Technical Note:

In 6A203.b., high speed single frame cameras can be used alone to produce a single image of a dynamic event, or several such cameras can be combined in a sequentially-triggered system to produce multiple images of an event.

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 50×10^3 Gy(silicon) (5×10^6 rad (silicon)) without operational degradation.

Technical Note:

The term Gy(silicon) refers to the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionising radiation.

6A205 "Lasers", "laser" amplifiers and oscillators, other than those specified in 0B001.g.5., 0B001.h.6. and 6A005; as follows:

N.B.: For copper vapour lasers, see 6A005.b.

a. Argon ion "lasers" having both of the following characteristics:

1. Operating at wavelengths between 400 nm and 515 nm; *and*

2. An average output power greater than 40 W;

b. Tunable pulsed single-mode dye laser oscillators having all of the following characteristics:

1. Operating at wavelengths between 300 nm and 800 nm;

2. An average output power greater than 1 W;

3. A repetition rate greater than 1 kHz; *and*

4. Pulse width less than 100 ns;

c. Tunable pulsed dye laser amplifiers and oscillators, having all of the following characteristics:

1. Operating at wavelengths between 300 nm and 800 nm;

2. An average output power greater than 30 W;

3. A repetition rate greater than 1 kHz; and

4. Pulse width less than 100 ns;

Note: 6A205.c. does not control single mode oscillators;

d. Pulsed carbon dioxide "lasers" having all of the following characteristics:

1. Operating at wavelengths between 9000 nm and 11000 nm;

2. A repetition rate greater than 250 Hz;

3. An average output power greater than 500 W; and

4. Pulse width of less than 200 ns;

e. Para-hydrogen Raman shifters designed to operate at 16 μm output wavelength and at a repetition rate greater than 250 Hz;

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f. Neodymium-doped (other than glass) "lasers" with an output wavelength between 1000 and 1100 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 40 W; 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 lasers, other than those specified in 6A005.d.2., having all of the following:

1. Operating at wavelengths between 5000 and 6000 nm;

2. A repetition rate greater than 250 Hz;

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

4. Pulse width of less than 200 ns.

6A225 Velocity interferometers for measuring velocities exceeding 1 km/s during time intervals of less than 10 microseconds.

Note: 6A225 includes velocity interferometers such as VISARs (Velocity Interferometer Systems for Any Reflector), DLIs (Doppler Laser Interferometers) and PDV (Photonic Doppler Velocimeters) also known as Het-V (Heterodyne Velocimeters).

6A226 Pressure sensors, as follows:

a. Shock pressure gauges capable of measuring pressures greater than 10 GPa, including gauges made with manganin, ytterbium, and polyvinylidene bifluoride (PVBF, PVF_2);

b. Quartz pressure transducers for pressures greater than 10 GPa.

42. *6B Test, Inspection and Production Equipment*

6B004 Optical equipment as follows:

a. Equipment for measuring absolute reflectance to an accuracy of ± 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 or less (better) against the required profile.

Note: 6B004 does not control microscopes.

6B007 Equipment to produce, align and calibrate land-based gravity meters with a static accuracy of 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.

N.B.: SEE ALSO 6B108.

6B108 Systems, other than those specified in 6B008, specially designed for radar cross section measurement usable for 'missiles' and their subsystems.

Technical Note:

In 6B108 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

43. *6C Materials*

6C002 Optical sensor materials as follows:

a. Elemental tellurium (Te) of purity levels of 99,9995 % or more;

b. Single crystals (including epitaxial wafers) of any of the following:

1. Cadmium zinc telluride (CdZnTe), with zinc content of less than 6 % by 'mole fraction';

2. Cadmium telluride (CdTe) of any purity level; or

3. Mercury cadmium telluride (HgCdTe) of any purity level.

Technical Note:

'Mole fraction' is defined as the ratio of moles of ZnTe to the sum of moles of CdTe and ZnTe present in the crystal.

6C004 Optical materials as follows:

a. Zinc selenide (ZnSe) and zinc sulphide (ZnS) "substrate blanks", produced by the chemical vapour deposition process and having any of the following:

1. A volume greater than 100 cm^3; *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 (KTA) (CAS 59400-80-5);

2. Silver gallium selenide (AgGaSe2, also known as AGSE) (CAS 12002-67-4);

3. Thallium arsenic selenide (Tl3AsSe3, also known as TAS) (CAS 16142-89-5);

4. Zinc germanium phosphide (ZnGeP2, also known as ZGP, zinc germanium biphosphide or zinc germanium diphosphide); or

5. Gallium selenide (GaSe) (CAS 12024-11-2);

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 ($\chi^{(3)}$, chi 3) of 10^{-6} m^2/V^2 or more; *and*

b. Response time of less than 1 ms; *or*

2. Second order non-linear susceptibility ($\chi^{(2)}$, chi 2) of $3{,}3 \times 10^{-11}$ m/V 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 (ZrF_4) (CAS 7783-64-4) and hafnium fluoride (HfF_4) (CAS 13709-52-9) 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 5×10^{-6};

f. Synthetically produced diamond material with an absorption of less than 10^{-5} cm^{-1} for wavelengths exceeding 200 nm but not exceeding 14,000 nm.

6C005 "Laser" materials as follows:

a. Synthetic crystalline "laser" host material in unfinished form as follows:

1. Titanium doped sapphire;

2. Not used.

b. Rare-earth-metal doped double-clad fibres having any of the following:

1. Nominal laser wavelength of 975 nm to 1150 nm and having all of the following:

a. Average core diameter equal to or greater than 25 μm; *and*

b. Core 'Numerical Aperture' ('NA') less than 0,065; *or*

Note: 6C005.b.1. does not control double-clad fibres having an inner glass cladding diameter exceeding 150 µm and not exceeding 300 µm.

2. Nominal laser wavelength exceeding 1530 nm and having all of the following:

   a. Average core diameter equal to or greater than 20 µm; *and*

   b. Core 'NA' less than 0.1.

Technical Notes

1. For the purposes of 6C005, the core 'Numerical Aperture' ('NA') is measured at the emission wavelengths of the fibre.

2. 6C005.b. includes fibres assembled with end caps.

44. *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 by 6A001.a.1.e.; and

   b. Automatically detecting, classifying and determining the location of divers or swimmers;

N.B.: For diver detection "software" or "source code", specially designed or modified for military use, see the Military Goods Controls.

b. Not used;

c. "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. Note 3.a.

d. "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;

e. Not used;

f. "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 by 6A006.e.;

4. "Source code" for "real time processing" of electromagnetic data using underwater electromagnetic receivers specified by 6A006.e;

g. "Software" specially designed to correct motional influences of gravity meters or gravity gradiometers;

h. "Software" as follows:

1. Air Traffic Control (ATC) "software" application "programmes" designed to be hosted on general purpose computers located at Air Traffic Control centres and capable of accepting radar target data from more than four primary radars;

2. "Software" for the design or "production" of radomes and having all of the following:

a. Specially designed to protect the "electronically steerable phased array antennae" specified in 6A008.e.; and

b. Resulting in an antenna pattern having an 'average side lobe level' more than 40 dB below the peak of the main beam level.

Technical Note:

'Average side lobe level' in 6D003.h.2.b. is measured over the entire array excluding the angular extent of the main beam and the first two side lobes on either side of the main beam.

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

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6D103 "Software" which processes post-flight, recorded data, enabling determination of vehicle position throughout its flight path, specially designed or modified for 'missiles'.

Technical Note:

In 6D103 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

6D203 "Software" specially designed to enhance or release the performance of cameras or imaging devices to meet the characteristics of 6A203.a. to 6A203.c.

45. *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. "Technology" as follows:

1. Optical surface coating and treatment "technology", "required" 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 5×10^{-3};

N.B.: See also 2E003.f.

Technical Note:

'Optical thickness' is the mathematical product of the index of refraction and the physical thickness of the coating.

2. Optical fabrication "technology" 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^2;

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., 6A008, 6A102, 6A107, 6A108, 6B108, 6D102 or 6D103.

Note: 6E101 only specifies "technology" for equipment specified in 6A008 When it is designed for airborne applications and is usable in "missiles".

6E201 "Technology" according to the General Technology Note for the "use" of equipment specified in 6A003, 6A005.a.2., 6A005.b.2., 6A005.b.3., 6A005.b.4., 6A005.b.6., 6A005.c.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 6A203a. to 6A203.c.

CATEGORY 7 — NAVIGATION AND AVIONICS

46. *7A Systems, Equipment and Components*

N.B.: For automatic pilots for underwater vehicles, see Category 8. For radar, see Category 6.

7A001 Accelerometers as follows and specially designed components therefor:

N.B.: SEE ALSO 7A101.

N.B.: For angular or rotational accelerometers, see 7A001.b.

a. Linear accelerometers having any of the following:

1. Specified to function at linear acceleration levels less than or equal to 15 g and having any of the following:

a. A "bias" "stability" of less (better) than 130 micro g with respect to a fixed calibration value over a period of one year; *or*

b. A "scale factor" "stability" of less (better) than 130 ppm with respect to a fixed calibration value over a period of one year;

2. Specified to function at linear acceleration levels exceeding 15 g but less than or equal to 100 g and having all of the following:

a. A "bias" "repeatability" of less (better) than 1250 micro g over a period of one year; and

b. A "scale factor" "repeatability" of less (better) than 1250 ppm over a period of one year; *or*

3. Designed for use in inertial navigation or guidance systems and specified to function at linear acceleration levels exceeding 100 g;

Note: 7A001.a.1. and 7A001.a.2. do not control accelerometers limited to measurement of only vibration or shock.

b. Angular or rotational accelerometers, specified to function at linear acceleration levels exceeding 100 g.

7A002 Gyros or angular rate sensors, having any of the following and specially designed components therefor:

N.B.: SEE ALSO 7A102.

N.B.: For angular or rotational accelerometers, see 7A001.b.

a. Specified to function at linear acceleration levels less than or equal to 100 g and having any of the following:

1. A rate range of less than 500 degrees per second and having any of the following:

a. A "bias" "stability" of less (better) than 0,5 degree per hour, when measured in a 1 g environment over a period of one month, and with respect to a fixed calibration value; or

b. An "angle random walk" of less (better) than or equal to 0.0035 degree per square root hour; *or*

Note: 7A002.a.1.b. does not control "spinning mass gyros".

2. A rate range greater than or equal to 500 degrees per second and having any of the following:

a. A "bias" "stability" of less (better) than 4 degrees per hour, when measured in a 1 g environment over a period of three minutes, and with respect to a fixed calibration value; or

b. An "angle random walk" of less (better) than or equal to 0,1 degree per square root hour; *or*

Note: 7A002.a.2.b. does not control "spinning mass gyros".

b. Specified to function at linear acceleration levels exceeding 100 g.

7A003 'Inertial measurement equipment or systems', having any of the following:

N.B.: SEE ALSO 7A103.

Note 1: 'Inertial measurement equipment or systems' incorporate accelerometers or gyroscopes to measure changes in velocity and orientation in order to determine or maintain heading or position without requiring an external reference once aligned. 'Inertial measurement equipment or systems' include:

– Attitude and Heading Reference Systems (AHRSs);

– Gyrocompasses;

– Inertial Measurement Units (IMUs);

– Inertial Navigation Systems (INSs);

– Inertial Reference Systems (IRSs);

– Inertial Reference Units (IRUs).

Note 2: 7A003 does not control 'inertial measurement equipment or systems' which are certified for use on "civil aircraft" by civil aviation authorities of one or more EU Member States or Wassenaar Arrangement Participating States.

Technical Notes:

1. 'Positional aiding references' independently provide position, and include:

a. Global Navigation Satellite Systems (GNSS);

b. "Data-Based Referenced Navigation" ("DBRN").

2. 'Circular Error Probable' ('CEP') - 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.

a. Designed for "aircraft", land vehicles or vessels, providing position without the use of 'positional aiding references', and having any of the following accuracies subsequent to normal alignment:

1. 0,8 nautical miles per hour (nm/hr) 'Circular Error Probable' ('CEP') rate or less (better);

2. 0,5 % distanced travelled 'CEP' or less (better); or

3. Total drift of 1 nautical mile 'CEP' or less (better) in a 24 hr period;

Technical Note:

The performance parameters in 7A003.a.1., 7A003.a.2. and 7A003.a.3. typically apply to 'inertial measurement equipment or systems' designed for "aircraft", vehicles and vessels, respectively. These parameters result from the utilisation of specialised non-positional aiding references (e.g., altimeter, odometer, velocity log). As a consequence, the specified performance values cannot be readily converted between these parameters. Equipment designed for multiple platforms are evaluated against each applicable entry 7A003.a.1., 7A003.a.2., or 7A003.a.3.

b. Designed for "aircraft", land vehicles or vessels, with an embedded 'positional aiding reference' and providing position after loss of all 'positional aiding references' for a period of up to 4 minutes, having an accuracy of less (better) than 10 meters 'CEP';

Technical Note:

7A003.b. refers to systems in which 'inertial measurement equipment or systems' and other independent 'positional aiding references' are built into a single unit (i.e., embedded) in order to achieve improved performance.

c. Designed for "aircraft", land vehicles or vessels, providing heading or True North determination and having any of the following:

1. A maximum operating angular rate less (lower) than 500 deg/s and a heading accuracy without the use of 'positional aiding references' equal to or less (better) than 0,07 deg sec(Lat) (equivalent to 6 arc minutes rms at 45 degrees latitude); or

2. A maximum operating angular rate equal to or greater (higher) than 500 deg/s and a heading accuracy without the use of 'positional aiding references' equal to or less (better) than 0,2 deg sec(Lat) (equivalent to 17 arc minutes rms at 45 degrees latitude); *or*

d. Providing acceleration measurements or angular rate measurements, in more than one dimension, and having any of the following:

1. Performance specified by 7A001 or 7A002 along any axis, without the use of any aiding references; or

2. Being "space-qualified" and providing angular rate measurements having an "angle random walk" along any axis of less (better) than or equal to 0,1 degree per square root hour.

Note: 7A003.d.2. does not control 'inertial measurement equipment or systems' that contain "spinning mass gyros" as the only type of gyro.

7A004 'Star trackers' and components therefor, as follows:

N.B.: SEE ALSO 7A104.

a. 'Star trackers' with a specified azimuth accuracy of equal to or less (better) than 20 seconds of arc throughout the specified lifetime of the equipment;

b. Components specially designed for equipment specified in 7A004.a. as follows:

1. Optical heads or baffles;

2. Data processing units.

Technical Note:

'Star trackers' are also referred to as stellar attitude sensors or gyro-astro compasses.

7A005 Global Navigation Satellite Systems (GNSS) receiving equipment having any of the following and specially designed components therefor:

N.B.: SEE ALSO 7A105.

N.B.: For equipment specially designed for military use, see Military Goods Controls.

a. Employing a decryption algorithm specially designed or modified for government use to access the ranging code for position and time; *or*

b. Employing 'adaptive antenna systems'.

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Note: 7A005.b. does not control GNSS receiving equipment that only uses components designed to filter, switch, or combine signals from multiple omni-directional antennae that do not implement adaptive antenna techniques.

Technical Note:

For the purposes of 7A005.b 'adaptive antenna systems' dynamically generate one or more spatial nulls in an antenna array pattern by signal processing in the time domain or frequency domain.

7A006 Airborne altimeters operating at frequencies other than 4.2 to 4.4 GHz inclusive and having any of the following:

N.B.: SEE ALSO 7A106.

a. "Power management"; or

b. Using phase shift key modulation.

7A008 Underwater sonar navigation systems using doppler velocity or correlation velocity logs integrated with a heading source and having a positioning accuracy of equal to or less (better) than 3 % of distance travelled 'Circular Error Probable' ('CEP') and specially designed components therefor.

Note: 7A008 does not control systems specially designed for installation on surface vessels or systems requiring acoustic beacons or buoys to provide positioning data.

N.B.: See 6A001.a. for acoustic systems, and 6A001.b. for correlation-velocity and Doppler-velocity sonar log equipment.

See 8A002 for other marine systems.

7A101 Linear accelerometers, other than those specified in 7A001, designed for use in inertial navigation systems or in guidance systems of all types, usable in 'missiles', having all the following characteristics, and specially designed components therefor:

a. A "bias" "repeatability" of less (better) than 1250 micro g; and

b. A "scale factor" "repeatability" of less (better) than 1250 ppm;

Note: 7A101 does not control accelerometers specially designed and developed as Measurement While Drilling (MWD) Sensors for use in downhole well service operations.

Technical Notes:

1. In 7A101 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km;

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

7A102 All types of gyros, other than those specified in 7A002, usable in 'missiles', with a rated "drift rate" 'stability' of less than 0.5 ° (1 sigma or rms) per hour in a 1 g environment and specially designed components therefor.

Technical Notes:

1. In 7A102 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

2. In 7A102 'stability' is defined as a measure of the ability of a specific mechanism or performance coefficient to remain invariant when continuously exposed to a fixed operating condition (IEEE STD 528-2001 paragraph 2,247).

7A103 Instrumentation, navigation equipment and systems, other than those specified in 7A003, as follows; and specially designed components therefor:

a. Inertial or other equipment, using accelerometers or gyros as follows, and systems incorporating such equipment:

1. Accelerometers specified in 7A001.a.3., 7A001.b. or 7A101 or gyros specified in 7A002 or 7A102; *or*

2. Accelerometers specified in 7A001,a,1, or 7A001,a,2, designed for use in inertial navigation systems or in guidance systems of all types, and usable in 'missiles';

Note: 7A103.a. does not specify equipment containing accelerometers specified in 7A001 where such accelerometers are specially designed and developed as MWD (Measurement While Drilling) sensors for use in down-hole well services operations.

b. Integrated flight instrument systems which include gyrostabilisers or automatic pilots, designed or modified for use in 'missiles';

c. 'Integrated navigation systems', designed or modified for 'missiles' and capable of providing a navigational accuracy of 200 m Circle of Equal Probability (CEP) or less;

Technical Note:

An 'integrated navigation system' typically incorporates the following components:

1. An inertial measurement device (e.g., an attitude and heading reference system, inertial reference unit, or inertial navigation system);

2. One or more external sensors used to update the position and/or velocity, either periodically or continuously throughout the flight (e.g., satellite navigation receiver, radar altimeter, and/or Doppler radar); and

3. Integration hardware and software;

d. Three axis magnetic heading sensors, designed or modified to be integrated with flight control and navigation systems, other than those specified in 6A006, having all the following characteristics, and specially designed components therefor;

1. Internal tilt compensation in pitch (± 90 degrees) and roll (± 180 degrees) axes;

2. Capable of providing azimuthal accuracy better (less) than 0,5 degrees rms at latitude of ± 80 degrees, reference to local magnetic field.

Note: Flight control and navigation systems in 7A103.d. include gyrostabilizers, automatic pilots and inertial navigation systems.

Technical Note:

In 7A103 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

7A104 Gyro-astro compasses and other devices, other than those specified in 7A004, which derive position or orientation by means of automatically tracking celestial bodies or satellites and specially designed components therefor.

7A105 Receiving equipment for Global Navigation Satellite Systems (GNSS; e.g. GPS, GLONASS, or Galileo), other than those specified in 7A005, having any of the following characteristics, and specially designed components therefor:

a. Designed or modified for use in space launch vehicles specified in 9A004, sounding rockets specified in 9A104 or unmanned aerial vehicles specified in 9A012 or 9A112.a; *or*

b. Designed or modified for airborne applications and having any of the following:

1. Capable of providing navigation information at speeds in excess of 600 m/s;

2. Employing decryption, designed or modified for military or governmental services, to gain access to GNSS secured signal/data; or

3. Being specially designed to employ anti-jam features (e.g. null steering antenna or electronically steerable antenna) to function in an environment of active or passive countermeasures.

Note: 7A105.b.2. and 7A105.b.3. do not control equipment designed for commercial, civil or 'Safety of Life' (e.g., data integrity, flight safety) GNSS services.

7A106 Altimeters, other than those specified in 7A006, of radar or laser radar type, designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

7A115 Passive sensors for determining bearing to specific electromagnetic source (direction finding equipment) or terrain characteristics, designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

Note: 7A115 includes sensors for the following equipment:

a. Terrain contour mapping equipment;

b. Imaging sensor equipment (both active and passive);

c. Passive interferometer equipment.

7A116 Flight control systems and servo valves, as follows; designed or modified for use in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

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

b. Attitude control equipment;

c. Flight control servo valves designed or modified for the systems specified in 7A116.a. or 7A116.b., and designed or modified to operate in a vibration environment greater than 10 g rms between 20 Hz and 2 kHz.

7A117 "Guidance sets", usable in "missiles" capable of achieving system accuracy of 3,33 % or less of the range (e.g., a "CEP" of 10 km or less at a range of 300 km).

47. *7B Test, Inspection and Production Equipment*

7B001 Test, calibration or alignment equipment, specially designed for equipment specified in 7A.

Note: 7B001 does not control test, calibration or alignment equipment for 'Maintenance Level I' or 'Maintenance Level II'.

Technical Notes:

1. 'Maintenance Level I'

The failure of an inertial navigation unit is detected on the aircraft by indications from the Control and Display Unit (CDU) or by the status message from the corresponding sub-system. By following the manufacturer's manual, the cause of the failure may be localised at the level of the malfunctioning Line Replaceable Unit (LRU). The operator then removes the LRU and replaces it with a spare.

2. 'Maintenance Level II'

The defective LRU is sent to the maintenance workshop (the manufacturer's or that of the operator responsible for level II maintenance). At the maintenance workshop, the malfunctioning LRU is tested by various appropriate means to verify and localise the defective Shop Replaceable Assembly (SRA) module responsible for the failure. This SRA is removed and replaced by an operative spare. The defective SRA (or possibly the complete LRU) is then shipped to the manufacturer. 'Maintenance Level II' does not include the disassembly or repair of controlled accelerometers or gyro sensors.

7B002 Equipment specially designed to characterize mirrors for ring "laser" gyros, as follows:

N.B.: SEE ALSO 7B102.

a. Scatterometers having a measurement accuracy of 10 ppm or less (better);

b. Profilometers having a measurement accuracy of 0,5 nm (5 angstrom) or less (better).

7B003 Equipment specially designed for the "production" of equipment specified in 7A.

Note: 7B003 includes:

– *Gyro tuning test stations;*

– *Gyro dynamic balance stations;*

– *Gyro run-in/motor test stations;*

– *Gyro evacuation and fill stations;*

– *Centrifuge fixtures for gyro bearings;*

– *Accelerometer axis align stations;*

– *Fibre optic gyro coil winding machines.*

7B102 Reflectometers specially designed to characterise mirrors, for "laser" gyros, having a measurement accuracy of 50 ppm or less (better).

7B103 "Production facilities" and "production equipment" as follows:

a. "Production facilities" specially designed for equipment specified in 7A117;

b. "Production equipment", and other test, calibration and alignment equipment, other than that specified in 7B001 to 7B003, designed or modified to be used with equipment specified in 7A.

48. *7C Materials*

None.

49. *7D Software*

7D001 "Software" specially designed or modified for the "development" or "production" of equipment specified in 7A. or 7B.

7D002 "Source code" for the operation or maintenance of any inertial navigation equipment, including inertial equipment not specified in 7A003 or 7A004, or Attitude and Heading Reference Systems ('AHRS').

Note: 7D002 does not control "source code" for the "use" of gimballed 'AHRS'.

Technical Note:

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'AHRS' generally differ from Inertial Navigation Systems (INS) in that an 'AHRS' provides attitude and heading information and normally does not provide the acceleration, velocity and position information associated with an INS.

7D003 Other "software" as follows:

a. "Software" specially designed or modified to improve the operational performance or reduce the navigational error of systems to the levels specified in 7A003, 7A004 or 7A008;

b. "Source code" for hybrid integrated systems which improves the operational performance or reduces the navigational error of systems to the level specified in 7A003 or 7A008 by continuously combining heading data with any of the following:

1. Doppler radar or sonar velocity data;

2. Global Navigation Satellite Systems (GNSS) reference data; or

3. Data from "Data-Based Referenced Navigation" ("DBRN") systems;

c. Not used;

d. Not used;

e. Computer-Aided-Design (CAD) "software" specially designed for the "development" of "active flight control systems", helicopter multi-axis fly-by-wire or fly-by-light controllers or helicopter "circulation controlled anti-torque or circulation-controlled direction control systems", whose "technology" is specified in 7E004.b., 7E004.c.1. or 7E004.c.2.

7D004 "Source code" incorporating "development" "technology" specified in 7E004.a.1. to 7E004.a.6. or 7E004.b.,for any of the following:

a. Digital flight management systems for "total control of flight";

b. Integrated propulsion and flight control systems;

c. "Fly-by-wire systems" or "fly-by-light systems";

d. Fault-tolerant or self-reconfiguring "active flight control systems";

e. Not used;

f. Air data systems based on surface static data; or

g. Three dimensional displays.

Note: 7D004. does not control "source code" associated with common computer elements and utilities (e.g., input signal acquisition, output signal transmission, computer program and data loading, built-in test, task scheduling mechanisms) not providing a specific flight control system function.

7D005 "Software" specially designed to decrypt Global Navigation Satellite Systems (GNSS) ranging code designed for government use.

7D101 "Software" specially designed or modified for the "use" of equipment specified in 7A001 to 7A006, 7A101 to 7A106, 7A115, 7A116.a., 7A116.b., 7B001, 7B002, 7B003, 7B102 or 7B103.

7D102 Integration "software" as follows:

a. Integration "software" for the equipment specified in 7A103.b.;

b. Integration "software" specially designed for the equipment specified in 7A003 or 7A103.a.

c. Integration "software" designed or modified for the equipment specified in 7A103.c.

Note: A common form of integration "software" employs Kalman filtering.

7D103 "Software" specially designed for modelling or simulation of the "guidance sets" specified in 7A117 or for their design integration with the space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

Note: "Software" specified in 7D103 remains controlled when combined with specially designed hardware specified in 4A102.

50. *7E Technology*

7E001 "Technology" according to the General Technology Note for the "development" of equipment or "software", specified in 7A, 7B, 7D001, 7D002, 7D003, 7D005 and 7D101 to 7D103.

Note: 7E001 includes key management "technology" exclusively for equipment specified in 7A005.a.

7E002 "Technology" according to the General Technology Note for the "production" of equipment specified in 7A or 7B.

7E003 "Technology" according to the General Technology Note for the repair, refurbishing or overhaul of equipment specified in 7A001 to 7A004.

Note: 7E003 does not control maintenance "technology" directly associated with calibration, removal or replacement of damaged or unserviceable LRUs and SRAs of a "civil aircraft" as described in 'Maintenance Level I' or 'Maintenance Level II'.

N.B.: See Technical Notes to 7B001.

7E004 Other "technology" as follows:

a. "Technology" for the "development" or "production" of any of the following:

1. Not used;

2. Air data systems based on surface static data only, i.e., which dispense with conventional air data probes;

3. Three dimensional displays for "aircraft";

4. Not used;

5. Electric actuators (i.e., electromechanical, electrohydrostatic and integrated actuator package) specially designed for "primary flight control";

6. "Flight control optical sensor array" specially designed for implementing "active flight control systems"; or

7. "DBRN" systems designed to navigate underwater, using sonar or gravity databases, that provide a positioning accuracy equal to or less (better) than 0.4 nautical miles;

b. "Development" "technology", as follows, for "active flight control systems" (including "fly-by-wire systems" or "fly-by-light systems"):

1. Photonic-based "technology" for sensing aircraft or flight control component state, transferring flight control data, or commanding actuator movement, "required" for "fly-by-light systems" "active flight control systems";

2. Not used;

3. Real-time algorithms to analyze component sensor information to predict and preemptively mitigate impending degradation and failures of components within an "active flight control system";

Note: 7E004.b.3. does not control algorithms for purpose of off-line maintenance.

4. Real-time algorithms to identify component failures and reconfigure force and moment controls to mitigate "active flight control system" degradations and failures;

Note: 7E004.b.4. does not control algorithms for the elimination of fault effects through comparison of redundant data sources, or off-line pre-planned responses to anticipated failures.

5. Integration of digital flight control, navigation and propulsion control data, into a digital flight management system for "total control of flight";

Note: 7E004.b.5. does not control:

a. "Development" "technology" for integration of digital flight control, navigation and propulsion control data, into a digital flight management system for "flight path optimisation";

b. "Development" "technology" for "aircraft" flight instrument systems integrated solely for VOR, DME, ILS or MLS navigation or approaches.

6. Not used;

7. "Technology" "required" for deriving the functional requirements for "fly-by-wire systems" having all of the following:

   a. 'Inner-loop' airframe stability controls requiring loop closure rates of 40 Hz or greater; and

   Technical Note:

   'Inner-loop' refers to functions of "active flight control systems" that automate airframe stability controls.

   b. Having any of the following:

      1. Corrects an aerodynamically unstable airframe, measured at any point in the design flight envelope, that would lose recoverable control if not corrected within 0.5 seconds;

      2. Couples controls in two or more axes while compensating for 'abnormal changes in aircraft state';

      Technical Note:

      'Abnormal changes in aircraft state' include in-flight structural damage, loss of engine thrust, disabled control surface, or destabilizing shifts in cargo load.

      3. Performs the functions specified in 7E004.b.5.; or

      Note: 7E004.b.7.b.3. does not control autopilots.

      4. Enables aircraft to have stable controlled flight, other than during take-off or landing, at greater than 18 degrees angle of attack, 15 degrees side slip, 15 degrees/second pitch or yaw rate, or 90 degrees/second roll rate;

8. "Technology" "required" for deriving the functional requirements for "fly-by-wire systems" to achieve all of the following:

   a. No loss of control of the aircraft in the event of a consecutive sequence of any two individual faults within the "fly-by-wire system"; and

   b. Probability of loss of control of the aircraft being less (better) than $1x10^{-9}$ failures per flight hour;

Note: 7E004.b. does not control technology associated with common computer elements and utilities (e.g., input signal acquisition, output signal transmission, computer program and data loading, built-in test, task scheduling mechanisms) not providing a specific flight control system function.

c. "Technology" for the "development" of helicopter systems, as follows:

1. Multi-axis fly-by-wire or fly-by-light controllers, which combine the functions of at least two of the following into one controlling element:

   a. Collective controls;

   b. Cyclic controls;

   c. Yaw controls;

2. "Circulation-controlled anti-torque or circulation-controlled directional control systems";

3. Rotor blades incorporating "variable geometry airfoils", for use in systems using individual blade control.

7E101 "Technology" according to the General Technology Note for the "use" of equipment specified in 7A001 to 7A006, 7A101 to 7A106, 7A115 to 7A117, 7B001, 7B002, 7B003, 7B102, 7B103, 7D101 to 7D103.

7E102 "Technology" for protection of avionics and electrical subsystems against electromagnetic pulse (EMP) and electromagnetic interference (EMI) hazards, from external sources, as follows:

a. Design "technology" for shielding systems;

b. Design "technology" for the configuration of hardened electrical circuits and subsystems;

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

7E104 "Technology" for the integration of the flight control, guidance, and propulsion data into a flight management system for optimization of rocket system trajectory.

CATEGORY 8 — MARINE

51. *8A Systems, Equipment and Components*

8A001 Submersible vehicles and surface vessels, as follows:

Note: For the control status of equipment for submersible vehicles, see:

– *Category 5, Part 2 "Information Security" for encrypted communication equipment;*

– *Category 6 for sensors;*

– *Categories 7 and 8 for navigation equipment;*

– *Category 8A for underwater equipment.*

a. Manned, tethered submersible vehicles designed to operate at depths exceeding 1000 m;

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b. Manned, untethered submersible vehicles having any of the following:

1. Designed to 'operate autonomously' and having a lifting capacity of all the following:

a. 10 % or more of their weight in air; and

b. 15 kN or more;

2. Designed to operate at depths exceeding 1000 m; 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;

Technical Notes:

1. For the purposes of 8A001.b., 'operate autonomously' means fully submerged, without snorkel, all systems working and cruising at minimum speed at which the submersible can safely control its depth dynamically by using its depth planes only, with no need for a support vessel or support base on the surface, sea-bed or shore, and containing a propulsion system for submerged or surface use.

2. For the purposes of 8A001.b., 'range' means half the maximum distance a submersible vehicle can 'operate autonomously'.

c. Unmanned, tethered submersible vehicles designed to operate at depths exceeding 1,000 m and 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. Unmanned, untethered submersible vehicles having any of the following:

1. Designed for deciding a course relative to any geographical reference without real-time human assistance;

2. Acoustic data or command link; or

3. Optical data or command link exceeding 1000 m;

e. Ocean salvage systems with a lifting capacity exceeding 5MN 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 1000 m and with positioning accuracies to within 10 m of a predetermined point;

f. Not used

g. Not used

h. Not used

i. Not used

8A002 Marine systems, equipment and components, as follows:

Note: For underwater communications systems, see Category 5, Part 1 - Telecommunications.

a. Systems, equipment and components, specially designed or modified for submersible vehicles and designed to operate at depths exceeding 1,000 m, 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;

Technical Note:

The objective of 8A002.a.4. should not be defeated by the export of 'syntactic foam' specified in 8C001 When an intermediate stage of manufacture has been performed and it is not yet in the final component form.

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 as follows:

1. Television systems and television cameras, as follows:

a. Television systems (comprising camera, monitoring and signal transmission equipment) having a 'limiting resolution' when measured in air of more than 800 lines and specially designed or modified for remote operation with a submersible vehicle;

b. Underwater television cameras having a 'limiting resolution' when measured in air of more than 1100 lines;

c. Low light level television cameras specially designed or modified for underwater use and having all of the following:

1. Image intensifier tubes specified in 6A002.a.2.a.; and

2. More than 150000 "active pixels" per solid state area array;

Technical Note:

'Limiting resolution' is a measure of horizontal resolution usually expressed in terms of the maximum number of lines per picture height discriminated on a test chart, using IEEE Standard 208/1960 or any equivalent standard.

2. Systems specially designed or modified for remote operation with an underwater vehicle, employing techniques to minimise the effects of back scatter and including range-gated illuminators or "laser" systems;

e. Photographic still cameras specially designed or modified for underwater use below 150 m, with a film format of 35 mm or larger and having any of the following:

1. Annotation of the film with data provided by a source external to the camera;

2. Automatic back focal distance correction; or

3. Automatic compensation control specially designed to permit an underwater camera housing to be usable at depths exceeding 1000 m;

f. Not used;

g. 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 1000 m;

h. "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 250Nm or more and using titanium based alloys or "composite" "fibrous or filamentary materials" in their structural members;

i. 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;

Technical Note:

Only functions having proportionally related motion control using positional feedback are counted when determining the number of degrees of 'freedom of movement'.

j. 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:

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;

k. Not used

l. Not used

m. Not used

n. Not used

o. Propellers, power transmission systems, power generation systems and noise reduction systems, as follows:

1. Not used

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2. 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 engines with a power output exceeding 2,5 MW;

   c. "Superconductive" propulsion engines or permanent magnet electric propulsion engines, with a power output exceeding 0,1 MW;

   d. Power transmission shaft systems incorporating "composite" material components and capable of transmitting more than 2 MW;

   e. Ventilated or base-ventilated propeller systems, rated at more than 2,5 MW;

3. Noise reduction systems designed for use on vessels of 1000 tonnes 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;

Technical Note:

'Active noise reduction or cancellation systems' incorporate electronic control systems capable of actively reducing equipment vibration by the generation of anti-noise or anti-vibration signals directly to the source.

p. Pumpjet 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;

q. Underwater swimming and diving equipment as follows:

   1. Closed circuit rebreathers;

   2. Semi-closed circuit rebreathers;

Note: 8A002.q. does not control individual rebreathers for personal use when accompanying their users.

N.B.: For equipment and devices specially designed for military use, see the Military Goods Controls.

r. 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 μPa at 1 m) at frequencies of 200 Hz and below.

Note 1: 8A002.r. does not control diver deterrent systems based on underwater explosive devices, air guns or combustible sources.

Note 2: 8A002.r. includes diver deterrent acoustic systems that use spark gap sources, also known as plasma sound sources.

52. *8B Test, Inspection and Production Equipment*

8B001 Water tunnels having a background noise of less than 100 dB (reference 1 μPa, 1 Hz), in the frequency range from 0 to 500 Hz and designed for measuring acoustic fields generated by a hydro-flow around propulsion system models.

53. *8C Materials*

8C001 'Syntactic foam' designed for underwater use and having all of the following:

N.B.: See also 8A002.a.4.

a. Designed for marine depths exceeding 1000 m; and

b. A density less than 561 kg/m^3.

Technical Note:

'Syntactic foam' consists of hollow spheres of plastic or glass embedded in a resin matrix.

54. *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.

55. *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 3830 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 1500 tonnes with a maximum design speed, fully loaded, exceeding 25 knots in a significant wave height of 4 m or more.

Technical Note:

A 'small waterplane area vessel' is defined by the following formula: waterplane area at an operational design draft less than 2x (displaced volume at the operational design draft) $^{2/3}$.

CATEGORY 9 — AEROSPACE AND PROPULSION

56. *9A Systems, Equipment and Components*

N.B.: For propulsion systems designed or rated against neutron or transient ionizing radiation, see the Military Goods Controls.

9A001 Aero gas turbine engines having any of the following:

N.B.: SEE ALSO 9A101.

a. Incorporating any of the "technologies" specified in 9E003.a., 9E003.h. or 9E003.i.; or

Note 1: 9A001.a. does not control aero gas turbine engines which meet all of the following:

a. Certified by the civil aviation authorities of one or more EU Member States or Wassenaar Arrangement Participating States; and

b. Intended to power non-military manned aircraft for which any of the following has been issued by civil aviation authorities of one or more a EU Member States or Wassenaar Arrangement Participating States for the aircraft with this specific engine type:

1. A civil type certificate; or

2. An equivalent document recognized by the International Civil Aviation Organisation (ICAO).

Note 2: 9A001.a. does not control aero gas turbine engines designed for Auxiliary Power Units (APUs) approved by the civil aviation authority in a EU Member States or Wassenaar Arrangement Participating States.

b. Designed to power an aircraft to cruise at Mach 1 or higher, for more than thirty minutes.

9A002 'Marine gas turbine engines' with an ISO standard continuous power rating of 24245 kW or more and a specific fuel consumption not exceeding 0.219 kg/kWh in the power range from 35 to 100 %, and specially designed assemblies and components therefor.

Note: The term 'marine gas turbine engines' includes those industrial, or aero-derivative, gas turbine engines adapted for a ship's electric power generation or propulsion.

9A003 Specially designed assemblies or components, incorporating any of the "technologies" specified in 9E003.a., 9E003.h. or 9E003i., for any of the following aero gas turbine engines:

a. Specified in 9A001; or

b. Whose design or production origins are either non- *EU Member States or Wassenaar Arrangement Participating States;*or unknown to the manufacturer.

9A004 Space launch vehicles, "spacecraft", "spacecraft buses", "spacecraft payloads", "spacecraft" on-board systems or equipment, and terrestrial equipment, as follows

N.B.: SEE ALSO 9A104.

a. Space launch vehicles;

b. "Spacecraft";

c. "Spacecraft buses";

d. "Spacecraft payloads" incorporating items specified in 3A001.b.1.a.4., 3A002.g., 5A001.a.1., 5A001.b.3., 5A002.a.5., 5A002.a.9., 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. On-board systems or equipment, specially designed for "spacecraft" and having any of the following functions:

1. 'Command and telemetry data handling';

Note: For the purpose of 9A004.e.1., 'command and telemetry data handling' includes bus data management, storage, and processing.

2. 'Payload data handling'; or

Note: For the purpose of 9A004.e.2., 'payload data handling' includes payload data management, storage, and processing.

3. 'Attitude and orbit control';

Note: For the purpose of 9A004.e.3., 'attitude and orbit control' includes sensing and actuation to determine and control the position and orientation of a "spacecraft".

N.B.: For equipment specially designed for military use, see Military Goods Controls.

f. Terrestrial equipment, specially designed for "spacecraft" as follows:

1. Telemetry and telecommand equipment;

2. Simulators.

9A005 Liquid rocket propulsion systems containing any of the systems or components, specified in 9A006.

N.B.: SEE ALSO 9A105 AND 9A119.

9A006 Systems and components, specially designed for liquid rocket propulsion systems, as follows:

N.B.: SEE ALSO 9A106, 9A108 AND 9A120.

a. Cryogenic refrigerators, flightweight dewars, cryogenic heat pipes or cryogenic systems, specially designed for use in space vehicles and capable of restricting cryogenic fluid losses to less than 30 % per year;

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b. Cryogenic containers or closed-cycle refrigeration systems, capable of providing temperatures of 100 K (– 173 °C) or less for "aircraft" capable of sustained flight at speeds exceeding Mach 3, launch vehicles or "spacecraft";

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^2 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^3 and tensile strengths exceeding 48 MPa.

9A007 Solid rocket propulsion systems having any of the following:

N.B.: SEE ALSO 9A107 AND 9A119.

a. Total impulse capacity exceeding 1,1MNs;

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.

Technical Note:

'Strong mechanical bond' means bond strength equal to or more than propellant strength.

9A008 Components specially designed for solid rocket propulsion systems, as follows:

N.B.: SEE ALSO 9A108.

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;

Technical Note:

'Strong mechanical bond' means bond strength equal to or more than propellant strength.

b. Filament-wound "composite" motor cases exceeding 0,61 m in diameter or having 'structural efficiency ratios (PV/W)' exceeding 25 km;

Technical Note:

'Structural efficiency ratio (PV/W)' is the burst pressure (P) multiplied by the vessel volume (V) divided by the total pressure vessel weight (W).

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 ± 5 °;

2. Angular vector rotations of 20 °/s or more; or

3. Angular vector accelerations of 40 °/s^2 or more.

9A009 Hybrid rocket propulsion systems having any of the following:

N.B.: SEE ALSO 9A109 AND 9A119.

a. Total impulse capacity exceeding 1,1MNs; 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:

N.B.: SEE ALSO 1A002 AND 9A110.

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 1C0010.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;

Note: The weight cut-off is not relevant for nose cones.

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 by 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 (the time required to achieve 90 % of total rated thrust from start-up) of less than 30 ms.

9A011 Ramjet, scramjet or combined cycle engines, and specially designed components therefor.

N.B.: SEE ALSO 9A111 AND 9A118.

9A012 "Unmanned aerial vehicles" ("UAVs"), unmanned "airships", related, equipment and components, as follows:

N.B.: SEE ALSO 9A112.

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;

Technical Notes:

1. *For the purposes of 9A012.a., 'operator' is a person who initiates or commands the "UAV" or unmanned "airship" flight.*

2. *For the purposes of 9A012.a., 'endurance' is to be calculated for ISA conditions (ISO 2533:1975) at sea level in zero wind.*

3. *For the purposes of 9A012.a., 'natural vision' means unaided human sight, with or without corrective lenses.*

b. Related equipment and components, as follows:

1. Not used

2. Not used

3. Equipment or components, specially designed to convert a manned "aircraft" or manned "airship", to a "UAV" or unmanned "airship", specified in 9A012.a.;

4. Air breathing reciprocating or rotary internal combustion type engines, specially designed or modified to propel "UAVs" or unmanned "airships", at altitudes above 15240 metres (50,000 feet).

9A101 Turbojet and turbofan engines, other than those specified in 9A001, as follows;

a. Engines having both of the following characteristics:

1. 'Maximum thrust value' greater than 400 N (achieved un-installed) excluding civil certified engines with a 'maximum thrust value' greater than 8890 N (achieved un-installed), and

2. Specific fuel consumption of 0,15 kg/N/hr or less (at maximum continuous power at sea level static conditions using the ICAO standard atmosphere);

Technical Note:

For the purpose of 9A101.a.1. 'maximum thrust value' is the manufacturers demonstrated maximum thrust for the engine type un-installed. The civil type certified thrust value will be equal or less than the manufacturers demonstrated maximum thrust for the engine type.

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.

Note: 9A102 does not control civil certified engines.

Technical Notes:

1. For the purposes of 9A102 a 'turboprop engine system' incorporates all of the following:

a. Turboshaft engine; and

b. Power transmission system to transfer the power to a propeller.

2. For the purposes of 9A102 the 'maximum power' is achieved uninstalled at sea level static conditions using ICAO standard atmosphere.

9A104 Sounding rockets, capable of a range of at least 300 km.

N.B.: SEE ALSO 9A004.

9A105 Liquid propellant rocket engines, as follows:

N.B.: SEE ALSO 9A119.

a. Liquid propellant rocket engines usable in "missiles", other than those specified in 9A005, integrated, or designed or modified to be integrated, into a liquid propellant propulsion system which has a total impulse capacity equal to or greater than 1.1MNs;

b. Liquid propellant rocket engines, 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 propulsion system which has a total impulse capacity equal to or greater than 0,841MNs.

9A106 Systems or components, other than those specified in 9A006 as follows, specially designed for liquid rocket propulsion systems:

a. Ablative liners for thrust or combustion chambers, usable in "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104;

b. Rocket nozzles, usable in "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104;

c. Thrust vector control sub-systems, usable in "missiles";

Technical Note:

Examples of methods of achieving thrust vector control specified in 9A106.c. are:

1. Flexible nozzle;

2. Fluid or secondary gas injection;

3. Movable engine or nozzle;

4. Deflection of exhaust gas stream (jet vanes or probes); or

5. Thrust tabs.

d. Liquid, 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.

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Note: The only servo valves, pumps and gas turbines specified in 9A106.d., are the following:

a. Servo valves designed for flow rates equal to or greater than 24 litres per minute, at an absolute pressure equal to or greater than 7 MPa, that have an actuator response time of less than 100 ms;

b. Pumps, for liquid propellants, with shaft speeds equal to or greater than 8000 r.p.m. at a maximum operating mode or with discharge pressures equal to or greater than 7 MPa.

c. Gas *turbines*, for liquid propellant turbopumps, with shaft speeds equal to or greater than 8000 r.p.m. at the maximum operating mode.

e. Combustion chambers *and* nozzles, usable in "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

9A107 Solid propellant rocket engines, 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 0,841MNs.

N.B.: SEE ALSO 9A119.

9A108 Components, other than those specified in 9A008, as follows, specially designed for solid rocket propulsion systems:

a. Rocket motor cases and "insulation" components therefor, usable in "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104;

b. Rocket nozzles, usable in "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104;

c. Thrust vector control sub-systems, usable in "missiles".

Technical Note:

Examples of methods of achieving thrust vector control specified in 9A108.c. are:

1. Flexible nozzle;

2. Fluid or secondary gas injection;

3. Movable engine or nozzle;

4. Deflection of exhaust gas stream (jet vanes or probes); or

5. Thrust tabs.

9A109 Hybrid rocket motors 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 0,841MNs, and specially designed components therefor;

b. Specially designed components for hybrid rocket motors specified in 9A009 that are usable in "missiles".

N.B.: SEE ALSO 9A009 and 9A119.

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.

N.B.: SEE ALSO 1A002.

Technical Note:

In 9A110 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

9A111 Pulse jet engines, usable in "missiles" or unmanned aerial vehicles specified in 9A012 or 9A112.a., and specially designed components therefor.

N.B.: SEE ALSO 9A011 AND 9A118.

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*

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.

Technical Notes:

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

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

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 unmanned aerial vehicles specified in 9A012 or 9A112.a.;

b. Vehicles for transport, handling, control, activation or launching, designed or modified for space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

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".

N.B.: SEE ALSO 9A121.

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 propellant tanks, other than those specified in 9A006, specially designed for propellants specified in 1C111 or 'other liquid propellants', used in rocket systems capable of delivering at least a 500 kg payload to a range of at least 300 km.

Note: In 9A120 'other liquid propellants' includes, but is not limited to, propellants specified in the Military Goods Controls.

9A121 Umbilical and interstage electrical connectors specially designed for "missiles", space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.

Technical Note:

Interstage connectors referred to in 9A121 also include electrical connectors installed between the "missile", space launch vehicle or sounding rocket and their payload.

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 μm 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 μm 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.

Note: Aerosol generating units are devices specially designed or modified for fitting to aircraft such as nozzles, rotary drum atomizers and similar devices.

Note: 9A350 does not control spraying or fogging systems and components that are demonstrated not to be capable of delivering biological agents in the form of infectious aerosols.

Technical Notes:

1. Droplet size for spray equipment or nozzles specially designed for use on aircraft, "lighter-than-air vehicles" or unmanned aerial vehicles should be measured using either of the following:

a. Doppler laser method;

b. Forward laser diffraction method.

2. In 9A350 'VMD' means Volume Median Diameter and for water-based systems this equates to Mass Median Diameter (MMD).

57. *9B Test, Inspection and Production Equipment*

9B001 Equipment, tooling or fixtures, specially designed for manufacturing gas turbine blades, vanes or "tip shroud" castings, as follows:

a. Directional solidification or single crystal casting equipment;

b. Cores or shells (moulds), specially designed for casting, manufactured from refractory metals or ceramics;

c. Directional-solidification or single-crystal additive-manufacturing equipment.

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 "technology" 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 airfoil-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:

N.B.: SEE ALSO 9B105.

a. Wind tunnels designed for speeds of Mach 1.2 or more;

Note: 9B005.a. does not control wind tunnels specially designed for educational purposes and having a 'test section size' (measured laterally) of less than 250 mm.

Technical Note:

'Test section size' means the diameter of the circle, or the side of the square, or the longest side of the rectangle, at the largest test section location.

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 25×10^6.

9B006 Acoustic vibration test equipment capable of producing sound pressure levels of 160 dB or more (referenced to 20 μPa) with a rated output of 4 kW or more at a test cell temperature exceeding 1273 K (1000 °C), and specially designed quartz heaters therefor.

N.B.: SEE ALSO 9B106.

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 turbine engine powder metallurgy rotor components capable of operating at stress levels of 60 % of Ultimate Tensile Strength (UTS) or more and metal temperatures of 873 K (600 °C) or more.

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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.

N.B.: SEE ALSO 9B005.

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

Technical Note:

1. In 9B105 'aerodynamic test facilities' includes wind tunnels and shock tunnels for the study of airflow over objects.

2. In Note to 9B105, 'test cross section size' means the diameter of the circle, or the side of the square, or the longest side of the rectangle, or the major axis of the ellipse at the largest 'test cross section' location. 'Test cross section' is the section perpendicular to the flow direction.

3. In 9B105 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

9B106 Environmental chambers and anechoic chambers, as follows:

a. Environmental chambers capable of simulating all the following flight conditions:

1. Having any of the following:

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

b. Temperature range from below 223 K (–50 °C) to above 398 K (+125 °C); 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;

Technical Notes:

1. 9B106.a.2. describes systems that are capable of generating a vibration environment with a single wave (e.g., a sine wave) and systems capable of generating a broad band random vibration (i.e., power spectrum).

2. In 9B106.a.2., 'designed or modified' means the environmental chamber provides appropriate interfaces (e.g., sealing devices) to incorporate a shaker unit or other vibration test equipment as specified in 2B116.

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

b. Environmental chambers capable of simulating the following flight conditions:

1. Acoustic environments at an overall sound pressure level of 140 dB or greater (referenced to 20 μPa) or with a total rated acoustic power output of 4 kW or greater; and

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

3. Temperature range from below 223 K (– 50 °C) to above 398 K (+ 125 °C).

9B115 Specially designed "production equipment" for the systems, 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'.

Technical Note:

In 9B116 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

9B117 Test benches and test stands for solid or liquid propellant rockets or rocket motors, having either of the following characteristics:

a. The capacity to handle more than 68 kN of thrust; or

b. Capable of simultaneously measuring the three axial thrust components.

58. *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 'missiles'.

Technical Note:

In 9C108 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

9C110 Resin impregnated fibre prepregs and metal coated fibre preforms therefor, for composite structures, laminates and manufactures specified in 9A110, made either with organic matrix or metal matrix utilising fibrous or filamentary reinforcements having a "specific tensile strength" greater than $7{,}62 \times 10^4$ m and a "specific modulus" greater than $3{,}18 \times 10^6$ m.

N.B.: SEE ALSO 1C010 AND 1C210.

Note: The only resin impregnated fibre prepregs specified in entry 9C110 are those using resins with a glass transition temperature (T_g), after cure, exceeding 418 K (145 °C) as determined by ASTM D4065 or equivalent.

59. *9D Software*

9D001 "Software" specially designed or modified for the "development" of equipment or "technology", specified in 9A001 to 9A119, 9B or 9E003.

9D002 "Software" 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, specially designed to collect, reduce and analyse data in real time and capable of feedback control, including the dynamic adjustment of test articles or test conditions, as 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. Not used;

e. "Software" specially designed or modified for the operation of items specified in 9A012;

f. "Software" specially designed to design the internal cooling passages of aero gas turbine blades, vans and "tip shrouds";

g. "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 or sounding rockets specified in 9A104, or "missiles" or the subsystems specified in 9A005, 9A007, 9A105, 9A106.c., 9A107, 9A108.c., 9A116 or 9A119.

Note: "Software" specified in 9D103 remains controlled when combined with specially designed hardware specified in 4A102.

9D104 "Software" specially designed or modified for the "use" of goods specified in 9A001, 9A005, 9A006.d., 9A006.g., 9A007.a., 9A008.d., 9A009.a., 9A010.d., 9A011, 9A101, 9A102, 9A105, 9A106.c., 9A106.d., 9A107, 9A108.c., 9A109, 9A111, 9A115.a., 9A116.d., 9A117 or 9A118.

9D105 "Software" which coordinates the function of more than one subsystem, other than that specified in 9D003.e.specially designed or modified for "use" in space launch vehicles specified in 9A004 or sounding rockets specified in 9A104.or 'missiles'

Technical Note:

In 9D105 'missile' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.

60. *9E Technology*

Note: "Development" or "production" "technology" specified in 9E001 to 9E003 for gas turbine engines remains controlled when used for repair or overhaul. Excluded from control are: technical data, drawings or documentation for maintenance activities directly associated with calibration, removal or replacement of damaged or unserviceable line replaceable units, including replacement of whole engines or engine modules.

9E001 "Technology" according to the General Technology Note for the "development" of equipment or "software", specified in 9A001.b., 9A004 to 9A012, 9A350, 9B or 9D.

9E002 "Technology" according to the General Technology Note for the "production" of equipment specified in 9A001.b., 9A004 to 9A011, 9A350 or 9B.

N.B.: For "technology" for the repair of controlled structures, laminates or materials, see 1E002.f.

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 001Miller Index Direction) a stress-rupture life exceeding 400 hours at 1,273 K (1000 °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 1883 K (1610 °C);

        b. Non-metallic liners;

        c. Non-metallic shells; or

d. Liners designed to operate at 'combustor exit temperature' exceeding 1883 K (1610 °C) and having holes that meet the parameters specified by 9E003.c.;

Note: The "required" "technology" for holes in 9E003.a.2. is limited to the derivation of the geometry and location of the holes.

Technical Note:

'Combustor exit temperature' is the bulk average gas path total (stagnation) temperature between the combustor exit plane and the leading edge of the turbine inlet guide vane (i.e., measured at engine station T40 as defined in SAE ARP 755A) when the engine is running in a 'steady state mode' of operation at the certificated maximum continuous operating temperature.

N.B.: See 9E003.c. for "technology" "required" for manufacturing cooling holes.

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*

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;

Technical Note:

A 'splitter duct' performs the initial separation of the air-mass flow between the bypass and core sections of the engine.

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4. Uncooled turbine blades, vanes or "tip-shrouds", designed to operate at a 'gas path temperature' of 1373 K (1100 °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 1693 K (1420 °C) or more;

Technical Notes:

1. 'Gas path temperature' is the bulk average gas path total (stagnation) temperature at the leading edge plane of the turbine component when the engine is running in a 'steady state mode' of operation at the certificated or specified maximum continuous operating temperature.

2. The term 'steady state mode' 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.

6. Airfoil-to-disk blade combinations using solid state joining;

7. Gas turbine engine components using "diffusion bonding" "technology" specified in 2E003.b.;

8. 'Damage tolerant' gas turbine engine rotor components using powder metallurgy materials specified in 1C002.b.; or

Technical Note:

'Damage tolerant' components are designed using methodology and substantiation to predict and limit crack growth.

9. Not used;

10. Not used;

11. Hollow fan blades;

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 2000 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 by 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^2;

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^2;

b. 'Hole shape ratio' greater than 5,65; and

c. 'Incidence angle' more than 25 °;

Note: 9E003.c. does not control "technology" for manufacturing constant radius cylindrical holes that are straight through and enter and exit on the external surfaces of the component.

Technical Notes:

1. For the purposes of 9E003.c., the 'cross-sectional area' is the area of the hole in the plane perpendicular to the hole axis.

2. For the purposes of 9E003.c., 'hole shape ratio' is the nominal length of the axis of the hole divided by the square root of its minimum 'cross-sectional area'.

3. For the purposes of 9E003.c., 'incidence angle' is the acute angle measured between the plane tangential to the aerofoil surface and the hole axis at the point where the hole axis enters the aerofoil surface.

4. Techniques for manufacturing holes in 9E003.c include "laser", water jet, Electro-Chemical Machining (ECM) or Electrical Discharge Machining (EDM) methods.

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^3 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^3 of 'box volume';

Technical Note:

'Box volume' in 9E003.e. is the product of three perpendicular dimensions measured in the following way:

Length	:	*The length of the crankshaft from front flange to flywheel face;*
Width	:	*The widest of any of the following:* *a. The outside dimension from valve cover to valve cover;* *b. The dimensions of the outside edges of the cylinder heads; or* *c. The diameter of the flywheel housing;*
Height	:	*The largest of any of the following:* *a. The dimension of the crankshaft centre-line to the top plane of the valve cover (or cylinder head) plus twice the stroke; or* *b. The diameter of the flywheel housing.*

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^3 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;

Technical Note:

'High output diesel engines' are diesel engines with a specified brake mean effective pressure of 1,8 MPa or more at a speed of 2300 r.p.m., provided the rated speed is 2300 r.p.m. or more.

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;

Note: 9E003.h. does not control technical data related to engine-aircraft integration required by the civil aviation authorities of one or more EU Member States or Wassenaar Arrangement Participating States to be published for general airline use (e.g., installation manuals, operating instructions, instructions for continued airworthiness) or interface functions (e.g., input/output processing, airframe thrust or shaft power demand).

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:

1. "Development" "technology" for deriving the functional requirements for the components that maintain engine stability;

2. "Development" or "production" "technology" for components unique to the adjustable flow path system and that maintain engine stability;

3. "Development" "technology" for the control law algorithms, including "source code", unique to the adjustable flow path system and that maintain engine stability.

Note: 9E003.i. does not control "development" or "production" "technology" for any of the following:

a. Inlet guide vanes;

b. Variable pitch fans or prop-fans;

c. Variable compressor vanes;

d. Compressor bleed valves; or

e. Adjustable flow path geometry for reverse thrust.

j. "Technology" "required" for the "development" of wing-folding systems designed for fixed-wing aircraft powered by gas turbine engines.

N.B.: For "technology" "required" for the "development" of wing-folding systems designed for fixed-wing aircraft see also Military Goods Controls.

9E101

a. "Technology" according to the General Technology Note for the "development" of goods specified in., 9A101, 9A102, 9A104 to 9 A111, 9A112.a. or 9A115 to 9A121.

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.

Technical Note:

In 9E101.b. 'UAV' means unmanned aerial vehicle systems capable of a range exceeding 300 km.

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 to9A111,9A112.a., 9A115 to 9A121, 9B105, 9B106, 9B115, 9B116, 9B117, 9D101 or 9D103.

Technical Note:

In 9E102 'UAV' means unmanned aerial vehicle systems capable of a range exceeding 300 km.

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ANNEX II

The following sections set out the Union general export authorisations for certain exports.

A. EXPORTS TO AUSTRALIA, CANADA, ICELAND, JAPAN, NEW ZEALAND, NORWAY, SWITZERLAND, INCLUDING LIECHTENSTEIN, AND UNITED STATES OF AMERICA

UNION GENERAL EXPORT AUTHORISATION NO EU001

(referred to in point (d) of Article 10(1) of this Regulation)

Exports to Australia, Canada, Iceland, Japan, New Zealand, Norway, Switzerland, including Liechtenstein, and United States of America

Issuing authority: European Union

Part 1 – Items

This general export authorisation covers all dual-use items specified in any entry in ▌ Annex I to this Regulation, except those listed in Section ***I*** of Annex ***II***.

Part 2 – Destinations

This export authorisation is valid throughout the ***customs territory of the*** Union for exports to the following destinations:

– Australia

– Canada

– Iceland

– Japan

– New Zealand

– Norway

– Switzerland, including Liechtenstein

– United States of America.

Part 3 – Conditions and requirements for use of this authorisation

– 1 This authorisation ▌ ***does not authorise the export of items where***:

(1) the exporter has been informed by the competent authority of the Member State in which he is resident or established that the items in question are or may be intended, in their entirety or in part**:**

(a) for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices, or the development, production, maintenance or storage of missiles capable of delivering such weapons;

(b) for a military end-use ***as defined in point (b) of Article 4(1) of this Regulation in a country subject to an arms embargo; or***

(c) for use as parts or components of military items listed in the national military list that have been exported from the territory of the Member State concerned without authorisation or in breach of an authorisation prescribed by the national legislation of that Member State*;*

(2) the exporter is aware that the items in question are intended, ***in their entirety or in part, for any of the uses referred to in subparagraph (1); or***

(3) the relevant items are exported to a customs free zone or free warehouse which is located in a destination covered by this authorisation.

– 2. Exporters ***will*** declare that the items are being exported under Union general export authorisation EU001 in the customs declaration.

– 3. ***Any exporter who uses this authorisation must notify the competent authority of the Member State where he is resident or established of the first use of this authorisation no later than 30 days after the date when the first export took place or, alternatively, and in accordance with a requirement by the competent authority of the Member State where the exporter is resident or established, prior to the first use of this authorisation. Member States will notify the Commission of the notification mechanism chosen for this authorisation. The Commission will publish the information notified to it in the C series of the Official Journal of the European Union.***

Reporting requirements attached to the use of this authorisation and additional information that the Member State from which the export is made might require on items exported under this authorisation are defined by Member States.

A Member State may require the exporters resident or established in that Member State to register prior to the first use of this authorisation. Registration will be automatic and acknowledged by the competent authority to the exporter without delay and in any case within 10 working days of receipt, subject to Article 10(7) of this Regulation.

– Where applicable, the requirements set out in the second and third paragraphs will be based on those defined for the use of national general export

authorisations granted by those Member States which provide for such authorisations.

B. EXPORTS OF CERTAIN DUAL-USE ITEMS TO CERTAIN DESTINATIONS

UNION GENERAL EXPORT AUTHORISATION No EU002

(referred to in point (d) of Article 10(1) of this Regulation)

Exports of certain dual-use items to certain destinations

Issuing authority: European Union

Part 1 — Items

This general export authorisation covers the following dual-use items specified in Annex I to this Regulation:

– 1A001,

– 1A003,

– 1A004,

– 1C003b-c,

– 1C004,

– 1C005,

– 1C006,

– 1C008,

– 1C009,

– 2B008,

– 3A001a3,

– 3A001a6 to 3A001a12,

– 3A002c to 3A002f,

– 3C001,

– 3C002,

– 3C003,

– 3C004,

– 3C005,

– 3C006.

Part 2 — Destinations

This authorisation is valid throughout the ***customs territory of the*** Union for exports to the following destinations:

– Argentina

– South Africa

– South Korea

– Turkey.

Part 3 — Conditions and requirements for use

– 1. This authorisation does not authorise the export of items where:

(1) the exporter has been informed by the competent authority of the Member State in which he is resident or established that the items in question are or may be intended, in their entirety or in part:

(a) for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices, or the development, production, maintenance or storage of missiles capable of delivering such weapons;

(b) for a military end-use ***as defined in point (b) of Article 4(1) of this Regulation in a country subject to an arms embargo;*** or

(c) for use as parts or components of military items listed in national military lists that have been exported from the territory of the Member State concerned without authorisation or in breach of an authorisation prescribed by the national legislation of that Member State;

(2) the exporter ▌ is aware that the items in question are intended, in their entirety or in part, for any of the uses referred to in subparagraph (1); ***or***

(3) the relevant items are exported to a customs-free zone or a free warehouse which is located in a destination covered by this authorisation.

– 2. Exporters ***will*** declare that the items are being exported under Union general export authorisation EU002 in the customs declaration.

3. Any exporter who uses this authorisation must notify the competent authority of the Member State where he is resident or established of the first use of this authorisation no later than 30 days after the date when the first export took place or, alternatively, and in accordance with a requirement by the competent authority

of the Member State where the exporter is resident or established, prior to the first use of this authorisation. Member States will notify the Commission of the notification mechanism chosen for this authorisation. The Commission will publish the information notified to it in the C series of the Official Journal of the European Union.

Reporting requirements attached to the use of this authorisation and additional information that the Member State from which the export is made might require on items exported under this authorisation are defined by Member States.

A Member State may require the exporters resident or established in that Member State to register prior to the first use of this authorisation. Registration will be automatic and acknowledged by the competent authority to the exporter without delay and in any case within 10 working days of receipt, subject to Article 10(7) of this Regulation.

Where applicable, the requirements set out in the second and third paragraphs will be based on those defined for the use of national general export authorisations granted by those Member States which provide for such authorisations. ▌

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C. EXPORT AFTER REPAIR/REPLACEMENT

UNION GENERAL EXPORT AUTHORISATION No EU003

(referred to in point (d) of Article 10(1) of this Regulation)

Export after repair/replacement

Issuing authority: European Union

Part 1 — Items

1. This general export authorisation covers all dual-use items specified in any entry in ▌Annex I to this Regulation except those listed in paragraph 2 where:

   (a) the items were reimported into the customs territory of the ▌Union for the purpose of maintenance, repair or replacement, and are exported or re-exported to the country of consignment without any changes to their original characteristics within a period of 5 years after the date when the original export authorisation has been granted; or

   (b) the items are exported to the country of consignment in exchange for items of the same quality and number which were reimported into the customs territory of the ▌Union for maintenance, repair or replacement within a period of 5 years after the date when the original export authorisation has been granted.

2. Items excluded:

   (a) all items listed in Section **I** of this Annex;

   (b) all items in Sections D and E set out in ▌Annex I to this Regulation;

   (c) the following items specified in ▌Annex I to this Regulation:

   – 1A002a,

   – 1C012a,

   – 1C227,

   – 1C228,

   – 1C229,

   – 1C230,

   – 1C231,

   – 1C236,

– 1C237,

– 1C240,

– 1C350,

– 1C450,

– 5A001b5,

▌

– ***5A002c to 5A002e,***

– ***5A003,***

– 6A001a2a1,

– 6A001a2a5,

– 6A002a1c,

– 8A001b,

– 8A001d,

– 9A011.

Part 2 — Destinations

This authorisation is valid throughout the ***customs territory of the*** Union for exports to the following destinations:

– Albania

– Argentina

– Bosnia and Herzegovina

– Brazil

– Chile

– China (including Hong Kong and Macao)

– the Republic of ***North*** Macedonia

– French Overseas Territories

– India

– Kazakhstan

– Mexico

– Montenegro

– Morocco

– Russia

– Serbia

– Singapore

– South Africa

– South Korea

– Tunisia

– Turkey

– Ukraine

– United Arab Emirates.

Part 3 — Conditions and requirements for use

– 1. This authorisation can only be used when the initial export has taken place under a Union general export authorisation or an initial export authorisation has been granted by the competent authority of the Member State where the original exporter was resident or established for the export of the items which have subsequently been reimported into the customs territory of the ▌ Union for the purposes of maintenance, repair or replacement. This authorisation is valid only for exports to the original end-user.

– 2. This authorisation does not authorise the export of items where:

(1) the exporter has been informed by the competent authority of the Member State in which he is resident or established that the items in question are or may be intended, in their entirety or in part,

(a) for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices or the development, production, maintenance or storage of missiles capable of delivering such weapons;

(b) for a military end-use ***as defined in point (b) of Article 4(1) of this Regulation where the purchasing country or country of destination is subject to an arms embargo;*** or

(c) for use as parts or components of military items listed in the national military list that have been exported from the territory of the Member

State concerned without authorisation or in breach of an authorisation prescribed by the national legislation of that Member State;

(2) the exporter is aware that the items in question are intended, in their entirety or in part, for any of the uses referred to in subparagraph (1);

(3) the relevant items are exported to a customs-free zone or a free warehouse which is located in a destination covered by this authorisation;

(4) the initial authorisation has been annulled, suspended, modified or revoked; ***or***

(5) the exporter ▌ is aware that the end-use of the items in question is different from that specified in the original export authorisation.

– 3. On exportation of any of the items pursuant to this authorisation, exporters ***will*** :

(1) mention the reference number of the initial export authorisation in the export declaration to customs together with the name of the Member State that granted the authorisation, and declare that the items are being exported under Union general export authorisation EU003 in the customs declaration;

(2) provide customs officers, if so requested, with documentary evidence of the date of importation of the items into the Union, of any maintenance, repair or replacement of the items carried out in the Union and of the fact that the items are being returned to the end-user and the country from which they were imported into the Union.

4. Any exporter who uses this authorisation must notify the competent authority of the Member State where he is resident or established of the first use of this authorisation no later than 30 days after the date when the first export took place or, alternatively, and in accordance with a requirement by the competent authority of the Member State where the exporter is resident or established, prior to the first use of this authorisation. Member States will notify the Commission of the notification mechanism chosen for this authorisation. The Commission will publish the information notified to it in the C series of the Official Journal of the European Union.

Reporting requirements attached to the use of this authorisation and additional information that the Member State from which the export is made might require on items exported under this authorisation are defined by Member States.

A Member State may require the exporter resident or established in that Member State to register prior to the first use of this authorisation. Registration will be automatic and acknowledged by the competent authority to the exporter without delay and in any case within 10 working days of receipt, subject to Article 10(7) of this Regulation.

Where applicable, the requirements set out in the second and third subparagraphs will be based on those defined for the use of national general export authorisations granted by those Member States which provide for such authorisations. ▌

–

5. This authorisation covers items for 'repair', 'replacement' and 'maintenance'. This may involve coincidental improvement on the original goods, e.g. resulting from the use of modern spare parts or from use of a later built standard for reliability or safety reasons, provided that this does not result in any enhancement to the functional capability of the items or provide the items with new or additional functions.

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D. TEMPORARY EXPORT FOR EXHIBITION OR FAIR

UNION GENERAL EXPORT AUTHORISATION No EU004

(referred to in point (d) of Article 10(1) of this Regulation)

Temporary export for exhibition or fair

Issuing authority: European Union

Part 1 — Items

This general export authorisation covers all dual-use items specified in any entry in ▌ Annex I to this Regulation except:

(a) all items listed in Section ***I*** of this Annex;

(b) all items in Section D set out in ▌ Annex I to this Regulation (this does not include software necessary to the proper functioning of the equipment for the purpose of the demonstration);

(c) all items in Section E set out in ▌ Annex I to this Regulation;

(d) the following items specified in ▌ Annex I to this Regulation:

– 1A002a,

– 1C002.b.4,

– 1C010,

– 1C012.a,

– 1C227,

– 1C228,

– 1C229,

– 1C230,

– 1C231,

– 1C236,

– 1C237,

– 1C240,

– 1C350,

– 1C450,

– 5A001b5,

▌

– ***5A002c to 5A002e,***

– ***5A003,***

– 6A001,

– 6A002a,

– 6A008l3,

– 8A001b,

– 8A001d,

– 9A011.

Part 2 — Destinations

This authorisation is valid throughout the ***customs territory of the*** Union for exports to the following destinations:

– Albania

– Argentina

– Bosnia and Herzegovina

– Brazil

– Chile

– China (including Hong Kong and Macao)

– the ▌ Republic of ***North*** Macedonia

– French Overseas Territories

– India,

– Kazakhstan

– Mexico

– Montenegro

– Morocco

– Russia

– Serbia

– Singapore

– South Africa

– South Korea

– Tunisia

– Turkey

– Ukraine

– United Arab Emirates.

Part 3 — Conditions and requirements for use

– 1. This authorisation authorises the export of items listed in Part 1 on condition that the export concerns temporary export for an exhibition or fair as defined in point 6 and that the items are reimported within a period of 120 days after the initial export, complete and without modification, into the customs territory of the ▌ Union.

– 2. The competent authority of the Member State where the exporter is resident or established may, at the exporter's request, waive the requirement that the items are to be reimported as stated in paragraph 1. To waive the requirement, the procedure for individual authorisations laid down in Article 10(2) of this Regulation ***will*** apply accordingly.

– 3. This authorisation does not authorise the export of items where:

(1) the exporter has been informed by the competent authority of the Member State in which he is resident or established that the items in question are or may be intended, in their entirety or in part:

(a) for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices, or the development, production, maintenance or storage of missiles capable of delivering such weapons;

(b) for a military end-use ***as defined in point (b) of Article 4(1) of this Regulation where the purchasing country or country of destination is subject to an arms embargo***; or

(c) for use as parts or components of military items listed in the national military list that have been exported from the territory of the Member State concerned without authorisation or in breach of an authorisation prescribed by the national legislation of that Member State;

(2) the exporter is aware that the items in question are intended, in their entirety or in part, for any of the uses referred to in subparagraph (1);

(3) the relevant items are exported to a customs-free zone or a free warehouse which is located in a destination covered by this authorisation;

(4) the exporter has been informed by a competent authority of the Member State in which he is resident or established, or is otherwise aware (e.g. from information received from the manufacturer), that the items in question have been classified by the competent authority as having a protective national security classification marking, equivalent to or above CONFIDENTIEL UE/EU CONFIDENTIAL;

(5) their return, in their original state, without the removal, copying or dissemination of any component or software, cannot be guaranteed by the exporter, or where a transfer of technology is connected with a presentation;

(6) the relevant items are to be exported for a private presentation or demonstration (e.g. in in-house showrooms);

(7) the relevant items are to be merged into any production process;

(8) the relevant items are to be used for their intended purpose, except to the minimum extent required for effective demonstration, but without making specific test outputs available to third parties;

(9) the export is to take place as a result of a commercial transaction, in particular as regards the sale, rental or lease of the relevant items;

(10) the relevant items are to be stored at an exhibition or fair only for the purpose of sale, rent or lease, without being presented or demonstrated;

(11) the exporter makes any arrangement which would prevent him from keeping the relevant items under his control during the whole period of the temporary export.

– 4. Exporters ***will*** declare that the items are being exported under Union general export authorisation EU004 in the customs declaration.

5. ***Any exporter who uses this authorisation must notify the competent authority of the Member State where he is resident or established of the first use of this authorisation no later than 30 days after the date when the first export took place or, alternatively, and in accordance with a requirement by the competent authority of the Member State where the exporter is resident or established, prior to the first use of this authorisation. Member States will notify the Commission of the notification mechanism chosen for this authorisation. The Commission will publish the information notified to it in the C series of the Official Journal of the European Union.***

Reporting requirements attached to the use of this authorisation and additional information that the Member State from which the export is made might require on items exported under this authorisation are defined by Member States.

A Member State may require the exporter resident or established in that Member State to register prior to the first use of this authorisation. Registration will be automatic and acknowledged by the competent authority to the exporter without delay and in any case within 10 working days of receipt, subject to Article 10(7) of this Regulation.

Where applicable, the requirements set out in the second and third subparagraphs will be based on those defined for the use of national general export authorisations granted by those Member States which provide for such authorisations. ▌

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6. For the purpose of this authorisation, 'exhibition or fair' means commercial events of a specific duration at which several exhibitors make demonstrations of their products to trade visitors or to the general public.

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E. TELECOMMUNICATIONS

UNION GENERAL EXPORT AUTHORISATION NO EU005

(referred to in point (d) of Article 10(1) of this Regulation)

Telecommunications

Issuing authority: European Union

Part 1 — Items

This general export authorisation covers the following dual-use items specified in ▌ Annex I to this Regulation:

(a) the following items of Category 5, Part l:

(i) items, including specially designed or developed components and accessories therefor specified in 5A001b2, ▌ 5A001c and ***5A001***d;

(ii) items specified in 5B001 and 5D001, where test, inspection and production equipment is concerned and software for items mentioned under (i);

(b) technology controlled by 5E001a, where required for the installation, operation, maintenance or repair of items specified under (a) and intended for the same end-user.

Part 2 — Destinations

This authorisation is valid throughout the ***customs territory of the*** Union for exports to the following destinations:

– Argentina

– China (including Hong Kong and Macao)

– India

– Russia

– South Africa

– South Korea

– Turkey

– Ukraine.

Part 3 — Conditions and requirements for use

1. This authorisation does not authorise the export of items where:

(1) the exporter has been informed by the competent authority of the Member State in which he is resident or established that the items in question are or may be intended, in their entirety or in part:

(a) for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices, or the development, production, maintenance or storage of missiles capable of delivering such weapons;

(b) for a military end-use ***as defined in point (b) of Article 4(1) of this Regulation where the purchasing country or country of destination is subject to an arms embargo***;

(c) for use as parts or components of military items listed in the national military list that have been exported from the territory of the Member State concerned without authorisation or in breach of an authorisation prescribed by the national legislation of that Member State; or

(d) for use in connection with a violation of human rights, democratic principles or freedom of speech as defined by the Charter of Fundamental Rights of the European Union, by using interception technologies and digital data transfer devices for monitoring mobile phones and text messages and targeted surveillance of Internet use (e.g. via Monitoring Centres and Lawful Interception Gateways);

(2) the exporter ▌ is aware that the items in question are intended, in their entirety or in part, for any of the uses referred to in subparagraph 1;

(3) the exporter ▌ is aware that the items in question will be re-exported to any destination other than those listed in Part 2 of this Section or in Part 2 of Section A of this Annex and the Member States;

(4) the relevant items are exported to a customs-free zone or a free warehouse which is located in a destination covered by this authorisation.

2. Exporters ***will*** declare that the items are being exported under Union general export authorisation EU005 in the customs declaration.

3. ***Any exporter who uses this authorisation must notify the competent authority of the Member State where he is resident or established of the first use of this authorisation no later than 30 days after the date when the first export took place or, alternatively, and in accordance with a requirement by the competent authority of the Member State where the exporter is resident or established, prior to the first use of this authorisation. Member States will notify the Commission of the notification mechanism chosen for this authorisation. The Commission will publish the information notified to it in the C series of the Official Journal of the European Union***.

Reporting requirements attached to the use of this authorisation and additional information that the Member State from which the export is made might require on items exported under this authorisation are defined by Member States.

A Member State may require exporters resident or established in that Member State to register prior to the first use of this authorisation. Registration will be automatic and acknowledged by the competent authority to the exporter without delay and in any case within 10 working days of receipt, subject to Article 10(7) of this Regulation.

Where applicable, the requirements set out in the second and third subparagraphs will be based on those defined for the use of national general export authorisations granted by those Member States which provide for such authorisations.

F. CHEMICALS

UNION GENERAL EXPORT AUTHORISATION No EU006

(referred to in point (d) of Article 10(1) of this Regulation)

Chemicals

Issuing authority: European Union

Part 1 — Items

This general export authorisation covers the following dual-use items specified in ▌ Annex I to this Regulation:

1C350:

1. Thiodiglycol (111-48-8);

2. Phosphorus oxychloride (10025-87-3);

3. Dimethyl methylphosphonate (756-79-6);

5. Methylphosphonyl dichloride (676-97-1);

6. Dimethyl phosphite (DMP) (868-85-9);

7. Phosphorus trichloride (7719-12-2);

8. Trimethyl phosphite (TMP) (121-45-9);

9. Thionyl chloride (7719-09-7);

10. 3-Hydroxy-1-methylpiperidine (3554-74-3);

11. N,N-Diisopropyl-(beta)-aminoethyl chloride (96-79-7);

12. N,N-Diisopropyl-(beta)-aminoethane thiol (5842-07-9);

13. Quinuclidin-3-ol (1619-34-7);

14. Potassium fluoride (7789-23-3);

15. 2-Chloroethanol (107-07-3);

16. Dimethylamine (124-40-3);

17. Diethyl ethylphosphonate (78-38-6);

18. Diethyl-N,N-dimethylphosphoramidate (2404-03-7);

19. Diethyl phosphite (762-04-9);

20. Dimethylamine hydrochloride (506-59-2);

21. Ethyl phosphinyl dichloride (1498-40-4);

22. Ethyl phosphonyl dichloride (1066-50-8);

24. Hydrogen fluoride (7664-39-3);

25. Methyl benzilate (76-89-1);

26. Methyl phosphinyl dichloride (676-83-5);

27. N,N-Diisopropyl-(beta)-amino ethanol (96-80-0);

28. Pinacolyl alcohol (464-07-3);

30. Triethyl phosphite (122-52-1);

31. Arsenic trichloride (7784-34-1);

32. Benzilic acid (76-93-7);

33. Diethyl methylphosphonite (15715-41-0);

34. Dimethyl ethylphosphonate (6163-75-3);

35. Ethyl phosphinyl difluoride (430-78-4);

36. Methyl phosphinyl difluoride (753-59-3);

37. 3-Quinuclidone (3731-38-2);

38. Phosphorus pentachloride (10026-13-8);

39. Pinacolone (75-97-8);

40. Potassium cyanide (151-50-8);

41. Potassium bifluoride (7789-29-9);

42. Ammonium hydrogen fluoride or ammonium bifluoride (1341-49-7);

43. Sodium fluoride (7681-49-4);

44. Sodium bifluoride (1333-83-1);

45. Sodium cyanide (143-33-9);

46. Triethanolamine (102-71-6);

47. Phosphorus pentasulphide (1314-80-3);

48. Di-isopropylamine (108-18-9);

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49. Diethylaminoethanol (100-37-8);

50. Sodium sulphide (1313-82-2);

51. Sulphur monochloride (10025-67-9);

52. Sulphur dichloride (10545-99-0);

53. Triethanolamine hydrochloride (637-39-8);

54. N,N-Diisopropyl-(Beta)-aminoethyl chloride hydrochloride (4261-68-1);

55. Methylphosphonic acid (993-13-5);

56. Diethyl methylphosphonate (683-08-9);

57. N,N-Dimethylaminophosphoryl dichloride (677-43-0);

58. Triisopropyl phosphite (116-17-6);

59. Ethyldiethanolamine (139-87-7);

60. O,O-Diethyl phosphorothioate (2465-65-8);

61. O,O-Diethyl phosphorodithioate (298-06-6);

62. Sodium hexafluorosilicate (16893-85-9);

63. Methylphosphonothioic dichloride (676-98-2);

64. Diethylamine (109-89-7);

65. N,N-Diisopropylaminoethanethiol hydrochloride (41480-75-5).

1C450 a:

4. Phosgene: Carbonyl dichloride (75-44-5);

5. Cyanogen chloride (506-77-4);

6. Hydrogen cyanide (74-90-8);

7. Chloropicrin: Trichloronitromethane (76-06-2);

1C450 b:

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 which is specified in 1C350.57;

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 (96-80-0) and N,N-Diethylaminoethanol (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 which is specified in 1C350;

8. Methyldiethanolamine (105-59-9).

Part 2 — Destinations

This authorisation is valid throughout the ***customs territory of the*** Union for exports to the following destinations:

– Argentina

– South Korea

– Turkey

– Ukraine.

Part 3 — Conditions and requirements for use

– 1. This authorisation does not authorise the export of items where:

(1) the exporter has been informed by the competent authority of the Member State in which he is resident or established that the items in question are or may be intended, in their entirety or in part:

(a) for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices, or the development, production, maintenance or storage of missiles capable of delivering such weapons;

(b) for a military end-use ***as defined in point (b) of Article 4(1) of this Regulation where the purchasing country or country of destination is subject to an arms embargo;*** or

(c) for use as parts or components of military items listed in the national military list that have been exported from the territory of the Member State concerned without authorisation or in breach of an authorisation prescribed by the national legislation of that Member State;

(2) the exporter ▌ is aware that the items in question are intended, in their entirety or in part, for any of the uses referred to in subparagraph 1;

(3) the exporter ▌ is aware that the items in question will be re-exported to any destination other than those listed in Part 2 of this Section or in Part 2 of Section A of this Annex and the Member States; or

(4) the relevant items are exported to a customs-free zone or a free warehouse which is located in a destination covered by this authorisation.

– 2. Exporters ***will*** declare that the items are being exported under Union general export authorisation EU006 in the customs declaration.

– 3. ***Any exporter who uses this authorisation must notify the competent authority of the Member State where he is resident or established of the first use of this authorisation no later than 30 days after the date when the first export took place or, alternatively, and in accordance with a requirement by the competent authority of the Member State where the exporter is resident or established, prior to the first use of this authorisation. Member States will notify the Commission of the notification mechanism chosen for this authorisation. The Commission will publish the information notified to it in the C series of the Official Journal of the European Union.***

Reporting requirements attached to the use of this authorisation and additional information that the Member State from which the export is made might require on items exported under this authorisation are defined by Member States.

A Member State may require exporters resident or established in that Member State to register prior to the first use of this authorisation. Registration will be automatic and acknowledged by the competent authority to the exporter without delay and in any case within 10 working days of receipt, subject to Article 10(7) of this Regulation.

Where applicable, the requirements set out in the second and third subparagraphs will be based on those defined for the use of national general export authorisations granted by those Member States which provide for such authorisations. ▌

▌***G.*** ▌INTRA-***GROUP*** EXPORT OF SOFTWARE AND TECHNOLOGY

UNION GENERAL EXPORT AUTHORISATION NO EU007

(referred to in point (d) of Article 10(1) of this Regulation)

▌***Intra-group export of software and technology***

Issuing authority: European Union

Part 1 – Items

This general export authorisation covers all technology and software specified in ▌ Annex I to this Regulation, except those listed in Section **I** of this Annex ***and technology and software related to items under 4A005, 4D004, 4E001.c, 5A001.f and 5A001.j***.

Part 2 – Destinations

This authorisation is valid throughout ***the customs territory of the Union*** for the ***export*** of software and technology to ***Argentina, Brazil, Chile, India, Indonesia, Israel, Jordan, Malaysia, Morocco, Mexico, Philippines, Singapore, South Africa, South Korea, Thailand and Tunisia*** ▌**.**

Part 3 – Conditions and requirements for use

– 1. This authorisation authorises the ***export*** of software and technology listed in Part 1 by any exporter ***that is a legal person*** ▌established in a Member State ***of the Union to*** ▌***a company wholly owned and controlled by the exporter (hereinafter "its subsidiary") or to a company directly and wholly owned and controlled by the same parent company as the exporter (hereafter - "sister company"),*** provided that:

(1) ▌***the parent company that controls directly and the entity ultimately controlling the exporter are resident or established in a Member State of the Union or in a country covered by EU001, and***;

(2) ▌***the parent company that controls directly the exporter provides a binding guarantee for the sister company's compliance with the requirements of this authorisation.***

For the purpose of this authorisation a parent company controls another company when it is capable of exercising decisive influence on it.

(3) the exported software and technology will be exclusively used for the commercial product development activities ***of the exporter and the subsidiary or sister company respectively,*** and, in the case of employees, pursuant to the agreement establishing the employment relationship***, and***

(4) the exported software and technology and any products resulting therefrom remain under the complete control of the exporter, or, for the purpose of fulfilling the requirements of this authorisation when the export is directed to a sister company, under the complete control of the parent company that controls directly the sister company and will not be shared with any other entity, and

(5) the exported software and technology will be returned to the exporter and completely deleted by the subsidiary or sister company when the development activity has been completed or in the event that the subsidiary or sister company is acquired by any other entity. Any resulting developed technology will also be transmitted to the exporter and completely deleted by the subsidiary or sister company.

– 2. This authorisation does not authorise ***the export*** of software and technology where:

(1) the exporter has been informed by the competent authority of the Member State in which he is ▌ established that the software or technology in question is or may be intended, in its entirety or in part:

(a) for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices, or the development, production, maintenance or storage of missiles capable of delivering such weapons;

(b) for a military, ***paramilitary, police, intelligence, surveillance end-use or other security end-use by the government or by entities acting on behalf of the government; or***;

(c) for use as parts or components of military items listed in the national military list that have been exported from the territory of the Member State concerned without authorisation or in breach of an authorisation prescribed by the national legislation of that Member State;

(d) for use in connection with a violation of human rights, democratic principles or freedom of speech as defined by the Charter of Fundamental Rights of the European Union;

(2) the exporter ▌ is aware that the software **or** technology in question **is** intended, in ***its*** entirety or in part, for any of the uses referred to in subparagraph 1; ***or***;

(3) the exporter ▌ is aware that the software **or** technology in question will be re-***exported*** to any destination other than those listed in Part 2 of Section A of this Annex and the Member States;

(4) the exporter is aware that the consignee or end-user of the items in question is a military, paramilitary, police or intelligence service, or another governmental service for security, or that the items are intended for entities acting on behalf of any of the aforementioned services;

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A Member State may adopt national legislation expanding the provisions of subparagraphs 2(2) and 2(3) above to cover circumstances where the exporter has grounds for suspecting that the software or technology in question are intended for the uses referred to in subparagraphs 2(2) or 2(3) above.

– 3. Any exporter intending to use this authorisation ***will*** implement an Internal Compliance Programme.

– 4. Exporters ***will*** declare that the items are being exported under Union general export authorisation ***EU007*** in the customs declaration in the case of tangible export of software ***or technology***.

– 5. ***Any exporter intending to use this authorisation will register prior to the first use of this authorisation with the competent authority of the Member State where he is established.***

Registration will be automatic and acknowledged by the competent authority to the exporter within 10 working days of receipt.

– 6. ***Any exporter who uses this authorisation will notify the competent authority of the Member State where he is established of the first use of this authorisation no later than 30 days prior to the date of the first export.***

– ***7. Any exporter who uses this authorisation will report to the competent authority of the Member State where he is established on the use of this authorisation. The report on the use of this authorisation will be produced at least once per year and will include at least information regarding:***

(1) the description of the software and technology;

(2) where available, the quantity and the value of the software and technology;

(3) the subsidiaries, sister companies and parent companies involved under this authorisation.

Additional information that the Member State from which the export is made might require on items exported under this authorisation are defined by Member States.

H. ENCRYPTION

UNION GENERAL EXPORT AUTHORISATION NO EU008

(referred to in point (d) of Article 10(1) of this Regulation)

Encryption

Issuing authority: European Union

Part 1 — Items

This general export authorisation covers dual-use items specified in ▌ Annex I to this Regulation ***as follows***:

▌

– 5A002.a.2,

– ***5A002.a.3,*** ▌

– 5A002.b, ***only 'cryptographic activation token' converting, by means of "cryptographic activation", an item not specified in Category 5 – Part 2 into an item specified in 5A002.a. as above or 5D002.c.1. as below, and not released by the Cryptography Note (Note 3 in Category 5 – Part 2);***

– ***5D002.a.1, only "Software" specially designed or modified for the "use" of equipment specified in 5A002.a as above or "software" specified in 5D002.c.1 as below.***

– ***5D002.b, "Software" having the characteristics of a 'cryptographic activation token' specified in 5A002.b. as above;***

– ***5D002.c.1, only "Software" having the characteristics of, or performing or simulating the functions of equipment specified in 5A002.a as above.*** ▌

– ***5E002.b, only "Technology" having the characteristics of a 'cryptographic activation token' specified in 5A002.b. as above.*** ▌

This authorization is only valid if the items meet all of the following:

They use only published or commercial cryptographic standards that have been approved or adopted by internationally recognised standard bodies.

They do not use cryptographic standards specially designed for government use (e.g. the cryptographic standards used in public safety radio systems, such as TETRA, TETRAPOL and P25); and

Any cryptographic functionality used by the item cannot be easily changed by the user.

This authorisation cannot be used if:

- ***The exporter has been informed by the competent authority of the Member State in which he is resident or established, or is otherwise aware (e.g. from information received from the manufacturer), that the items in question have been accredited or otherwise formally approved by the designated authority in a Member State (or are in the process of accreditation or other formal approval) to transmit, process or store classified information, equivalent to or above RESTREINT UE/EU RESTRICTED.***

- ***The exporter has been informed by the competent authority of the Member State in which he is resident or established, or is otherwise aware (e.g. from information received from the manufacturer), that the items in question have been classified by the designated authority in a Member State (or are in the process of classification) as having a protective national security classification marking, equivalent to or above RESTREINT UE/EU RESTRICTED.***

Part 2 — Destinations

This authorisation is valid throughout the ***customs territory of the*** Union for exports to all destinations, excluding ▌:

a. destinations eligible for export under EU001

b. Afghanistan, Armenia, Azerbaijan, Belarus, Burma (Myanmar), Cambodia, Central African Republic, China (including Hong Kong and Macao), Democratic Republic of Congo, Republic of Congo, Egypt, Eritrea, Georgia, Iran, Iraq, Israel, Kazakhstan, Kyrgyzstan, Lebanon, Libya, Malaysia, Mali, Mauritius, Mongolia, North Korea, Oman, Pakistan, Russian Federation, Qatar, Saudi Arabia, Somalia, South Sudan, Sudan, Syria, Tajikistan, Turkmenistan, United Arab Emirates, Uzbekistan, Venezuela, Yemen, Zimbabwe;

c. any destination, other than those listed in b above, subject to an arms embargo or subject to restrictive measures of the Union applicable to dual-use ***items*** ▌**.**

Part 3 — Conditions and requirements for use

– 1. This authorisation does not authorise the export of items where:

(1) the exporter has been informed by the competent authority of the Member State in which he is resident or established that the items in question are or may be intended, in their entirety or in part:

(a) for use in connection with the development, production, handling, operation, maintenance, storage, detection, identification or dissemination of chemical, biological or nuclear weapons or other nuclear explosive devices, or the development, production, maintenance or storage of missiles capable of delivering such weapons;

(b) for a military, ***paramilitary, police, intelligence, surveillance end-use, or other security*** *end-use* ***by the government or by entities acting on behalf of the government;***

(c) for use as parts or components of military items listed in national military lists that have been exported from the territory of the Member State concerned without authorisation or in breach of an authorisation prescribed by the national legislation of that Member State;

(d) for use in connection with a violation of human rights, democratic principles or freedom of speech as defined by the Charter of Fundamental Rights of the European Union,

(2) the exporter ▌ is aware that the items in question are intended, in their entirety or in part, for any of the uses referred to in subparagraph 1;

(3) the exporter ▌ is aware that the items in question will be re-exported to any destination ***excluded by b or c of Part 2 of this authorisation****;*

(4) the relevant items are exported to a customs-free zone or a free warehouse which is located in a destination covered by this authorisation;

(5) the exporter is aware that the consignee or end-user of the items in question is a military, paramilitary, police or intelligence service, or another governmental service for security, or that the items are intended for entities acting on behalf of any of the aforementioned services; or

(6) the export is controlled by virtue of any entry in Annex I to this Regulation not specified in this Union general export authorisation.

– 2. ***Where a customs declaration is required,*** exporters ***will*** declare that the items are being exported under Union General Export Authorisation ***EU008*** in the customs declaration.

– 3. Any exporter intending to use this authorisation ***will*** register prior to the first use of this authorisation with the competent authority of the Member State where he is resident or established. Registration ***will*** be automatic and acknowledged by the competent authority to the exporter within 10 working days of receipt.

4. The registered exporter ***will*** notify the first use of this authorisation to the competent authority of the Member State where he is resident or established, no later than 10 days before the date of the first export.

5. The exporter will, at the request of the competent authority of the Member State where he is resident or established, submit technical data of any export planned or conducted under this authorisation. If such technical data has been requested in relation to a specific item and the technical data changes, the exporter will notify the competent authority of this without delay. The technical data will include at least the following information of the item:

(1) manufacturer;

(2) product name;

(3) model number;

(4) item description - a brief general description of the item such as might be contained in a product brochure;

(5) when necessary, as determined by the competent authority, technical specifications, which will include:

(a) a list of all relevant cryptographic algorithms, including associated key management, related to data confidentiality;

(b) a list of any protocols to which the item adheres;

(c) specification of pre- or post-processing of data, such as compression of plain text or packetizing of encrypted data;

(d) details of programming interfaces that can be used to gain access to the cryptographic functionality of the item;

(6) Export Control Classification.

6. The competent Authority of the Member State where the exporter is resident or established may, for reasons of national security, prohibit the exporter from using this General Export Authorisation for any item mentioned in part 1. The Member State concerned shall inform the Commission and the other Member States on the use of this provision.

7. The registered exporter ***will at the request of*** the competent authority of the Member State where he is resident or established ***report*** on the use of this authorisation. ***Upon request*** the report on the use of this authorisation ***will*** be produced at least once per year and will include at least the following information:

(1) export control classification of the dual-use items;

(2) the quantity and the value of the dual-use items;

(3) the name and address of the consignee;

(4) where known, the end-use and end-user of the dual-use items;

(5)a reference to the last submission of technical data for the dual-use items.

▌

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I. List referred to in *point (a) of* Article 10(6) of this Regulation and Section A, C and D of this Annex

The entries do not always provide a complete description of the items and the related notes in ▌ Annex I. Only ▌ Annex I provides a complete description of the items.

The mention of an item in this Section does not affect the application of the General Software Note (GSN) in ▌ Annex I.

- all items specified in ▌ Annex IV,

- 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,

- 0C002 "Special fissile materials" other than those specified in ▌ Annex IV,

- 0D001 "Software" specially designed or modified for the "development", "production" or "…" of goods specified in Category 0, in so far as it relates to 0C001 or to those items of 0C002 that are excluded from ▌ Annex IV,

- 0E001 "Technology" in accordance with the Nuclear Technology Note for the "development", "production" or "…" of goods specified in Category 0, in so far as it relates to 0C001 or to those items of 0C002 that are excluded from ▌ Annex IV,

- 1A102 Resaturated pyrolised carbon-carbon components designed for space launch vehicles specified in 9A004 or sounding rockets specified in 9A104,

- 1C351 Human and animal pathogens and "toxins",

- 1C353 Genetic elements and genetically modified organisms,

- 1C354 Plant pathogens,

- 1C450.a.1. Amiton: O,O-Diethyl S-[2-(diethylamino)ethyl] phosphorothiolate (78-53-5) and corresponding alkylated or protonated salts,

- 1C450.a.2. PFIB: 1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene (382-21-8),

- 7E104 "Technology" for the integration of flight control, guidance and propulsion data into a flight management system for optimisation of rocket system trajectory,

- 9A009.a. Hybrid rocket propulsion systems with total impulse capacity exceeding 1.1 MNs,

- 9A117 Staging mechanisms, separation mechanisms and interstages usable in "missiles".

ANNEX III

A. Model for individual or global export authorisation forms

(referred to in Article 10(2) of this Regulation)

When granting the export authorisations, Member States will strive to ensure the visibility of the nature of the authorisation (individual or global) on the form issued.

This is an export authorisation valid in all Member States of the European Union until its expiry date.

EUROPEAN UNION

EXPORT OF DUAL-USE ITEMS (Reg. (EU) No …[1])

<table>
<tr><td>1</td><td>1. Exporter No</td><td colspan="2">2. Identification number</td><td>3. Expiry date (if applicable)</td></tr>
<tr><td rowspan="6">LICENCE</td><td rowspan="2"></td><td colspan="3">4. Contact point details</td></tr>
<tr><td>5. Consignee</td><td colspan="3" rowspan="2">6. Issuing authority</td></tr>
<tr><td rowspan="3">7.Agent/Representative No (if different from exporter)</td></tr>
<tr><td colspan="2">~~8. Country of origin~~

~~9.~~ 8. Country of consignment</td><td>~~Code~~[2]</td></tr>
<tr><td rowspan="3">~~10~~ 9. End user (if different from consignee)</td><td colspan="2">~~11.~~ 10. Member State of current or future location of the items</td><td>Code[1]</td></tr>
<tr><td colspan="2">~~12.~~11. Member State of intended entry into the customs export procedure</td><td>Code[1]</td></tr>
<tr><td>1</td><td colspan="2">~~13.~~ 12. Country of final destination</td><td>Code[1]</td></tr>
</table>

[1] OJ: please insert the number of this Regulation.

~~[2] SeeRegulation (EC) No 1172/95 (OJ L 118, 25.5.1995, p. 10)~~

	~~14.~~ 13. Description of the items[3]	**14. Country of origin**		**Code[2]**
		15. Harmonised System or Combined Nomenclature Code (if applicable with 8 digit; CAS number if available)		16. Control list no (for listed items)
		17. Currency and Value		18. Quantity of the items
	19. End use	20. Contract date (if applicable)	21. Customs export procedure	
	22. Additional information required by national legislation (to be specified on the form)			
	Available for pre-printed information At discretion of Member States			
		For completion by issuing authority Signature Stamp Issuing Authority		
		Date		

[3] If needed, this description may be given in one or more attachments to this form (1bis). In this case, indicate the exact number of attachments in this box. The description should be as precise as possible and integrate, where relevant, the CAS or other references for chemical items in particular.

1 **Bis**	1. Exporter	2. Identification number	
LICENCE	~~14.~~ 13. Description of the items	**14. Country of origin**	**Code[2]**
		15. Commodity code (if applicable with 8 digit; CAS number if available)	16. Control list no (for listed items)
		17. Currency and Value	18. Quantity of the items
	13. Description of the items	**14. Country of origin**	**Code[2]**
		15. Commodity code (if applicable with 8 digit; CAS number if available)	16. Control list no (for listed items)
		17. Currency and Value	18. Quantity of the items
	13. Description of the items	**14. Country of origin**	**Code[2]**
		15. Commodity code	16. Control list no
		17. Currency and value	18. Quantity of the items
	13. Description of the items	**14. Country of origin**	**Code[2]**
		15. Commodity code	16. Control list no
		17. Currency and value	18. Quantity of the items
	13. Description of the items	**14. Country of origin**	**Code[2]**
		15. Commodity code	16. Control list no
		17. Currency and value	18. Quantity of the items
	13. Description of the items	**14. Country of origin**	**Code[2]**
		15. Commodity code	16. Control list no
		17. Currency and value	18. Quantity of the items

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13. Description of the items	**14. Country of origin**	**Code[2]**
	15. Commodity code	16. Control list no
	17. Currency and value	18. Quantity of the items
~~14.~~ 13. Description of the items	**14. Country of origin**	**Code[2]**
	15. Commodity code	16. Control list no
	17. Currency and value	18. Quantity of the items
13. Description of the items	**14. Country of origin**	**Code[2]**
	15. Commodity code	16. Control list no
	17. Currency and value	18. Quantity of the items
13. Description of the items	**14. Country of origin**	**Code[2]**
	15. Commodity code	16. Control list no
	17. Currency and value	18. Quantity of the items

Note: In part 1 of column 24, write the quantity still available and in part 2 of column 24, write the quantity deducted on this occasion.			
23. Net quantity/value (Net mass/other unit with indication of unit)		26. Customs document (Type and number) or extract (Nr) and date of deduction	27. Member state, name and signature, stamp of deduction
24. In numbers	25. In words for quantity/value deducted		
1.			
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B. Model for brokering services / technical assistance authorisation forms

(referred to in Article 11(5) of this Regulation)

EUROPEAN UNION PROVISION OF BROKERING SERVICES / TECHNICAL ASSISTANCE (Reg. (EU) No …[4])

<table>
<tr><td>1</td><td colspan="2">1. Broker/ Supplier of technical assistance/ Applicant No</td><td>2. Identification number</td><td>3. Expiry date (if applicable)</td></tr>
<tr><td rowspan="8">LICENCE</td><td colspan="2" rowspan="2"></td><td colspan="2">4. Contact point details</td></tr>
<tr><td colspan="2">5. Exporter in originating third country (if applicable)</td><td colspan="2" rowspan="2">6. Issuing authority</td></tr>
<tr><td colspan="2" rowspan="3">7. Consignee
No</td></tr>
<tr><td>8. Member State in which the broker / supplier of technical assistance is resident or established</td><td>Code[5]</td></tr>
<tr><td>9. Originating third country/Third country of location of the items subject of brokering services</td><td>Code[1]</td></tr>
<tr><td colspan="2" rowspan="3">10. End user in third country of destination (if different from consignee)</td><td>11. Third country of destination</td><td>Code[1]</td></tr>
<tr><td>12. Third parties involved, e.g. agents (if applicable)</td><td></td></tr>
<tr><td>1</td><td></td><td></td></tr>
</table>

[4] OJ: please insert the number of this Regulation.

[5] See Regulation (EC) No 1172/95 (OJ L 118, 25.5.1995, p. 10).

	13. Description of the items / **technical assistance**.	14. Harmonised System or Combined Nomenclature Code (if applicable)	15. Control list no **(if applicable)**
		16. Currency and Value	17. Quantity of the items (if applicable)
	18. End use		
	19. Additional information required by national legislation (to be specified on the form)		
	Available for pre-printed information At discretion of Member States		
		For completion by issuing authority Signature Stamp Issuing Authority	
		Date	

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C. Common elements for publication of national general export authorisations in national Official Journals (referred to in *point (b) of* Article 10(6) of this Regulation)

1. Title of general export authorisation

2. Authority issuing the authorisation

3. EU validity. The following text shall be used:

   'This is a general export authorisation under the terms of Article 10(6) of Regulation (EU) […] . This authorisation, in accordance with Article 10(6) of that Regulation, is valid in all Member States of the European Union.'

   Validity: according to national practices.

4. Items concerned: the following introductory text shall be used:

   'This export authorisation covers the following items'

5. Destinations concerned: the following introductory text shall be used:

   'This export authorisation is valid for exports to the following destinations'

6. Conditions and requirements

ANNEX IV

(List referred to in Article 9(1) of this Regulation)

The entries do not always cover the complete description of the item and the related notes in Annex I[6]. Only Annex I provides for the complete description of the items.

The mention of an item in this Annex does not affect the application of the provisions concerning mass-market products in Annex I.

The terms appearing in straight double quotes are defined terms in the global definitions list of Annex I

PART I

(possibility of National General Authorisation for intra-Union trade)

Items of stealth technology

1C001		***Materials specially designed for use as absorbers of electromagnetic waves, or intrinsically conductive polymers.*** ***N.B. SEE ALSO 1C101***
1C101		***Materials or 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.*** ***Note: 1C101 does not control materials if such goods are formulated solely for civil applications.*** ***<u>Technical Note:</u>*** ***In 1C101 'missiles' means complete rocket systems and unmanned aerial vehicle systems capable of a range exceeding 300 km.***
1D103		***"Software" specially designed for analysis of reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures.***
1E101		***"Technology" according to the GTN for the "use" of goods specified in 1C101 or 1D103.***
1E102		***"Technology" according to the GTN for the "development" of "software" specified in 1D103.***
6B008		***Pulse radar cross-section measurement systems having transmit pulse widths of 100 ns or less and specially designed components therefor.***

[6] The differences in the wordings/scopes between Annex I and Annex IV are indicated with bold italic text.

		N.B. SEE ALSO 6B108
6B108		***Systems specially designed for radar cross section measurement usable for "missiles" and their subsystems.***

Items of the Union strategic control

1A007		***Equipment and devices, specially designed to initiate charges and devices containing energetic materials, by electrical means, as follows:*** ***N.B. SEE ALSO MILITARY GOODS CONTROLS, 3A229 AND 3A232.*** ***a. Explosive detonator firing sets designed to drive multiple controlled detonators specified in 1A007.b. below;*** ***b. Electrically driven explosive detonators as follows:*** • ***1. Exploding bridge (EB);*** • ***2. Exploding bridge wire (EBW);*** • ***3. Slapper;*** • ***4. Exploding foil initiators (EFI).*** ***Note: 1A007.b. does not control detonators using only primary explosives, such as lead azide.***
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^3 and having a detonation velocity greater than 8000 m/s.***
1E201		***"Technology" according to the General Technology Note for the "use" of goods specified in 1C239.***
3A229		***High-current pulse generators, as follows …*** ***N.B. SEE ALSO MILITARY GOODS CONTROLS***
3A232		***Multipoint initiation systems, other than those specified in 1A007 above, as follows…*** ***N.B. SEE ALSO MILITARY GOODS CONTROLS***
3E201		***"Technology" according to the General Technology Note for the 'use' of equipment specified in 3A229 or 3A232.***
6A001		***Acoustics, limited to the following:***
6A001.a.1.b.		***Object detection or location systems having any of the following:*** ***1. A transmitting frequency below 5 kHz;***

		6. Designed to withstand …;
6A001.a.2.a.2.		***Hydrophones … Incorporating …***
6A001.a.2.a.3.		***Hydrophones … Having any …***
6A001.a.2.a.6.		***Hydrophones … Designed for …***
6A001.a.2.b.		***Towed acoustic hydrophone arrays …***
6A001.a.2.c.		***Processing equipment, specially designed for real time application with towed acoustic hydrophone arrays, having "user-accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;***
6A001.a.2.e.		***Bottom or bay cable systems having any of the following:*** ***1. Incorporating hydrophones …, or*** ***2. Incorporating multiplexed hydrophone group signal modules …;***
6A001.a.2.f.		***Processing equipment, specially designed for real time application with bottom or bay cable systems, having "user-accessible programmability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;***
6D003.a.		***"Software" for the "real-time processing" of acoustic data;***
8A002.o.3.		***Noise reduction systems designed for use on vessels of 1000 tonnes displacement or more, as follows:*** ***b. Active noise reduction or cancellation systems, or magnetic bearings, specially designed for power transmission systems, and incorporating electronic control systems capable of actively reducing equipment vibration by the generation of anti-noise or anti-vibration signals directly to the source;***
8E002.a.		***"Technology" for the "development", "production", repair, overhaul or refurbishing (re-machining) of propellers specially designed for underwater noise reduction.***

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Items of the Union strategic control — Cryptography — Category 5 Part 2

5A004		***Equipment designed or modified to perform 'cryptanalytic functions'.*** ***Note: 5A004 includes systems or equipment, designed or modified to perform 'cryptanalytic functions' by means of reverse engineering.*** ***Technical Note:'Cryptanalytic functions' are functions designed to defeat cryptographic mechanisms in order to derive confidential variables or sensitive data, including clear text, passwords or cryptographic keys.***
5D002.c		***"Software" having the characteristics of, or performing or simulating the functions of, any of the following:*** ***3. Equipment specified in 5A004;***
5E002.a.		***Only "technology" for the "development", "production" or "use" of the goods specified in 5A004 or 5D002.c. above.***

Items of the MTCR technology

7A117		***"Guidance sets", usable in "missiles" capable of achieving system accuracy of 3,33 % or less of the range (e.g., a 'CEP' of 10 km or less at a range of 300 km), except "guidance sets" designed for missiles with a range under 300 km or manned aircraft.***
7B001		***Test, calibration or alignment equipment specially designed for equipment specified in 7A117 above.*** ***Note: 7B001 does not control test, calibration or alignment equipment for Maintenance Level I or Maintenance Level II.***
7B003		***Equipment specially designed for the "production" of equipment specified in 7A117 above.***
7B103		***"Production facilities" specially designed for equipment specified in 7A117 above.***
7D101		***"Software" specially designed for the "use" of equipment specified in 7B003 or 7B103 above.***
7E001		***"Technology" according to the General Technology Note for the "development" of equipment or "software" specified in 7A117, 7B003, 7B103 or 7D101 above.***
7E002		***"Technology" according to the General Technology Note for the "production" of equipment specified in 7A117, 7B003 and 7B103 above.***
7E101		***"Technology" according to the General Technology Note for the "use" of equipment specified in 7A117, 7B003, 7B103 and 7D101 above.***

9A004		***Space launch vehicles capable of delivering at least a 500 kg payload to a range of at least 300 km.*** ***<u>N.B.</u> SEE ALSO 9A104.*** ***<u>Note 1:</u>9A004 does not control payloads.***
9A005		***Liquid rocket propulsion systems containing any of the systems or components specified in 9A006 usable for space launch vehicles specified in 9A004 above or sounding rockets specified in 9A104 below.*** ***<u>N.B.</u> SEE ALSO 9A105 and 9A119.***
9A007.a.		***Solid rocket propulsion systems, usable for space launch vehicles specified in 9A004 above or sounding rockets specified in 9A104 below, with any of the following:*** ***<u>N.B.</u> SEE ALSO 9A119.*** ***a. Total impulse capacity exceeding 1,1 MNs;***
9A008.d.		***Components, as follows, specially designed for solid rocket propulsion systems:*** ***<u>N.B.</u> SEE ALSO 9A108.c.*** ***d. Movable nozzle or secondary fluid injection thrust vector control systems, usable for space launch vehicles specified in 9A004 above or sounding rockets specified in 9A104 below, capable of any of the following:*** ***1. Omni-axial movement exceeding ± 5°;*** ***2. Angular vector rotations of 20°/s or more; or*** ***3. Angular vector accelerations of 40°/s^2 or more.***
9A104		***Sounding rockets, capable of delivering at least a 500 kg payload to a range of at least 300 km.*** ***<u>N.B.</u> SEE ALSO 9A004.***
9A105.a.		***Liquid propellant rocket engines, as follows:*** ***<u>N.B.</u> SEE ALSO 9A119.*** ***a. Liquid propellant rocket engines usable in 'missiles', other than those specified in 9A005, integrated, or designed or modified to be integrated,***

		into a liquid propellant propulsion system which has a total impulse capacity equal to or greater than 1,1 MNs having a total impulse capacity equal to or greater than 1,1 MNs; except liquid propellant apogee engines designed or modified for satellite applications and having all of the following: ***1. nozzle throat diameter of 20 mm or less; and*** ***2. combustion chamber pressure of 15 bar or less.***
9A106.c.		***Systems or components, other than those specified in 9A006, usable in "missiles", as follows, specially designed for liquid rocket propulsion systems:*** ***c. Thrust vector control sub-systems, except those designed for rocket systems that are not capable of delivering at least a 500 kg payload to a range of at least 300 km.*** ***Technical Note:*** ***Examples of methods of achieving thrust vector control specified in 9A106.c. are:*** ***1. Flexible nozzle;*** ***2. Fluid or secondary gas injection;*** ***3. Movable engine or nozzle;*** ***4. Deflection of exhaust gas stream (jet vanes or probes); or*** ***5. Thrust tabs.***
9A108.c.		***Components, other than those specified in 9A008, usable in 'missiles' as follows, specially designed for solid rocket propulsion systems:*** ***c. Thrust vector control sub-systems, except those designed for rocket systems that are not capable of delivering at least a 500 kg payload to a range of at least 300 km.*** ***Technical Note:*** ***Examples of methods of achieving thrust vector control specified in 9A108.c. are:*** ***1. Flexible nozzle;*** ***2. Fluid or secondary gas injection;*** ***3. Movable engine or nozzle;***

		4. Deflection of exhaust gas stream (jet vanes or probes); or ***5. Thrust tabs.***
9A116		***Reentry vehicles, usable in "missiles", and equipment designed or modified therefor, as follows, except for reentry vehicles designed for non-weapon payloads:*** ***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.***
9A119		***Individual rocket stages, usable in complete rocket systems or unmanned aerial vehicles, capable of delivering at least a 500 kg payload to a range of 300 km, other than those specified in 9A005 or 9A007.a. above***
9B115		***Specially designed "production equipment" for the systems, sub-systems and components specified in 9A005, 9A007.a., 9A008.d., 9A105.a., 9A106.c., 9A108.c., 9A116 or 9A119 above.***
9B116		***Specially designed "production facilities" for the space launch vehicles specified in 9A004, or systems, sub-systems, and components specified in 9A005, 9A007.a., 9A008.d., 9A104, 9A105.a., 9A106.c., 9A108.c., 9A116 or 9A119 above.***
9D101		***'Software' specially designed for the 'use' of goods specified in 9B116 above.***
9E001		***"Technology" according to the General Technology Note for the "development" of equipment or "software" specified in 9A004, 9A005, 9A007.a., 9A008.d., 9B115, 9B116 or 9D101 above.***
9E002		***"Technology" according to the General Technology Note for the "production" of equipment specified in 9A004, 9A005, 9A007.a., 9A008.d., 9B115 or 9B116 above.*** ***Note:For "technology" for the repair of controlled structures, laminates or materials, see 1E002.f.***
9E101		***"Technology" according to the General Technology Note for the "development" or "production" of goods specified in 9A104, 9A105.a., 9A106.c., 9A108.c., 9A116 or 9A119 above.***
9E102		***"Technology" according to the General Technology Note for the "use" of space launch vehicles specified in 9A004, 9A005, 9A007.a., 9A008.d., 9A104, 9A105.a., 9A106.c., 9A108.c., 9A116, 9A119, 9B115, 9B116 or***

		9D101 above.

Exemptions:

Annex IV does not control the following items of the MTCR technology:

1. that are transferred on the basis of orders pursuant to a contractual relationship placed by the European Space Agency (ESA) or that are transferred by ESA to accomplish its official tasks;

2. that are transferred on the basis of orders pursuant to a contractual relationship placed by a Member State's national space organisation or that are transferred by it to accomplish its official tasks;

3. that are transferred on the basis of orders pursuant to a contractual relationship placed in connection with a Union space launch development and production programme signed by two or more European governments;

4. that are transferred to a State-controlled space launching site in the territory of a Member State, unless that Member State controls such transfers within the terms of this Regulation.

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PART II

(no National General Authorisation for intra-Union trade)

Items of the CWC (Chemical Weapons Convention)

1C351.d.4.		***Ricin***
1C351.d.5.		***Saxitoxin***

Items of the NSG technology

All Category 0 of Annex I is included in Annex IV, subject to the following:

– ***0C001: this item is not included in Annex IV.***

– ***0C002: this item is not included in Annex IV, with the exception of special fissile materials as follows:***

(a) separated plutonium;

(b) 'uranium enriched in the isotopes 235 or 233' to more than 20 %.

– ***0C003 only if for use in a "nuclear reactor" (within 0A001.a)***

– ***0D001 (software) is included in Annex IV except insofar as it relates to 0C001 or to those items of 0C002 that are excluded from Annex IV.***

– ***0E001 (technology) is included in Annex IV except insofar as these related to 0C001 or to those items of 0C002 that are excluded from Annex IV.***

1B226		***Electromagnetic isotope separators designed for, or equipped with, single or multiple ion sources capable of providing a total ion beam current of 50 mA or greater.*** ***Note:1B226 includes separators:*** ***a. Capable of enriching stable isotopes;*** ***b. With the ion sources and collectors both in the magnetic field and those configurations in which they are external to the field.***
1C012		***Materials as follows:*** ***Technical Note:*** ***These materials are typically used for nuclear heat sources.***

		b.'Previously separated' neptunium-237 in any form. ***<u>Note:</u> 1C012.b. does not control shipments with a neptunium-237 content of 1 g or less.***
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.***
1B233		***Lithium isotope separation facilities or plants, and equipment therefor, as follows:*** ***a. Facilities or plants for the separation of lithium isotopes;*** ***b. Equipment for the separation of lithium isotopes, as follows:*** ***1. Packed liquid-liquid exchange columns specially designed for lithium amalgams;*** ***2. Mercury or lithium amalgam pumps;*** ***3. Lithium amalgam electrolysis cells;*** ***4. Evaporators for concentrated lithium hydroxide solution.***
1C233		***Lithium enriched in the lithium-6 (6Li) 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.*** ***<u>Note:</u>1C233 does not control thermoluminescent dosimeters.*** ***<u>Technical Note:</u>*** ***The natural isotopic abundance of lithium-6 is approximately 6,5 weight % (7,5 atom %).***
1C235		***Tritium, tritium compounds, mixtures containing tritium in which the ratio of tritium to hydrogen atoms exceeds 1 part in 1000, and products or devices containing any of the foregoing.*** ***Note:1C235 does not control a product or device containing less than 1,48 ×***

		10^3 GBq (40 Ci) of tritium.
1E001		***"Technology" according to the General Technology Note for the "development" or "production" of equipment or materials specified in 1C012.b.***
1E201		***"Technology" according to the General Technology Note for the "use" of goods specified in 1B226, 1B231, 1B233, 1C233 or 1C235.***
3A228		***Switching devices, as follows:*** ***a. Cold-cathode tubes, whether gas filled or not, operating similarly to a spark gap, having all of the following characteristics:*** ***1. Containing three or more electrodes;*** ***2. Anode peak voltage rating of 2,5 kV or more;*** ***3. Anode peak current rating of 100 A or more; and*** ***4. Anode delay time of 10 µs or less;*** ***Note:** 3A228 includes gas krytron tubes and vacuum sprytron tubes.*** ***b. Triggered spark-gaps having both of the following characteristics:*** ***1. An anode delay time of 15 µs or less; and*** ***2. Rated for a peak current of 500 A or more;***
3A231		***Neutron generator systems, including tubes, having both of the following characteristics:*** ***a. Designed for operation without an external vacuum system; and*** ***b. Utilizing electrostatic acceleration to induce a tritium-deuterium nuclear reaction***
3E201		***"Technology" according to the General Technology Note for the "use" of equipment specified in3A228 or 3A231.***
6A203		***Cameras and components, other than those specified in 6A003, as follows:*** ***a. Mechanical rotating mirror streak cameras, as follows, and specially designed components therefor:*** ***1. Streak cameras with writing speeds greater than 0,5 mm per microsecond;*** ***b. Mechanical rotating mirror framing cameras, as follows, and specially designed components therefor:*** ***1. Framing cameras with recording rates greater than 225 000***

		frames per second; ***<u>Note</u>: In 6A203.a. components of such cameras include their synchronizing electronics units and rotor assemblies consisting of turbines, mirrors and bearings.***
6A225		***Velocity interferometers for measuring velocities exceeding 1 km/s during time intervals of less than 10 microseconds.*** ***<u>Note:</u> 6A225 includes velocity interferometers such as VISARs (Velocity interferometer systems for any reflector) and DLIs (Doppler laser interferometers).***

6A226		***Pressure sensors, as follows:*** ***a. Manganin gauges for pressures greater than 10 GPa;*** ***b. Quartz pressure transducers for pressures greater than 10 GPa.***

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ANNEX II

Statement by the Commission on a capacity-building programme

for the control of dual-use exports

The Commission recognises the importance of a common licensing and enforcement capacity-building and training programme for an effective EU export control system. The Commission, in consultation with the Dual-Use Coordination Group, will undertake to explore the human and financial resource implications that such a programme may entail, with a view to identifying options for the design, modalities and deployment of a capacity-building and training programme.