A Guide to

September 1996

Canada's Export Controls

Department of Foreign Affairs and International Trade
Ministère des Affaires étrangères et du Commerce international

Canada

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Information and Assistance

The issuance of Export Permits is administered by the Export Controls Division of the Department of Foreign Affairs and International Trade. The Division provides assistance to exporters in determining if export permits are required. It also publishes brochures and Notices to Exporters that are freely available on request.

The Export Controls Division can be contacted at the following:

Telephone: (613) 996-2387
Facsimile: (613) 996-9933

STREET ADDRESS:

Department of Foreign Affairs and International Trade
Export Controls Division (EPE)

Lester B. Pearson Building
125 Sussex Drive – C-4
Ottawa, Ontario
K1A 0G2

MAILING ADDRESS:

Department of Foreign Affairs and International Trade
Export Controls Division (EPE)

Lester B. Pearson Building
P.O. Box 481, Station "A"
Ottawa, Ontario
K1N 9K6

FOR ENQUIRIES ON THE STATUS OF AN EXPORT PERMIT APPLICATION:

Call (613) 996-2387 and quote your export permit application identification number.

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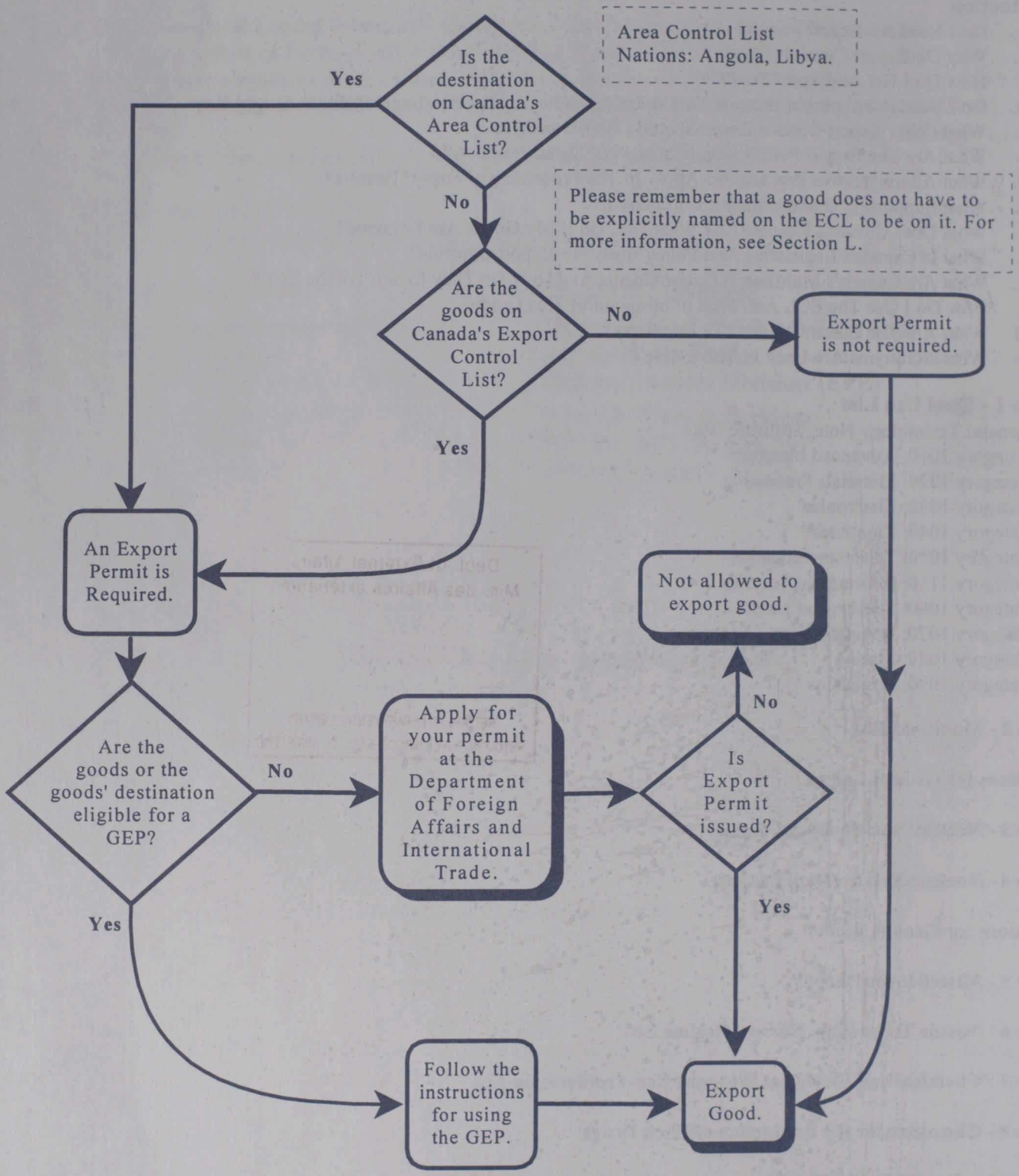


Introduction

A. Do I Need An Export Permit?

This is the first question facing an exporter. Some goods, and some destinations of goods, require that an exporter first receive a Federal export permit from the Department of Foreign Affairs and International Trade (DFAIT) before the goods are exported. To help understand the decision process involved, please refer to the flow-chart on the opposite page.

Export permits are required if goods are:

- destined for a country on Canada's Area Control List;
- on Canada's Export Control List; ***or***
- of U.S. origin.

Step 1: Destination of the Goods

Regardless of the product, any goods going to a country on the Area Control List (ACL) require a permit before they can be exported. At time of publication, the ACL included Angola and Libya. Similarly, any nation that is embargoed by the United Nations may require additional approvals over and above any export permit which may be required (e.g., Iraq).

Step 2: The Type of Goods

Some specific goods require permits for export, regardless of their destination. The list of these goods is contained in Canada's Export Control List (ECL) which is contained in this Guide. The ECL is quite detailed, covering many products that Canada wishes to control for various reasons. Section L, "How do I Use the ECL and Find Information in the Guide?", on page xiv, provides some practical information in using the ECL.

Step 3: U.S. Origin Goods

Exporters should note that the export of all goods of U.S. origin, as defined in ECL Item 5400, and regardless of their nature and destination, require permits (see Section D.2.).

If goods are not destined for a nation on the ACL (Step 1), are not listed on the ECL (Step 2), and are not of U.S. origin (Step 3), then there are no (DFAIT) controls over the export of the good. **An export permit from DFAIT is not required.**

Step 4: Other Possible Export Controls

Exporters should note that even if DFAIT controls do not exist, other controls may still apply. Some listed and non-listed goods may require approval for export by, for example, the Atomic Energy Control Board (nuclear/atomic items). For more information about exporting requirements, please contact your local Canada Customs office or the responsible Government Department or Agency. These can be found in the blue pages of your local telephone book under "Government of Canada".

B. Why Do Export Controls Exist?

1. For some goods, such as U.S. origin items, controls exist to fulfill Canada's obligations in bilateral and multilateral agreements. However, most of Canada's export controls exist because Canada is a partner in international agreements to limit the movement of strategic goods. These include goods such as chemicals for drug production, as well as nuclear and military items. As examples, consider these two international agreements and the items they control:

• The Australia Group - defines controls on the proliferation and development of chemical and biological weapons	• Missile Technology Control Regime - controls missile weapons systems capable of delivering chemical, biological or nuclear weapons

2. Canada's export controls are not intended to hamper business. Rather, the regulations are designed to prevent the movement of certain goods that may not be in the strategic interest of Canada or its allies or that may be contrary to Canada's bilateral or multilateral commitments. Considering the volatility of the international political environment - and the speed with which new technologies are being developed - it is clear that these controls are necessary to protect Canadian security and political interests.

3. If exporters have questions regarding the international agreements as identified in Section K, please contact the Export Controls Division. The telephone number and mailing address are on the inside front cover of this Guide.

C. How Do I Get An Export Permit?

1. In almost all cases, exporters apply for individual export permits at the Department of Foreign Affairs and International Trade (DFAIT). To receive a permit, an exporter must first complete an application form and send it - either by mail or courier - to DFAIT for processing. The form required is DFAIT's form EXT-1042, *Application for Permit to Export Goods.* These forms can be mailed to you from DFAIT in Ottawa, or can be obtained from any of the International Trade Centre offices listed on the back cover of this booklet. On the inside back cover of this booklet you will find a sample of the form; the mailing and courier addresses for DFAIT are on the inside front cover.

2. Every effort will be made to process the application for a permit quickly. For most goods, the processing time is within 10 working days of arriving in the Export Controls Division. Some goods, however, such as military and nuclear-related products, may require 4-6 weeks to process. Exporters who would like DFAIT to courier approved permits back to them (the exporter will be billed for courier costs) should note this on their application.

3. An approved application to export goods will have a unique permit number, featured prominently in the lower right-hand corner of the permit. Exporters will be required by Canada Customs to record this number in the appropriate field of the Canada Customs B-13/B-13A document they complete when exporting the goods.

4. Export permits for goods in ECL Groups 1, 4, 6, 7, 8 and ECL Item 5400 are valid for two years. Extensions are not granted. Permits for goods in ECL Groups 2, 3, and most Items in Group 5 are valid for one year. Extensions to these permits may be granted for one additional year.

5. All export permits for military goods in ECL Group 2, ECL Item 5500, and selected other ECL items are issued on the condition that a quarterly or annual report, as the case may be, is submitted to the Export Controls Division. This report must detail the actual shipments of goods made against each export permit.

6. Reporting conditions may also apply to other items on the ECL. Recipients ofexport permits should examine the processed export permit to determine whether or not any reporting conditions have been attached to the permit and to whom the reports are to be supplied.

D. Do I Need A Permit For Exports To The United States, Or For The Export Of U.S. Origin Goods?

1. Exports to the United States

Under a bilateral arrangement with the United States, export permits are not required when shipping goods to the U.S. for most ECL items. However, all goods in Groups 3 and 4, and some goods in Groups 5, 7 and 8 require an individual export permit, when the final destination is the US (contact the Export Controls Division to determine which items are exempt).

2. Export of United States Origin Goods

United States origin goods are controlled for re-export from Canada under Item 5400 of Group 5. Although this states all goods including non-strategic U.S. origin goods require an export permit, exporters may benefit, in most cases, from a General Export Permit (GEP). GEPs have several advantages and are administratively easy to use. They are discussed in greater detail in Section E. For the re-export of non-strategic U.S. goods, General Export Permit No. Ex. 12 may be applicable in most cases.

If GEP No. Ex. 12 is not applicable and an individual export permit is required, exporters may be required to provide a copy of a U.S. export licence or verification that the specified goods may be exported to the specified country without the U.S. licence, prior to issuance of an individual export permit. For more information, contact the Export Controls Division.

3. Export of U.S. Origin Goods: Iran, Cuba, North Korea, ACL Countries

As noted above, all U.S. origin goods defined under Item 5400 of the ECL require an export permit. If these goods are going to Iran, Cuba, or North Korea, or to any country on Canada's Area Control List (ACL), the exporter must apply to DFAIT for an individual export permit. General Export Permit No. EX. 12 is not applicable in these circumstances.

E. What Other Export Control Issues Should I Be Aware Of?

1. Automatic Firearms Country Control List (AFCCL)

In addition to the ECL and the ACL, export controls exist specifically for automatic firearms. Automatic firearms as defined in ECL Item 5500 may be exported only to countries with which Canada has intergovernmental defence, research, development and production arrangements. The countries on this list are:

Australia	France	Netherlands	Spain	United States
Belgium	Germany	Norway	Sweden	
Denmark	Italy	Saudi Arabia	United Kingdom	

2. Fees for Export Permits

Under the authority of the *Export and Import Permits and Certificate Fees Order, 1995* a fee is levied for each permit covering most Items in Group 5. Most goods under Group 5, except Items 5400, 5401 and 5500 of the Export Control List, are assessed a $14 administrative fee for each export permit application submitted. For softwood lumber under Item 5104, a $9 fee is assessed if export permit applications are completed and submitted electronically (see *Notices to Exporters no. 90 and 92*). For more information about fee charges please refer to *Notices to Exporters No. 83* and *No. 87*.

Money orders or cheques payable to the Receiver General for Canada are the only acceptable forms of payment, and must be included with your application for an export permit. Exporters who make frequent shipments may prefer to be placed on a monthly billing system. If you would prefer to be billed monthly, rather than for each individual permit, please submit your request to:

Director General
Export and Import Controls Bureau (EPD)
Department of Foreign Affairs and International Trade
P.O. Box 481, Station "A"
Ottawa, Ontario
K1N 9K6

3. General Export Permits (GEP)

General Export Permits (GEP) enable an exporter to export certain goods which are subject to control to eligible destinations without the necessity of submitting individual export permit applications. A GEP is a valid export permit which is used to minimize the administrative burden for exporters and to streamline licensing procedures. By using a GEP, exporters do not have to apply to DFAIT for an individual export permit for each shipment of goods. Instead, a simple administrative procedure is used. No additional paperwork is required for exporters, and DFAIT does not become directly involved. However, some GEP's contain conditions which must be adhered to in order to use them. In some cases, the use of a GEP is conditional on exporter undertakings such as reporting on actual volume of exports made against the GEP.

GEP's are available for specific goods, and specific destinations. The following is a list of widely available GEP's:

GEP 1:	Export of Goods for Special and Personal Use	GEP 27:	Nuclear-related Dual-use Goods
GEP 3:	Export of Consumable Stores Supplied to Vessels and Aircraft	GEP 28:	Exports to Angola
GEP 5:	Export of Logs	GEP 31:	Peanut Butter
GEP 11:	Exports to Libya	GEP 32:	Cryptographic Products for Personal Use
GEP 12:	United States Origin Goods	GEP 33:	Computers
GEP 26:	Industrial Chemicals	GEP 34:	Telecommunications
		GEP 35:	Certain Industrial Goods

Again, GEPs apply only to these goods or to the destinations of these goods. For details about using a GEP, please contact the Export Controls Division.

4. Nuclear and Atomic Energy Goods and Technologies

In addition to the nuclear and nuclear-related items identified in Groups 3 and 4, which are controlled by international agreements, the Atomic Energy Control Board (AECB) also controls, by regulation under the *Atomic Energy Control Act*, certain radioactive substances and isotopes which are deemed capable of releasing atomic energy or being required for the production, use, or application of atomic energy.

Exporters of certain radioactive materials not identified in this Guide, as well as Group 4 goods which are not subject to individual export permits, but qualify for General Export Permit No. EX 27, require an export licence separately from the AECB. Information relating to such controls may be obtained by contacting:

Atomic Energy Control Board
Non-Proliferation, Safeguards and Security Division
P.O. Box 1046, Station "B"
Ottawa, Ontario
K1P 5S9

Telephone: (613) 995-0369
Facsimile: (613) 995-5086

5. Narcotics, Controlled Drugs and Precursors

In addition to the illicit drug precursors items identified in Group 8, which are controlled by international agreements, Health Canada also controls, by regulation under the *Controlled Drugs and Substances Act*, certain drugs, controlled substances, and precursors.

Exporters of drugs, controlled substances, and precursors not identified in this Guide, can obtain information relating to such controls by contacting:

Health Canada
Bureau of Drug Surveillience
122 Bank Street
Ottawa, Ontario
K1A 1B9

Telephone: (613) 954-6522
Facsimile: (613) 952-7738

F. What Are The Export Permit Requirements For Forest Products?

A variety of export controls apply to Canadian forest products listed in Group 5 of the ECL. Remember that most Group 5 Items, including forest products, require a $14 processing fee (softwood lumber's processing fee is $9) for each export permit application. The following details what exporters must do if exporting a controlled forest product:

1. Logs and Pulpwood: All Provincial/Territories except British Columbia and the Yukon

Exporters are required to apply for an export permit for logs and pulpwood identified in ECL Group 5. The export permit application is sent directly to the Export Controls Division for processing.

2. Logs and Pulpwood: Originating from British Columbia

Exporters must apply to the B.C. Ministry of Forests on Provincial Form F.S. 418, "Application for Exemption to Export Unmanufactured Timber Products". This begins the surplus testing process. Once this process is completed, a copy of a duly completed provincial application form FS-38 must be completed and submitted, together with the Federal export permit application, to the Export Controls Division of DFAIT for processing. Applications to export woodchips (pulpwood) must include a copy of the relevant *Order of the Lieutenant Governor in Council* issued by the Province of British Columbia. The approval or rejection of an application will be issued by DFAIT.

3. Logs and Pulpwood: Originating from Indian Reserves in British Columbia

a. For logs harvested or for timber proposed to be harvested from Indian Reserves and surrendered lands as defined in the *Indian Act* and *Indian Timber Regulations*, the applicant must submit the following documentation to the B.C. Ministry of Forests Provincial Regional Office:

   i) The Provincial form, F.S. 38, Application for Permit to Export Unmanufactured Timber;

   ii) Written Letter of Consent; ***and***

   iii) A stock scale in approved format.

b. The exporter must obtain a Written Letter of Consent by applying to the Department of Indian Affairs and Northern Development (DIAND) in Vancouver. Once the Letter of Consent is issued by DIAND, it is sent to DFAIT with copies to the B.C. Ministry of Forests and the applicable Indian Band. For information contact:

   Department of Indian Affairs and Northern Development
   Lands and Resources
   B.C. Region
   300 - 1550 Alberni Street
   Vancouver, B.C. V6G 3C5
   Telephone: (604)666-6320 Facsimile: (604)666-6474

c. Upon receipt of the documentation noted in paragraph a) above, the Provincial Regional Office will return copies of the documents to the applicant. The applicant then applies to the Export and Import Controls Bureau for a Federal export permit on form EXT-1042, Application for Permit to Export Goods, and include copies of all documents noted in paragraph a).

d. Upon receipt of the documents noted in paragraph c) above, the Export Controls Division will issue the requisite Federal export permit.

e. All timber is subject to, and must be available for, inspection by the B.C. Ministry of Forests. As well, all logs must be marked to identify their origin.

4. Logs and Pulpwood: Originating from the Yukon Territory

Exporters must apply to DFAIT for a normal export permit, but should allow 20 working days for processing. The delay in processing is due to the fact that each case must be discussed among DFAIT, DIAND and the government of the Yukon. While other governments are involved, the approval or rejection of an export application will be issued by DFAIT. Any questions exporters have about their application are to be directed to DFAIT.

5. Softwood Lumber

Exports of softwood lumber require export permits if destined to the United States. For detailed information on these controls, please consult *Notices to Exporters No. 90 and 92 (Softwood Lumber Products)*.

G. What Administrative Procedures Apply In The Processing Of Export Permits?

1. Opinions on Proposed Exports

It is common for exporters to request an opinion on the prospect for receiving an export permit. This advice is provided wherever possible, but is not binding. Exporters who wish a firm decision should apply for an export permit, which would be subject to extension or renewal (see G.8., Amendments, for details on extensions).

2. Temporary Export Permits

Such permits are common for goods exported for trade shows, exhibitions, demonstrations, geological surveying, and other events where the goods will return to Canada. Exporters must apply for a permit as normal, but note in the body of the application that they are asking for a temporary permit. In granting a temporary export permit, DFAIT may place certain conditions on the export. These conditions may include:

- adhering to the expiry date of the permit (normally 12 months);
- ensuring the goods are properly supervised while abroad; **and**
- providing verification that the goods returned to Canada unchanged.

... and other types of conditions as are required.

3. Multiple Shipments/Multiple Consignee Permits (Strategic/Other Goods)

In some cases, an exporter may use an export permit for more than one shipment to the consignees specified on the export permit (a maximum of three consignees per permit is allowed) and up to the value and quantity noted on the permit. This procedure applies to all goods in Groups 1, 4, 5 (except ECL Item 5500), 6, 7 and 8.

4. Single Shipment Permits (Offensive Military Equipment)

As a general rule, export permits for military goods falling under ECL items 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009 (a) and (g), 2010 (a), 2012, 2016, 2017 (b), 2019 and ECL Item 5500 will be issued for a single shipment/single consignee only. The export permit becomes invalid after the first shipment is made even if the shipment was only a partial one. Exporters must re-apply for a new export permit to cover any shortfall.

5. Multiple Shipments/Single Consignee Permits (Non-offensive Military/Atomic Energy Equipment)

Other ECL Items in Group 2 not identified in 4. above and all items in ECL Group 3 may be permitted to a single consignee on a multiple shipment basis.

6. Export Permit Status Enquiries

Exporters may obtain information regarding the processing of their permit application by contacting the direct telephone number (613) 996-2387 and citing the red I.D. number located in the upper right-hand corner of the export permit application. Please allow at least five working days from time of mailing before enquiring as to the status of applications.

7. Distribution and Retention of Permit Copies

Once the export permit has been approved, the exporter will receive an "Exporter's Copy" duly signed and authorized. This copy must be presented to Canada Customs at the port of export together with the appropriate shipping documents and Customs Declaration Form (if applicable). If the permit allows multiple shipments, then a photocopy of the "Exporters Copy" must be submitted to Customs for subsequent shipments.

The exporter must retain, at his/her place of business or residence, all documents in respect of each export made under an export permit whether it is a General Export Permit (GEP) or an Individual Export Permit (IEP), for a period of six years.

8. Amendments

Requests to amend existing export permits must be made in writing, addressed to the Director, Export Controls Division. All such requests should be received in the Division at least four weeks prior to the expiry date of the export permit. **Once the permit has expired, it cannot be amended.**

Requests for amendments are reviewed individually in light of the circumstances prevailing at the time of the request. Extensions will be approved on a one time basis only for permits originally issued with an expiry date of one year. Where a permit is issued with an expiry date of two years, an extension will not normally be granted. In most cases, the number of consignees per permit is limited to three. Amendments to consignees will be considered although no increase in the number of consignees beyond three will be allowed. Changes in consignee must be accompanied by End-use Certificates (EUC) or International Import Certificates (IIC), see Section H, below. Limited additional quantities of new items may be added to an existing permit. Requests to add new items or to change the quantities or values of items on existing permits will be reviewed on a case-by-case basis. Amendments to permits covering military goods (ECL Group 2) will generally be approved only when the changes are of a minor nature.

9. Access to Information

As a general rule, under the *Privacy Act* and the *Access to Information Act*, information in the possession of the federal government cannot be disclosed, regardless of the source of such information. However, both the *Privacy Act* and the *Access to Information Act* contain provisions which require the government to disclose certain information under certain circumstances. Please refer to the Acts for more information.

H. What Supporting Documentation Is Required?

Canada and its major industrialized trading partners have harmonized to a large extent their export control systems in order to prevent diversions or trans-shipments of controlled commodities to unauthorized end-uses or unauthorized destinations. In addition, required documentation for nuclear and nuclear-related dual-use items may be somewhat different. In some cases, government-to-government assurances from the end-user may be necessary. Applicants should bear such considerations in mind when planning their requirements for an export permit. Generally speaking, however, for end-use assurances, Canada has in place a system whereby these assurances appear in several internationally recognized forms:

A. International Import Certificates (IIC);
B. End-use Certificates (EUC), and/or Import Licences (IL);
C. Delivery Verification Certificates (DV);
D. End-use Statements (EUS).

In order to expedite the processing of export permit applications exporters are encouraged to obtain IICs, DVs, EUCs, ILs or EUSs from the importers well in advance of applying for an export permit. This ensures that applications are processed with minimal delays.

Under certain defined circumstances, the need for an EUC, IIC, IL, EUS or DV may be waived. Please refer to sub-section 5, below, where the waivers are explained in detail.

1. International Import Certificates (IIC)

When an IIC is required, the exporter must request that the importer (or consignee) obtain an IIC from the government of the importing country. This IIC means that the government of the importing country is aware of the proposed shipment of goods. Further, the IIC alerts the government of the importing country about the goods, ensuring that they are not diverted en route or upon arrival.

Once the IIC is validated by the foreign authorities, the original as well as the importer's office copy are returned to the importer. The original must then be sent by the importer to the Canadian exporter, who must forward it to the Export Controls Division with the export permit application. Only then can an export permit be processed. Exporters should note that IICs usually have a limited validity period (normally 6 months) and must be submitted to the Export Controls Division within the validity period.

For exports to Canada, the foreign government may require a Canadian IIC before the foreign export permit/licence is issued. The Canadian importer applies for the IIC from the Export Controls Division.

2. Delivery Verification Certificates (DV)

Most countries that issue IICs also issue Delivery Verification Certificates (DV). DVs certify that the goods have arrived in the importing country. On some occasions, Canadian exporters may be required to obtain DVs from the importer's government. DVs are normally issued by import or export control authorities in the country of final destination. The DV provides official confirmation that the goods have been delivered in accordance with the terms of both the Canadian export permit and the foreign-issued IIC.

In the case of exports to Canada, the foreign government may require a Canadian DV. The DV is requested by the exporter who forwards the request to the Canadian importer who, in turn, completes and submits a DV application form to the Export Controls Division for processing.

3. End-Use Certificates (EUC)/ Import Licences (IL)

The Canadian exporter should request the importer to obtain the EUC or IL, whichever is required, from the designated authorities. The foreign importer forwards this document to the Canadian exporter for delivery to the Export Controls Division together with the export permit application.

4. End-Use Statements (EUS)

Some governments do not issue any type of end-use certificates or other official assurances about the final use of a good. In such cases an End-Use Statement (EUS) from the importer may be acceptable. The statement must be on the importer's letterhead (photocopy not acceptable) and must:

i. identify the end-user as well as purpose and use of the products to be imported;
ii. correspond to the commodity description which appears on the export permit application;
iii. identify whether the goods are being used for civilian or military application; ***and***
iv. declare that the imported goods will not be diverted or re-exported.

5. General Waiver of Supporting Documentation

At the discretion of the Export Controls Division, the supporting documentation requirements may be waived for applications to export certain goods. Unless otherwise indicated below, the waiver normally applies only to ECL Group 1 goods. Exporters who consider that their particular transaction qualifies for waiver of supporting documentation should state this in the body of the export permit application.

i. **Single Shipments of Less Than $6,000 (Cdn)**

ii. **Government Departments or Agencies (All ECL Groups)**
Government Departments are entities operated by government-paid personnel performing governmental administrative functions: e.g. Ministry of Defence, Ministry of Health; etc. Government Agencies considered to be government-controlled (i.e. more than 50% government owned) are public service entities, such as transportation systems, postal, telephone, telegraph, broadcasting and hydro power systems.

iii. **Relief Agencies for Use in Relief Projects**

iv. **Educational Institutions (e.g. University, Academy, College, Research Institute, etc)**

v. **Temporary Permits (All ECL Groups)**
For an application to export goods for exhibition, demonstration or testing purposes.

vi. **Firearms (ECL Items 2001 only)**
Applies only to rifles, carbines, revolvers or pistols (except those covered under ECL Item5500) if the total shipment does not exceed fifteen of these firearms.

vii. **Maintenance/Repair Parts-Commercial Aircraft**

viii. **Maintenance/Repair parts –Other Goods**

ix. **Returned Goods**
Returned goods are those:
- *returned from Canada to the foreign country for repair or replacement;*
- *returned after being repaired in Canada; or*
- *replace goods previously exported from Canada which have been returned to Canada for replacement.*

Note: In certain cases, GEP No. EX. 1 may apply to your export in situations identified in paragraphs vii, viii and ix above.

6. Countries Administering IIC, DV, EUC and IL Requirements

Australia	IIC/DV	Hungary	IIC	Nigeria	IIC
Austria	IIC/DV	Ireland	IIC/DV EUC	Norway	IIC/DV
Belgium	IIC/DV	Israel	IIC/CC**	Pakistan	IIC/DV
Bolivia	DV	Italy	IIC/DV	Portugal	IIC/DV
Brunei	IL	Japan	IIC/DV	Singapore	IIC/DV
Chile	IIC/DV equivalents	Republic of Korea	IIC/DV	Spain	IIC/DV
PRC*	EUC/MOFERT	Liechtenstein	Swiss Blue	Sweden	IIC/DV
Denmark	IIC/DV	Luxembourg	IIC/DV	Switzerland	Swiss Blue
Finland	EUC	Macau	IL	Turkey	IIC/DV
France	IIC/DV	Malaysia	IIC/DV	United Kingdom	IIC/DV
Germany	IIC/DV	Myanmar (Burma)	EUC	United States	IIC/DV
Greece	IIC/DV	Netherlands	IIC/DV	Yugoslavia	EUC
Hong Kong	IIC/DV	New Zealand	EUC		

* PRC = People's Republic of China

**Customs Certificate in lieu of a DV

I. What Does Customs Require And What Do I Do If My Goods Are Detained?

1. Before allowing the export of goods, it is the duty of Customs Officers, under the *Export and Import Permits Act* (EIPA), and the *Customs Act*, to satisfy themselves that the export does not contravene the EIPA.

2. At the time the goods are presented for export it is necessary to present a completed Customs and Excise Declaration form B-13/B-13A along with the exporter's original copy of an export permit. In those instances where the exporter is unable to provide the original copy, an export permit stamped "this is a certified true copy" and signed by the appropriate officer of DFAIT will be accepted. It is the responsibility of the exporter to declare on the B-13/B-13A the Permit Number, if applicable. If a permit is required, the Individual Export Permit number or the General Export Permit number must be cited in Box 9 of the B-13/B-13A. If no permit is required, this fact must be stated on the export documentation.

3. For permits valid for multiple shipments, it is the responsibility of the exporter to present the original copy of the export permit to Customs at the time of the first exported shipment. Copies of attachments listing consignees, goods, etc., must also be presented with the same information stated on the B-13 (i.e. consignee name and address). Photocopies will be accepted for all additional exports. Each shipment will be recorded by Customs until the export permit expires or the quantity/value of the export permit has been reached, whichever comes first. However, it should be noted that it is the responsibility of the exporter to keep records and not to ship beyond the limits of the export permit.

4. For more information on presentation and processing of Customs export documents, please contact your local Customs office.

5. Exporters whose goods are being detained by Customs should contact the Detention Liaison Clerk, Export Controls Division, Department of Foreign Affairs and International Trade ([613]996-5711). If the detained goods require an Individual Export Permit, the exporter will be required to obtain and present to Customs the valid export permit before the goods will be considered for release.

6. Exporters believed to be in violation of the *Export and Import Permits Act* (EIPA) may have their goods seized by Canada Customs. In these instances, the exporter may be liable for severe penalties under the *Customs Act* or the *EIPA*. Following seizure, Canada Customs assumes the sole responsibility for all seized goods.

7. Permits will not be issued for goods under seizure until such time as the goods are released to the exporter.

Reminder: *Canada Customs compares the goods described on the export permit and the Customs Declaration form B-13/B-13A or equivalent export documentation. Discrepancies in the documentation, including goods being exported without the required permit, could result in the export being detained, pending clarification, or in extreme cases, seized.*

J. What Is Canada's Legislative And Policy Basis For Export Controls?

1. General

The Minister of Foreign Affairs is responsible for the administration of the *Export and Import Permits Act* (EIPA). The Export Controls Division, Export and Import Controls Bureau administers, on behalf of the Minister, Canadian policies and procedures related to controlled goods and technologies. The Export Controls Division also cooperates with other Government Departments and Agencies which administer policies and procedures, and exercise separate licensing responsibilities, related to the export of controlled goods and technologies pursuant to other relevant legislation. Generally speaking, there are established guidelines, procedures, and policies with respect to exports of strategic and military goods.

2. Strategic Goods

Groups 1, 3, 6 and 7 of the Export Control List cover strategic goods and technologies. Groups 4, 6 and 7 of the ECL also cover dual-use materials, equipment and components which could contribute to chemical, biological and nuclear weapons proliferation, and their delivery systems. Generally, exports of strategic civilian goods are considered favourably with some exceptions. For example, an export permit application may be denied where there is a risk of diversion of these goods to an unacceptable use or destination as determined by international agreements, commitments or arrangements. An export application may be denied where there is a risk of proliferation of nuclear weapons (Groups 3 and 4), missile systems (Group 6) or chemical/biological weapons (Group 7) to any country.

3. Military Goods

With respect to military goods, (ECL Group 2 and ECL Item 5500) Canadian export control policy has, for many years, been restrictive. Under present policy guidelines set out by Cabinet in 1986, Canada closely controls the export of military goods and technology to:

i. countries which pose a threat to Canada and its allies;
ii. countries involved in or under imminent threat of hostilities;
iii. countries under United Nations Security Council sanctions, or
iv. countries whose governments have a persistent record of serious violations of the human rights of their citizens, unless it can be demonstrated that there is no reasonable risk that the goods might be used against the civilian population.

4. Policy Assessments

After the technical assessment is completed, the application is further reviewed by taking into consideration the type of goods exported, the importing country and the intended use of the product. A thorough examination of the relevant foreign policy and security concerns is undertaken.

5. Consultations

a. The purpose of intra/interdepartmental consultations is to fully assess the risk related to proposed exports. Consultations may be carried out at the national, bilateral or multilateral levels.

b. Various Canadian Government Departments, Agencies or Boards may be involved in the export control process. These may include the Departments of National Defence, Industry Canada and Revenue Canada (Customs and Excise); the Atomic Energy Control Board; the Communications Security Establishment; the Canadian Security Intelligence Service; the Royal Canadian Mounted Police; and various Divisions within the Department of Foreign Affairs and International Trade.

K. What are Canada's Multilateral Commitments and How do They Relate to the ECL?

1. COCOM

From 1950 to 1994 Canada was a member of the Coordinating Committee for Multilateral Strategic Export Controls (COCOM). On March 31, 1994 COCOM ceased to exist. At that time COCOM members agreed to establish a new multilateral arrangement. The new arrangement is known as the "Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-use Goods and Technologies".

2. Wassenaar Arrangement (ECL Groups 1 and 2)

The Wassenaar Arrangement (WA) was established in order to contribute to regional and international security and stability, by promoting transparency and greater responsibility in transfers of conventional arms and dual-use goods and technologies, thus preventing destabilizing accumulations. The thirty-three participating states of the WA will seek to ensure that transfers of these items do not contribute to the development or enhancement of military capabilities which undermine these goals, and are not diverted to support such capabilities.

The WA will complement and reinforce, with minimal duplication, the existing control regimes for weapons of mass destruction and their delivery systems. This arrangement is also intended to enhance cooperation to prevent the acquisition of armaments and sensitive dual-use items for military end-uses, if the situation in a region or the behaviour of a state is, or becomes, a cause for serious concern to the participating states. Finally, it will not be directed against any state or group of states and will not impede bona fide civil transactions. ECL Group 1 comprises dual-purpose goods and technologies that have both civilian and military application. ECL Group 2 comprises goods and technologies that are specially designed or modified for military purposes. The current members of the WA include:

Argentina	Denmark	Italy	Poland	Sweden
Australia	Finland	Japan	Portugal	Switzerland
Austria	France	Korea, Republic of	Romania	Turkey
Belgium	Germany	Luxembourg	Russian Federation	Ukraine
Bulgaria	Greece	Netherlands	Slovak Republic	United Kingdom
Canada	Hungary	New Zealand	Spain	United States
Czech Republic	Ireland	Norway		

3. Nuclear Non-proliferation (ECL Groups 3 and 4)

Canada has a long-standing nuclear non-proliferation policy which is designed, *inter alia*, to ensure that Canada's nuclear exports are not used for any nuclear explosive purpose. Canada has concluded with its nuclear trading partners bilateral cooperation agreements in which there are reciprocal commitments.

As a party to the Treaty on the Non-proliferation of Nuclear Weapons (NPT) that came into force in 1970, Canada is obliged not to provide source or special fissionable material, or equipment or material especially designed or prepared for the processing, use or production of special fissionable material to any non-nuclear weapon state (NNWS) for peaceful purposes unless the source or special fissionable material is subject to International Atomic Energy Agency (IAEA) safeguards. In the early 1970's, Canada, as a member of a group of states that became known as the Zangger Committee, adopted a common understanding with respect to the implementation of this commitment that included an elaboration of those nuclear goods requiring the application of IAEA safeguards.

In the late 1970's, a group of nuclear suppliers, including Canada, agreed on a further set of guidelines for nuclear transfers to any NNWS for peaceful purposes. These became known as the Nuclear Suppliers' Group (NSG) guidelines. In 1992, the NSG established a list of nuclear-related dual-use goods and technologies that could make a major contribution to a nuclear explosive activity or an unsafeguarded nuclear fuel cycle activity. There are thirty-two NSG member countries.

Group 3 includes goods that are nuclear-specific. Group 4 includes goods that are nuclear-related, dual-use, goods; that is, items that can be used for nuclear as well as non-nuclear applications and that could be used in the proliferation of nuclear weapons or nuclear explosive devices.

4. Miscellaneous Non-Strategic Export Controls (ECL Group 5)

Canada is a participant in a number of bilateral and multilateral organizations designed to control the export from Canada of various non-strategic goods. Included in Group 5 are forest products, medical products, agricultural and food products, U.S. origin goods and automatic weapons.

5. Missile Technology Control Regime (ECL Group 6)

The MTCR was established in 1987 to reduce and ultimately eliminate the proliferation of systems capable of delivering weapons of mass destruction, namely chemical, biological or nuclear weapons. As of 1996, twenty-eight countries are members of the MTCR. The goods and technologies identified in Group 6 of this Guide encompass MTCR controls. Group 6 includes goods and technologies agreed upon by the MTCR that are used or could be used in the proliferation of systems capable of delivering chemical, biological and nuclear weapons.

6. Australia Group (ECL Group 7)

In 1985, Canada, together with a number of other countries, agreed that the proliferation of chemical and biological weapons required immediate attention. The Australia Group controls chemical substances and biological agents and related equipment that could be used in the production of chemical and biological weapons. As of 1996, twenty-nine countries, were members of the Australia Group. Chemical weapon precursors and biological agents and related dual-use equipment are identified in Group 7 of this Guide.

7. Chemical Weapons Convention (ECL Group 7)

Also contained in ECL Group 7 are chemicals and precursors controlled under the Chemical Weapons Convention (CWC). Many of the CWC chemicals and precursors are also controlled by the Australia Group. The CWC is expected to come into effect in early 1997.

8. Chemical Action Task Force (CATF) (ECL Group 8)

The CATF maintains a list of chemical precursors that could be used in the production of illicit drugs.Group 8 contains a list of chemical precursors used in the manufacture of illicit drugs. Some of the chemicals are also subject to controls imposed under the "United Nations Convention Against Illicit Traffic in Narcotic and Psychotropic Substances". This list is not all-inclusive. Other chemicals used in the production of illicit drugs are controlled by Health Canada.

L. How do I Use the ECL and Find Information in the Guide?

Most of this Guide consists of the Export Control List, a lengthy and very technical list of goods that require Federal permits if they are exported. Novice users can find themselves swamped in so much information they lose sight of what they are looking for. Because of this, understanding how to read the ECL and how to find information in it is vital. This section will help explain how the ECL is organized, and how to find specific information in it.

Reading the ECL

1. The ECL is divided into eight different chapters, known as **Groups**. These Groups each consist of items that in many ways appear similar to each other. The following is a list of all of the Groups, and the items that they control:

Group 1: Dual Use List*	Group 5: Miscellaneous Goods
Group 2: Munitions List	Group 6: Missile Technology Control Regime List
Group 3: Nuclear Non-Proliferation List	Group 7: Chemical and Biological Weapons Non-Proliferation List
Group 4: Nuclear-Related Dual Use List*	Group 8: Chemicals for the Production of Illicit Drugs.

* "Dual Use" items are industrial products with a civilian/military or nuclear/non-nuclear use.

2. The text of each Group reflects the international agreement(s) that Canada has entered into concerning the items controlled in that Group. For example, the text of Group 7, which deals with chemical and biological weapons, is very similar to the texts of the Australia Group arrangement on chemical and biological weapons and the Chemical Weapons Convention Treaty.

3. Each portion of distinct information in the ECL is known as an **Item**. Items are the bits of information that make up the ECL, and are collected into the Groups. Items are numbered to make it easier to find the information.

4. Numbering of Items reflects the Group that contains that Item. For example, in Group 2 (the Group concerning Munitions) all of its Items' numbering starts with the number "2". So, for example, bombs, torpedoes and rockets are Item 2004. Item 2005 discusses fire control systems, such as bomb sights. All of the Items in Group 4 begin with the number 4, Group 6's begin with the number 6, and so on. This is important to remember, and makes it easier to find a listed good or technology: if you know the good's Item number, you will automatically know which Group contains it.

5. **Sub-Items** are also given unique numbers. Numbers for sub-items are based upon the main Item number the sub-item refers to: for example, Item 2004.1 is a sub-item of Item 2004. When there are many sub-items, the numbering can become complicated. Consider, for example, Item 1061: it has dozens of sub-items, one of them being 1061.5.c.2.b).(1), which discusses Q-switched lasers.

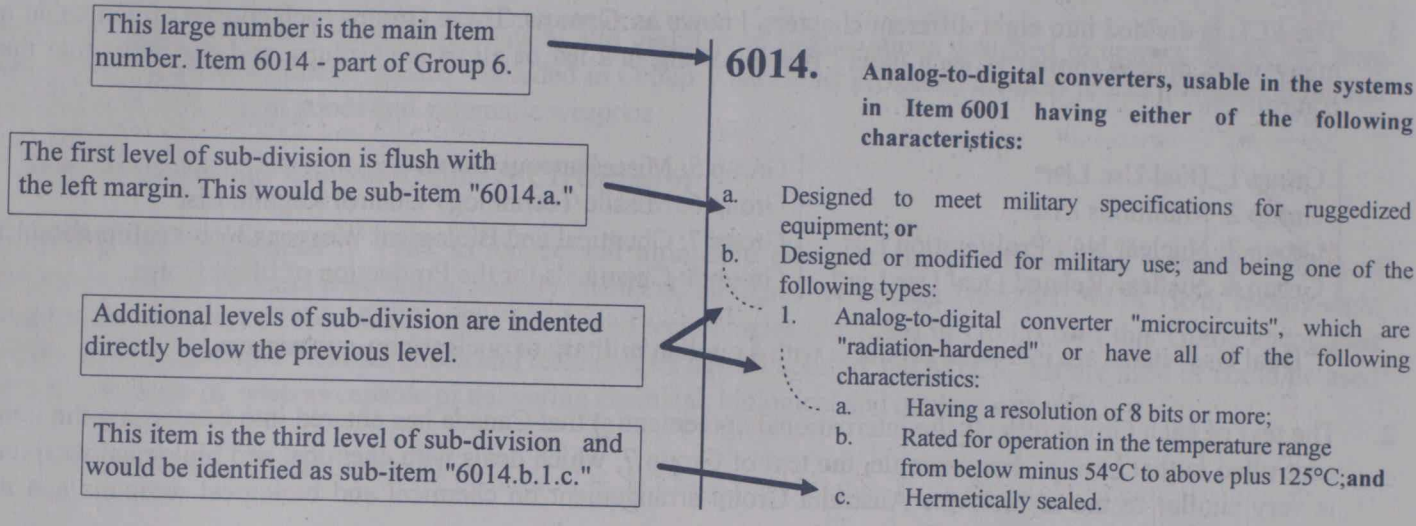
6. As evidenced by the example above, the number of sub-items alternates between number and letter. Thus, in 1061.5.c.2.b).(1):
   1061. is the main Item
   5. is the first level of sub-item
   c. is the second level of sub-item
   2. is the third level
   ... etc.

7. In addition to numbering, sub-items are identified by indentations into the text.

8. Many of the terms in the ECL are in quotations. For example, "aircraft" appears several times. These quotes signify that the word or phrase contained in the quotes has a specific **definition** applied to it. The definitions for terms are found at the end of each Group, and apply to that specific Group. The definitions originate from the various international agreements to which Canada subscribes.

9. Below is an example that illustrates the text of the ECL. It may help demonstrate how the numbering system is structured, and how Items/sub-items relate to one another.

An Example of ECL Text



Finding a Specific Good in the ECL

It is common for readers to know specifically what products they deal with, and if those goods are controlled. There are two main ways to try to locate specific goods:

1. Use the **Index** to specifically find the Item.
2. Search through Groups that contain like products to find any Items that apply to your goods.

1. The first step is obvious. At the back of this Guide is a detailed, but not exhaustive, Index to terms found in the ECL. By using this Index, readers can quickly find all of the important references the ECL may have concerning a specific good. Exporters are cautioned that the Index is not all-inclusive and that generic names or other terms may be used in place of common or trade terminology.

2. If specific goods are not mentioned, exporters are advised to review the pertinent sections of the ECL to find out if controls nonetheless apply. This is because some Items apply to a large number of goods, but do not list them by name; hence the goods do not appear in the Index. Exporters are encouraged to contact the responsible government department or agency if there is any doubt about the applicability of a particular product or commodity. Item 5400, in Group 5 of the ECL, is a good example of this. No specific goods are mentioned in Item 5400, but it states that all U.S. origin products require an export permit, regardless of destination or the nature of the good.

Goods Identified Under More Than One Group / Item of this Guide

Each Group of this Guide must be considered independently, but goods or technologies identified in one Group/Item may also be identified in other Groups/Items. Exporters should ensure that they have reviewed this Guide in sufficient detail to assure themselves that all relevant Groups/Items have been considered.

M. What are the Current Notices to Exporters?

The Export Controls Division issues various Notices to Exporters to assist the exporting community in understanding current policies and procedures. The following current Notices to Exporters are available upon request from the Export Controls Division.

No.	Subject
23.	Exports of Logs from B.C.
26.	Exports of Red Cedar suitable for Use in the Manufacture of Shakes and Shingles
52.	Export of Unprocessed Roe Herring
60.	Libya
71.	Angola
72.	Nuclear-Related Dual-Use Goods
74.	Chemical and Biological Weapons
79.	Croatia
81.	Peanut Butter
82.	Sugar-Containing Products
83.	Changes to the Export and Import Permits and Certificates Fees
84.	Sugar-Containing Products
86.	Transfer of Missile Equipment and Technology
87.	Changes to the Export and Import Permits and Certificates Fees (see also Notice 83)
88.	Textiles and Clothing: Administration under NAFTA
89.	Yugoslavia
90.	Softwood Lumber
92.	Item 5104: Softwood Lumber Products

N. What Acronyms are Used in this Guide?

ACL	Area Control List
AECB	Atomic Energy Control Board
AFCCL	Automatic Firearms Country Control List
B-13/B-13A	Customs Export Declaration Form
DFAIT	Department of Foreign Affairs and International Trade
DIAND	Department of Indian Affairs and Northern Development
DV	Delivery Verification Certificate
ECL	Export Control List
EIPA	*Export and Import Permits Act*
EPE	Export Controls Division
EUS	End-Use Statement
GEP	General Export Permit
IEP	Individual Export Permit
IIC	International Import Certificate
MTCR	Missile Technology Control Regime
NPT	Nuclear Non-proliferation Treaty
RCMP	Royal Canadian Mounted Police
UN	United Nations
WA	Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies

Notes

Group 1 – Dual Use List

Note:
Terms in "double quotation marks" are defined terms. Refer to "Definition of the Terms used in Groups 1 and 2" on pages 55 to 62.

General Technology Note

The export of "technology" which is "required" for the "development", "production" or "use" of products controlled in the Dual-Use List is controlled according to the provisions in each Category. This "technology" remains under control even when applicable to any uncontrolled product.

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

N.B.:
This does not release the repair "technology" controlled by Category 1085.2.a.

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

General "Software" Note

The Dual-Use List does not control "software" which is either:

1. Generally available to the public by being:
   a. Sold from stock at retail selling points, without restriction, by means of:
      1. Over-the-counter transactions;
      2. Mail order transactions; **or**
      3. Telephone call transactions; **and**
   b. Designed for installation by the user without further substantial support by the supplier; **or**
2. "In the public domain".

Category 1010: Advanced Materials

1011. Systems, Equipment and Components

1. 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 controlled by 1013.9.b. or 1013.9.c.;
   b. Piezoelectric polymers and copolymers made from vinylidene fluoride materials controlled by 1013.9.a.:
      1. In sheet or film form; **and**
      2. With a thickness exceeding 200 µm;
   c. Seals, gaskets, valve seats, bladders or diaphragms made from fluoroelastomers containing at least one vinylether monomer, specially designed for "aircraft", aerospace or missile use.
2. "Composite" structures or laminates, having any of the following:
   a. An organic "matrix" and made from materials controlled by 1013.10.c., 1013.10.d. or 1013.10.e.; **or**
   b. Having a metal or carbon "matrix" and made from:
      1. Carbon "fibrous or filamentary materials" with:
         a) A specific modulus exceeding 10.15×10^6 m; **and**
         b) A specific tensile strength exceeding 17.7×10^4 m; **or**
      2. Materials controlled by 1013.10.c.

Note 1:
Item 1011.2. does not control finished or semi-finished items specially designed for purely civilian applications as follows:
1. *sporting goods;*
2. *automotive industry;*
3. *machine tool industry;*
4. *medical applications.*

Note 2:
1011.2. does not control composite structures or laminates made from epoxy resin impregnated carbon "fibrous or filamentary materials" for the repair of aircraft structures or laminates, provided the size does not exceed 1 m^2.

Technical Notes:
1. *Specific modulus: 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)%.*
2. *Specific tensile strength: 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)%.*

3. Manufactures of non-fluorinated polymeric substances controlled by 1013.8.a.3., in film, sheet, tape or ribbon form:
   a. With a thickness exceeding 0.254 mm; **or**
   b. Coated or laminated with carbon, graphite, metals or magnetic substances.

Note:
1011.3. does not control manufactures when coated or laminated with copper and designed for the production of electronic printed circuit boards.

4. Protective and detection equipment and components not specially designed for military use, as follows:
   a. Gas masks, filter canisters and decontamination equipment therefor designed or modified for defence against biological agents or radioactive materials "adapted for use in war" or chemical warfare (CW) agents and specially designed components therefor;
   b. Protective suits, gloves and shoes specially designed or modified for defence against biological agents or radioactive materials "adapted for use in war" or chemical warfare (CW) agents;
   c. Nuclear, biological and chemical detection systems (NBC) specially designed or modified for detection or identification

1011.4.c. con't.

of biological agents or radioactive materials "adapted for use in war" or chemical warfare (CW) agents and specially designed components therefor.

Note:
Item 1011.4 does not control :
a. Personal radiation monitoring dosimeters;
b. Equipment limited by design or function to protect against hazards specific to civil industries, such as mining, quarrying, agriculture, pharmaceuticals, medical, veterinary, environmental, waste management, or to the food industry.
N.B.:
Also see Item 2007. on Munitions List.

5. Body armour, and specially designed components therefor, not manufactured to military standards or specifications, nor to their equivalents in performance.
Note 1:
Item 1011.5. does not control individual suits of body armour and accessories therefor, when accompanying their users for his/her own personal protection.
Note 2:
Item 1011.5. does not control body armour designed to provide frontal protection only from both fragment and blast from non-military explosive devices.
N.B.:
Also see Item 2013. on Munitions List.

1012. Test, Inspection and Production Equipment

1. Equipment for the production of fibres, prepregs, preforms or "composites" controlled by 1011.2. or 1013.10., as follows, and specially designed components and accessories therefor:
   a. Filament winding machines of which the motions for positioning, wrapping and winding fibres are coordinated and programmed in three or more axes, specially designed for the manufacture of "composite" structures or laminates from "fibrous or filamentary materials";
   b. Tape-laying or tow-placement machines of which the motions for positioning and laying tape, tows or sheets are coordinated and programmed in two or more axes, specially designed for the manufacture of "composite" airframe or missile structures;
   c. Multidirectional, multidimensional weaving machines or interlacing machines, including adapters and modification kits, for weaving, interlacing or braiding fibres to manufacture "composite" structures;
   Note:
   Item 1012.1.c. does not control textile machinery not modified for the above end-uses.
   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 controlled by 1013.10.e. by the hot melt method;
   f. Non-destructive inspection equipment capable of inspecting defects three dimensionally, using ultrasonic or X-ray tomography and specially designed for "composite" materials.
2. Systems and components therefor, specially designed to avoid contamination and specially designed for producing metal alloys, metal alloy powder or alloyed materials controlled by 1013.2.a.2., 1013.2.b. or 1013.2.c.
3. Tools, dies, moulds or fixtures, for "superplastic forming" or "diffusion bonding" titanium or aluminium or their alloys, specially designed for the manufacture of:
   a. Airframe or aerospace structures;
   b. "Aircraft" or aerospace engines; **or**
   c. Specially designed components for those structures or engines.

1013. Materials

Technical Note:

Metals and alloys
Unless provision to the contrary is made, the words 'metals' and 'alloys' 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.

1. Materials specially designed for use as absorbers of electromagnetic waves, or intrinsically conductive polymers, as follows:
   a. Materials for absorbing frequencies exceeding 2×10^8 Hz but less than 3×10^{12} Hz;
   Note 1:
   Item 1013.1.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 characteristics:
   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);

1013.1.a. Note 1 con't.

Technical Note:
Absorption test samples for 1013.1.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/m²; **and***
3. *Compressive strength less than 14×10^6 N/m²;*

d. *Planar absorbers made of sintered ferrite, having:*
1. *A specific gravity exceeding 4.4; **and***
2. *A maximum operating temperature of 548 K (275°C).*

Note 2:
Nothing in 1013.1.a. releases magnetic materials to provide absorption when contained in paint.

1. b. Materials for absorbing frequencies exceeding 1.5×10^{14} Hz but less than 3.7×10^{14} Hz and not transparent to visible light;

c. Intrinsically conductive polymeric materials with a bulk electrical conductivity exceeding 10,000 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.

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

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

Note:
1013.2. does not control metal alloys, metal alloy powder or alloyed materials for coating substrates.

a. Metal alloys, as follows:
1. Nickel or titanium-based alloys in the form of aluminides, as follows, in crude or semi-fabricated forms:
a) Nickel aluminides containing a minimum of 15 weight percent aluminium, a maximum of 38 weight percent aluminum and at least one additional alloying element;
b) Titanium aluminides containing 10 weight percent or more aluminium aluminum and at least one additional alloying element;
2. Metal alloys, as follows, made from metal alloy powder or particulate material controlled by 1013.2.b.:
a) Nickel alloys with:
(1) A stress-rupture life of 10,000 hours or longer at 923 K (650°C) at a stress of 676 MPa; **or**
(2) A low cycle fatigue life of 10,000 cycles or more at 823 K (550°C) at a maximum stress of 1,095 MPa;
b) Niobium alloys with:
(1) A stress-rupture life of 10,000 hours or longer at 1,073 K (800°C) at a stress of 400 MPa; **or**
(2) A low cycle fatigue life of 10,000 cycles or more at 973 K (700°C) at a maximum stress of 700 MPa;
c) Titanium alloys with:
(1) A stress-rupture life of 10,000 hours or longer at 723 K (450°C) at a stress of 200 MPa; **or**
(2) A low cycle fatigue life of 10,000 cycles or more at 723 K (450°C) at a maximum stress of 400 MPa;
d) Aluminium alloys with a tensile strength of:
(1) 240 MPa or more at 473 K (200°C); **or**
(2) 415 MPa or more at 298 K (25°C);
e) Magnesium alloys with a tensile strength of 345 MPa or more and 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;

Technical Notes:
1. *The metal alloys in 1013.2.a. 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 (K_t) equal to 1. The average stress is defined as maximum stress minus minimum stress divided by maximum stress.*

2. b. Metal alloy powder or particulate material for materials controlled by 1013.2.a., as follows:
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); **and**
2. Made in a controlled environment by any of the following processes:
a) "Vacuum atomization";
b) "Gas atomization";
c) "Rotary atomization";
d) "Splat quenching";
e) "Melt spinning" and "comminution";
f) "Melt extraction" and "comminution"; **or**
g) "Mechanical alloying";

c. Alloyed materials, in the form of uncomminuted flakes, ribbons or thin rods produced in a controlled environment by "splat quenching", "melt spinning" or "melt extraction", used in the manufacture of metal alloy powder or particulate material controlled by 1013.2.b.

3. Magnetic metals, of all types and of whatever form, having any of the following characteristics:
a. Initial relative permeability of 120,000 or more and a thickness of 0.05 mm or less;
Technical Note:
Measurement of initial permeability must be performed on fully annealed materials.

b. Magnetostrictive alloys, having any of the following characteristics:
1. A saturation magnetostriction of more than 5×10^{-4}; **or**

1013.3.b. con't

2. A magnetomechanical coupling factor (k) of more than 0.8; **or**

3. c. Amorphous or nanocrystalline alloy strips having all of the following characteristics:
   1. A composition having a minimum of 75 weight percent 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 1013.3.c. are those materials having a crystal grain size of 50 nm or less, as determined by X-ray diffraction.

4. 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 1,250 MPa;
   c. An ultimate tensile strength exceeding 1,270 Mpa; **and**
   d. An elongation exceeding 8%.

5. "Superconductive" "composite" conductors in lengths exceeding 100 m or with a mass exceeding 100 g, as follows:
   a. Multifilamentary "superconductive" "composite" conductors containing one or more niobium-titanium filaments:
      1. Embedded in a "matrix" other than a copper or copper-based mixed "matrix"; **or**
      2. Having a cross-section area less than 0.28×10^{-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) but less than 24 K (-249.16 °C);
      2. With a cross-section area less than 0.28×10^{-4} mm^2; **and**
      3. Remaining in the "superconductive" state at a temperature of 4.2 K (-268.96°C) when exposed to a magnetic field corresponding to a magnetic induction of 12 T.

6. Fluids and lubricating materials, as follows:
   a. Hydraulic fluids containing, as their principal ingredients, any of the following compounds or materials:
      1. Synthetic hydrocarbon oils or silahydrocarbon oils, having all of the following:
         Note:
         For the purpose of 1013.6.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:
         Note:
         For the purpose of 1013.6.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 compounds or materials:
      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 5,000 mm^2/s (5,000 centistokes) measured at 298 K (25°C);
   c. Damping or flotation fluids with a purity exceeding 99.8%, containing less than 25 particles of 200 µm or larger in size per 100 ml and made from at least 85% of any of the following compounds or materials:
      1. Dibromotetrafluoroethane;
      2. Polychlorotrifluoroethylene (oily and waxy modifications only); **or**
      3. Polybromotrifluoroethylene;
   d. Fluorocarbon electronic cooling fluids having all of the following characteristics:
      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.

   Technical Note:
   For the purpose of 1013.6.:
   a. Flash point is determined using the Cleveland Open Cup Method described in ASTM D-92 or national equivalents;
   b. Pour point is determined using the method described in ASTM D-97 or national equivalents;
   c. Viscosity index is determined using the method described in ASTM D-2270 or national equivalents;
   d. 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:
   1. The loss in weight of each ball is less than 10 mg/mm^2 of ball surface;
   2. The change in original viscosity as determined at 311 K (38°C) is less than 25%; and
   3. The total acid or base number is less than 0.40;
   e. Autogenous ignition temperature is determined using the method described in ASTM E-659 or national equivalents.

7. Ceramic base materials, non-"composite" ceramic materials, ceramic-"matrix" "composite" materials and precursor materials, as follows:
   a. Base materials of single or complex borides of titanium having total metallic impurities, excluding intentional additions, of less than 5,000 ppm, an average particle size equal to or less than 5 µm and no more than 10% of the particles larger than 10 µm;

1013.7. con't

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:
Item 1013.7.b. does not control abrasives.

7. c. Ceramic-ceramic "composite" materials with a glass or oxide-"matrix" and reinforced with fibres made from any of the following systems:
   1. Si-N;
   2. Si-C;
   3. Si-Al-O-N; **or**
   4. Si-O-N;

   having a specific tensile strength exceeding 12.7×10^3m;

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 controlled by 1013.7.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; **or**
   2. Si-C-N.

Note:
1013.7.f. does not control "composites" containing fibres from these systems with a fibre tensile strength of less than 700 MPa at 1,273 K (1,000° C) or fibre tensile creep resistance of more than 1% creep strain at 100 MPa load and 1,273 K (1,000° C) for 100 hours.

8. Non-fluorinated polymeric substances, as follows:

a. 1. Bismaleimides;
   2. Aromatic polyamide-imides;
   3. Aromatic polyimides;
   4. Aromatic polyetherimides having a glass transition temperature (T_g) exceeding 513 K (240°C) as measured by the wet method;

Note:
1013.8.a. does not control non-fusible compression moulding powders or moulded forms.

b. Thermoplastic liquid crystal copolymers having a heat distortion temperature exceeding 523 K (250°C) measured according to ASTM D-648, method A, or national equivalents, with a load of 1.82 N/mm^2 and composed of:
   1. Any of the following:
      a) Phenylene, biphenylene or naphthalene; **or**
      b) Methyl, tertiary-butyl or phenyl substituted phenylene, biphenylene or naphthalene; **and**
   2. Any of the following acids:
      a) Terephthalic acid;
      b) 6-hydroxy-2 naphthoic acid; **or**
      c) 4-hydroxybenzoic acid;

c. Polyarylene ether ketones, as follows:
   1. Polyether ether ketone (PEEK);
   2. Polyether ketone ketone (PEKK);
   3. Polyether ketone (PEK);
   4. Polyether ketone ether ketone ketone (PEKEKK);

d. Polyarylene ketones;

e. Polyarylene sulphides, where the arylene group is biphenylene, triphenylene or combinations thereof;

f. Polybiphenylenethersulphone.

Technical Note:
The glass transition temperature (Tg) for 1013.8 materials is determined using the method described in ASTM D 3418 using the dry method.

9. Unprocessed fluorinated compounds, as follows:
   a. Copolymers of vinylidene fluoride having 75% or more beta crystalline structure without stretching;
   b. Fluorinated polyimides containing 10% or more of combined fluorine;
   c. Fluorinated phosphazene elastomers containing 30% or more of combined fluorine.

10. "Fibrous and filamentary materials" which may be used in organic "matrix", metallic "matrix" or carbon "matrix" "composite" structures or laminates, as follows:

a. Organic "fibrous or filamentary materials" having all of the following:
   1. A specific modulus exceeding 12.7×10^6 m; **and**
   2. A specific tensile strength exceeding 23.5×10^4 m;

Note:
1013.10.a. does not control polyethylene.

b. Carbon "fibrous or filamentary materials", having all of the following:
   1. A specific modulus exceeding 12.7×10^6 m; **and**
   2. A specific tensile strength exceeding 23.5×10^4 m;

Technical Note:
Properties for materials described in 1013.10.b. should be determined using SACMA recommended methods SRM 12 to 17, or national equivalent tow tests, such as Japanese Industrial Standard JIS-R-7601, Paragraph 6.6.2., and based on lot average.

Note:
1013.10.b. does not control fabric made from "fibrous or filamentary materials" for the repair of aircraft structures or laminates, in which the size of individual sheets does not exceed 50 cm x 90 cm.

c. Inorganic "fibrous or filamentary materials", having all of the following:
   1. A specific modulus exceeding 2.54×10^6 m; **and**
   2. A melting, decomposition or sublimation point exceeding 1,922 K (1,649°C) in an inert environment;

Note:
1013.10.c. does not control :
1. *Discontinuous, multiphase, polycrystalline alumina fibres in chopped fibre or random mat form, containing 3 weight percent or more silica, with a specific modulus of less than 10×10^6 m;*
2. *Molybdenum and molybdenum alloy fibres;*
3. *Boron fibres;*
4. *Discontinuous ceramic fibres with a melting, decomposition or sublimation point lower than 2,043 K (1,770°C) in an inert environment.*

d. "Fibrous or filamentary materials":
   1. Composed of any of the following:
      a) Polyetherimides controlled by 1013.8.a; **or**
      b) Materials controlled by 1013.8.b. to 1013.8.f.; **or**
   2. Composed of materials controlled by 1013.10.d.1.a. or 1013.10.d.1.b). and "commingled" with other fibres controlled by 1013.10.a., 1013.10.b. or 1013.10.c.;

e. Resin-impregnated or pitch-impregnated fibres (prepregs), metal or carbon-coated fibres (preforms) or "carbon fibre preforms", as follows:
   1. Made from "fibrous or filamentary materials" controlled by 1013.10.a., 1013.10.b. or 1013.10.c.;

1013.10.e. con't.

2. Made from organic or carbon "fibrous or filamentary materials":
   a) With a specific tensile strength exceeding 17.7×10^4 m;
   b) With a specific modulus exceeding 10.15×10^6 m;
   c) Not controlled by 1013.10.a. or 1013.10.b.; **and**
   d) When impregnated with materials controlled by 1013.8. or 1013.9.b., having a glass transistion temperature (T_g) exceeding 383 K (110°C) or with phenolic or epoxy resins, having a glass transition temperature (T_g) exceeding 418 K (145°C).

Note:
1013.10.e. does not control:
1. *Epoxy resin "matrix" impregnated carbon "fibrous or filamentary materials" (prepregs) for the repair of aircraft structures or laminates, in which the size of individual sheets of prepreg does not exceed 50 cm x 90 cm;*
2. *Prepregs when impregnated with phenolic or epoxy resins having a glass transition temperature (Tg) less than 433 K (160°C) and a cure temperature lower than the glass transition temperature.*

Technical Note:
The glass transition temperature (Tg) for 1013.10.e materials is determined using the method described in ASTM D 3418 using the dry method. The glass transition temperature for phenolic and epoxy resins is determined using the method described in ASTM D 4065 at a frequency of 1 Hz and a heating rate of 2 K (2°C) per minute using the dry method.

Technical Notes:
1. *'Specific modulus': 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)%.*
2. *'Specific tensile strength': 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)%.*

11. Metals and compounds, as follows:
    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 of these;
    N.B.:
    The metals or alloys listed in 1013.11.a. are controlled whether or not the metals or alloys are encapsulated in aluminium, magnesium, zirconium or beryllium.

    b. Boron or boron carbide of 85% purity or higher and a particle size of 60 µm or less;
    N.B.:
    The metals or alloys listed in 1013.11.b. are controlled whether or not the metals or alloys are encapsulated in aluminium, magnesium, zirconium or beryllium.

    c. Guanidine nitrate.
12. Materials for nuclear heat sources, as follows:
    a. Plutonium in any form with a plutonium isotopic assay of plutonium-238 of more than 50 % by weight;
    Note:
    1013.12.a. does not control:
    1. *Shipments with a plutonium content of one 1 g or less;*
    2. *Shipments of 3 "effective grammes" or less when contained in a sensing component in instruments.*

    b. "Previously separated" neptunium-237 in any form.
    Note:
    1013.12.b. does not control shipments with a neptunium-237 content of 1 g or less.

1014. Software

1. "Software" specially designed or modified for the "development", "production" or "use" of equipment controlled by 1012.
2. "Software" for the "development" of organic "matrix", metal "matrix" or carbon "matrix" laminates or "composites".

1015. Technology

1. "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials controlled by 1011.1.b., 1011.1.c., 1011.2. to 1011.5.,1012. or 1013.
2. 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 base materials or non-"composite" ceramic materials:
      1. Base materials having all of the following characteristics:
         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) Total metallic impurities, excluding intentional additions, of less than:
            (1) 1,000 ppm for single oxides or carbides; **or**
            (2) 5,000 ppm for complex compounds or single nitrides;
            and
         c) Having any of the following:
            (1) Average particle size equal to or less than 5 µm and no more than 10% of the particles larger than 10 µm; **or**
            Note:
            For zirconia, these limits are 1 µm and 5 µm respectively;
            (2) Having all of the following:
               (a) Platelets with a length to thickness ratio exceeding 5;
               (b) Whiskers with a length to diameter ratio exceeding 10 for diameters less than 2 µm; **and**
               (c) Continuous or chopped fibres less than 10 µm in diameter;
      2. c. 2. Non-"composite" ceramic materials composed of the materials described in 1015.2.c.1.;
      Note:
      1015.2.c.2. does not control technology for the design or production of abrasives.

1015.2. con't.

d. Technology for the "production" of aromatic polyamide fibres;

e. Technology for the installation, maintenance or repair of materials controlled by 1013.1.;

f. Technology for the repair of "composite" structures, laminates or materials controlled by 1011.2., 1013.7.c. or 1013.7.d.

Note:
1015.2.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.

Category 1020: Materials Processing

1021. Systems, Equipment and Components

N.B.:
For quiet running bearings, see Item 2009 on the Munitions List.

1. Anti-friction bearings and bearing systems, as follows, and components therefor:

Note:
1021.1. 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 tolerances specified by the manufacturer in accordance with ABEC 7, ABEC 7P, ABEC 7T or ISO Standard Class 4 or better (or national equivalents), and having rings, balls or rollers made from monel or beryllium;

Note:
1021.1.a. does not control tapered roller bearings.

b. Other ball bearings and solid roller bearings having tolerances specified by the manufacturer in accordance with ABEC 9, ABEC 9P or ISO Standard Class 2 or better (or national equivalents);

Note:
1021.1.b. does not control tapered roller bearings.

c. Active magnetic bearing systems using any of the following:
   1. Materials with flux densities of 2.0 T or greater and yield strengths greater than 414 MPa;
   2. All-electromagnetic 3D homopolar bias designs for actuators; **or**
   3. High temperature (450 K (177°C) and above) position sensors.

1022. 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.*
   N.B.:
   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. *Axis nomenclature shall be in accordance with International Standard ISO 841, 'Numerical Control Machines - Axis and Motion Nomenclature'.*
3. *For the purposes of this Category a "tilting spindle" is counted as a rotary axis.*
4. *Guaranteed positioning accuracy levels instead of individual test protocols may be used for each machine tool model using the agreed ISO test procedure.*
5. *The positioning accuracy of "numerically controlled " machine tools is to be determined and presented in accordance with ISO 230/2.*

1. Machine tools, as follows, 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":
   a. Machine tools for turning, having all of the following characteristics :
      1. Positioning accuracy with all compensations available of less (better) than 6 µm along any linear axis (overall positioning); **and**
      2. Two or more axes which can be coordinated simultaneously for "contouring control";

      Note:
      1022.1.a. does not control turning machines specially designed for the production of contact lenses.

   b. Machine tools for milling, having any of the following characteristics :
      1. a) Positioning accuracies with all compensations available of less (better) than 6 µm along any linear axis (overall positioning); **and**
         b) Three linear axes plus one rotary axis which can be coordinated simultaneously for "contouring control";
      2. Five or more axis which can be coordinated simultaneously for "contouring control"; **or**
      3. A positioning accuracy for jig boring machines with all compensations available, of less (better) than 4 µm along any linear axis (overall positioning);
   c. Machine tools for grinding, having any of the following characteristics:
      1. a) Positioning accuracy with all compensations available of less (better) than 4 µm along any linear axis (overall positioning); **and**
         b) Three or more axes which can be coordinated simultaneously for "contouring control"; **or**
      2. Five or more axis which can be coordinated simultaneously for "contouring control";

      Notes:
      1022.1.c. does not control grinding machines, as follows:
      1. *Cylindrical external, internal, and external-internal grinding machines having all the following characteristics:*
         a. *Limited to cylindrical grinding; **and***
         b. *Limited to a maximum workpiece capacity of 150 mm outside diameter or length;*
      2. *Machines designed specifically as jig grinders having any of the following characteristics:*
         a. *The c-axis is used to maintain the grinding wheel normal to the work surface; **or***
         b. *The a-axis is configured to grind barrel cams;*
      3. *Tool or cutter grinding machines shipped as complete systems with "software" specially designed for the production of tools or cutters;*
      4. *Crank shaft or cam shaft grinding machines;*
      5. *Surface grinders.*

1022.1. con't.

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":

1. By means of:
   a) Water or other liquid jets, including those employing abrasive additives;
   b) Electron beam; **or**
   c) "Laser" beam; **and**
2. Having two or more rotary axes which:
   a) Can be coordinated simultaneously for "contouring control"; **and**
   b) Have 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 5,000 mm and specially designed components therefor.

2. Non-"numerically controlled" machine tools for generating optical quality surfaces, as follows, and specially designed components therefor:

a. Turning machines using a single point cutting tool and having all of the following characteristics:
   1. Slide positioning accuracy less (better) than 0.0005 mm per 300 mm of travel;
   2. Bidirectional slide positioning repeatability less (better) than 0.00025 mm per 300 mm of travel;
   3. Spindle "run out" and "camming" less (better) than 0.0004 mm TIR;
   4. Angular deviation of the slide movement (yaw, pitch and roll) less (better) than 2 seconds of arc, TIR, over full travel; **and**
   5. Slide perpendicularity less (better) than 0.001 mm per 300 mm of travel;

Technical Note:
The bidirectional slide positioning repeatability (R) of an axis is the maximum value of the repeatability of positioning at any position along or around the axis determined using the procedure and under the conditions specified in part 2.11 of ISO 230/2: 1988.

b. Fly cutting machines having all of the following characteristics:
   1. Spindle "run out" and "camming" less (better) than 0.0004 mm TIR; **and**
   2. Angular deviation of slide movement (yaw, pitch and roll) less (better) than 2 seconds of arc, TIR, over full travel.

3. "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 (R_c = 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).

4. Hot "isostatic presses", having all of the following, and specially designed dies, moulds, components, accessories and controls therefor:

a. A controlled thermal environment within the closed cavity and possessing a chamber cavity with an inside diameter of 406 mm or more; **and**

b. Any of the following:
   1. A maximum working pressure exceeding 207 MPa;
   2. A controlled thermal environment exceeding 1,773 K (1,500°C); **or**
   3. A facility for hydrocarbon impregnation and removal of resultant gaseous degradation products.

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.

5. 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 1025.3.f., and specially designed automated handling, positioning, manipulation and control components therefor:

a. "Stored programme controlled" chemical vapour deposition (CVD) production equipment having all of the following:
   1. Process modified for one of the following:
      a) Pulsating CVD;
      b) Controlled nucleation thermal decomposition (CNTD); **or**
      c) Plasma enhanced or plasma assisted CVD; **and**
   2. 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. "Stored programme controlled" ion implantation production equipment having beam currents of 5 mA or more;

c. "Stored programme controlled" electron beam physical vapour deposition (EB-PVD) production equipment incorporating all of the following:
   1. Power systems rated for over 80 kW;
   2. A liquid pool level "laser" control system which regulates precisely the ingots feed rate; **and**
   3. 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. "Stored programme controlled" plasma spraying production equipment having any of the following characteristics:
   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. "Stored programme controlled" sputter deposition production equipment capable of current densities of 0.1 mA/mm^2 or higher at a deposition rate of 15 µm/hr or more;

f. "Stored programme controlled" cathodic arc deposition production equipment incorporating a grid of electromagnets for steering control of the arc spot on the cathode;

1022.5. con't.

g. "Stored programme controlled" ion plating production equipment allowing for the *in situ* measurement of any of the following:
   1. Coating thickness on the substrate and rate control; **or**
   2. Optical characteristics.

   Note:
   1022.5.a., 1022.5.b., 1022.5.e., 1022.5.f. and 1022.5.g. do not control chemical vapour deposition, cathodic arc, sputter deposition, ion plating or ion implantation equipment specially designed for cutting or machining tools.

6. Dimensional inspection and measuring systems and equipment, as follows:
   a. Computer controlled, "numerically controlled" or "stored programme controlled" dimensional inspection machines, having a three dimensional length (volumetric) "measurement uncertainty" equal to or less (better) than (1.7 + L/1,000) µm (L is the measured length in mm) tested according to ISO 10360-2;
   b. Linear and angular displacement measuring instruments, as follows:
      1. Linear measuring instruments having any of the following:
         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 voltage differential transformer systems having all of the following characteristics:
            (1) "Linearity" equal to or less (better) than 0.1% within a measuring range up to 5 mm; **and**
            (2) Drift equal to or less (better) than 0.1% per day at a standard ambient test room temperature ±1 K; **or**
         c) Measuring systems having all of the following:
            (1) Containing a "laser"; **and**
            (2) Maintaining, for at least 12 hours, over a temperature range of ±1 K around a standard temperature and at a standard pressure, all of the following:
               a. A "resolution" over their full scale of 0.1 µm or less (better); **and**
               b. A "measurement uncertainty" equal to or less (better) than (0.2 + L/2,000) µm (L is the measured length in mm);

      Note:
      1022.6.b.1. does not control measuring interferometer systems, without closed or open loop feedback, containing a "laser" to measure slide movement errors of machine-tools, dimensional inspection machines or similar equipment.

      2. Angular measuring instruments having an "angular position deviation" equal to or less (better) than 0.00025°;

      Note:
      1022.6.b.2. does not control optical instruments, such as autocollimators, using collimated light to detect angular displacement of a mirror.

6. c. Equipment for measuring surface irregularities, by measuring optical scatter as a function of angle, with a sensitivity of 0.5 nm or less (better).

Notes:
1. *Machine tools which 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.*
2. *A machine described in 1022.6. is controlled if it exceeds the control threshold anywhere within its operating range.*

7. "Robots", having any of the following characteristics, and specially designed controllers and "end-effectors" therefor:
   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;

      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 explosive munitions environments;
   c. Specially designed or rated as radiation-hardened to withstand greater than 5×10^3 Gy (Si) without operational degradation; **or**
   d. Specially designed to operate at altitudes exceeding 30,000 m.
8. Assemblies, units or inserts specially designed for machine tools, or for equipment controlled by 1022.6. or 1022.7., as follows:
   a. Linear position feedback units (e.g., inductive type devices, graduated scales, infrared systems or "laser" systems) having an overall "accuracy" less (better) than $(800 + (600 \times L \times 10^{-3}))$ nm (L equals the effective length in mm);

      Note:
      For "laser" systems see also Note to Item 1022.6.b.1.

   b. Rotary position feedback units (e.g., inductive type devices, graduated scales, infrared systems or "laser" systems) having an "accuracy" less (better) than 0.00025°;

      Note:
      For "laser" systems see also Note to Item 1022.6.b.1.

   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 1022.
9. Spin-forming or flow-forming machines and flow-forming machines, which, according to the manufacturer's technical specification, can be equipped with "numerical control" units or a computer control and having all of the following:
   a. Two or more controlled axes of which at least two can be coordinated simultaneously for "contouring control"; **and**
   b. A roller force more than 60 kN.

   Technical Note:
   Machines combining the function of spin-forming and flow-forming are for the purpose of 1022.9. regarded as flow-forming machines.

1023. Materials

None.

1024. Software

1. "Software" specially designed or modified for the "development", "production" or "use" of equipment controlled by 1021. or 1022.
2. "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 any of the following:
   a. Coordinating simultaneously more than 4 axes for "contouring control"; **or**
   b. "Real time processing" of data to modify tool path, feed rate and spindle data, during the machine operation, by any of the following:
      1. Automatic calculation and modification of part program data for machining in two or more axes by means of measuring cycles and access to source data; **or**
      2. "Adaptive control" with more than one physical variable measured and processed by means of a computing model (strategy) to change one or more machining instructions to optimize the process.

Note:
1024.2. does not control "software" specially designed or modified for the operation of machine tools not controlled by Category 1020.

1025. Technology

1. "Technology" according to the General Technology Note for the "development" of equipment or "software" controlled by 1021., 1022. or 1024.
2. "Technology" according to the General Technology Note for the "production" of equipment controlled by 1021. or 1022.
3. 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 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 of Deposition Techniques), 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.

Table - Deposition Techniques

Coating Process (1)*	Substrate	Resultant Coating
* **Note:** The numbers in brackets refer to the *Notes* following this table.		
A. Chemical Vapour Deposition (CVD)	"Superalloys"	Aluminides for internal passages
	Ceramics and Low-expansion glasses (14)	Silicides Carbides Dielectric layers (15)
	Carbon-carbon, Ceramic and Metal "matrix""composites"	Silicides Carbides Refractory metals Mixtures thereof (4) Dielectric layers (15) Aluminides Alloyed aluminides (2)
	Cemented tungsten carbide (16), Silicon carbide	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15)
	Sensor window materials (9)	Dielectric layers (15)
B. Thermal-Evaporation Physical Vapour Deposition (TE-PVD)		
B. 1. Physical VapourDeposition (PVD): Electron-Beam (EB-PVD)	"Superalloys"	Alloyed silicides Alloyed aluminides (2) MCrAlX (5) Modified zirconia (12) Silicides Alumides Mixtures thereof (4)
	Ceramics 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)
	Cemented tungsten carbide (16), Silicon carbide	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Dielectric layers (15) Borides
	Sensor window materials (9)	Dielectric layers (15)
	Titanium alloys (13)	Borides Nitrides

Coating Process (1)*	Substrate	Resultant Coating
* **Note:** The numbers in brackets refer to the *Notes* following this table.		
B. 2. Ion assisted resistive heating Physical Vapour Deposition (Ion Plating)	Ceramics and Low-expansion glasses (14)	Dielectric layers (15)
	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	Dielectric layers (15)
B. 3. Physical Vapour Deposition: "laser" evaporation	Ceramics and Low-expansion glasses (14)	Silicides Dielectric layers (15)
	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: cathodic arc discharge	"Superalloys"	Alloyed silicides Alloyed aluminides (2) MCrAlX (5)
	Polymers (11) and Organic "matrix" "composites"	Borides Carbides Nitrides
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 Ni-Cr-Al-Bentonite Abradable Al-Si- Polyester Alloyed aluminides (2)

Coating Process (1)*	Substrate	Resultant Coating
* **Note:** The numbers in brackets refer to the *Notes* following this table.		
D. Plasma spraying (con't)	Aluminium alloys (6)	MCrAlX (5) Modified zirconia (12) Silicides Mixtures thereof (4)
	Refractory metals and alloys (8)	Aluminides Silicides Carbides
	Corrosion resistant steel (7)	Modified zirconia (12) Mixtures thereof (4)
	Titanium alloys (13)	Carbides Aluminides Silicides Alloyed aluminides (2) Abradable Nickel-Graphite Abradable Ni-Cr-Al-Bentonite Abradable Al-Si-Polyester
E. Slurry Deposition and alloys (8)	Refractory metals	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)
	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)

Coating Process (1)*	Substrate	Resultant Coating
F. Sputter Deposition (con't)	Cemented tungsten carbide (16), Silicon carbide	Carbides Tungsten Mixtures thereof (4) Dielectric layers (15)
	Molybdenum and Molybdenum alloys	Dielectric layers (15)
	Beryllium and Beryllium alloys	Borides Dielectric layers (15)
	Sensor window materials (9)	Dielectric layers (15)
	Refractory metals and alloys (8)	Aluminides Silicides Oxides Carbides
G. Ion Implantation	High temperature bearing steels	Additions of Chromium, Tantalum or Niobium (Columbium)
	Titanium alloys (13)	Borides Nitrides
	Beryllium and Beryllium alloys	Borides
	Cemented tungsten carbide (16)	Carbides Nitrides

*** Note:** The numbers in brackets refer to the *Notes* following this table.

Notes applicable to Table– Deposition Techniques:

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. *Mixtures consist of 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 weight percent in various proportions and combinations, except:*
   a. *CoCrAlY coatings which contain less than 22 weight percent of chromium, less than 7 weight percent of aluminium and less than 2 weight percent of yttrium;*
   b. *CoCrAlY coatings which contain 22 to 24 weight percent of chromium, 10 to 12 weight percent of aluminium and 0.5 to 0.7 weight percent of yttrium; **or***
   c. *NiCrAlY coatings which contain 21 to 23 weight percent of chromium, 10 to 12 weight percent of aluminium and 0.9 to1.1 weight percent 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 consist of 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 and the following metal halides: potassium iodide, potassium fluoride, or sensor window materials of more than 40 mm diameter for thallium bromide and thallium chlorobromide.*
10. *Technology for single-step pack cementation of solid airfoils is not controlled by Category 1020.*
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 to aerospace alloys having an ultimate tensile strength of 900 MPa or more measured at 293 K (20°C).*
14. *Low-expansion glasses refers to glasses which have a coefficient of thermal expansion of $1 \times 10^{-7}\ K^{-1}$ 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.*

Technical Notes to Table - Deposition Techniques:

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 decomposition (CNTD), plasma enhanced or plasma assisted CVD processes.*
2. Pack denotes a substrate immersed in a powder mixture.
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. *Resistive Heating PVD employs electrically resistive heating sources capable of producing a controlled and uniform flux of evaporated coating species;*
   3. *"Laser" Evaporation uses either pulsed or continuous wave "laser" beams to heat 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.

c. *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 to be deposited 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.*

d. *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 1,030 K (757°C) and 1,375 K (1,102°C) for sufficient time to deposit the coating.

e. *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 carried out underwater.*
   N.B.:
   1. *Low pressure means less than ambient atmospheric pressure.*
   2. *High velocity refers to nozzle-exit gas velocity exceeding 750 m/s calculated at 293 K (20°C) at 0.1 MPa.*

f. *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.*

g. *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 vapourisation of non-metallic coating materials.*
   2. *Low-energy ion beams (less than 5 keV) can be used to activate the deposition.*

h. *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.*

Statement of Understanding

It is understood that the following technical information, accompanying the table of deposition techniques, is for use as appropriate.

1. *"Technology" for pretreatments of the substrates listed in the Table, as follows:*
   a. *Chemical stripping and cleaning bath cycle parameters, as follows:*
      1. *Bath composition*
         a) *For the removal of old or defective coatings, corrosion product or foreign deposits;*
         b) *For preparation of virgin substrates;*
      2. *Time in bath;*
      3. *Temperature of bath;*
      4. *Number and sequences of wash cycles;*
   b. *Visual and macroscopic criteria for acceptance of the cleaned part;*
   c. *Heat treatment cycle parameters, as follows:*
      1. *Atmosphere parameters, as follows:*
         a) *Composition of the atmosphere;*
         b) *Pressure of the atmosphere;*
      2. *Temperature for heat treatment;*
      3. *Time of heat treatment;*
   d. *Substrate surface preparation parameters, as follows:*
      1. *Grit blasting parameters, as follows:*
         a) *Grit composition;*
         b) *Grit size and shape;*
         c) *Grit velocity;*
      2. *Time and sequence of cleaning cycle after grit blast;*
      3. *Surface finish parameters;*
   e. *Masking technique parameters, as follows:*
      1. *Material of mask;*
      2. *Location of mask;*
2. *"technology" for in situ quality assurance techniques for evaluation of the coating processes listed in the Table, as follows:*
   a. *Atmosphere parameters, as follows:*
      1. *Composition of the atmosphere;*
      2. *Pressure of the atmosphere;*
   b. *Time parameters;*
   c. *Temperature parameters;*
   d. *Thickness parameters;*
   e. *Index of refraction parameters;*
3. *"Technology" for post deposition treatments of the coated substrates listed in the Table, as follows:*
   a. *Shot peening parameters, as follows:*
      1. *Shot composition;*
      2. *Shot size;*
      3. *Shot velocity;*
   b. *Post shot peening cleaning parameters;*
   c. *Heat treatment cycle parameters, as follows:*
      1. *Atmosphere parameters, as follows:*
         a) *Composition of the atmosphere;*
         b) *Pressure of the atmosphere;*
      2. *Time-temperature cycles;*
   d. *Post heat treatment visual and macroscopic criteria for acceptance of the coated substrates;*
4. *"Technology" for quality assurance techniques for the evaluation of the coated substrates listed in the Table, as follows:*
   a. *Statistical sampling criteria;*
   b. *Microscopic criteria for:*
      1. *Magnification;*
      2. *Coating thickness uniformity;*
      3. *Coating composition;*
      4. *Coating and substrates bonding;*
   c. *Criteria for optical properties assessment:*
      1. *Reflectance;*
      2. *Transmission;*
      3. *Absorption;*
      4. *Scatter;*
5. *"Technology" and parameters related to specific coating and surface modification processes listed in the Table, as follows:*
   a. *For Chemical Vapour Deposition:*
      1. *Coating source composition and formulation;*
      2. *Carrier gas composition;*

3. *Substrate temperature;*
4. *Time-temperature-pressure cycles;*
5. *Gas control and part manipulation*

b. *For Thermal Evaporation - Physical Vapour Deposition:*
1. *Ingot or coating material source composition;*
2. *Substrate temperature;*
3. *Reactive gas composition;*
4. *Ingot feed rate or material vaporisation rate;*
5. *Time-temperature-pressure cycles;*
6. *Beam and part manipulation;*
7. *"Laser" parameters, as follows:*
   a) *Wave length;*
   b) *Power density;*
   c) *Pulse length;*
   d) *Repetition ratio;*
   e) *Source;*
   f) *Substrate orientation;*

c. *For Pack Cementation:*
1. *Pack composition and formulation;*
2. *Carrier gas composition;*
3. *Time-temperature-pressure cycles;*

d. *For Plasma Spraying:*
1. *Powder composition, preparation and size distributions;*
2. *Feed gas composition and parameters;*
3. *Substrate temperature;*
4. *Gun power parameters;*
5. *Spray distance;*
6. *Spray angle;*
7. *Cover gas composition, pressure and flow rates;*
8. *Gun control and part manipulation;*

e. *For Sputter Deposition:*
1. *Target composition and fabrication;*
2. *Geometrical positioning of part and target;*
3. *Reactive gas composition;*
4. *Electrical bias;*
5. *Time-temperature-pressure cycles;*
6. *Triode power;*
7. *Part manipulation;*

f. *For ion Implantation:*
1. *Beam control and part manipulation;*
2. *Ion source design details;*
3. *Control techniques for ion beam and deposition rate parameters;*
4. *Time-temperature-pressure cycles.*

g. *For Ion Plating:*
1. *Beam control and part manipulation;*
2. *Ion source design details;*
3. *Control techniques for ion beam and deposition rate parameters;*
4. *Time-temperature-pressure cycles;*
5. *Coating material feed rate and vaporisation rate;*
6. *Substrate temperature;*
7. *Substrate bias parameters.*

Category 1030: Electronics

1031. Systems, Equipment and Components

Notes:

1. *The control status of equipment and components described in 1031., other than those described in 1031.1.a.3. to 1031.1.a.10. or 1031.1.a.12., 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.*
2. *The control status of integrated circuits described in 1031.1.a.3. to 1031.1.a.9. or 1031.1.a.12. 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 1031.1.a.3. to 1031.1.a.9. or 1031.1.a.12.

If the integrated circuit is a silicon-based "microcomputer microcircuit" or microcontroller microcircuit described in 1031.1.a.3. having an operand (data) word length of 8 bit or less, the control status of the integrated circuit is determined in 1031.1.a.3.

1. Electronic components, as follows:

a. General purpose integrated circuits, as follows:

Notes:

1. *The control status of wafers (finished or unfinished), in which the function has been determined, is to be evaluated against the parameters of 1031.1.a.*
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".

1. Integrated circuits, designed or rated as radiation hardened to withstand any of the following:
   a) A total dose of 5×10^3 Gy (Si) or higher; **or**
   b) A dose rate upset of 5×10^6 Gy (Si)/s or higher;
2. Integrated circuits described in 1031.1.a.3 to 1031.1.a.10. or 1031.1.a.12., EEPROMs, flash memories and 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:
   1031.1.a.2. does not apply to integrated circuits for civil automobile or railway train applications.

1. a. 3. "Microprocessor microcircuits", "microcomputer microcircuits" and microcontroller microcircuits, having any of the following:

   Note:
   1031.1.a.3. includes digital signal processors, digital array processors and digital coprocessors.

   a) A "composite theoretical performance ("CTP") of 260 million theoretical operations per second (Mtops) or more and an arithmetic logic unit with an access width of 32 bit or more;
   b) Manufactured from a compound semiconductor and operating at a clock frequency exceeding 40 MHz; **or**
   c) More than one data or instruction bus or serial communication port for external interconnection in a parallel processor with a transfer rate exceeding 2.5 Mbyte/s;
4. Storage integrated circuits manufactured from a compound semiconductor;
5. Analogue-to-digital and digital-to-analogue converter integrated circuits, as follows:
   a) Analogue-to-digital converters having any of the following:

1031.1.a.5.a). con't.

(1) A resolution of 8 bit or more, but less than 12 bit, with a total conversion time to maximum resolution of less than 10 ns;

(2) A resolution of 12 bit with a total conversion time to maximum resolution of less than 200 ns; **or**

(3) A resolution of more than 12 bit with a total conversion time to maximum resolution of less than 2 μs;

b) Digital-to-analogue converters with a resolution of 12 bit or more, and a "settling time" of less than 10 ns;

1. a. 6. Electro-optical and "optical integrated circuits" designed for "signal processing" 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 gate arrays having any of the following:
      a) An equivalent usable gate count of more than 30,000 (2 input gates); **or**
      b) A typical "basic gate propagation delay time" of less than 0.4 ns;
   8. Field programmable logic arrays having any of the following:
      a) An equivalent usable gate count of more than 30,000 (2 input gates); **or**
      b) A toggle frequency exceeding 133 MHz;
   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 208 terminals;
      b) A typical "basic gate propagation delay time" of less than 0.35 ns; **or**
      c) An operating frequency exceeding 3 GHz;
   11. Digital integrated circuits, other than those described in 1031.1.a.3 to 1031.1.a.10. or 1031.1.a.12., based upon any compound semiconductor and having any of the following:
      a) An equivalent gate count of more than 300 (2 input gates); **or**
      b) A toggle frequency exceeding 1.2 GHz;
   12. Fast Fourier Transform (FFT) processors having any of the following:
      a) A rated execution time for a 1,024-point complex FFT of less than 1 ms;
      b) A rated execution time for an N-point complex FFT of other than 1,024 points of less than $N \log_2 N$ /10,240 ms, where N is the number of points; **or**
      c) A butterfly throughput of more than 5.12 Mhz;

b. Microwave or millimetre wave components, as follows:
   1. Electronic vacuum tubes and cathodes, as follows:
      Note:
      1031.1.b.1. does not control tubes designed or rated to operate in the ITU allocated bands at frequencies not exceeding 31 GHz.
      a) Travelling wave tubes, pulsed or continuous wave, as follows:
         (1) Operating at frequencies higher than 31 GHz;
         (2) 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 an "instantaneous bandwidth" of more than 7% or a peak power exceeding 2.5 kW;
         (4) Helix tubes, or derivatives thereof, with any of the following characteristics:
            (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, with any of the following:
         (1) A turn on time to rated emission of less than 3 seconds; **or**
         (2) Producing a continuous emission current density at rated operating conditions exceeding 5 A/cm^2;

1. b. 2. Microwave integrated circuits or modules containing "monolithic integrated circuits" operating at frequencies exceeding 3 GHz;
   Note:
   1031.1.b.2. does not control circuits or modules for equipment designed or rated to operate in the ITU allocated bands at frequencies not exceeding 31 GHz.
   3. Microwave transistors rated for operation at frequencies exceeding 31 GHz;
   4. Microwave solid state amplifiers, having any of the following:
      a) Operating frequencies exceeding 10.5 GHz and an "instantaneous bandwidth" of more than half an octave; **or**
      b) Operating frequencies exceeding 31 GHz;
   5. Electronically or magnetically tunable band-pass or band-stop filters having more than 5 tunable resonators capable of tuning across a 1.5:1 frequency band (f_{max}/f_{min}) in less than 10 μs 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. Microwave assemblies capable of operating at frequencies exceeding 31 GHz;
   7. Mixers and converters designed to extend the frequency range of equipment described in 1031.2.c., 1031.2.e. or 1031.2.f. beyond the limits stated therein;
   8. Microwave power amplifiers containing tubes controlled by 1031.1.b. and having all of the following:

1031.1.b.8. con't.

a) Operating frequencies above 3 GHz;
b) An average output power density exceeding 80 W/kg; **and**
c) A volume of less than 400 cm^3;

Note:
1031.1.b.8. does not control equipment designed or rated for operation in an ITU allocated band.

1. c. Acoustic wave devices, as follows, and specially designed components therefor:
   1. Surface acoustic wave and surface skimming (shallow bulk) acoustic wave devices (i.e., "signal processing" devices employing elastic waves in materials), having any of the following:
      a) A carrier frequency exceeding 2.5 GHz;
      b) A carrier frequency exceeding 1 GHz but not exceeding 2.5 GHz, and having any of the following:
         (1) A frequency side-lobe rejection exceeding 55 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 1 GHz or less, 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 55 dB and a bandwidth greater than 50 MHz;
   2. Bulk (volume) acoustic wave devices (i.e., "signal processing" devices employing elastic waves) which permit the direct processing of signals at frequencies exceeding 1 GHz;
   3. Acoustic-optic "signal processing" devices employing interaction between acoustic waves (bulk wave or surface wave) and light waves which permit the direct processing of signals or images, including spectral analysis, correlation or convolution;

d. Electronic devices and circuits containing components, manufactured from "superconductive" materials specially designed for operation at temperatures below the "critical temperature" of at least one of the "superconductive" constituents, with any of the following:
   1. Electromagnetic amplification:
      a) At frequencies equal to or less than 31 GHz with a noise figure of less than 0.5 dB; **or**
      b) At frequencies exceeding 31 GHz;
   2. 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**
   3. Frequency selection at all frequencies using resonant circuits with Q-values exceeding 10,000;

e. High energy devices, as follows:
   1. Batteries and photovoltaic arrays, as follows:

Note:
1031.1.e.1. does not control batteries with volumes equal to or less than 27 cm^3 (e.g., standard C-cells or R14 batteries).

a) Primary cells and batteries having an energy density exceeding 480 Wh/kg and rated for operation in the temperature range from below 243 K (-30°C) to above 343 K (70°C);
b) Rechargeable cells and batteries having an energy density exceeding 150 Wh/kg after 75 charge/discharge cycles at a discharge current equal to C/5 hours (C being the nominal capacity in ampere hours) when operating in the temperature range from below 253 K (-20°C) to above 333 K (60°C);

Technical Note:
Energy density is obtained by multiplying the average power in watts (average voltage in volts times average current in amperes) by the duration of the discharge in hours to 75% of the open circuit voltage divided by the total mass of the cell (or battery) in kg.

c) "Space qualified" and radiation hardened photovoltaic arrays with a specific power exceeding 160 W/m^2 at an operating temperature of 301 K (28°C) under a tungsten illumination of 1 kW/m^2 at 2,800 K (2,527°C);

1. e. 2. High energy storage capacitors, as follows:
   a) Capacitors with a repetition rate of less than 10 Hz (single shot capacitors) 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 25 kJ;
   b) Capacitors with a repetition rate of 10 Hz or more (repetition rated capacitors) having all of the following:
      (1) A voltage rating equal to or more than 5 kV;
      (2) An energy density equal to or more than 50 J/kg;
      (3) A total energy equal to or more than 100 J; **and**
      (4) A charge/discharge cycle life equal to or more than 10,000;
   3. "Superconductive" electromagnets and solenoids specially designed to be fully charged or discharged in less than one second, having all of the following:

Note:
1031.1.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;

f. Rotary input type shaft absolute position encoders having any of the following:
   1. A resolution of better than 1 part in 265,000 (18 bit resolution) of full scale; **or**
   2. An accuracy better than ± 2.5 seconds of arc.

2. General purpose electronic equipment, as follows:
   a. Recording equipment, as follows, and specially designed test tape therefor:

1031.2.a. con't.

1. Analogue instrumentation magnetic tape recorders, including those permitting the recording of digital signals (e.g., using a high density digital recording (HDDR) module), having any of the following:
   a) A bandwidth exceeding 4 MHz per electronic channel or track;
   b) A bandwidth exceeding 2 MHz per electronic channel or track and having more than 42 tracks; **or**
   c) A time displacement (base) error, measured in accordance with applicable IRIG or EIA documents, of less than ± 0.1 µs;

Note:
Analogue magnetic tape recorders specially designed for civilian video purposes are not considered to be instrumentation tape recorders.

2. a. 2. Digital video magnetic tape recorders having a maximum digital interface transfer rate exceeding 180 Mbit/s;

Note:
1031.2.a.2. does not control digitial video magnetic tape recorders specially dsigned for television recording using a single format standardised or recommended by the CCIR or the IEC for civil television applications.

3. Digital instrumentation magnetic tape data recorders employing helical scan techniques or fixed head techniques, having any of the following:
   a) A maximum digital interface transfer rate exceeding 175 Mbit/s; **or**
   b) Being "space qualified";

Note:
1031.2.a.3. does not control analogue magnetic tape recorders equipped with HDDR conversion electronics and configured to record only digital data.

4. Equipment, having a maximum digital interface transfer rate exceeding 175 Mbit/s, designed to convert digital video magnetic tape recorders for use as digital instrumentation data recorders;
5. Waveform digitisers and transient recorders having all of the following:
   a) Digitising rates equal to or more than 200 million samples per second and a resolution of 10 bits or more; **and**
   b) A continuous throughput of 2 Gbit/s or more;

Technical Note:
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.
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.

2. b. "Frequency synthesiser" "electronic assemblies" having a "frequency switching time" from one selected frequency to another of less than 1 ms;

c. "Signal analysers", as follows:
1. "Signal analysers" capable of analysing frequencies exceeding 31 GHz;
2. "Dynamic signal analysers" having a "real-time bandwidth" exceeding 25.6 kHz;

Note:
1031.2.c.2. does not control those "dynamic signal analysers" using only constant percentage bandwidth filters.

Technical Note:
Constant percentage bandwidth filters are also known as octave or fractional octave filters.

d. Frequency synthesised signal generators producing output frequencies, the accuracy and short term and long term stability of which are controlled, derived from or disciplined by the internal master frequency, and having any of the following:
1. A maximum synthesised frequency exceeding 3 GHz;
2. A "frequency switching time" from one selected frequency to another of less than 1 ms; **or**
3. A single sideband (SSB) phase noise better than $-(126 + 20 \log_{10} F - 20 \log_{10} f)$ in dBc/Hz, where F is the off-set from the operating frequency in Hz and f is the operating frequency in MHz;

Note:
1031.2.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.

e. Network analysers with a maximum operating frequency exceeding 40 GHz;

f. Microwave test receivers having all of the following:
1. A maximum operating frequency exceeding 40 GHz; **and**
2. Being capable of measuring amplitude and phase simultaneously;

g. Atomic frequency standards having any of the following:
1. Long term stability (aging) less (better) than 1×10^{-11} /month; **or**
2. Being "space qualified".

Note:
1031.2.g.1. does not control non-"space qualified" rubidium standards.

1032. Test, Inspection and Production Equipment

1. Equipment for the manufacturing of semiconductor devices or materials, as follows, and specially designed components and accessories therefor:
   a. "Stored programme controlled" equipment for epitaxial growth, as follows:
      1. Equipment capable of producing a layer thickness uniform to less than ± 2.5% across a distance of 75 mm or more;
      2. Metal organic chemical vapour deposition (MOCVD) reactors specially designed for compound semiconductor crystal growth by the chemical reaction between materials controlled by 1033.3 or 1033.4;
      3. Molecular beam epitaxial growth equipment using gas sources;
   b. "Stored programme controlled" equipment designed for ion implantation, having any of the following:
      1. An accelerating voltage exceeding 200 keV;
      2. Being specially designed and optimized to operate at an accelerating voltage of less than 10 keV;
      3. Direct write capability; **or**
      4. Being capable of high energy oxygen implant into a heated semiconductor material "substrate";
   c. "Stored programme controlled" anisotropic plasma dry etching equipment, as follows:

1032.1.c. con't.

1. Equipment with cassette-to-cassette operation and load-locks, and having any of the following:
   a) Magnetic confinement; **or**
   b) Electron cyclotron resonance (ECR);
2. Equipment specially designed for equipment controlled by 1032.1.e. and having any of the following:
   a) Magnetic confinement; **or**
   b) ECR;

1. d. "Stored programme controlled" plasma enhanced CVD equipment, as follows:
   1. Equipment with cassette-to-cassette operation and load-locks, and having any of the following:
      a) Magnetic confinement; **or**
      b) ECR;
   2. Equipment specially designed for equipment controlled by 1032.1.e. and having any of the following:
      a) Magnetic confinement; **or**
      b) ECR;

e. "Stored programme controlled" 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 pieces of semiconductor processing equipment are to be connected; **and**
   2. Designed to form an integrated system in a vacuum environment for sequential multiple wafer processing;

Note:
1032.1.e. does not control automatic robotic wafer handling systems not designed to operate in a vacuum environment.

f. "Stored programme controlled" lithography equipment, as follows:
   1. Align and expose step and repeat equipment for wafer processing using photo-optical or X-ray methods, having any of the following:
      a) A light source wavelength shorter than 400 nm; **or**
      b) Capable of producing a pattern with a minimum resolvable feature size of 0.7 µm or less;

Note:
The minimum resolvable feature size is calculated by the following formula:

$$MRF = \frac{\text{(an exposure light source wavelength in mm) X (K factor)}}{\text{numerical aperture}}$$

where the K factor = 0.7.
MRF = minimum resolvable feature size.

   2. Equipment specially designed for mask making or semiconductor device processing using deflected focussed electron beam, ion beam or "laser" beam, having any of the following:
      a) A spot size smaller than 0.2 µm;
      b) Being capable of producing a pattern with a feature size of less than 1 µm; **or**
      c) An overlay accuracy of better than ± 0.20 µm (3 sigma);

g. Masks and reticles designed for integrated circuits controlled by 1031.1.;

h. Multi-layer masks with a phase shift layer.

2. "Stored programme controlled" test equipment, specially designed for testing finished or unfinished semiconductor devices, as follows, and specially designed components and accessories therefore:

a. For testing S-parameters of transistor devices at frequencies exceeding 31 GHz;

b. For testing integrated circuits capable of performing functional (truth table) testing at a pattern rate of more than 60 MHz;

Note:
1032.2.b. does not control test equipment specially designed for testing:
1 "Electronic assemblies" or a class of "electronic assemblies" for home or entertainment applications;
2. Uncontrolled electronic components, "electronic assemblies" or integrated circuits.

c. For testing microwave integrated circuits at frequencies exceeding 3 GHz;

Note:
1032.2.c. does not control test equipment specially designed for testing microwave integrated circuits for equipment designed or rated to operate in the ITU allocated bands at frequencies not exceeding 31 GHz.

d. Electron beam systems designed for operation at 3 keV or below, or "laser" beam systems, for the non-contactive probing of powered-up semiconductor devices, having all of the following:
   1. Stroboscopic capability with either beam-blanking or detector strobing; **and**
   2. An electron spectrometer for voltage measurement with a resolution of less than 0.5 V.

Note:
*1032.2.d. does not control scanning electron microscopes, **except** when specially designed and instrumented for the non-contactive probing of powered-up semiconductor devices.*

1033. Materials

1. Hetero-epitaxial materials consisting of a "substrate" with stacked epitaxially grown multiple layers of any of the following:
   a. Silicon;
   b. Germanium; **or**
   c. III/V compounds of gallium or indium.

Technical Note:
III/V compounds are 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).

2. Resist materials, as follows, and "substrates" coated with controlled resists:
   a. Positive resists designed for semiconductor lithography specially adjusted (optimised) for use at wavelengths below 370 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. All resists, designed for use with X-rays, with a sensitivity of 2.5 mJ/mm^2 or better;
   d. All resists optimized for surface imaging technologies, including silylated resists.

Technical Note:
Silylation techniques are defined as processes incorporating oxidation of the resist surface to enhance performance for both wet and dry developing.

1033. con't.

3. 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:
   1033.3. only controls compounds whose metallic, partly metallic or non-metallic element is directly linked to carbon in the organic part of the molecule.

4. Hydrides of phosphorus, arsenic or antimony, having a purity better than 99.999%, even diluted in inert gases or hydrogen.

   Note:
   1033.4. does not control hydrides containing 20% molar or more of inert gases or hydrogen.

1034. Software

1. "Software" specially designed for the "development" or "production" of equipment controlled by 1031.1.b. to 1031.2.g. or 1032.
2. "Software" specially designed for the "use" of "stored programme controlled" equipment controlled by 1032.
3. Computer-aided-design (CAD) "software" designed for semiconductor devices or integrated circuits, having any of the following:
   a. Design rules or circuit verification rules;
   b. Simulation of the physically laid out circuits; **or**
   c. Lithographic processing simulators for design.

   Technical Note:
   A lithographic processing simulator is a "software" package used in the design phase to define the sequence of lithographic, etching and deposition steps for translating masking patterns into specific topographical patterns in conductors, dielectrics or semiconductor material.

Note:
1034.3. does not control "software" specially designed for schematic entry, logic simulation, placing and routing, layout verification or pattern generation tape.

N.B.:
Libraries, design attributes or associated data for the design of semiconductor devices or integrated circuits are considered as "technology".

1035. Technology

1. "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials controlled by 1031., 1032. or 1033.

   Note:
   1035.1. does not control "technology" for the "development" or "production" of:
   a. Microwave transistors operating at frequencies below 31 GHz;
   b. Integrated circuits controlled by 1031.1.a.3. to 12., having both of the following:
   *1. Using technology of 1 µm or more, **and***
   2. Not incorporating multi-layer structures.

   N.B.:
   The term multi-layer structures in Note b.2. above does not include devices incorporating a maximum of two metal layers and two polysilicon layers.

2. Other "technology" for the "development" or "production" of:
   a. Vacuum microelectronic devices;
   b. Hetero-structure semiconductor devices such as high electron mobility transistors (HEMT), hetero-bipolar transistors (HBT), quantum well or super lattice devices;
   c. "Superconductive" electronic devices;
   d. Substrates of films of diamond for electronic components.

Category 1040: 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 1050 (Telecommunications).

N.B.:
1. *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 1050 (Telecommunications).*
2. *For the control status of "software" specially designed for packet switching, see Category 1054.(Telecommunications).*

Note 2:
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 1151. (Information Security).

1041. Systems, Equipment and Components

1. Electronic computers and related equipment, as follows, and "electronic assemblies" and specially designed components therefor:
   a. Specially designed to have either of the following characteristics:
      1. Rated for operation at an ambient temperature below 228 K (-45°C) or above 358 K (85°C);

      Note:
      1041.1.a.1. does not apply to computers specially designed for civil automobile or railway train applications.

      2. Radiation hardened to exceed any of the following specifications:
         a) Total Dose 5×10^3 Gy (Si);
         b) Dose Rate Upset 5×10^6 Gy (Si)/sec; **or**
         c) Single Event Upset 1×10^{-7} Error/bit/day;

         N.B.:
         For equipment designed or rated for transient ionising radiation, see Group 2, Munitions List.
   b. Having characteristics or performing functions exceeding the limits in Category 1150 (Information Security).
2. "Hybrid computers", as follows, and "electronic assemblies" and specially designed components therefor:
   a. Containing "digital computers" controlled by 1041.3.;
   b. Containing analogue-to-digital converters having all of the following characteristics:
      1. 32 channels or more; **and**
      2. A resolution of 14 bits (plus sign bit) or more with a conversion rate of 200,000 conversions/s or more.
3. "Digital computers", "electronic assemblies", and related equipment therefor, as follows, and specially designed components therefor:

1041.3. con't.

Notes:

1. *1041.3. includes the following:*
   a. *vector processors;*
   b. *array processors;*
   c. *digital signal processors;*
   d. *logic processors;*
   e. *Equipment for "image enhancement" or "signal processing".*
2. *The control status of the "digital computers" and related equipment described in 1041.3. 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.*
      2 *For the control status of "digital computers" or related equipment for telecommunications equipment, see Category 1050 (Telecommuni-cations).*
   c. *The technology for the "digital computers" and related equipment is determined by 1045.*

3. a. Designed or modified for "fault tolerance";

Note:

For the purposes of 1041.3.a., "digital computers" and related equipment are not considered to be designed or modified for "fault tolerance" if they utilize any of the following:

1. *Error detection or correction algorithms in "main storage";*
2. *The interconnection of two "digital computers" so that, if the active central processing unit fails, an idling but mirroring central processing unit can continue the system's functioning;*
3. *The interconnection of two central processing units by data channels or by use of shared storage to permit one central processing unit to perform other work until the second central processing unit fails, at which time the first central processing unit takes over in order to continue the system's functioning; **or***
4. *The synchronisation of two central processing units by "software" so that one central processing unit recognises when the other central processing unit fails and recovers tasks from the failing unit.*

b. "Digital computers" having a "CTP" exceeding 710 Mtops;

c. "Electronic assemblies" specially designed or modified to be capable of enhancing performance by aggregation of "computing elements" ("CEs") so that the "CTP" of the aggregation exceeds the limit in 1041.3.b.;

Notes:

1. *1041.3.c. applies only to "electronic assemblies" and programmable interconnections not exceeding the limit in 1041.3.b. when shipped as unintegrated "electronic assemblies". It does not apply to "electronic assemblies" inherently limited by nature of their design for use as related equipment controlled by 1041.3.d., 1041.3.e. or 1041.3.f.*
2. *1041.3.c. does not control "electronic assemblies" specially designed for a product or family of products whose maximum configuration does not exceed the limit of 1041.3.b.*

d. Graphics accelerators and graphics coprocessors exceeding a "three dimensional vector rate" of 3,000,000;

e. Equipment performing analogue-to-digital conversions exceeding the limits in 1031.1.a.5.;

f. Equipment containing "terminal interface equipment" exceeding the limits in 1051.b.3.;

Note:

For the purposes of 1041.3.f. "terminal interface equipment" includes "local area network" interfaces and other communications interfaces. "Local area network" interfaces are evaluated as "network access controllers".

g. Equipment specially designed to provide external interconnection of "digital computers" or associated equipment which allows communications at data rates exceeding 80 Mbyte/s.

Note:

1041.3.g. does not control internal interconnection equipment (e.g., backplanes, buses) or passive interconnection equipment.

4. Computers, as follows, and specially designed related equipment, "electronic assemblies" and components therefor:
   a. "Systolic array computers";
   b. "Neural computers";
   c. "Optical computers".

1042. Test, Inspection and Production Equipment

None.

1043. Materials

None.

1044. Software

Note:

The control status of "software" for the "development", "production", or "use" of equipment described in other Categories is dealt with in the appropriate Category. The control status of "software" for equipment described in this Category is dealt with herein.

1. "Software" specially designed or modified for the "development", "production" or "use" of equipment or "software" controlled by 1041. or 1044.
2. "Software" specially designed or modified to support "technology" controlled by 1045.
3. Specific "software", as follows:
   a. Operating system "software", "software" development tools and compilers specially designed for "multi-data-stream processing" equipment, in "source code";
   b. "Expert systems" or "software" for "expert system" inference engines providing both:
      1. Time dependent rules; **and**
      2. Primitives to handle the time characteristics of the rules and the facts;
   c. "Software" having characteristics or performing functions exceeding the limits in Category 1150 (Information Security);
   d. Operating systems specially designed for "real time processing" equipment which guarantees a "global interrupt latency time" of less than 20 μs.

1045. Technology

1. "Technology" according to the General Technology Note, for the "development", "production" or "use" of equipment or "software" controlled by 1041. or 1044.

Technical Note on "Composite Theoretical Performance" ("CTP"):

Abbreviations used in this Technical Note:

"CE" = "computing element" (typically an arithmetic logical unit)
FP = floating point
XP = fixed point
t = execution time
XOR = exclusive OR
CPU = central processing unit
TP = theoretical performance (of a single "CE")
"CTP" = "composite theoretical performance" (multiple "CEs")
R = effective calculating rate
WL = word length
L = word length adjustment
* = multiply

Execution time 't' is expressed in microseconds, TP and "CTP" are expressed in millions of theoretical operations per second (Mtops) and WL is expressed in bits.

Outline of "CTP" Calculation Method

"CTP" is a measure of computational performance given in Mtops. In calculating the "CTP" of an aggregation of "CEs" the following three steps are required:

1. *Calculate the effective calculating rate R for each "CE";*
2. *Apply the word length adjustment (L) to the effective calculating rate (R), resulting in a Theoretical Performance (TP) for each "CE";*
3. *If there is more than one "CE", combine the TPs, resulting in a "CTP" for the aggregation.*

Details for these steps are given in the following sections.

Note 1:
For aggregations of multiple "CEs" which have both shared and unshared memory subsystems, the calculation of "CTP" is completed hierarchically, in two steps: first, aggregate the groups of "CEs" sharing memory; second, calculate the "CTP" of the groups using the calculation method for multiple "CEs" not sharing memory.

Note 2:
"CEs" that are limited to input/output and peripheral functions (e.g., disk drive, communication and video display controllers) are not aggregated into the "CTP" calculation.

The following table shows the method of calculating the Effective Calculating Rate R for each "CE":

Step 1: The Effective Calculating Rate R:

For "CEs" Implementing: Note: **Every "CE" must be evaluated independently**	Effective calculating Rate, R

XP only
 	
(R_{xp})
	$\frac{1}{3 * (t_{xp\ add})}$
	
	if no add is implemented use:
	$\frac{1}{(t_{xp\ mult})}$
	
	if neither add nor multiply is implemented use the fastest available arithmetic operation as follows:
	$\frac{1}{3 * t_{xp}}$
	
	See Notes X and Z.

FP Only (R_{fp})	$\max \frac{1}{t_{xp\ add}}, \frac{1}{t_{fp\ mult}}$ See Notes X and Y.
Both FP and XP (R)	Calculate both R_{xp}, R_{fp}
For simple logic processors not implementing any of the specified arithmetic operations.	$\frac{1}{3 * t_{log}}$ Where t_{log} is the execute time of the XOR, or for logic hardware not implementing the XOR, the fastest simple logic operation. See Notes X and Z.
For special logic processors not using any of the specified arithmetic or logic operations.	$R = R' * WL / 64$ Where R' is the number of results per second, WL is the numberof bits upon which the logic operation occurs, and 64 is a factor to normalize to a 64 bit operation.

Technical Note on "CTP": con't.

Note W:

For a pipelined "CE" capable of executing up to one arithmetic or logic operation every clock cycle after the pipeline is full, a pipelined rate can be established. The effective calculating rate (R) for such a "CE" is the faster of the pipelined rate or non-pipelined execution rate.

Note X:

For a "CE" which performs multiple operations of a specific type in a single cycle (e.g., two additions per cycle or two identical logic operations per cycle), the execution time t is given by:

$$t = \frac{\text{cycle time}}{\text{the \# of identical operations per machine cycle}}$$

"CEs" which perform different types of arithmetic or logic operations in a single machine cycle are to be treated as multiple separate "CEs" performing simultaneously (e.g., a "CE" performing an addition and a multiplication in one cycle is to be treated as two "CEs", the first performing an addition in one cycle and the second performing a multiplication in one cycle).

If a single "CE" has both scalar function and vector function, use the shorter execution time value.

Note Y:

For the "CE" that does not implement FP add or FP multiply, but that performs FP divide:

$$R_{fp} = \frac{1}{t_{fp\ divide}}$$

If the "CE" implements FP reciprocal but not FP add, FP multiply or FP divide, then:

$$R_{fp} = \frac{1}{t_{fp\ reciprocal}}$$

If none of the specified instructions is implemented, the effective FP rate is 0.

Note Z:

In simple logic operations, a single instruction performs a single logic manipulation of no more than two operands of given lengths.

In complex logic operations, a single instruction performs multiple logic manipulations to produce one or more results from two or more operands.

Rates should be calculated for all supported operand lengths considering both pipelined operations (if supported), and non-pipelined operations using the fastest executing instruction for each operand length based on:

1. *Pipelined or register-to-register operations. Exclude extraordinarily short execution times generated for operations on a predetermined operand or operands (for example, multiplication by 0 or 1). If no register-to-register operations are implemented, continue with 2;*
2. *The faster of register-to-memory or memory-to-register operations; if these also do not exist, then continue with 3;*
3. *Memory-to-memory.*

In each case above, use the shortest execution time certified by the manufacturer.

Step 2: TP for each supported operand length WL:

Adjust the effective rate R (or R') by the word length adjustment L as follows:

$$TP = R * L$$
$$\text{where } L = (1/3 + WL/96)$$

Note:

The word length WL used in these calculations is the operand length in bits. (If an operation uses operands of different lengths, select the largest word length.)

The combination of a mantissa ALU and an exponent ALU of a floating point processor or unit is considered to be one "CE" with a Word Length (WL) equal to the number of bits in the data representation (typically 32 or 64) for purposes of the "CTP" calculation.

This adjustment is not applied to specialized logic processors which do not use XOR instructions. In this case TP = R.

Select the maximum resulting value of TP for:

Each XP-only "CE" (R_{xp});

Each FP-only "CE" (R_{fp});

Each combined FP and XP "CE" (R);

*Each simple logic processor not implementing any of the specified arithmetic operations; **and***

Each special logic processor not using any of the specified arithmetic or logic operations.

Step 3: "CTP" for aggregations of "CEs", including CPUs.

For a CPU with a single "CE",

$$\text{"CTP"} = TP$$

(for "CEs" performing both fixed and floating point operations $TP = \max (TP_{fp}, TP_{xp})$)

"CTP" for aggregations of multiple "CEs" operating simultaneously is calculated as follows:

Notes:

1. *For aggregations that do not allow all of the "CEs" to run simultaneously, the possible combination of "CEs" that provides the largest "CTP" should be used. The TP of each contributing "CE" is to be calculated at its maximum value theoretically possible before the "CTP" of the combination is derived.*

   N.B.:

   To determine the possible combinations of simultaneously operating "CEs", generate an instruction sequence that initiates operations in multiple "CEs", beginning with the slowest "CE" (the one needing the largest number of cycles to complete its operation) and ending with the fastest "CE". At each cycle of the sequence, the combination of "CEs" that are in operation during that cycle is a possible combination. The instruction sequence must take into account all hardware and/or architectural constraints on overlapping operations.
2. *A single integrated circuit chip or board assembly may contain multiple "CEs".*
3. *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.*
4. *"CTP" values are not to be aggregated for "CE" 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.*
5. *"CTP" values must be aggregated for multiple "CEs" specially designed to enhance performance by aggregation, operating simultaneously and sharing memory,- or multiple memory/"CE"- combinations operating simultaneously utilising specially designed hardware.*

This aggregation does not apply to "electronic assemblies" described by 1041.3.d.

$$\text{"CTP"} = TP_1 + C_2 * TP_2 + \ldots + C_n * TP_n,$$

where the TPs are ordered by value, with TP_1 being the highest, TP_2 being the second highest, ..., and TP_n being the lowest. C_i is a coefficient determined by the strength of the interconnection between "CEs", as follows:

For multiple "CEs" operating simultaneously and sharing memory:

$$C_2 = C_3 = C_4 = \ldots = C_n = 0.75$$

Notes:

1. *When the "CTP" calculated by the above method does not exceed 194 Mtops, the following formula may be used to calculate C_i:*

   $$C_i = \frac{0.75}{\sqrt{m}} \quad (i = 2, \ldots, n)$$

   where m = the number of "CEs" or groups of "CEs" sharing access.

   provided:

   a. *The TP_i of each "CE" or group of "CEs" does not exceed 30 Mtops;*
   b. *The "CEs" or groups of "CEs" share access to main memory (excluding cache memory) over a single channel; **and***
   c. *Only one "CE" or group of "CEs" can have use of the channel at any given time.*

   N.B.:

   This does not apply to items controlled under Category 1030.

2. *"CEs" share memory if they access a common segment of solid state memory. This memory may include cache memory, main memory or other internal memory. Peripheral memory devices such as disk drives, tape drives or RAM disks are not included.*

Technical Note on "CTP": con't.

For Multiple "CEs" or groups of "CEs" not sharing memory, interconnected by one or more data channels:

C_i = $0.75 * k_i$ $(i = 2, \ldots, 32)$ *(see Note below)*

= $0.60 * k_i$ $(i = 33, \ldots, 64)$

= $0.45 * k_i$ $(i = 65, \ldots, 256)$

= $0.30 * k_i$ $(i > 256)$

The value of C_i is based on the number of "CE"s, not the number of nodes.

where k_i = *min* $(S_i / K_r, 1)$, *and*

K_r = *normalizing factor of 20 MByte/s.*

S_i = *sum of the maximum data rates (in units of MByte/s) for all data channels connected to the* i^{th} *"CE" or group of "CEs" sharing memory.*

When calculating a C_i for a group of "CEs", the number of the first "CE" in a group determines the proper limit for C_i. For example, in an aggregation of groups consisting of 3 "CEs" each, the 22nd group will contain "CE"$_{64}$, "CE"$_{65}$ and "CE"$_{66}$ The proper limit for C_i for this group is 0.60.

Aggregation (of "CEs" or groups of "CEs") should be from the fastest-to-slowest; i.e.:

$TP_1 \geq TP_2 \geq \ldots \geq TP_n$, *and*

in the case of $TP_i = TP_{i+1}$, *from the largest to smallest; i.e.,* : $C_i \geq C_{i+1}$

Note:

The k_i factor is not to be applied to "CEs" 2 to 12 if the TP_i of the "CE" or group of "CEs" is more than 50 Mtops; i.e., C_i for "CEs" 2 to 12 is 0.75.

Category 1050: Telecommunications

Notes:

1. *The control status of components, "lasers", test and production equipment, materials and "software" therefor which are specially designed for telecommunications equipment or systems is determined in Category 1050.*
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.*
3. *Export Permits are not required for the following items when exported to Wassenaar Arrangement members:*
   1051.2.a.;
   1051.2.c. to 1051.2.f.;
   1051.3.;
   1051.4.a.1.;
   1052., but limited to equipment for the "production" or "use" of items listed in this Note;
   1053.;
   1054.1., but limited to "software" for the "production" or "use" of items listed in this Note;
   1054.3.b., but limited to "software" specially designed or modified to provide characteristics, functions or features of items listed in this Note;
   1055.1., but limited to "technology" for the "use" of items listed in this Note.

N.B.:

Wassenaar Arrangement members are as follows:
Argentina, Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovak Republic, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom and United States.

1051. Systems, Equipment, and Components

1. Any type of telecommunications equipment having any of the following characteristics, functions or features:
   a. Specially designed to withstand transitory electronic effects or electromagnetic pulse effects arising from a nuclear explosion;
   b. Specially hardened to withstand gamma, neutron or ion radiation; **or**
   c. Specially designed to operate outside the temperature range from 218 K (-55°C) to 397 K (124°C).

   Note:
   1051.1.c. applies only to electronic equipment.

   Note:
   1051.1.b. and 1051.1.c. do not apply to equipment on board satellites.

2. Telecommunication transmission equipment and systems, and specially designed components and accessories therefor, having any of the following characteristics, functions or features:

   Note:
   Telecommunication transmission equipment:
   a. *Categorised as follows, or combinations thereof:*
      1. *Radio equipment (e.g., transmitters, receivers and transceivers);*
      2. *Line terminating equipment;*
      3. *Intermediate amplifier equipment;*
      4. *Repeater equipment;*
      5. *Regenerator equipment;*
      6. *Translation encoders (transcoders);*
      7. *Multiplex equipment (statistical mutiplex included);*
      8. *Modulators/demodulators (modems);*
      9. *Transmultiplex equipment (see CCITT Rec. G701);*
      10. *"Stored programme controlled" digital crossconnection equipment;*
      11. *"Gateways" and bridges;*
      12. *"Media access units"; **and***
   b. *Designed for use in single or multi-channel communication via any of the following:*
      1. *Wire (line);*
      2. *Coaxial cable;*
      4. *Electromagnetic radiation; **or***
      5. *Underwater acoustic wave propagation.*

   a. Employing digital techniques, including digital processing of analogue signals, and designed to operate at a "digital transfer rate" at the highest multiplex level exceeding 45 Mbit/s or a "total digital transfer rate" exceeding 90 Mbit/s;

      Note:
      1051.2.a. does not control equipment specially designed to be integrated and operated in any satellite system for civil use.

      N.B.:
      See Note 3. to 1050.

   b. Being underwater communications systems having any of the following characteristics:
      1. An acoustic carrier frequency outside the range from 20 kHz to 60 kHz;
      2. Using an electromagnetic carrier frequency below 30 kHz; **or**
      3. Using electronic beam steering techniques;
   c. Being equipment containing any of the following:
      1. "Network access controllers" and their related common medium having a "digital transfer rate" exceeding 156 Mbit/s; **or**
      2. "Communication channel controllers" with a digital output having a "data signalling rate" exceeding 2.1 Mbit/s per channel;

      Note:
      If any uncontrolled equipment contains a "network access controller", it cannot have any type of telecommunications interface except those described in, but not controlled by 1051.2.c.

      N.B.:
      See Note 3. to 1050.

1051.2. con't.

d. Employing a "laser" and having any of the following characteristics:
   1. A transmission wavelength exceeding 1,000 nm;
   2. Employing analogue techniques and having a bandwidth exceeding 45 MHz;
      Note:
      1051.2.d.2. does not control commercial TV systems.
   3. Employing coherent optical transmission or coherent optical detection techniques (also called optical heterodyne or homodyne techniques);
   4. Employing wavelength division multiplexing techniques; **or**
   5. Performing "optical amplification";

   N.B.:
   See Note 3. to 1050.

e. Being radio equipment operating at input or output frequencies exceeding 31 GHz;
   Note:
   1051.2.e. does not control equipment designed or modified for operation in any ITU allocated band.
   N.B.:
   See Note 3. to 1050.

f. Being radio equipment employing any of the following:
   1. Quadrature-amplitude-modulation (QAM) techniques above level 4 if the "total digital transfer rate" exceeds 8.5 Mbit/s;
   2. QAM techniques above level 16 if the "total digital transfer rate" is equal to or less than 8.5 Mbit/s; **or**
   3. Other digital modulation techniques and having a "spectral efficiency" exceeding 3 bit/sec/Hz;

   Notes:
   1. *1051.2.f. does not control equipment specially designed to be integrated and operated in any satellite system for civil use.*
   2. *1051.2.f. does not control radio relay equipment for operation in an ITU allocated band:*
      a. *1. Not exceeding 960 MHz; **or***
         *2. With a "total digital transfer rate" not exceeding 8.5 Mbit/s; **and***
      b. *Having a "spectral efficiency" not exceeding 4 bit/sec/Hz.*

   N.B.:
   See Note 3. to 1050.

2. g. Being radio equipment operating in the 1.5 to 87.5 MHz band and having any of the following characteristics:
   1. Incorporating adaptive techniques providing more than 15 dB suppression of an interfering signal; **or**
   2. Having all of the following:
      a. Automatically predicting and selecting frequencies and "total digital transfer rates" per channel to optimize the transmission; **and**
      b. Incorporating a linear power amplifier configuration having a capability to support multiple signals simultaneously at an output power of 1 kW or more in the 1.5 to 30 MHz frequency range or 250 W or more in the 30 to 87.5 MHz frequency range, over an "instantaneous bandwidth" of one octave or more and with an output harmonic and distortion content of better than -80 dB;

h. Being radio equipment employing "spread spectrum" or "frequency agility" (frequency hopping) techniques having either of the following characteristics:
   1. User programmable spreading codes; **or**
   2. A total transmitted bandwidth which is 100 or more times the bandwidth of any one information channel and in excess of 50 kHz.
      Note:
      1051.2.h.2. does not control cellular radio equipment operating in civil bands.

   Note:
   1051.2.h. does not control equipment operating at an output power of 1.0 watt or less.

i. Being digitally controlled radio receivers having all of the following:
   1. more than 1,000 channels;
   2. A "frequency switching time" of less than 1 ms;
   3. Automatic searching or scanning of a part of the electromagnetic spectrum; **and**
   4. Identification of the received signals or the type of transmitter; **or**

   Note:
   1051.2.i. does not control cellular radio equipment operating in civil bands.

j. Employing functions of digital "signal processing" to provide voice coding at rates of less than 2,400 bits/s.

3. "Stored programme controlled" switching equipment and related signalling systems, having any of the following characteristics, functions or features, and specially designed components and accessories therefor:
   Note:
   Statistical multiplexers with digital input and digital output which provide switching are treated as "stored programme controlled" switches.
   N.B.:
   See Note 3. to 1050.

   a. "Common channel signalling" operating in either non-associated or quasi- associated mode of operation;
   b. "Dynamic adaptive routing";
      Note:
      1051.3.b. does not control packet switches or routers with ports or lines not exceeding the limits in 1051.3.c.

   c. Being packet switches, circuit switches and routers with ports or lines exceeding any of the following:
      1. A "data signalling rate" of 2.1 Mbit/s per channel for a "communications channel controller"; **or**
         Note:
         1051.3.c.1. does not preclude the multiplexing over a composite link of communications channels not controlled by 1051.3.c.1.
      2. A "digital transfer rate" of 156 Mbit/s for a "network access controller" and related common medium;

   d. "Optical switching";
   e. Employing "Asynchronous Transfer Mode" ("ATM") techniques.

4. Optical fibre communication cables, optical fibres and accessories, as follows:
   a. Optical fibres and optical fibre cables of more than 50 m in length having any of the following characteristics:
      1. Designed for single mode operation; **or**
         N.B.:
         See Note 3. to 1050.

1051.4.a. con't.

2. For optical fibres, specified by the manufacturer as being capable of withstanding a proof test tensile stress of 2×10^9 N/m^2 or more;

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 and relative humidity 40%.

N.B.:

Equivalent national standards may be used for executing the proof test.

b. Optical fibre cables and accessories designed for underwater use.

Note:

1051.4.b. does not control standard civil telecommunication cables and accessories.

N.B.:

For fibre-optic hull penetrators or connectors, see1081.2.c.

5. "Electronically steerable phased array antennae" operating above 31 GHz.

Note:

1051.5. does not control "electronically steerable phased array antennae" for landing systems wiht instruments meeting ICAO standards covering microwave landing systems (MLS).

1052. Test, Inspection and Production Equipment

1. Equipment and specially designed components or accessories therefor, specially designed for the "development", "production" or "use" of equipment, materials, functions or features controlled by Category 1050.

Note:

1052.1. does not control optical fibres and "optical fibre preform" characterization equipment not using semiconductor "lasers".

N.B.:

See Note 3. to 1050.

1053. Materials

1. Preforms of glass or of any other material optimized for the manufacture of optical fibres controlled by 1051.4.

N.B.:

See Note 3. to 1050.

1054. Software

1. "Software" specially designed or modified for the "development", "production" or "use" of equipment, functions or features controlled by Category 1050.

N.B.:

See Note 3. to 1050.

2. "Software" specially designed or modified to support "technology" controlled by 1055.

3. Specific "software" as follows:
   a. "Software", other than in machine-executable form, specially designed or modified for the "use" of digital cellular radio equipment or systems;
   b. "Software" specially designed or modified to provide characteristics, functions or features of equipment controlled by 1051. or 1052.;

   N.B.:

   See Note 3. to 1050.

   c. "Software" which provides the capability of recovering "source code" of telecommunications "software" controlled by Category 1050.;
   d. "Software", other than in machine-executable form, specially designed for "dymanic adaptive routing".

N.B.:

For "software" for "signal processing" see also 1044. and 1064.

1055. Technology

1. "Technology" according to the General Technology Note for the "development", "production" or "use" (excluding operation) of equipment, functions or features, materials or "software" controlled by Category 1050.

N.B.:

See Note 3. to 1050.

2. Specific technologies, as follows:
   a. "Required" "technology" for the "development" or "production" of telecommunications equipment specially designed to be used on board satellites;
   b. "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;
   c. "Technology" for the processing and application of coatings to optical fibre specially designed to make it suitable for underwater use;
   d. "Technology" for the "development" of equipment employing "Synchronous Digital Hierarchy" ("SDH") or "Synchronous Optical Network" ("SONET") techniques;
   e. "Technology" for the "development" of "switch fabric" exceeding 64,000 bit/s per information channel other than for digital cross connect integrated in the switch;
   f. "Technology" for the "development" of centralized network control or "dynamic adaptive routing";
   g. "Technology" for the "development" of digital cellular radio systems;
   h. "Technology" for the "development" of "Integrated Services Digital Network" ("ISDN");
   i. "Technology" for the "development" of QAM techniques, for radio equipment, above level 4;
   j. "Technology" for the "development" of "spread spectrum" or "frequency agility" (frequency hopping) techniques.

Category 1150: Information Security

Note:
The control status of "information security" equipment, "software", systems, application specific "electronic assemblies", modules, integrated circuits, components or functions is determined in this Category even if they are components or "electronic assemblies" of other equipment.

1151. Systems, Equipment and Components

1. Systems, equipment, application specific "electronic assemblies", modules or integrated circuits for "information security", as follows, and other specially designed components therefor:
   N.B.:
   For the control of global navigation satellite systems receiving equipment containing or employing decryption (i.e., GPS or GLONASS), see 1071.5.

   a. Designed or modified to use "cryptography" employing digital techniques to ensure "information security";
   b. Designed or modified to perform cryptanalytic functions;
   c. Designed or modified to use "cryptography" employing analogue techniques to ensure "information security";
      Note:
      1151.1.c. does not control the following:
      1. *Equipment using "fixed" band scrambling not exceeding 8 bands and in which the transpositions change not more frequently than once every second;*
      2. *Equipment using "fixed" band scrambling exceeding 8 bands and in which the transpositions change not more frequently than once every ten seconds;*
      3. *Equipment using "fixed" frequency inversion and in which the transpositions change not more frequently than once every second;*
      4. *Facsimile equipment;*
      5. *Restricted audience broadcast equipment;*
      6. *Civil television equipment.*

   d. Designed or modified to suppress the compromising emanations of information-bearing signals;
      Note:
      1151.1.d. does not control equipment specially designed to suppress emanations for reasons of health or safety.

   e. Designed or modified to use cryptographic techniques to generate the spreading code for "spread spectrum" or the hopping code for "frequency agility" systems;
   f. Designed or modified to provide certified or certifiable "multilevel security" or user isolation at a level exceeding Class B2 of the Trusted Computer System Evaluation Criteria (TCSEC) or equivalent;
   g. Communications cable systems designed or modified using mechanical, electrical or electronic means to detect surreptitious intrusion.

Note:
1151. does not control:
a. "Personalized smart cards" or specially designed components therefor, with any of the following characteristics:
   1. Not capable of message traffic encryption or encryption of user-supplied data or related key management functions therefor; or
   2. When restricted for use in equipment or systems excluded from control under entries 1. to 6. of the Note to 1151.1.c. or under entries b. to h. of this Note;
b. Equipment containing "fixed" data compression or coding techniques;
c. Receiving equipment for radio broadcast, pay television or similar restricted audience television of the consumer type, without digital encryption and where digital decryption is limited to the video, audio or management functions;
d. Portable or mobile radiotelephones for civil use (e.g., for use with commercial civil cellular radiocommunications systems) that are not capable of end-to-end encryption;
e. Decryption functions specially designed to allow the execution of copy-protected "software", provided the decryption functions are not user-accessible;
f. Access control equipment, such as automatic teller machines, self-service statement printers or point of sale terminals, which protects password or personal identification numbers (PIN) or similar data to prevent unauthorized access to facilities but does not allow for encryption of files or text, except as directly related to the password or PIN protection;
g. Data authentication equipment which calculates a Message Authentication Code (MAC) or similar result to ensure no alteration of text has taken place, or to authenticate users, but does not allow for encryption of data, text or other media other than that needed for the authentication;
h. Cryptographic equipment specially designed and limited for use in machines for banking or money transactions, such as automatic teller machines, self-service statement printers, or point of sale terminals.

1152. Test, Inspection and Production Equipment

1. Equipment specially designed for:
   a. The "development" of equipment or functions controlled by Category 1150, including measuring or test equipment;
   b. The "production" of equipment or functions controlled by Category 1150, including measuring, test, repair or production equipment.
2. Measuring equipment specially designed to evaluate and validate the "information security" functions controlled by 1151. or 1154.

1153. Materials

None.

1154. Software

1. "Software" specially designed or modified for the "development", "production" or "use" of equipment or "software" controlled by Category 1150.
2. "Software" specially designed or modified to support "technology" controlled by 1155.
3. Specific "software" as follows:
   a. "Software" having the characteristics, or performing or simulating the functions of the equipment controlled by 1151. or 1152.;
   b. "Software" to certify "software" controlled by 1154.3.a.

Note:
1154. does not control:
a. "Software" required for the "use" of equipment excluded from control under the Note to 1151.;
b. "Software" providing any of the functions of equipment excluded from control under the Note to 1151.

1155. Technology

1. "Technology" according to the General Technology Note for the "development", "production" or "use" of equipment or "software" controlled by Category 1150.

Category 1060: Sensors and Lasers

1061. Equipment, Assemblies and Components

1. **Acoustics**
   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:
1061.1.a.1. does not control:
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) Wide-swath bathymetric survey systems designed for sea bed topographic mapping, having all of the following:
(1) Being designed to take measurements at an angle exceeding 20° from the vertical;
(2) Being designed to measure depths exceeding 600 m below the water surface; **and**
(3) Being designed to provide any of the following:
(a) Incorporation of multiple beams any of which is less than 1.9°; **or**
(b) Data accuracies of better than 0.3% of water depth across the swath averaged over the individual measurements within the swath.

1. a. 1. b) Object detection or location systems 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 1,000 m and having transducers with any of the following:
(a) Dynamic compensation for pressure; **or**
(b) Incorporating other than lead zirconate titanate as the transduction element;

c) Acoustic projectors, including transducers, incorporating piezoelectric, magnetostrictive, electrostrictive, electrodynamic or hydraulic elements operating individually or in a designed combination, having any of the following:

Notes:
1. The control status of acoustic projectors, including transducers, specially designed for other equipment is determined by the control status of the other equipment.
2. 1061.1.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.

(1) An instantaneous radiated acoustic power density exceeding 0.01 $mW/mm^2/Hz$ for devices operating at frequencies below 10 kHz;
(2) A continuously radiated acoustic power density exceeding 0.001 $mW/mm^2/Hz$ for devices operating at frequencies below 10 kHz;

Technical Note:
Acoustic power density is obtained by dividing the output acoustic power by the product of the area of the radiating surface and the frequency of operation.

(3) Designed to withstand pressure during normal operation at depths exceeding 1,000 m; **or**
(4) Side-lobe suppression exceeding 22 dB;

d) Acoustic systems, equipment and specially designed components for determining the position of surface vessels or underwater vehicles having any of the following:

Note:
1061.1.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.

(1) Designed to operate at a range exceeding 1,000 m with a positioning accuracy of less than 10 m rms (root mean square) when measured at a range of 1,000 m; **or**
(2) Designed to withstand pressure at depths exceeding 1,000 m;

1. a. 2. Passive (receiving, whether or not related in normal application to separate active equipment) systems, equipment and specially designed components therefor, as follows:
a) Hydrophones (transducers) having any of the following characteristics:
(1) Incorporating continuous flexible sensors or assemblies of discrete sensor elements with either a diameter or length less than 20 mm and with a separation between elements of less than 20 mm;
(2) Having any of the following sensing elements:
(a) Optical fibres;
(b) Piezoelectric polymers; **or**
(c) Flexible piezoelectric ceramic materials;
(3) A hydrophone sensitivity better than -180 dB at any depth with no acceleration compensation;

1061.1.a.2.a). con't.

(4) When designed to operate at depths not exceeding 35 m, a hydrophone sensitivity better than -186 dB with acceleration compensation;

(5) When designed for normal operation at depths exceeding 35 m, a hydrophone sensitivity better than -192 dB with acceleration compensation;

(6) When designed for normal operation at depths exceeding 100 m, a hydrophone sensitivity better than -204 dB; **or**

(7) Designed for operation at depths exceeding 1,000 m;

Technical Note:

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.

1. a. 2. b) Towed acoustic hydrophone arrays having any of the following:

(1) Hydrophone group spacing of less than 12.5 m;

(2) Hydrophone group spacing of 12.5 m to less than 25 m and designed or able to be modified to operate at depths exceeding 35 m;

Technical Note:

'Able to be modified' in 1061.1.a.2.b).(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) Hydrophone group spacing of 25 m or more and designed to operate at depths exceeding 100 m;

(4) Heading sensors controlled by 1061.1.a.2.d).;

(5) Longitudinally reinforced array hoses;

(6) An assembled array of less than 40 mm in diameter;

(7) Multiplexed hydrophone group signals 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; **or**

(8) Hydrophone characteristics specified in 1061.1.a.2.a).;

1. a. 2. 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) Any of the following:

(a) Designed to be incorporated within the array hosing and 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; **or**

(b) Designed to be mounted external to the array hosing and having a sensor unit capable of operating with 360° roll at depths exceeding 35 m;

e) Bottom or bay cable systems having any of the following:

(1) Incorporating hydrophones specified in 1061.1.a.2.a).; or

(2) Incorporating multiplexed hydrophone group signals 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; **or**

(3) Processing equipment, specially designed for bottom or bay cable systems, with "user accessible program-mability" and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

1. b. Correlation-velocity sonar log equipment designed to measure the horizontal speed of the equipment carrier relative to the sea bed at distances between the carrier and the sea bed exceeding 500 m.

2. Optical Sensors

a. Optical detectors, as follows:

Note:

1061.2.a. does not control germanium or silicon photodevices.

1. "Space-qualified" solid-state detectors, as follows:

a) "Space-qualified" solid-state detectors, having all of the following:

(1) A peak response in the wavelength range exceeding 10 nm but not exceeding 300 nm; **and**

(2) A response of less than 0.1% relative to the peak response at a wavelength exceeding 400 nm;

b) "Space-qualified" solid state detectors, having all of the following:

(1) A peak response in the wavelength range exceeding 900 nm but not exceeding 1,200 nm; **and**

(2) A response "time constant" of 95 ns or less;

c) "Space-qualified" solid state detectors having a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm;

2. a. 2. Image intensifier tubes and specially designed components therefor, as follows:

a) Image intensifier tubes having all of the following:

1061.2.a.2.a). con't.

(1) A peak response in the wavelength range exceeding 400 nm but not exceeding 1,050 nm;

(2) A microchannel plate for electron image amplification with a hole pitch (centre-to-centre spacing) of 15 µm or less; **and**

(3) Photocathodes, as follows:

(a) S-20, S-25 or multialkali photocathodes with a luminous sensitivity exceeding 240 µA/lm;

(b) GaAs or GaInAs photocathodes;

(c) Other III/V compound semiconductor photocathodes;

Note:

1061.2.a.2.a).(3).(c). does not control compound semiconductor photocath-odes with a maximum radiant sen-sitivity of 10 mA/W or less.

b) Specially designed components, as follows:

(1) Microchannel plates having a hole pitch (centre-to-centre spacing) of 15 µm or less;

(2) GaAs or GaInAs photocathodes;

(3) Other III/V compound semiconductor photocathodes;

Note:

1061.2.a.2.b).(3). does not control compound semiconductor photocathodes with a maximum radiant sensitivity of 10 mA/W or less.

2. a. 3. Non-"space-qualified" "focal plane arrays", as follows:

Technical Note:

Linear or two-dimensional multi-element detector arrays are referred to as "focal plane arrays".

Notes:

1. *1061.2.a.3. includes photoconductive arrays and photovoltaic arrays.*
2. *1061.2.a.3. does not control silicon "focal plane arrays", multi-element (not to exceed 16 elements) encapsulated photoconductive cells or pyroelectric detectors using any of the following:*
   a. *Lead sulphide;*
   b. *Triglycine sulphate and variants;*
   c. *Lead-lanthanum-zirconium titanate and variants;*
   d. *Lithium tantalate;*
   e. *Polyvinylidene fluoride and variants;*
   f. *Strontium barium niobate and variants; or*
   g. *Lead selenide.*

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 1,050 nm; **and**

(2) A response "time constant" of less than 0.5 ns;

b) Non-"space-qualified" "focal plane arrays", having all of the following:

(1) Individual elements with a peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,200 nm; **and**

(2) A response "time constant" of 95 ns or less;

c) Non-"space-qualified" "focal plane arrays", having individual elements with a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm.

2. b. "Monospectral imaging sensors" and "Multispectral imaging sensors" designed for remote sensing applications, having any of the following:

1. An Instantaneous-Field-Of-View (IFOV) of less than 200 µr (microradians); **or**
2. Being specified for operation in the wavelength range exceeding 400 nm but not exceeding 30,000 nm and having all of the following:
   a) Providing output imaging data in digital format; **and**
   b) Being any of the following:
      (1) "Space-qualified"; **or**
      (2) Designed for airborne operation, using other than silicon detectors, and having an IFOV of less than 2.5 mr (milliradians).

c. Direct view imaging equipment operating in the visible or infrared spectrum, incorporating any of the following:

1. Image intensifier tubes controlled by 1061.2.a.2.a).; **or**
2. "Focal plane arrays" controlled by 1061.2.a.3.

Technical Note:

'Direct view' refers to imaging equipment, operating in the visible or infrared spectrum, 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:

1061.2.c. does not control the following equipment 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 2,500 hours;
   b) Joule-Thomson (JT) self-regulating mini-coolers 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.

e. "Space qualified" "focal plane arrays" having more than 2,048 elements per array and having a peak response in the wavelength range exceeding 300 nm but not exceeding 900 nm.

3. Cameras

N.B.:
For cameras specially designed or modified for underwater use, see 1081.2.d. and 1081.2.e.

a. Instrumentation cameras, as follows:

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 13,150 frames/s;

   Note:
   1061.3.a.1. does not control cinema recording cameras for normal civil purposes.

2. Mechanical high speed cameras, in which the film does not move, capable of recording at rates exceeding 1,000,000 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 having writing speeds exceeding 10 mm/µs;
4. Electronic framing cameras having a speed exceeding 1,000,000 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.

b. Imaging cameras, as follows:

Note:
1061.3.b. does not control television or video cameras specially designed for television broadcasting.

1. Video cameras incorporating solid state sensors, having any of the following:
   a) More than 4×10^6 "active pixels" per solid state array for monochrome (black and white) cameras;
   b) More than 4×10^6 "active pixels" per solid state array for colour cameras incorporating three solid state arrays; **or**
   c) More than 12×10^6 "active pixels" for solid state array colour cameras incorporating one solid state array;
2. Scanning cameras and scanning camera systems, having all of the following:
   a) Linear detector arrays with more than 8,192 elements per array; **and**
   b) Mechanical scanning in one direction;
3. Imaging cameras incorporating image intensifiers controlled by 1061.2.a.2.a).;
4. Imaging cameras incorporating "focal plane arrays" controlled by 1061.2.a.3.

4. Optics

a. Optical mirrors (reflectors), as follows:

1. "Deformable mirrors" having either continuous or multi-element surfaces, and specially designed components therefor, capable of dynamically repositioning portions of the surface of the mirror at rates exceeding 100 Hz;
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. Beam steering mirrors more than 100 mm in diameter or length of major axis which maintain a flatness of lambda/2 or better (lambda is equal to 633 nm) having a control bandwidth exceeding 100 Hz.

b. Optical components made from zinc selenide (ZnSe) or zinc sulphide (ZnS) with transmission in the wavelength range exceeding 3,000 nm but not exceeding 25,000 nm and having any of the following:
   1. Exceeding 100 cm^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. Lightweighted to less than 20% "equivalent density" compared with a solid blank of the same aperture and thickness;
   2. Substrates, 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. 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. Specially designed to maintain the surface figure or orientation of the "space-qualified" components controlled by 1061.4.c.1. or 1061.4.c.3.;
   2. Having steering, tracking, stabilisation or resonator alignment bandwidths equal to or more than 100 Hz and an accuracy of 10 µr (microradians) 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 µr (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 r(radians)/s^2; **or**
         (2) Exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 0.5 r(radians)/s^2;
   4. Specially designed to maintain the alignment of phased array or phased segment mirror systems consisting of mirrors with a segment diameter or major axis length of 1 m or more.

5. Lasers

"Lasers", components and optical equipment, as follows:

Notes:

1. *Pulsed "lasers" include those that run in a continuous wave (CW) mode with pulses superimposed.*
2. *Pulse-excited "lasers" include those that run in a continuously excited mode with pulse excitation superimposed.*
3. *The control status of Raman "lasers" is determined by the parameters of the pumping source "lasers". The pumping source "lasers" can be any of the "lasers" described below.*

5. a. Gas "lasers", as follows:
   1. Excimer "lasers" having any of the following:
      a) An output wavelength not exceeding 150 nm and having any of the following:
         (1) An output energy exceeding 50 mJ per pulse; **or**
         (2) An average or CW output power exceeding 1 W;
      b) An output wavelength exceeding 150 nm but not exceeding 190 nm and having any of the following:
         (1) An output energy exceeding 1.5 J per pulse; **or**
         (2) An average or CW output power exceeding 120 W;
      c) An output wavelength exceeding 190 nm but not exceeding 360 nm and having any of the following:
         (1) An output energy exceeding 10 J per pulse; **or**
         (2) An average or CW output power exceeding 500 W; **or**
      d) An output wavelength exceeding 360 nm and having any of the following:
         (1) An output energy exceeding 1.5 J per pulse; **or**
         (2) An average or CW output power exceeding 30 W;
   2. Metal vapour "lasers", as follows:
      a) Copper (Cu) "lasers" having an average or CW output power exceeding 20 W;
      b) Gold (Au) "lasers" having an average or CW output power exceeding 5 W;
      c) Sodium (Na) "lasers" having an output power exceeding 5 W;
      d) Barium (Ba) "lasers" having an average or CW output power exceeding 2 W;
   3. Carbon monoxide (CO) "lasers" having any of the following:
      a) An output energy exceeding 2 J per pulse and a pulsed "peak power" exceeding 5kW; **or**
      b) An average or CW output power exceeding 5kW;
   4. Carbon dioxide (CO_2) "lasers" having any of the following:
      a) A CW output power exceeding 15kW;
      b) A pulsed output having a "pulse duration" exceeding 10 µs and having any of the following:
         (1) An average output power exceeding 10kW; **or**
         (2) A pulsed "peak power" exceeding 100kW; **or**
      c) A pulsed output having a "pulse duration" equal to or less than 10 µs and having any of the following:
         (1) A pulse energy exceeding 5 J per pulse ; **or**
         (2) An average output power exceeding 2.5kW.

5. a. 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. Gas discharge and ion "lasers", (i.e., krypton ion or argon ion "lasers"), having any of the following:
      a) An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 50 W; **or**
      b) An average or CW output power exceeding 50 W.
   7. Other gas "lasers" having any of the following:

      Note:

      1061.5.a.7. does not control nitrogen "lasers".

      a) An output wavelength not exceeding 150 nm and having any of the following:
         (1) An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; **or**
         (2) An average or CW output power exceeding 1 W;
      b) An output wavelength exceeding 150 nm but not exceeding 800 nm and having any of the following:
         (1) An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 30 W; **or**
         (2) An average or CW output power exceeding 30 W;
      c) An output wavelength exceeding 800 nm but not exceeding 1,400 nm and having any of the following:
         (1) An output energy exceeding 0.25 J per pulse and a pulsed "peak power" exceeding 10 W; **or**
         (2) An average or CW output power exceeding 10 W; **or**
      d) An output wavelength exceeding 1,400 nm and an average or CW output power exceeding 1 W.

   b. Individual, multiple-transverse mode semiconductor "lasers" and arrays of individual semiconductor "lasers", having any of the following:
      1. An output energy exceeding 500 µJ per pulse and a pulsed "peak power" exceeding 10 W; **or**
      2. An average or CW output power exceeding 10 W.

      Technical Note:

      Semiconductor "lasers" are commonly called "laser" diodes.

      Notes:

      1. *Item 1061.5.b. includes semiconductor "lasers" having optical output connectors (e.g., fibre optic pigtails).*
      2. *The control status of semiconductor "lasers" specially designed for other equipment is determined by the control status of the other equipment.*

5. c. Solid state "lasers", as follows:
   1. "Tunable" "lasers" having any of the following:

      Note:

      1061.5.c.1. includes titanium - sapphire(Ti: Al_2O_3), thulium - YAG (Tm: YAG), thulium - YSGG (Tm: YSGG), alexandrite (Cr: $BeAl_2O_4$) and colour centre "lasers".

      a) An output wavelength less than 600 nm and having any of the following:

1061.5.c.1.a). con't.

(1) An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; **or**
(2) An average or CW output power exceeding 1 W;

b) An output wavelength of 600 nm or more but not exceeding 1,400 nm and having any of the following:
(1) An output energy exceeding 1 J per pulse and a pulsed "peak power" exceeding 20 W; **or**
(2) An average or CW output power exceeding 20 W; **or**

c) An output wavelength exceeding 1,400 nm and having any of the following:
(1) An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; **or**
(2) An average or CW output power exceeding 1 W.

5. c. 2. Non-"tunable" "lasers", as follows:

Note:
1061.5.c.2. includes atomic transition solid state "lasers".

a) Neodymium glass "lasers", as follows:
(1) "Q-switched lasers" having any of the following:
(a) An output energy exceeding 20 J but not exceeding 50 J per pulse and an average output power exceeding 10 W; **or**
(b) An output energy exceeding 50 J per pulse.
(2) Non-"Q-switched lasers" having any of the following:
(a) An output energy exceeding 50 J but not exceeding 100 J per pulse and an average output power exceeding 20 W; **or**
(b) An output energy exceeding 100 J per pulse.

b) Neodymium-doped (other than glass) "lasers", having an output wavelength exceeding 1,000 nm but not exceeding 1,100 nm, as follows:

N.B.:
For neodymium-doped (other than glass) "lasers" having an output wavelength not exceeding 1,000 nm or exceeding 1,100 nm, see 1061.5.c.2.c).

(1) Pulse-excited, mode-locked, "Q-switched lasers" having a "pulse duration" of less than 1 ns and having any of the following:
(a) A "peak power" exceeding 5 GW;
(b) An average output power exceeding 10 W; **or**
(c) A pulsed energy exceeding 0.1 J.
(2) Pulse-excited, "Q-switched lasers" having a pulse duration equal to or more than 1 ns, and having any of the following:
(a) A single-transverse mode output having:
i) A "peak power" exceeding 100 MW;
ii) An average output power exceeding 20 W; **or**
iii) A pulsed energy exceeding 2 J; **or**
(b) A multiple-transverse mode output having:
i) A "peak power" exceeding 400 MW;
ii) An average output power exceeding 2 kW; **or**
iii) A pulsed energy exceeding 2 J;
(3) Pulse-excited, non-"Q-switched lasers", having:
(a) A single-transverse mode output having:
i) A "peak power" exceeding 500 kW; **or**
ii) An average output power exceeding 150 W; **or**
(b) A multiple-transverse mode output having:
i) A "peak power" exceeding 1 MW; **or**
ii) An average power exceeding 2 kW;
(4) Continuously excited "lasers" having:
(a) A single-transverse mode output having:
i) A "peak power" exceeding 500 kW; **or**
ii) An average or CW output power exceeding 150 W; **or**
(b) A multiple-transverse mode output having:
i) A "peak power" exceeding 1 MW; **or**
ii) An average or CW output power exceeding 2 kW;

5. c. 2. c) Other non-"tunable" "lasers", having any of the following:
(1) A wavelength less than 150 nm and having any of the following:
(a) An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; **or**
(b) An average or CW output power exceeding 1 W;
(2) A wavelength of 150 nm or more but not exceeding 800 nm and having any of the following:
(a) An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 30 W; **or**
(b) An average or CW output power exceeding 30 W;
(3) A wavelength exceeding 800 nm but not exceeding 1,400 nm, as follows:
(a) "Q-switched lasers" having:
i) An output energy exceeding 0.5 J per pulse and a pulsed "peak power" exceeding 50 W; **or**
ii) An average output power exceeding:
a. 10 W for single-mode "lasers";
b. 30 W for multimode "lasers";
(b) Non-"Q-switched lasers" having:
i) An output energy exceeding 2 J per pulse and a pulsed "peak power" exceeding 50 W; **or**
ii) An average or CW output power exceeding 50 W; **or**
(4) A wavelength exceeding 1,400 nm and having any of the following:
(a) An output energy exceeding 100 mJ per pulse and a pulsed "peak power" exceeding 1 W; **or**
(b) An average or CW output power exceeding 1 W;

5. d. Dye and other liquid "lasers", having any of the following:
   1. A wavelength less than 150 nm and:
      a) An output energy exceeding 50 mJ per pulse and a pulsed "peak power" exceeding 1 W; **or**
      b) An average or CW output power exceeding 1 W;
   2. A wavelength of 150 nm or more but not exceeding 800 nm and having any of the following:
      a) An output energy exceeding 1.5 J per pulse and a pulsed "peak power" exceeding 20 W;
      b) An average or CW output power exceeding 20 W; **or**
      c) A pulsed single longitudinal mode oscillator having an average output power exceeding 1 W and a repetition rate exceeding 1 kHz if the "pulse duration" is less than 100 ns;
   3. A wavelength exceeding 800 nm but not exceeding 1,400 nm and having any of the following:
      a) An output energy exceeding 0.5 J per pulse and a pulsed "peak power" exceeding 10 W; **or**
      b) An average or CW output power exceeding 10 W; **or**
   4. A wavelength exceeding 1,400 nm and having any of the following;
      a) An output energy exceeding 100 mJ per pulse and a pulsed "peak power" exceeding 1 W; **or**
      b) An average or CW output power exceeding 1 W;

   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 specially designed for use with controlled "lasers";

   f. Optical equipment, as follows:
      N.B.:
      For shared aperture optical elements, capable of operating in "Super-High Power Laser" ("SHPL") applications, see Item 2019.,Note 2,d. on the Munitions List.
      1. Dynamic wavefront (phase) measuring equipment capable of mapping at least 50 positions on a beam wavefront having 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 1,000 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 μr (microradians);
      3. Optical equipment and components specially designed for a phased-array "SHPL" system for coherent beam combination to an accuracy of lambda/10 at the designed wavelength, or 0.1 μm, whichever is the smaller;
      4. Projection telescopes specially designed for use with "SHPL" systems.

6. Magnetometers

"Magnetometers", "magnetic gradiometers", "intrinsic magnetic gradiometers" and compensation systems, and specially designed components therefor, as follows:

Note:
1061.6. does not control instruments specially designed for biomagnetic measurements for medical diagnostics.

a. "Magnetometers" using "superconductive", optically pumped or nuclear precession (proton/Overhauser) "technology" having a "noise level" (sensitivity) lower (better) than 0.05 nT rms per square root Hz;
b. Induction coil "magnetometers" having a "noise level" (sensitivity) lower (better) than any of the following:
   1. 0.05 nT rms per square root Hz at frequencies of less than 1 Hz;
   2. 1×10^{-3} nT rms per square root Hz at frequencies of 1 Hz or more but not exceeding 10 Hz; **or**
   3. 1×10^{-4} nT rms per square root Hz at frequencies exceeding 10 Hz;
c. Fibre optic "magnetometers" having a "noise level" (sensitivity) lower (better) than 1 nT rms per square root Hz;
d. "Magnetic gradiometers" using multiple "magnetometers" controlled by 1061.6.a., 1061.6.b. or 1061.6.c.;
e. Fibre optic "intrinsic magnetic gradiometers" having a magnetic gradient field "noise level" (sensitivity) lower (better) than 0.3 nT/m rms per square root Hz.
f. "Intrinsic magnetic gradiometers", using "technology" other than fibre-optic "technology", having a magnetic gradient field "noise level" (sensitivity) lower (better) than 0.015 nT/m rms per square root Hz;
g. Magnetic compensation systems for magnetic sensors designed for operation on mobile platforms;
h. "Superconductive" electromagnetic sensors, containing components manufactured from "superconductive" materials:
   1. Designed for operation at temperatures below the "critical temperature" of at least one of their "superconductive" constituents (including Josephson effect devices or "superconductive" quantum interference devices (SQUIDS));
   2. Designed for sensing electromagnetic field variations at frequencies of 1 kHz or less; **and**
   3. Having any of the following characteristics:
      a) Incorporating thin-film SQUIDS with a minimum feature size of less than 2 μm and with associated input and output coupling circuits;
      b) Designed to operate with a magnetic field slew rate exceeding 1×10^{6} magnetic flux quanta per second;
      c) Designed to function without magnetic shielding in the earth's ambient magnetic field; **or**
      d) Having a temperature coefficient less (smaller) than 0.1 magnetic flux quantum/K.

7. Gravimeters

Gravity meters (gravimeters) and gravity gradiometers, as follows:

a. Gravity meters for ground use having a static accuracy of less (better) than 10 μgal;
   Note:
   1061.7.a. does not control ground gravity meters of the quartz element (Worden) type.

1061.7. con't.

b. Gravity meters for mobile platforms for ground, marine, submersible, space or airborne use, having all of the following:
   1. A static accuracy of less (better) than 0.7 mgal; **and**
   2. An in-service (operational) accuracy of less (better) than 0.7 mgal having a time-to- steady-state registration of less than 2 minutes under any combination of attendant corrective compensations and motional influences;

c. Gravity gradiometers.

8. Radar

Radar systems, equipment and assemblies having any of the following characteristics, and specially designed components therefor:

Note:

1061.8. does not control:

a. Secondary surveillance radar (SSR);
b. Car radar designed for collision prevention;
c. Displays or monitors used for air traffic control (ATC) having no more than 12 resolvable elements per mm;
d. Meteorological (weather) radar.

a. Operating at frequencies from 40 GHz to 230 GHz and having an average output power exceeding 100 mW;
b. Having 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) or sidelooking airborne (SLAR) radar mode;
e. Incorporating "electronically steerable phased array antennae";
f. Capable of heightfinding non-cooperative targets;

Note:

1061.8.f. does not control precision approach radar equipment (PAR) conforming to ICAO standards.

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 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:

1061.8.i. does not control:

a. Fishing ground surveillance radar;
b. Ground radar equipment specially designed for enroute air traffic control, provided that all the following conditions are met:
   1. It has a maximum "instrumented range" of 500 km or less;
   2. It is configured so that radar target data can be transmitted only one way from the radar site to one or more civil ATC centres;
   *3. It contains no provisions for remote control of the radar scan rate from the enroute ATC centre; **and***
   4. It is to be permanently installed.
c. Weather balloon tracking radars.

j. Being "laser" radar or Light Detection and Ranging (LIDAR) equipment, having any of the following:
   1. "Space-qualified"; **or**
   2. Employing coherent heterodyne or homodyne detection techniques and having an angular resolution of less (better) than 20 μr (microradians);

Note:

1061.8.j. does not control LIDAR equipment specially designed for surveying or for meteorological observation.

k. Having signal processing sub-systems using "pulse compression" with any of the following:
   1. A "pulse compression" ratio exceeding 150; **or**
   2. A pulse width of less than 200 ns; **or**
l. Having data processing sub-systems with 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;

Note:

1061.8.l.1. does not control conflict alert capability in ATC systems, or marine or harbour radar.

   2. Calculation of target velocity from primary radar having non-periodic (variable) scanning rates;
   3. Processing for automatic pattern recognition (feature extraction) and comparison with target characteristic data bases (waveforms or imagery) to identify or classify targets; **or**
   4. Superposition and correlation, or fusion, of target data from two or more "geographically dispersed" and "interconnected radar sensors" to enhance and discriminate targets.

Note:

1061.8.l.4. does not control systems, equipment and assemblies used for marine traffic control.

1062. Test, Inspection and Production Equipment

1. Acoustics – None.
2. Optical Sensors – None.
3. Cameras – None.
4. Optics

   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:

   1062.4. does not control microscopes.

5. Lasers– None.
6. Magnetometers – None.
7. Gravimeters

   Equipment to produce, align and calibrate land-based gravity meters with a static accuracy of better than 0.1 mgal.
8. Radar

   Pulse radar cross-section measurement systems having transmit pulse widths of 100 ns or less and specially designed components therefor.

1063. Materials

1. Acoustics - None.
2. Optical Sensors
   Optical sensor materials, as follows:
   a. Elemental tellurium (Te) of purity levels of 99.9995% or more;
   b. Single crystals of cadmium telluride (CdTe), cadmium zinc telluride (CdZnTe) or mercury cadmium telluride (HgCdTe) of any purity level, including epitaxial wafers thereof.
3. Cameras – None.
4. Optics
   Optical materials, as follows:
   a. Zinc selenide (ZnSe) and zinc sulphide (ZnS) "substrate blanks" produced by the chemical vapour deposition process, having any of the following:
      1. A volume greater than 100 cm^3; **or**
      2. A diameter greater than 80 mm and having a thickness of 20 mm or more;
   b. Boules of the following electro-optic materials:
      1. Potassium titanyl arsenate (KTA);
      2. Silver gallium selenide ($AgGaSe_2$);
      3. Thallium arsenic selenide (Tl_3AsSe_3, also known as TAS);
   c. Non-linear optical materials having all of the following:
      1. Third order susceptibility (chi 3) of 10^{-6} m^2/V^2 or more; **and**
      2. A response time of less than 1 ms;
   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) and hafnium fluoride (HfF_4), 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.
5. Lasers
   Synthetic crystalline "laser" host material in unfinished form, as follows:
   a. Titanium doped sapphire;
   b. Alexandrite.
6. Magnetometers – None.
7. Gravimeters – None.
8. Radar - None.

1064. Software

1. "Software" specially designed for the "development" or "production" of equipment controlled by 1061.4, 1061.5., 1061.8 or 1062.8.
2. "Software" specially designed for the "use" of equipment controlled by 1061.2.b., 1061.8. or 1062.8.
3. Other "software", as follows:
   a. Acoustics
      "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 bottom or bay cable systems and having beamforming or "source code" for "real time processing" of acoustic data for passive reception;
   b. Optical Sensors – None;
   c. Cameras – None;
   d. Optics – None;
   e. Lasers – None;
   f. Magnetometers
      "Software", as follows:
      1. "Software" specially designed for magnetic compensation systems for magnetic sensors designed to operate on mobile platforms;
      2. "Software" specially designed for magnetic anomaly detection on mobile platforms;
   g. Gravimeters
      "Software" specially designed to correct motional influences of gravity meters or gravity gradiometers;
   h. Radar
      "Software", as follows:
      1. Air Traffic Control "software" application "programmes" hosted on general purpose computers located at Air Traffic Control centres and capable of any of the following:
         a) Processing and displaying more than 150 simultaneous "system tracks"; **or**
         b) Accepting radar target data from more than four primary radars;
      2. "Software" for the design or "production" of radomes which:
         a) Are specially designed to protect the "electronically steerable phased array antennae" controlled by 1061.8.e.; **and**
         b) Result 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 1064.3.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.

1065. Technology

1. "Technology" according to the General Technology Note for the "development" of equipment, materials or "software" controlled by 1061., 1062., 1063. or 1064.
2. "Technology" according to the General Technology Note for the "production" of equipment or materials controlled by 1061., 1062. or 1063.
3. Other "technology", as follows:
   a. Acoustics – None;
   b. Optical Sensors – None;
   c. Cameras – None;

1065.3. con't.

d. Optics
"Technology", as follows:
1. Optical surface coating and treatment "technology" "required" to achieve 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 1025.3.f.

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;

e. Lasers
"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;

f. Magnetometers
"Technology" "required" for the "development" or "production" of fluxgate "magnetometers" or fluxgate "magnetometer" systems, having any of the following:
1. A "noise level" of less than 0.05 nT rms per square root Hz at frequencies of less than 1 Hz; **or**
2. A "noise level" of less than 1×10^{-3} nT rms per square root Hz at frequencies of 1 Hz or more;

g. Gravimeters – None;

h. Radar – None.

Category 1070: Navigation and Avionics

1071. Systems, Equipment and Components

N.B.:
For automatic pilots for underwater vehicles, see Category 1080; For radar, see Category 1060.

1. Accelerometers designed for use in inertial navigation or guidance systems and having any of the following characteristics, and specially designed components therefor:
   a. A "bias" "stability" of less (better) than 130 micro g with respect to a fixed calibration value over a period of one year;
   b. A "scale factor" "stability" of less (better) than 130 ppm with respect to a fixed calibration value over a period of one year; **or**
   c. Specified to function at linear acceleration levels exceeding 100 g.
2. Gyros having any of the following characteristics, and specially designed components therefor:
   a. A "drift rate" "stability", when measured in a 1 g environment over a period of three months and with respect to a fixed calibration value, of:
      1. Less (better) than 0.1° per hour when specified to function at linear acceleration levels below 10 g; **or**
      2. Less (better) than 0.5° per hour when specified to function at linear acceleration levels from 10 to 100 g inclusive; **or**
   b. Specified to function at linear acceleration levels exceeding 100 g.
3. Inertial navigation systems (gimballed and strapdown) and inertial equipment designed for "aircraft", land vehicle or "spacecraft" for attitude, guidance or control having any of the following characteristics, and specially designed components therefor:
   a. Navigation error (free inertial) subsequent to normal alignment of 0.8 nautical mile per hour (50% Circular Error Probable (CEP)) or less (better); **or**
   b. Specified to function at linear acceleration levels exceeding 10 g.

Note 1:
The parameters of 1071.3.a. are applicable with any of the following enviromental conditions:
1. *Input random vibration with an overall magnitude of 7.7 g rms in the first half hour and a total test duration of one and one half hour and a total test duration of one and one half hour per axis in each of the three perpendicular axes., when random vibration meets the following:*
   a. *A constant power spectral density (PSD) value of 0.04 g^2/Hz over a frequency interval of 15 to 1,000Hz; **and***
   b. *The PSD attenuates with the frequency from 0.04 g^2/Hz to 0.01 g^2/Hz over a frequency interval from 1,000 to 2,000 Hz; **or***
2. *A roll and yaw rate of equal to or more than +2.62 radians/s (150 deg/s); **or***
3. *According to national standards equivalent to 1. or 2. above.*

Note 2:
1071.3. does not control inertial navigation systems which are certified for use on "civil aircraft" by civil authorities of a participating state.

4. Gyro-astro compasses, and other devices which derive position or orientation by means of automatically tracking celestial bodies or satellites, with an azimuth accuracy of equal to or less (better) than 5 seconds of arc.
5. Global navigation satellite systems (i.e., GPS or GLONASS) receiving equipment having any of the following characteristics, and specially designed components therefor:
   a. Employing decryption; **or**
   b. A null-steerable antenna.
6. Airborne altimeters operating at frequencies other than 4.2 to 4.4 GHz inclusive, having any of the following characteristics:
   a. "Power management"; **or**
   b. Using phase shift key modulation.
7. Direction finding equipment operating at frequencies above 30 Mhz and having all of the following characteristics, and specially designed components therefor:
   a. "Instantaneous bandwidth" of 1 Mhz or more;
   b. Parallel processing of more than 100 frequency channels; **and**
   c. Processing rate of more than 1,000 direction finding results per second and per frequency channel.

Note:
For inertial navigation equipment for ships or submersibles, see Item 2009.e. on the Munitions List.

1072. Test, Inspection and Production Equipment

1. Test, calibration or alignment equipment specially designed for equipment controlled by 1071.
   Note:
   1072.1. 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.
      N.B.:
      Maintenance Level II does not include the removal of controlled accelerometers or gyro sensors from the SRA.

2. Equipment, as follows, specially designed to characterize mirrors for ring "laser" gyros:
   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).
3. Equipment specially designed for the "production" of equipment controlled by 1071.
   Note:
   1072.3. includes:
   a. Gyro tuning test stations;
   b. Gyro dynamic balance stations;
   c. Gyro run-in/motor test stations;
   d. Gyro evacuation and fill stations;
   e. Centrifuge fixtures for gyro bearings;
   f. Accelerometer axis align stations.

1073. Materials

None.

1074. Software

1. "Software" specially designed or modified for the "development" or "production" of equipment controlled by 1071. or 1072.
2. "Source code" for the "use" of any inertial navigation equipment or Attitude Heading Reference Systems (AHRS) including inertial equipment not controlled by 1071.3. or 1071.4.
   Note:
   1074.2. does not control "source code" for the "use" of gimballed AHRS.
   Technical Note:
   AHRS generally differ from inertial navigation systems (INS) in that an AHRS provides attitude heading information and normally does not provide the acceleration, velocity and position information associated with an INS.

3. 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 1071.3. or 1071.4.;
   b. "Source code" for hybrid integrated systems which improves the operational performance or reduces the navigational error of systems to the level specified in 1071.3. by continuously combining inertial data with any of the following navigation data:
      1. Doppler radar velocity;
      2. Global navigation satellite systems (i.e., GPS or GLONASS) reference data; **or**
      3. Terrain data from data bases;
   c. "Source code" for integrated avionics or mission systems which combine sensor data and employ "expert systems";
   d. "Source code" for the "development" of any of the following:
      1. Digital flight management systems for "total control of flight";
      2. Integrated propulsion and flight control systems;
      3. Fly-by-wire or fly-by-light control systems;
      4. Fault-tolerant or self-reconfiguring "active flight control systems";
      5. Airborne automatic direction finding equipment;
      6. Air data systems based on surface static data; **or**
      7. Raster-type head-up displays or three dimensional displays;
   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 cirulation-controlled direction control systems" whose "technology" is controlled in 1075.4.b., 1075.4.c.1. or 1075.4.c.2.

1075. Technology

1. "Technology" according to the General Technology Note for the "development" of equipment or "software" controlled by 1071., 1072. or 1074.
2. "Technology" according to the General Technology Note for the "production" of equipment controlled by 1071. or 1072.
3 "Technology" according to the General Technology Note for the repair, refurbishing or overhaul of equipment controlled by 1071.1. to 1071.4.
   Note:
   1075.3. 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 1072.1.

4. Other technology, as follows:
   a. Technology for the "development" or "production" of:
      1. Airborne automatic direction finding equipment operating at frequencies exceeding 5 MHz;
      2. Air data systems based on surface static data only, i.e., which dispense with conventional air data probes;
      3. Raster-type head-up displays or three dimensional displays for "aircraft";
      4. Inertial navigation systems or gyro-astro compasses containing accelerometers or gyros controlled by 1071.1. or 1071.2.;
      5. Electric actuators (i.e., electromechanical, electro-hydrostatic and integrated actuator package) specially designed for "primary flight control";

1075.4.a. con't.

6. "Flight control optical sensor array" specially designed for implementating "active flight control systems";

b. "Development" "technology", as follows, for "active flight control systems" (including fly-by-wire or fly-by-light):

1. Configuration design for interconnecting multiple microelectronic processing elements (on-board computers) to achieve "real time processing" for control law implementation;
2. Control law compensation for sensor location or dynamic airframe loads, i.e., compensation for sensor vibration environment or for variation of sensor location from the centre of gravity;
3. Electronic management of data redundancy or systems redundancy for fault detection, fault tolerance, fault isolation or reconfiguration;

Note:
1075.4.b.3. does not control technology for the design of physical redundancy.

4. Flight controls which permit inflight reconfiguration of force and moment controls for real time autonomous air vehicle control;
5. Integration of digital flight control, navigation and propulsion control data into a digital flight management system for "total control of flight";

Note:
1075.4.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 optimization";
b. "Development" "technology" for "aircraft" flight instrument systems integrated solely for VOR, DME, ILS or MLS navigation or approaches.

6. Full authority digital flight control or multisensor mission management systems employing "expert systems";

N.B.:
For "technology" for Full Authority Digital Engine Control ("FADEC"), see 1095.3.a.9.

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.

Category 1080: Marine

1081. Systems, Equipment and Components

1. Submersible vehicles and surface vessels, as follows:

N.B.:
For the control status of equipment for submersible vehicles, see: Category 1150 Information Security for encrypted communication equipment; Category 1060 for sensors; Categories 1070 and 1080 for navigation equipment; Category 1081. for underwater equipment.

a. Manned, tethered submersible vehicles designed to operate at depths exceeding 1,000 m;

b. Manned, untethered submersible vehicles having any of the following:

1. Designed to operate autonomously and having a lifting capacity of all of the following:
   a) 10% or more of their weight in air; **and**
   b) 15 kN or more;
2. Designed to operate at depths exceeding 1,000 m; **or**
3. Having all of the following:
   a) Designed to carry a crew of 4 or more;
   b) Designed to operate autonomously for 10 hours or more;
   c) Having a range of 25 nautical miles or more; **and**
   d) Having a length of 21 m or less;

Technical Notes:
1. For the purposes of 1081.1.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 1081.1.b., range means half the maximum distance a submersible vehicle can cover.

c. Unmanned, tethered submersible vehicles designed to operate at depths exceeding 1,000 m, having any of the following:

1. Designed for self-propelled manoeuvre using propulsion motors or thrusters controlled by 1081.2.a.2.; **or**
2. Having a 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. Having an acoustic data or command link; **or**
3. Having a fibre optic data or command link exceeding 1,000 m;

e. Ocean salvage systems with a lifting capacity exceeding 5 MN for salvaging objects from depths exceeding 250 m and having any of the following:

1. Dynamic positioning systems capable of position keeping within 20 m of a given point provided by the navigation system; **or**
2. Sea-floor navigation and navigation integration systems for depths exceeding 1,000 m with positioning accuracies to within 10 m of a pre-determined point;

f. Surface-effect vehicles (fully skirted variety) having all of the following characteristics:
   1. A maximum design speed, fully loaded, exceeding 30 knots in a significant wave height of 1.25 m (Sea State 3) or more;
   2. A cushion pressure exceeding 3,830 Pa; **and**
   3. A light-ship-to-full-load displacement ratio of less than 0.70;

g. Surface-effect vehicles (rigid sidewalls) with a maximum design speed, fully loaded, exceeding 40 knots in a significant wave height of 3.25 m (Sea State 5) or more;

h. 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 (Sea State 5) or more;

i. Small waterplane area vessels having any of the following:
   1. 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 (Sea State 5) or more; **or**
   2. A full load displacement exceeding 1,500 tonnes with a maximum design speed, fully loaded, exceeding 25 knots in a significant wave height of 4 m (Sea State 6) or more.

   Technical Note:
   A small waterplane area vessel is defined by the following formula: waterplane area at an operational design draft less than 2 x (displaced volume at the operational design draft)$^{2/3}$.

2. Systems and equipment, as follows:

   N.B.:
   For underwater communications systems, see Category 1050 - Telecommunications.

   a. Systems and equipment, specially designed or modified for submersible vehicles, 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;

   b. Systems specially designed or modified for the automated control of the motion of equipment for submersible vehicles controlled by 1081.1. using navigation data and having closed loop servo-controls:
      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 hull penetrators or connectors;

   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 1,100 lines;
         c) Low light level television cameras specially designed or modified for underwater use containing all of the following:
            (1) Image intensifier tubes controlled by 1061.2.a.2.a.; **and**
            (2) More than 150,000 "active pixels" per solid state area array;

         Technical Note:
         Limiting resolution in television 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, including range-gated illuminators or "laser" systems;

   e. Photographic still cameras specially designed or modified for underwater use below 150m having 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 1,000 m;

   f. Electronic imaging systems, specially designed or modified for underwater use, capable of storing digitally more than 50 exposed images;

   g. Light systems, as follows, specially designed or modified for underwater use:
      1. Stroboscopic light systems capable of a light output energy of more than 300 J per flash and a flash rate of more than 5 flashes per second;
      2. Argon arc light systems specially designed for use below 1,000 m;

   h. "Robots" specially designed for underwater use, controlled by using a dedicated "stored programme controlled" computer, having any of the following:
      1. Systems that control the "robot" using information from sensors which measure force or torque applied to an external object, distance to an external object, or tactile sense between the "robot" and an external object; **or**
      2. The ability to exert a force of 250 N or more or a torque of 250 Nm or more and using titanium based alloys or "fibrous or filamentary" "composite" materials in their structural members;

   i. Remotely controlled articulated manipulators specially designed or modified for use with submersible vehicles, having any of the following:
      1. Systems which control the manipulator using the information from sensors which measure the torque or force applied to an external object, or tactile sense between the manipulator and an external object; **or**
      2. Controlled by proportional master-slave techniques or by using a dedicated "stored programme controlled" computer, and having 5 degrees of freedom of movement or more;

1081.2.i.2. con't.

Note:
Only functions having proportional control using positional feedback or by using a dedicated "stored programme controlled" computer are counted when determining the number of degrees of freedom of movement.

2. 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 specially designed:
         (1) To pressurise the products of reaction or for fuel reformation;
         (2) To store the products of the reaction; **and**
         (3) 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 having either 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 specially designed:
         (1) To pressurise the products of reaction or for fuel reformation;
         (2) To store the products of the reaction; **and**
         (3) To discharge the products of the reaction against a pressure of 100 kPa or more;
   4. Sterling 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;

2. k. Skirts, seals and fingers, having any of the following:
   1. Designed for cushion pressures of 3,830 Pa or more, operating in a significant wave height of 1.25 m (Sea State 3) or more and specially designed for surface effect vehicles (fully skirted variety) controlled by 1081.1.f.; **or**
   2. Designed for cushion pressures of 6,224 Pa or more, operating in a significant wave height of 3.25 m (Sea State 5) or more and specially designed for surface effect vehicles (rigid sidewalls) controlled by 1081.1.g.;

   l. Lift fans rated at more than 400 kW specially designed for surface effect vehicles controlled by 1081.1.f. or 1081.1.g.;

   m. Fully submerged subcavitating or supercavitating hydrofoils specially designed for vessels controlled by 1081.1.h.;

   n. Active systems specially designed or modified to control automatically the sea-induced motion of vehicles or vessels controlled by 1081.1.f., 1081.1.g., 1081.1.h. or 1081.1.i.;

   o. Propellers, power transmission systems, power generation systems and noise reduction systems, as follows:
      1. Water-screw propeller or power transmission systems, as follows, specially designed for surface effect vehicles (fully skirted or rigid sidewall variety), hydrofoils or small waterplane area vessels controlled by 1081.1.f., 1081.1.g., 1081.1.h. or 1081.1.i.:
         a) Supercavitating, super-ventilated, partially-submerged or surface piercing propellers rated at more than 7.5 MW;
         b) Contrarotating propeller systems rated at more than 15 MW;
         c) Systems employing pre-swirl or post-swirl techniques for smoothing the flow into a propeller;
         d) Light-weight, high capacity (K factor exceeding 300) reduction gearing;
         e) Power transmission shaft systems, incorporating "composite" material components, capable of transmitting more than 1 MW;
      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, incor-porating "composite" material components, 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 1,000 tonnes displacement or more, as follows:

1081.2.o.3. con't

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, 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, 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;

p. Pumpjet propulsion systems having a power output exceeding 2.5 MW using divergent nozzle and flow conditioning vane techniques to improve propulsive efficiency or reduce propulsion-generated underwater-radiated noise.

q. Self-contained, closed or semi-closed circuit (rebreathing) diving and underwater swimming apparatus.

1082. Test, Inspection and Production Equipment

1. Water tunnels, having a background noiseof less than 100 dB (reference 1 µPa, 1 Hz) in the frequency range from 0 to 500 Hz, designed for measuring acoustic fields generated by a hydro-flow around propulsion system models.

1083. Materials

1. Syntactic foam designed for underwater use, having all of the following:
   a. Designed for marine depths exceeding 1,000 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.

1084. Software

1. "Software" specially designed or modified for the "development", "production" or "use" of equipment or materials controlled by 1081., 1082. or 1083.
2. Specific "software" specially designed or modified for the "development", "production", repair, overhaul or refurbishing (re-machining) of propellers specially designed for underwater noise reduction.

1085. Technology

1. "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials controlled by 1081., 1082. or 1083.
2. 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 controlled by 1081.1., 1081.2.b., 1081.2.j., 1081.2.o. or 1081.2.p.

Category 1090: Propulsion

1091. Systems, Equipment and Components

N.B.:
For propulsion systems designed or rated against neutron or transient ionizing radiation, see Group 2, Munitions List.

1. Aero gas turbine engines incorporating any of the technologies controlled by 1095.3.a., as follows:
   a. Not certified for the specific "civil aircraft" for which they are intended;

      Note:
      For the purpose of the "civil aircraft" certification process, a limited number of up to 16 civil certified engines, assemblies or components including spares, is considered appropriate.

   b. Not certified for civil use by the aviation authorities in a participating state;
   c. Designed to cruise at speeds exceeding Mach 1.2 for more than thirty minutes.
2. Marine gas turbine engines with an ISO standard continuous power rating of 24,245 kW or more and a specific fuel consumption of less than 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.

3. Specially designed assemblies and components, incorporating any of the technologies controlled by 1095.3.a., for gas turbine engine propulsion systems, as follows:
   a. Controlled by 1091.1.; **or**
   b. Whose design or production origins are either non-participating states or unknown to the manufacturer.
4. Space launch vehicles and "spacecraft".

   Notes:
   1. *1091.4. does not control payloads.*
   2. *For the control status of products contained in "spacecraft" payloads, see the appropriate Categories.*

5. Liquid rocket propulsion systems containing any of the systems or components controlled by 1091.6.

6. Systems and components specially designed for liquid rocket propulsion systems, as follows:
   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;

1091.6. con't

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 0.381mm or smaller in diameter (an area of 1.14×10^{-3} cm^2 or smaller for non-circular orifices) specially designed for liquid rocket engines;
h. One-piece carbon-carbon thrust chambers or one-piece carbon-carbon exit cones with densities exceeding 1.4g/cm^3 and tensile strengths exceeding 48 MPa.

7. Solid rocket propulsion systems with any of the following:
   a. Total impulse capacity exceeding 1.1 MNs;
   b. Specific impulse of 2.4 kNs/kg or more when the nozzle flow is expanded to ambient sea level conditions for an adjusted chamber pressure of 7 MPa;
   c. Stage mass fractions exceeding 88% and propellant solid loadings exceeding 86%;
   d. Any of the components controlled by 1091.8.; **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:
      For the purposes of 1091.7.e., a strong mechanical bond means bond strength equal to or more than propellant strength.

8. Components, as follows, specially designed for solid rocket propulsion systems:
   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:
      For the purposes of 1091.8.a., a 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:
      The 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.

9. Hybrid rocket propulsion systems with:
   a. Total impulse capacity exceeding 1.1 MNs; **or**
   b. Thrust levels exceeding 220 kN in vacuum exit conditions.
10. Specially designed components, systems and structures for launch vehicles, launch vehicle propulsion systems or "spacecraft", as follows:
    a. Components or structures exceeding 10kg, specially designed for launch vehicles manufactured using metal "matrix", "composite", organic "composite", ceramic "matrix" or intermetallic reinforced materials controlled by 1013.7. or 1013.10.;
       Note:
       The weight cut-off is not relevant for nose cones.
    b. Components and structures specially designed for launch vehicle propulsion systems controlled by 1091.5. to 1091.9. manufactured using metal matrix, composite, organic composite, ceramic matrix or intermetallic reinforced materials controlled by 1013.7. or 1013.10.;
    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 1kN/kg and a response time (the time required to achieve 90% of total rated thrust from start-up) of less than 30 ms.
11. Ramjet, scramjet or combined cycle engines and specially designed components therefor.

1092. Test, Inspection and Production Equipment

1. Specially designed equipment, tooling and fixtures, as follows, for manufacturing or measuring gas turbine blades, vanes or tip shroud castings:
   a. Directional solidification or single crystal casting equipment;
   b. Ceramic cores or shells;
   c. Ceramic core manufacturing equipment or tools;
   d. Ceramic shell wax pattern preparation equipment.
2. On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, specially designed for the "development" of gas turbine engines, assemblies or components incorporating technologies controlled by 1095.3.a.
3. 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.
4. Tools, dies or fixtures for the solid state joining of "superalloy" , titanium or intermetallic airfoil-to-disk combinations described in 1095.3.a.3. or 1095.3.a.6. for gas turbines.
5. 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 wind tunnels or devices:

a. Wind tunnels designed for speeds of Mach 1.2 or more, except those specially designed for educational purposes and having a test section size (measured laterally) of less than 250 mm;

Technical Note:

Test section size: 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.

6. 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 1,273 K (1,000 °C), and specially designed quartz heaters therefor.
7. Equipment specially designed for inspecting the integrity of rocket motors using non-destructive test (NDT) techniques other than planar X-ray or basic physical or chemical analysis.
8. Transducers specially designed for the direct measurement of the wall skin friction of the test flow with a stagnation temperature exceeding 833 K (560°C).
9. 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.

1093. Materials

None.

1094. Software

1. "Software" required for the "development" of equipment or "technology" controlled by 1091., 1092. or 1095.3.
2. "Software" required for the "production" of equipment controlled by 1091. or 1092.
3. "Software" required for the "use" of full authority digital electronic engine controls ("FADEC") for propulsion systems controlled by 1091. or equipment controlled by 1092., as follows:
   a. "Software" in digital electronic controls for propulsion systems, aerospace test facilities or air breathing aero-engine test facilities;
   b. Fault-tolerant "software" used in "FADEC" systems for propulsion systems and associated test facilities.
4. 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 casting;
   d. "Software" in "source code", "object code" or machine code required for the "use" of active compensating systems for rotor blade tip clearance control.

Note:

1094.4.d. does not control "software" embedded in uncontrolled equipment or required for maintenance activities associated with the calibration or repair or updates to the active compensating clearance control system.

1095. Technology

1. "Technology" according to the General Technology Note for the "development" of equipment or "software" controlled by 1091.1.c., 1091.4. to 1091.11., 1092. or 1094.
2. "Technology" according to the General Technology Note for the "production" of equipment controlled by 1091.1.c., 1091.4. to 1091.11. or 1092.

Notes:

1. *For "technology" for the repair of controlled structures, laminates or materials, see 1015.2.f.*
2. *"Development" or "production" "technology" controlled by 1095. for gas turbine engines remains controlled when used as "use" "technology" for repair, rebuild and 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.*

3. 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 having (in the 001 Miller Index Direction) a stress-rupture life exceeding 400 hours at 1,273 K (1,000°C) at a stress of 200 MPa, based on the average property values;
      2. Multiple domed combustors operating at average burner outlet temperatures exceeding 1,813 K (1,540°C), or combustors incorporating thermally decoupled combustion liners, non-metallic liners or non-metallic shells;
      3. Components manufactured from organic "composite" materials designed to operate above 588 K (315°C), or from metal "matrix" "composite", ceramic "matrix", intermetallic or intermetallic reinforced materials controlled by 1011.2. or 1013.7.;
      4. Uncooled turbine blades, vanes, tip-shrouds or other components designed to operate at gas path temperatures of 1,323 K (1,050°C) or more;
      5. Cooled turbine blades, vanes or tip-shrouds, other than those described in 1095.3.a.1., exposed to gas path temperatures of 1,643 K (1,370°C) or more;
      6. Airfoil-to-disk blade combinations using solid state joining;
      7. Gas turbine engine components using "diffusion bonding" "technology" controlled by 1025.3.b.;
      8. Damage tolerant gas turbine engine rotating components using powder metallurgy materials controlled by 1013.2.b.;
      9. "FADEC' for gas turbine and combined cycle engines and their related diagnostic components, sensors and specially designed components;

1095.3.a. con't

10. Adjustable flow path geometry and associated control systems for:
    a) Gas generator turbines;
    b) Fan or power turbines;
    c) Propelling nozzles;

    Notes:
    1. *Adjustable flow path geometry and associated control systems in 1095.3.a.10. do not include inlet guide vanes, variable pitch fans, variable stators or bleed valves for compressors.*
    2. *1095.3.a.10. does not control "development" or "production" technology for adjustable flow path geometry for reverse thrust.*

11. Rotor blade tip clearance control systems employing active compensating casing "technology" limited to a design and development data base; **or**
12. Wide chord hollow fan blades without part-span support;

3. b. "Technology" "required" for the "development" or "production" of any of the following:
    1. Wind tunnel aero-models equipped with non-intrusive sensors capable of transmitting data from the sensors to the data acquisition system; **or**
    2. "Composite" propeller blades or propfans capable of absorbing more than 2,000 kW at flight speeds exceeding Mach 0.55;

c. "Technology" "required" for the "development" or "production" of gas turbine engine components using "laser", water jet, ECM or EDM hole drilling processes to produce holes having any of the following sets of characteristics:
    1. All of the following:
        a) Depths more than four times their diameter;
        b) Diameters less than 0.76 mm; **and**
        c) Incidence angles equal to or less than 25°; **or**
    2. All of the following:
        a) Depths more than five times their diameter;
        b) Diameters less than 0.4 mm; **and**
        c) Incidence angles of more than 25°;

    Technical Note:
    For the purposes of 1095.3.c., incidence angle is measured from a plane tangential to the airfoil surface at the point where the hole axis enters the airfoil surface.

3. d. "Technology" "required" for any of the following:
    1. The "development" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems; **or**
    2. The "production" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems.

e. 1. "Technology" for the "development" or "production" of reciprocating diesel engine ground vehicle propulsion systems having all of the following:
    a) A box volume of 1.2 m^3 or less;
    b) An overall power output of more than 750 kW based on 80/1269/EEC, ISO 2534 or national equivalents; **and**
    c) A power density of more than 700 kW/m^3 of box volume;

    Technical Note:
    Box volume: 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 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 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.

2. "Technology" "required" for the "production" of specially designed components, as follows, for high output diesel engines:
    a) "Technology" "required" for the "production" of engine systems having all of the following components employing ceramics materials controlled by 1013.7:
        (1) Cylinder liners;
        (2) Pistons;
        (3) Cylinder heads; **and**
        (4) One or more other components (including exhaust ports, turbochargers, valve guides, valve assemblies or insulated fuel injectors);

3. e. 2. b) "Technology" "required" for the "production" of turbocharger systems, with single-stage compressors having all of the following:
        (1) Operating at pressure ratios of 4:1 or higher;
        (2) A mass flow in the range from 30 to 130 kg per minute; **and**
        (3) Variable flow area capability within the compressor or turbine sections;
    c) "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)), having both of the following:
        (1) Injection amount in excess of 230 mm^3 per injection per cylinder; **and**
        (2) Specially designed electronic control features for switching governor characteristics automatically depending on fuel property to provide the same torque characteristics by using the appropriate sensors;
3. "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, 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: diesel engines with a specified brake mean effective pressure of 1.8 MPa or more at a speed of 2,300 r.p.m., provided the rated speed is 2,300 r.p.m. or more.

Group 2 – Munitions List

Note:
Terms in "double quotation marks" are defined terms. Refer to "Definition of the Terms used in Groups 1 and 2" on pages 55 to 63.

General "Technology" Note

The export of "technology" which is "required" for the "development", "production" or "use" of items controlled in the Munitions List is controlled according to the provisions in the Munitions List entries. This "technology" remains under control even when applicable to an uncontrolled item.

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

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

2001. Arms and automatic weapons with a calibre of 12.7 mm (calibre of 0.50 inches) or less and accessories, as follows, and specially designed components therefor:

a. Rifles, carbines, revolvers, pistols, machine pistols and machine guns;
Note:
2001.a. does not control the following:
1. *Muskets, rifles and carbines dated earlier than 1938;*
2. *Reproductions of muskets, rifles and carbines, the originals of which were manufactured earlier than 1890;*
3. *Revolvers, pistols and machine guns manufactured earlier than 1890, and their reproductions.*

b. Smooth-bore weapons specially designed for military use;
c. Weapons using caseless ammunition;
d. Silencers, special gun-mountings, clips and flash suppressors for arms controlled by sub-items 2001.a., 2001.b. or 2001.c.

Technical Note:
Smooth-bore weapons specially designed for military use as specified in sub-item 2001.b. are those which:
a. *Are proof tested at pressures above 1,300 bars;*
b. *Operate normally and safely at pressures above 1,000 bars; **and***
c. *Are capable of accepting ammunition above 76.2 mm in length (e.g., commercial 12-gauge magnum shot gun shells).*

The parameters in this Technical Note are to be measured according to the standards of the Commission Internationale Permanente.

Notes:
1. *2001. does not control smooth-bore weapons used for hunting or sporting purposes. These weapons must not be specially designed for military use or of the fully automatic firing type.*
2. *2001. does control firearms specially designed for dummy ammunition and which are incapable of firing any controlled ammunition.*
3. *2001. does not control weapons using non-centre fire cased ammunition and which are not of the fully automatic firing type.*

2002. Armament or weapons with a calibre greater than 12.7 mm (calibre 0.50 inches), projectors and accessories, as follows, and specially designed components therefor:

a. Guns, howitzers, cannon, mortars, anti-tank weapons, projectile launchers, military flame throwers, recoilless rifles and signature reduction devices therefor;
Note:
2002.a. includes injectors, metering devices, storage tanks and other specially designed components for use with liquid propelling charges for any of the equipment controlled by 2002.a.

b. Military smoke, gas and pyrotechnic projectors or generators.
Note:
2002.b. does not control signal pistols.

2003. Ammunition, and specially designed components therefor, for the weapons controlled by Items 2001., 2002. or 2012.

Notes:
1. *Specially designed components include:*
   a. *Metal or plastic fabrications such as primer anvils, bullet cups, cartridge links, rotating bands and munitions metal parts;*
   b. *Safing and arming devices, fuses, sensors and initiating devices;*
   c. *Power supplies with high one-time operational output;*
   d. *Combustible cases for charges;*
   e. *Submunitions including bomblets, minelets and terminally guided projectiles.*
2. *2003. does not control ammunition crimped without a projectile (blank star) and dummy ammunition with a pierced powder chamber.*

2004. Bombs, torpedoes, rockets, missiles, and related equipment and accessories, as follows, specially designed for military use, and specially designed components therefor:

a. Bombs, torpedoes, grenades, smoke canisters, rockets, mines, missiles, depth charges, demolition-charges, demolition -devices and demolition-kits, "military pyrotechnics", cartridges and simulators (i.e., equipment simulating the characteristics of any of these items);
Note:
2004.a. includes:
1. *Smoke grenades, fire bombs, incendiary bombs and explosive devices;*
2. *Missile rocket nozzles and re-entry vehicle nosetips.*

b. Equipment specially designed for the handling, control, activation, powering with one-time operational output, launching, laying, sweeping, discharging, decoying, jamming, detonation or detection of items controlled by 2004.a.

Note:
2004.b. includes:
1. *Mobile gas liquefying equipment capable of producing 1,000 kg or more per day of gas in liquid form;*
2. *Buoyant electric conducting cable suitable for sweeping magnetic mines.*

2005. Fire control, and related alerting and warning equipment, and related systems and countermeasure equipment, as follows, specially designed for military use, and specially designed components and accessories therefor:

a. Weapon sights, bombing computers, gun laying equipment and weapon control systems;
b. Target acquisition, designation, range-finding, surveillance or tracking systems; detection, data fusion, recognition or identification equipment; and sensor integration equipment;
c. Countermeasure equipment for Items 2005.a. and 2005.b.

2006. Ground vehicles and components therefor specially designed or modified for military use.

Technical Note:
For the purposes of 2006. the term ground vehicles includes trailers.

Note 1:
2006. includes:
a. Tanks and other military armed vehicles and military vehicles fitted with mountings for arms or equipment for mine laying or the launching of munitions controlled under 2004.;
b. Armoured vehicles;
c. Amphibious and deep water fording vehicles;
d. Recovery vehicles and vehicles for towing or transporting ammunition or weapons systems and associated load handling equipment.

Note 2:
Modification of a ground vehicle for military use entails a structural, electrical or mechanical change involving one or more specially designed military components. Such components include:
a. Pneumatic tyre casings of a kind specially designed to be bullet-proof or to run when deflated;
b. Tyre inflation pressure control systems, operated from inside a moving vehicle;
c. Armoured protection of vital parts, (e.g. fuel tanks or vehicle cabs);
d. Special reinforcements for mountings for weapons.

Note 3:
2006. does not control civil automobiles or bank trucks having armoured protection.

2007. Toxicological agents, "tear gases", related equipment, components, materials and "technology" as follows:

Note:
The CAS numbers are shown as examples. They do not cover all the chemicals and mixtures controlled by Item 2007.

a. Biological agents and radioactive materials "adapted for use in war" to produce casualties in humans or animals, degrade equipment or damage crops or the environment, and chemical warfare (CW) agents;
b. CW binary precursors and key precursors, as follows:
   1. Alkyl (Methyl, Ethyl, n-Propyl or Isopropyl Phosphonyl Difluorides such as: DF: Methyl Phosphonyldifluoride (CAS 676-99-3);
   2. O-Akyl (H or equal to or less than C_{10}, including cycloalkyl) O-2-diakyl (Methyl Ethyl, n-Propyl or Isopropyl) amininoethyl alkyl (Methyl Ethyl, n-Propyl or Isopropyl) phossphonite and corresponding alkylated and protenated salts, such as:
      QL: O-Ethyl-2-di-isopropylamino ethyl methylphosphonite (CAS 57856-11-8);
   3. Chlorosarin: O-Isopropyl methylphosphonochloridate (CAS 1445-76-7);
   4. Chlorosoman: O-Pinakolyl methylphosphon-ochloridate (CAS 7040-57-5);
c. "Tear gases" and "riot control agents" including:
   1. Bromobenzyl cyanide (CA) (CAS 5798-79-8);
   2. o-Chlorobenzylidenemalononitrile (o-Chlorobenzalmalononitrile) (CS) (CAS 2698-41-1);
   3. Phenylacyl chloride (ω-chloroacetophenone) (CN) (CAS 532-27-4);
   4. Dibenz-(b,f)-1,4-oxazephine (CR) (CAS 257-07-8);
d. Equipment specially designed or modified for the dissemination of the materials or agents controlled by 2007.a. and specially designed components therefor;
e. Equipment specially designed or modified for defence against materials or agents controlled by 2007.a. and specially designed components therefor;
   Note:
   2007.e. includes protective clothing;
f. Equipment specially designed for the detection or identification of materials controlled by 2007.a. and specially designed components therefor;
   Note:
   2007.f. does not control personal radiation monitoring dosimeters.
   N.B.
   For civil gas masks and protective equipment see also Item 1011.4. on the Dual Use List. (Group 1)
g. "Biopolymers" specially designed or processed for the detection or identification of CW agents controlled by 2007.a., and the cultures of specific cells used to produce them;
h. "Biocatalysts" for the decontamination or degradation of CW agents, and biological systems therefor, as follows:
   1. "Biocatalysts" specially designed for the decontamination or degradation of CW agents controlled by 2007.a. resulting from directed laboratory selection or genetic manipulation of biological systems;
   2. Biological systems, as follows: "expression vectors", viruses or cultures of cells containing the genetic information specific to the production of "biocatalysts" controlled by Item 2007.h.1.;
i. "Technology" as follows:
   1. "Technology" for the "development", "production" or "use" of toxicological agents, related equipment or components controlled by Item 2007.a. to 2007.f.;
   2. "Technology" for the "development", "production" or "use" of "biopolymers" or cultures of specific cells controlled by 2007.g.;
   3. "Technology" exclusively for the incorporation of "biocatalysts", controlled by 2007.h.1., into military carrier substances or military material.

Notes:
1. 2007.a. includes the following:
   a. CW nerve agents:
      1. O-Alkyl (equal to or less than C_{10}, including cycloalkyl) alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) - phosphonofluoridates, such as: Sarin (GB):o-Isopropyl methylphosphonofluoridate (CAS 107-44-8); and Soman (GD): O-Pinacolyl methylphosphonofluoridate (CAS 96-64-0);
      2. O-Alkyl (equal to or less than C_{10}, including cycloalkyl) N,N-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphoramidocyanidates, such as: Tabun (GA):O-Ethyl N,N-dimethylphosphoramidocyanidate (CAS 77-81-6);
      3. O-Alkyl (H or equal to or less than C_{10}, including cycloalkyl) S-2-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl)-aminoethyl alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphonothiolates and corresponding alkylated and protonated salts, such as: VX:

O-Ethyl S-2-diisopropylaminoethyl methyl phosphonothiolate (CAS 50782-69-9);

b. *CW vesicant agents:*
   1. *Sulphur mustards, such as:*
      2-Chloroethylchloromethylsulphide (CAS 2625-76-5);
      Bis(2-chloroethyl) sulphide (CAS 505-60-2);
      Bis(2-chloroethylthio) methane (CAS 63869-13-6);
      1,2-bis (2-chloroethylthio) ethane (CAS 3563-36-8);
      1,3-bis (2-chloroethylthio) -n-propane (CAS 63905-10-2);
      1,4-bis (2-chloroethylthio) -n-butane;
      1,5-bis (2-chloroethylthio) -n-pentane;
      Bis (2-chloroethylthiomethyl) ether;
      Bis (2-chloroethylthioethyl) ether (CAS 63918-89-8);
   2. *Lewisites, such as:*
      2-chlorovinyldichloroarsine (CAS 541-25-3);
      Tris (2-chlorovinyl) arsine (CAS 40334-70-1);
      Bis (2-chlorovinyl) chloroarsine (CAS 40334-69-8);
   3. *Nitrogen mustards, such as:*
      HN1: bis (2-chloroethyl) ethylamine (CAS 538-07-8);
      HN2: bis (2-chloroethyl) methylamine (CAS 51-75-2);
      HN3: tris (2-chloroethyl) amine (CAS 555-77-1);

c. *CW incapacitating agents such as: 3 -Quinuclidinyl benzilate (BZ) (CAS 6581-06-2).*

d. *CW defoliants such as:*
   1. *Butyl 2-chloro-4-flourophenoxyacetate (LNF);*
   2. *2,4,5,-trochlorophenoxyacetate acid mixed with 2,4-dichlorophenoxyacetic acid (Agent Orange)*

2. *2007.e. includes air conditioning units specially designed or modified for nuclear, biological or chemical filtration.*

3. *Sub-item 2007.a. and 2007.c. does not control:*
   - *a. Cyanogen chloride;*
   - *b. Hydrocyanic acid;*
   - *c. Chlorine;*
   - *d. Carbonyl chloride (phosgene);*
   - *e. Diphosgene (trichloromethyl-chloroformate);*
   - *f. Ethyl bromoacetate;*
   - *g. Xylyl bromide;*
   - *h. Benzyl bromide;*
   - *i. Benzyl iodide;*
   - *j. Bromo acetone;*
   - *k. Cyanogen bromide;*
   - *l. Bromo methylethylketone;*
   - *m. Chloro acetone;*
   - *n. Ethyl iodoacetate;*
   - *o. Iodo acetone;*
   - *p. Chloropicrin.*

4. *The "technology", cultures of cells and biological systems listed in 2007.g., 2007.h.2. and 2007.i.3. are exclusive and these sub-items do not control "technology", cells or biological systems for civil purposes, such as agricultural, pharmaceutical, medical, veterinary, environmental, waste management, or in the food industry.*

5. *2007.c. does not control tear gases or riot control agents individually packaged for personal self defence purposes.*

6. *2007.d., 2007.e. and 2007.f. control equipment specially designed or modified for military purposes.*

N.B.

See also Group 1: Dual Use List Item 1011.4.

2008. "Military explosives" and fuels, including propellants, and related substances, as follows:

a. Substances, as follows, and mixtures thereof:
   1. Spherical aluminium powder (CAS 7429-90-5) with a particle size of 60 µm or less, manufactured from material with an aluminium content of 99% or more;
   2. Metal fuels in particle form whether spherical, atomized, spheroidal, flaked or ground, manufactured from material consisting of 99 % or more of any of the following:
      a. Metals and mixtures thereof:
         1) Beryllium (CAS 7440-41-7) in particle sizes of less than 60 µm;
         2) Iron powder (CAS 7439-89-6) with particle size of 3 µm or less produced by reduction of iron oxide with hydrogen;
      b. Mixtures, which contain any of the following:
         1) Zirconium (CAS 7440-67-7), magnesium (CAS 7439-95-4) and alloys of these in particle sizes of less than 60 µm;
         2) Boron (CAS 7440-42-8) or boron carbide (CAS 12069-32-8) fuels of 85% purity or higher and particle sizes of less than 60 µm;
   3. Perchlorates, chlorates and chromates composited with powdered metal or other high energy fuel components;
   4. Nitroguanidine (NQ) (CAS 556-88-7);
   5. Compounds composed of fluorine and any of the following: other halogens, oxygen, nitrogen;
   6. Carboranes; decaborane(CAS 17702-41-9); pentaborane and derivatives thereof;
   7. Cyclotetramethylenetetranitramine (HMX) (CAS 2691-41-0); octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazine; 1,3,5,7-tetranitro-1,3,5,7-tetraza-cyclooctane; (octogen, octogene);
   8. Hexanitrostilbene (HNS) (CAS 20062-22-0);
   9. Diaminotrinitrobenzene (DATB) (CAS 630-08-6);
   10. Triaminotrinitrobenzene (TATB) (CAS 3058-38-6);
   11. Triaminoguanidinenitrate (TAGN) (CAS 4000-16-2);
   12. Titanium subhydride of stoichiometry TiH 0.65-1.68;
   13. Dinitroglycoluril (DNGU, DINGU) (CAS 55510-04-8); tetranitroglycoluril (TNGU, SORGUYL) (CAS 55510-03-7);
   14. Tetranitrobenzotriazolobenzotriazole (TACOT) (CAS 25243-36-1);
   15. Diaminohexanitrobiphenyl (DIPAM) (CAS 17215-44-0);
   16. Picrylaminodinitropyridine (PYX) (CAS 38082-89-2);
   17. 3-nitro-1,2,4-triazol-5-one (NTO or ONTA) (CAS 932-64-9);
   18. Hydrazine (CAS 302-01-2) in concentrations of 70% or more; hydrazine nitrate (CAS 37836-27-4); hydrazine perchlorate (CAS 27978-54-7); unsymmetrical dimethyl hydrazine (CAS 57-14-7); monomethyl hydrazine (CAS 60-34-4); symmetrical dimethyl hydrazine (CAS 540-73-8);
   19. Ammonium perchlorate (CAS 7790-98-9);
   20. Cyclotrimethylenetrinitramine (RDX) (CAS 121-82-4) ; cyclonite; T4; hexahydro-1,3,5-trinitro-1,3,5-triazine; 1,3,5-trinitro-1,3,5-triaza-cyclohexane (hexogen, hexogene);
   21. Hydroxylammonium nitrate (HAN) (CAS 13465-08-2); hydroxylammonium perchlorate (HAP) (CAS 15588-62-2);
   22. 2-(5-cyanotetrazolato) penta amine-cobalt (III) perchlorate (or CP) (CAS 70247-32-4);
   23. cis-bis (5-nitrotetrazolato) tetra amine-cobalt (III) perchlorate (or BNCP);
   24. 7-Amino-4,6-dinitrobenzofurazane-1-oxide (ADNBF) (CAS 97096-78-1); amino dinitrobenzofuroxan;
   25. 5,7-diamino-4,6-dinitrobenzofurazane-1-oxide (CAS 117907-74-1), (CL-14 or diamino dinitrobenzofuroxan);
   26. 2,4,6-trinitro-2,4,6-triazacyclohexanone (K-6 or Keto-RDX) (CAS 115029-35-1);
   27. 2,4,6,8-tetranitro-2,4,6,8-tetraaza-bicyclo [3,3,0]-octanone-3 (CAS 130256-72-3) (tetranitro-semiglycouril, K-55 or keto-bicyclic HMX);
   28. 1,1,3-trinitroazetidine (TNAZ) (CAS 97645-24-4);
   29. 1,4,5,8-tetranitro-1,4,5,8-tetraazadecalin (TNAD) (CAS 135877-16-6);
   30. Hexanitrohexaazaisowurtzitane (CAS 135285-90-4) (CL-20) or HNIW; and chlathrates of CL-20);
   31. Polynitrocubanes with more than four nitro groups;
   32. Ammonium dinitramide (ADN or SR 12) (CAS 140456-78-6);
   33. Trinitrophenylmethylnitramine (tetryl) (CAS 479-45-8);

b. Explosives and propellants that meet the following performance parameters:
   1. Any explosive with a detonation velocity exceeding 8,700 m/s or a detonation pressure exceeding 34 GPa (340 kilobars);
   2. Other organic explosives not listed in Item 2008. yielding detonation pressures of 25 GPa (250 kilobars) or more that will remain stable at temperatures of 523 K (250° C) or higher for periods of 5 minutes or longer;
   3. Any other United Nations (UN) Class 1.1 solid propellant not listed in Item 2008. with a theoretical specific impulse (under standard conditions) of more than 250 s for non-metallised, or more than 270 s for aluminised compositions;
   4. Any UN Class 1.3 solid propellant with a theoretical specific impulse of more than 230 s for non-halogenised, 250 s for non-metallised and 266 s for metallised compositions;
   5. Any other gun propellants not listed in Item 2008. having a force constant of more than 1,200 kJ/kg;
   6. Any other explosive, propellant or pyrotechnic not listed in Item 2008. that can sustain a steady-state burning rate of more than 38 mm/s under standard conditions of 6.89 MPa (68.9 bar) pressure and 294 K (21° C); **or**
   7. Elastomer modified cast double based propellants (EMCDB) with extensibility at maximum stress of more than 5% at 233 K (-40° C);

c. "Military pyrotechnics";

d. Other substances, as follows:
   1. Aircraft fuels specially formulated for military purposes;
   2. Military materials containing thickeners for hydrocarbon fuels specially formulated for use in flamethrowers or incendiary munitions, such as metal stearates or palmates (also known as octal) (CAS 637-12-7) and M1, M2, M3 thickeners;
   3. Liquid oxidisers comprised of or containing inhibited red fuming nitric acid (IRFNA) (CAS 8007-58-7) or oxygen difluoride;

e. "Additives" and "precursors", as follows:
   1. Azidomethylmethyloxetane (AMMO) and its polymers;
   2. Basic copper salicylate (CAS 62320-94-9); lead salicylate (CAS 15748-73-9);
   3. Bis(2,2-dinitropropyl) formal (CAS 5917-61-3) or Bis(2,2-dinitropropyl) acetal (CAS 5108-69-0);
   4. Bis-(2-fluoro-2,2-dinitroethyl) formal (FEFO) (CAS 17003-79-1);
   5. Bis-(2-hydroxyethyl) glycolamide (BHEGA) (CAS 17409-41-5);
   6. Bis(2-methyl aziridinyl) methylamino phosphine oxide (Methyl BAPO) (CAS 85068-72-0);
   7. Bisazidomethyloxetane and its polymers (CAS 17607-20-4);
   8. Bischloromethyloxetane (BCMO) (CAS142173-26-0);
   9. Butadienenitrileoxide (BNO);
   10. Butanetrioltrinitrate (BTTN) (CAS 6659-60-5);
   11. Catocene (CAS 37206-42-1) (2,2-Bis-ethylferrocenyl propane); ferrocene carboxylic acids; N-butyl-ferrocene (CAS 319904-29-7); Butacene (CAS 125856-62-4) and other adducted polymer ferrocene derivatives;
   12. Dinitroazetidine-t-butyl salt;
   13. Energetic monomers, plasticisers and polymers containing nitro, azido, nitrate, nitraza or difluoroamino groups;
   14. Poly-2,2,3,3,4,4-hexafluoropentane-1,5-diol formal (FPF-1);
   15. Poly-2,4,4,5,5,6,6-heptafluoro-2-tri-fluoromethyl-3-oxaheptane-1,7-diol formal (FPF-3);
   16. Glycidylazide Polymer (GAP) (CAS 143178-24-9) and its derivatives;
   17. Hexabenzylhexaazaisowurtzitane (HBIW) (CAS 124782-15-6);
   18. Hydroxyl terminated polybutadiene (HTPB) with a hydroxyl functionality equal to or greater than 2.2 and less than or equal to 2.4, a hydroxyl value of less than 0.77 meq/g, and a viscosity at 30° C of less than 47 poise (CAS 69102-90-5);
   19. Superfine iron oxide (Fe_20_3 hematite) with a specific surface area more than 250 m^2/g and an average particle size of 0.003 µm or less (CAS 1309-37-1);
   20. Lead beta-resorcylate (CAS 20936-32-7);
   21. Lead stannate (CAS 12036-31-6), lead maleate (CAS 19136-34-6), lead citrate (CAS 14450-60-3);
   22. Lead-copper chelates of beta-resorcylate or salicylates (CAS 68411-07-4);
   23. Nitratomethylmethyloxetane or poly (3-Nitratomethyl, 3-methyl oxetane); (Poly-NIMMO) (NMMO) (CAS 84051-81-0);
   24. 3-Nitraza-1,5-pentane diisocyanate (CAS 7406-61-9);
   25. N-Methyl-p-Nitroaniline (CAS 100-15-2);
   26. Organo-metallic coupling agents, specifically:
      a. Neopentyl [diallyl] oxy, tri [dioctyl] phosphato titanate (CAS 103850-22-2); also known as titanium IV, 2,2 [bis 2-propenolato-methyl, butanolato, tris (dioctyl) phosphato] (CAS 110438-25-0); or LICA 12 (CAS 103850-22-2);
      b. Titanium IV, [(2-propenolato-1) methyl, n-propanolatomethyl] butanolato-1, tris[dioctyl] pyrophosphate; or KR3538;
      c. Titanium IV, [(2-propenolato-1)methyl, n-propanolatomethyl] butanolato-1, tris(dioctyl) phosphate;
   27. Polycyanodifluoroaminoethyleneoxide (PCDE);
   28. Polyfunctional aziridine amides with isophthalic, trimesic (BITA or butylene imine trimesamide), isocyanuric or trimethyladipic backbone structures and 2-methyl or 2-ethyl substitutions on the aziridine ring;
   29. Polyglycidylnitrate or poly (nitratomethyl oxirane); (Poly-GLYN) (PGN) (CAS 27814-48-8);
   30. Polynitroorthocarbonates;
   31. Propyleneimine, 2-methylaziridine (CAS 75-55-8);
   32. Tetraacetyldibenzylhexaazaisowurtzitane (TAIW);
   33. Tetraethylenepentaamineacrylonitrile (TEPAN) (CAS 68412-45-3); cyanoethylated polyamine and its salts;
   34. Tetraethylenepentaamineacrylonitrileglycidol (TEPANOL) (CAS 68412-46-4); cyanoethylated polyamine adducted with glycidol and its salts;
   35. Triphenyl bismuth (TPB) (CAS 603-33-8);
   36. Tris-1-(2-methyl)aziridinyl phosphine oxide (MAPO) (CAS 57-39-6); bis(2-methyl aziridinyl) 2-(2-hydroxypropanoxy) propylamino phosphine oxide (BOBBA 8); and other MAPO derivatives;
   37. 1,2,3-Tris [1,2-bis (difluoroamino) ethoxy] propane (CAS 53159-39-0); tris vinoxy propane adduct (TVOPA);
   38. 1,3,5-trichlorobenzene (CAS 108-70-3);

39. 1,2,4 trihydroxybutane (1,2,4-butanetriol);
40. 1,3,5,7 tetraacetyl-1,3,5,7,-tetraaza cyclo-octane (TAT)(CAS 41378-98-7);
41. 1,4,5,8 Tetraazadecalin (CAS 5409-42-7);
42. Low (less than 10,000) molecular weight, alcohol-functionalised, poly(epichlorohydrin); poly(epichlorohydrindiol) and triol.

Notes:

1. *The military explosives and fuels containing the metals or alloys listed in 2008.a.1. and 2008.a.2. are controlled whether or not the metals or alloys are encapsulated in aluminium, magnesium, zirconium or beryllium.*
   N.B.
   See also Group 1: Dual Use List Item 1013.11.
2. *2008. does not control boron and boron carbide enriched with boron-10 (20% or more of total boron-10 content).*
3. *Aircraft fuels controlled by 2008.d.1. are finished products not their constituents.*
4. *2008. does not control perforators specially designed for oil well logging.*
5. *2008. does not control the following substances when not compounded or mixed with military explosives or powdered metals:*

a. Ammonium picrate;
b. Black powder;
c. Hexanitrodiphenylamine;
d. Difluoroamine (HNF_2);
e. Nitrostarch;
f. Potassium nitrate;
g. Tetranitronaphthalene;
h. Trinitroanisol;
i. Trinitronaphthalene;
j. Trinitroxylene;
k. Fuming nitric acid non-inhibited and not enriched;
l. Acetylene;
m. Propane;
n. Liquid oxygen;
o. Hydrogen peroxide in concentrations of less than 85%;
p. Misch metal;
q. N-pyrrolidinone; 1-methyl-2-pyrrolidinone;
r. Dioctylmaleate;
s. Ethylhexylacrylate;
t. Triethylaluminium (TEA), trimethylaluminium (TMA), and other pyrophoric metal alkyls and aryls of lithium, sodium, magnesium, zinc and boron;
u. Nitrocellulose;
v. Nitroglycerin (or glyceroltrinitrate, trinitroglycerine) (NG);
w. 2,4,6-trinitrotoluene (TNT);
x. Ethylenediaminedinitrate (EDDN);
y. Pentaerythritoltetranitrate (PETN);
z. Lead azide, normal and basic lead styphnate, and primary explosives or priming compositions containing azides or azide complexes;
aa. Triethyleneglycoldinitrate (TEGDN);
bb. 2,4,6-trinitroresorcinol (styphnic acid);
cc. Diethyldiphenyl urea; dimethylidiphenyl urea; methylethyldiphenyl urea [Centralites]
dd. N,N-diphenylurea (unsymmetrical diphenylurea);
ee. Methyl-N,N-diphenylurea (methyl unsymmetrical diphenylurea);
ff. Ethyl-N,N-diphenylurea (ethyl unsymmetrical diphenylurea);
gg. 2-Nitrodiphenylamine (2-NDPA);
hh. 4-Nitrodiphenylamine (4-NDPA);
ii. 2,2-Dinitropropanol;
jj. Chlorine trifluoride.

2009. Vessels of war, special naval equipment and accessories, as follows, and components therefor, specially designed for military use :

a. Combatant vessels and vessels (surface or underwater) specially designed or modified for offensive or defensive action, whether or not converted to non-military use, regardless of current state of repair or operating condition, and whether or not they contain weapon delivery systems or armour, and hulls or parts of hulls for such vessels;
b. Engines, as follows:
   1. Diesel engines specially designed for submarines with both of the following characteristics:
      a. A power output of 1.12 MW (1,500 hp.) or more; **and**
      b. A rotary speed of 700 rpm or more;
   2. Electric motors specially designed for submarines having all of the following characteristics:
      a. A power output of more than 0.75 MW (1,000 hp.);
      b. Quick reversing;
      c. Liquid cooled; **and**
      d. Totally enclosed;
   3. Non-magnetic diesel engines specially designed for military use with a power output of 37.3 kW (50 hp.) or more and with a non-magnetic content in excess of 75% of total mass;
c. Underwater detection devices specially designed for military use and controls thereof;
d. Submarine and torpedo nets;
e. Equipment for guidance and navigation specially designed for military use;
f. Hull penetrators and connectors specially designed for military use that enable interaction with equipment external to a vessel;

   Note:
   2009.f. includes connectors for vessels which are of the single-conductor, multi-conductor, coaxial or waveguide type, and hull penetrators for vessels, both of which are capable of remaining impervious to leakage from without and of retaining required characteristics at marine depths exceeding 100 m; and fibre-optic connectors and optical hull penetrators specially designed for "laser" beam transmission regardless of depth. It does not include ordinary propulsive shaft and hydrodynamic control-rod hull penetrators.

g. Silent bearings with gas or magnetic suspension, active signature or vibration suppression controls, and equipment containing those bearings, specially designed for military use.

2010. "Aircraft", unmanned airborne vehicles, aero-engines and "aircraft" equipment, related equipment and components, specially designed or modified for military use, as follows:

a. Combat "aircraft" and specially designed components therefor;
b. Other "aircraft" specially designed or modified for military use, including military reconnaissance, assault, military training, transporting and airdropping troops or military equipment, logistics support, and specially designed components therefor;
c. Aero-engines specially designed or modified for military use, and specially designed components therefor;
d. Unmanned airborne vehicles, including remotely piloted air vehicles (RPVs), and autonomous, programmable vehicles specially designed or modified for military use and their launchers, ground support and related equipment for command and control;
e. Airborne equipment, including airborne refuelling equipment, specially designed for use with the "aircraft" controlled by 2010.a. or 2010.b. or the aero-engines controlled by 2010.c., and specially designed components therefor;
f. Pressure refuellers, pressure refuelling equipment, equipment specially designed to facilitate operations in confined areas and ground equipment, developed specially for "aircraft" controlled by 2010.a. or 2010.b., or for aero-engines controlled by 2010.c.;
g. Pressurised breathing equipment and partial pressure suits for use in "aircraft", anti-g suits, military crash helmets and protective masks, liquid oxygen converters used for "aircraft" or missiles, and catapults and cartridge actuated devices for emergency escape of personnel from "aircraft";

h. Parachutes used for combat personnel, cargo dropping or "aircraft" deceleration, as follows:
   1. Parachutes for:
      a. Pin point dropping of rangers;
      b. Dropping of paratroopers;
   2. Cargo parachutes;
   3. Paragliders drag parachutes, drogue parachutes for stabilisation and attitude control of dropping bodies, (e.g., recovery capsules, ejection seats, bombs);
   4. Drogue parachutes for use with ejection seat systems for deployment and inflation sequence regulation of emergency parachutes;
   5. Recovery parachutes for guided missiles, drones or space vehicles;
   6. Approach parachutes and landing deceleration parachutes;
   7. Other military parachutes;

i. Automatic piloting systems for parachuted loads; equipment specially designed or modified for military use for controlled opening jumps at any height, including oxygen equipment.

Notes:

1. *2010.b. does not control "aircraft" or variants of those "aircraft" specially designed for military use which:*
   a. *Are not configured for military use and are not fitted with equipment or attachments specially designed or modified for military use; **and***
   b. *Have been certified for civil use by the civil aviation authority in a participating state.*
2. *2010.c. does not control:*
   a. *Aero-engines designed or modified for military use which have been certified by civil aviation authorities in a participating state for use in "civil aircraft", or specially designed components therefor;*
   b. *Reciprocating engines or specially designed components therefor.*
3. *The control in 2010.b. and 2010.c. on specially designed components and related equipment for non-military "aircraft" or aero-engines modified for military use applies only to those military components and to military related equipment required for the modification to military use.*

2011. Electronic equipment, not controlled elsewhere on the Munitions List, specially designed for military use and specially designed components therefor.

Note:

This Item includes:

a. Electronic countermeasure and electronic counter-countermeasure equipment (i.e., equipment designed to introduce extraneous or erroneous signals into radar or radio communication receivers or otherwise hinder the reception, operation or effectiveness of adversary electronic receivers including their countermeasure equipment), including jamming and counter-jamming equipment;

b. Frequency agile tubes;

c. Electronic systems or equipment designed either for surveillance and monitoring of the electro-magnetic spectrum for military intelligence or security purposes or for counteracting such surveillance and monitoring;

d. Underwater countermeasures, including acoustic and magnetic jamming and decoy, equipment designed to introduce extraneous or erroneous signals into sonar receivers;

e. Data processing security equipment, data security equipment and transmission and signalling line security equipment, using ciphering processes;

f. Identification, authentification and keyloader equipment and key management, manufacturing and distribution equipment.

2012. High velocity kinetic energy weapon systems and related equipment, as follows, and specially designed components therefor:

a. Kinetic energy weapon systems specially designed for destruction or effecting mission-abort of a target;

b. Specially designed test and evaluation facilities and test models, including diagnostic instrumentation and targets, for dynamic testing of kinetic energy projectiles and systems;

N.B.:

For weapon systems using sub-calibre ammunition or employing solely chemical propulsion, and ammunition therefor, see Items 2001. to 2004.

Notes:

1. *2012. includes the following when specially designed for kinetic energy weapon systems:*
   a. *Launch propulsion systems capable of accelerating masses larger than 0.1 g to velocities in excess of 1.6 km/s, in single or rapid fire modes;*
   b. *Prime power generation, electric armour, energy storage, thermal management, conditioning, switching or fuel-handling equipment; and electrical interfaces between power supply, gun and other turret electric drive functions;*
   c. *Target acquisition, tracking, fire control or damage assessment systems;*
   d. *Homing seeker, guidance or divert propulsion (lateral acceleration) systems for projectiles.*
2. *2012. controls weapon systems using any of the following methods of propulsion:*
   a. *Electromagnetic;*
   b. *Electrothermal;*
   c. *Plasma;*
   d. *Light gas; **or***
   e. *Chemical (when used in combination with any of the above).*
3. *2012. does not control "technology" for magnetic induction for continuous propulsion of civil transport devices.*

2013. Armoured or protective equipment and constructions and components, as follows:

a. Armoured plate as follows:
   1. Manufactured to comply with a military standard or specification; **or**
   2. Suitable for military use;

b. Combinations of metallic and non-metallic materials or combinations thereof specially designed to provide ballistic protection for military systems;

c. Military helmets;

d. Body armour, and flak suits manufactured according to military standards or specifications, or equivalent, and specially designed components therefor.

Notes:

1. *2013.b. includes materials specially designed to form explosive reactive armour or to construct military shelters.*
2. *2013.c. does not control conventional steel helmets, neither modified or designed to accept, nor equiped with any type of accessory device.*
3. *2013.d. does not control individual suits of body armour for personal protection and accessories therefor when accompanying their users .*

N.B

See also Group 1: Dual Use List Item 1011.5.

2014. Specialised equipment for military training or for simulating military scenarios, and specially designed components and accessories therefor:

Technical Note:

1. *The term 'specialised equipment for military training' includes military types of attack trainers, operational flight trainers, radar target trainers, radar target generators, gunnery training devices, anti-submarine warfare trainers, flight simulators (including human-rated centrifuges for pilot/astronaut training), radar trainers, instrument flight trainers, navigation trainers, missile launch trainers, target equipment, drone "aircraft", armament trainers, pilotless "aircraft" trainers and mobile training units.*
2. *Item 2014. includes image generating and interactive environment systems for simulators when specially designed or modified for military use.*

2015. Imaging or countermeasure equipment, as follows, specially designed for military use, and specially designed components and accessories therefor:

a. Recorders and image processing equipment;
b. Cameras, photographic equipment and film processing equipment;
c. Image intensifier equipment;
d. Infrared or thermal imaging equipment;
e. Imaging radar sensor equipment;
f. Countermeasure or counter-countermeasure equipment for the equipment controlled by 2015.a. to 2015.e.

Note:
2015.f. includes equipment designed to degrade the operation or effectiveness of military imaging systems or to minimize such degrading effects.

Notes:
1. *The term 'specially designed components' includes the following when specially designed for military use:*
   a. *Infrared image converter tubes;*
   b. *Image intensifier tubes (other than first generation);*
   c. *Microchannel plates;*
   d. *Low-light-level television camera tubes;*
   e. *Detector arrays (including electronic interconnection or read out systems);*
   f. *Pyroelectric television camera tubes;*
   g. *Cooling systems for imaging systems;*
   h. *Electrically triggered shutters of the photochromic or electro-optical type having a shutter speed of less than 100 µs,* ***except*** *in the case of shutters which are an essential part of a high speed camera;*
   i. *Fibre optic image inverters;*
   j. *Compound semiconductor photocathodes.*
2. *2015. does not control "first generation image intensifier tubes."*

N.B.
See also Items 1061.2.a.2. and 1061.2.b. on the Dual-Use List (Group 1).

2016. Forgings, castings and other unfinished products the use of which in a controlled product is identifiable by material composition, geometry or function, and which are specially designed for any products controlled by 2001. to 2004., 2006., 2009., 2010., 2012. or 2019.

2017. Miscellaneous equipment, materials and libraries, as follows, and specially designed components therefor:

a. Self-contained diving and underwater swimming apparatus, as follows:
   1. Closed or semi-closed circuit (rebreathing) apparatus specially designed for military use (i.e., specially designed to be non magnetic) ;
   2. Specially designed components for use in the conversion of open-circuit apparatus to military use;
   3. Articles designed exclusively for military use with self-contained diving and underwater swimming apparatus;
b. Construction equipment specially designed for military use;
c. Fittings, coatings and treatments for signature suppression, specially designed for military use;
d. Field engineer equipment specially designed for use in a combat zone;
e. "Robots", "robot" controllers and "robot" "end-effectors", having any of the following characteristics:
   1. Specially designed for military use;
   2. Incorporating means of protecting hydraulic lines against externally induced punctures caused by ballistic fragments (e.g., incorporating self-sealing lines) and designed to use hydraulic fluids with flash points higher than 839 K (566°C); **or**
   3. Specially designed or rated for operating in an electro-magnetic pulse (EMP) environment;
f. Libraries (parametric technical databases) specially designed for military use with equipment controlled by Group 2, Munitions List;
g. Nuclear power generating equipment or propulsion equipment, including nuclear reactors, specially designed for military use and components therefor specially designed or modified for military use;
h. Equipment and material coated or treated for signature suppression specially designed for military use, other than those controlled elsewhere in Group 2, Munitions List;
i. Simulators specially designed for military "nuclear reactors";
j. Mobile repair shops specially designed to service military equipment;
k. Field generators specially designed for military use;
l. Containers specially designed for military use.

Technical Note:
For the purpose of 2017., the term 'library' (parametric technical database) means a collection of technical information of a military nature, reference to which may enhance the performance of military equipment or systems.

2018. Equipment and "technology" for the production of products referred to in the Munitions List, as follows:

Technical Note:
For the purposes of 2018., the term 'production' includes design, examination, manufacture, testing and checking.

a. Specially designed or modified production equipment for the production of products controlled by this List, and specially designed components therefor;
b. Specially designed environmental test facilities and specially designed equipment therefor, for the certification, qualification or testing of products controlled by the Munitions List;
c. Specific production "technology", even if the equipment with which such "technology" is to be used is not controlled;
d. "Technology" specific to the design of, the assembly of components into, and the operation, maintenance and repair of complete production installations even if the components themselves are not controlled.

Technical Note:
For the purposes of 2018., the term "production" includes design, examination, manufacture, testing and checking.

Note:
1. *2018.a. and 2018.b. include the following equipment:*
   a. *Continuous nitrators;*
   b. *Centrifugal testing apparatus or equipment having any of the following characteristics:*
      1. *Driven by a motor or motors having a total rated horsepower of more than 298 kW (400 hp);*
      2. *Capable of carrying a payload of 113 kg or more; or*
      3. *Capable of exerting a centrifugal acceleration of 8 g or more on a payload of 91 kg or more;*
   c. *Dehydration presses;*
   d. *Screw extruders specially designed or modified for military explosive extrusion;*
   e. *Cutting machines for the sizing of extruded propellants;*

2018. ***Note 1*** **con't**

f. Sweetie barrels (tumblers) 1.85 m or more in diameter and having over 227 kg product capacity;
g. Continuous mixers for solid propellants;
h. Fluid energy mills for grinding or milling the ingredients of military explosives;
i. Equipment to achieve both sphericity and uniform particle size in metal powder listed in 2008.a.1.;
j. Convection current converters for the conversion of materials listed in Item 2008.a.6.

2. a. The term 'products referred to in the Munitions List' includes:
1. Products not controlled if inferior to specified concentrations as follows:
a) hydrazine (see 2008.a.18.);
b) "Military explosives" (see 2008.);
2. Products not controlled if inferior to technical limits, (i.e. "superconductive" materials not controlled by 1013.5. on the Dual-Use List; "superconductive" electromagnets not controlled by 1031.1.e.3. on the Dual-Use List; "superconductive" electrical equipment excluded from control under Item 2020.b.);
3. Metal fuels and oxidants deposited in laminar form from the vapour phase (see 2008.a.2.);
b. The term 'products referred to in the Munitions List' does not include:
1 Signal pistols (see Item 2002.b.);
2. The substances excluded from control under Note 3 to Item 2007.;
3. Personal radiation monitoring dosimeters (see 2007.f.) and masks for protection against specific industrial hazards (see also Group 1, Dual-Use List);
4. Acetylene, propane, liquid oxygen, difluoramine (HNF_2), fuming nitric acid and potassium nitrate powder (see Note 5 to Item 2008.);
5. Aero-engines excluded from control under Item 2010.;
6. Conventional steel helmets not equipped with, or modified or designed to accept, any type of accessory device (see Note 2 to Item 2013.);
7. Equipment fitted with industrial machinery which is not controlled, such as coating machinery not elsewhere specified and equipment for the casting of plastics;
8. Muskets, rifles and carbines dated earlier than 1938, reproductions of muskets, rifles and carbines dated earlier than 1890, revolvers, pistols and machine guns dated earlier than 1890, and their reproductions;
N.B.:
Note 2.b.8. of 2018. does not allow the export of "technology" or production equipment for non-antique small arms, even if used to produce reproductions of antique small arms.

3. 2018.d. does not include "technology" for civil purposes, such as agricultural, pharmaceutical, medical, veterinary, environmental, waste management, or in the food industry (see Note 5 to Item 2007.).

2019. Directed energy weapon systems (DEW), related or countermeasure equipment and test models, as follows, and specially designed components therefor:

a. "Laser" systems specially designed for destruction or effecting mission-abort of a target;
b. Particle beam systems capable of destruction or effecting mission-abort of a target;
c. High power radio-frequency (RF) systems capable of destruction or effecting mission-abort of a target;
d. Equipment specially designed for the detection or identification of, or defence against, systems controlled by 2019.a., 2019.b. or 2019.c.;
e. Physical test models and related test results for the systems, equipment and components controlled by this entry.

Notes:

1. Directed energy weapon systems controlled by 2019. include systems whose capability is derived from the controlled application of:
a. "Lasers" of sufficient continuous wave or pulsed power to effect destruction similar to the manner of conventional ammunition;
b. Particle accelerators which project a charged or neutral particle beam with destructive power;
c. High pulsed power or high average power radio frequency beam transmitters which produce fields sufficiently intense to disable electronic circuitry at a distant target.

2. 2019. includes the following when specially designed for directed energy weapon systems:
a. Prime power generation, energy storage, switching, power conditioning or fuel-handling equipment;
b. Target acquisition or tracking systems;
c. Systems capable of assessing target damage, destruction or mission-abort;
d. Beam-handling, propagation or pointing equipment;
e. Equipment with rapid beam slew capability for rapid multiple target operations;
f. Adaptive optics and phase conjugators;
g. Current injectors for negative hydrogen ion beams;
h. "Space qualified" accelerator components;
i. Negative ion beam funnelling equipment;
j. Equipment for controlling and slewing a high energy ion beam;
k. "Space qualified" foils for neutralising negative hydrogen isotope beams.

2020. Cryogenic and "superconductive" equipment, as follows, and specially designed components and accessories therefor:

a. Equipment specially designed or configured to be installed in a vehicle for military ground, marine, airborne or space applications, capable of operating while in motion and of producing or maintaining temperatures below 103K (–170°C);

Note:
2020.a. includes mobile systems incorporating or employing accessories or components manufactured from non-metallic or non-electrical conductive materials, such as plastics or epoxy-impregnated materials.

b. "Superconductive" electrical equipment (rotating machinery and transformers) specially designed or configured to be installed in a vehicle for military ground, marine, airborne or space applications, capable of operating while in motion.

Note:
2020.b. does not control direct-current hybrid homopolar generators that have single-pole normal metal armatures which rotate in a magnetic field produced by superconducting windings, provided those windings are the only superconducting component in the generator.

2021. "Software", as follows:

a. "Software" specially designed or modified for the "development", "production" or "use" of equipment or materials controlled by the Munitions List;
b. Specific "software", as follows:
1. "Software" specially designed for:
a. Modelling, simulation or evaluation of military weapon systems;
b. "Development", monitoring, maintenance or up-dating of "software" embedded in military weapon systems;
c. Modelling or simulating military operation scenarios, not controlled by Item 2014.;
d. Command, Communications, Control and Intelligence (C^3I) applications;
2. "Software" for determining the effects of conventional, nuclear, chemical or biological warfare weapons.

2022. "Technology" according to the General Technology Note of the Munitions List for the "development", "production" or "use" of items controlled in the Munitions List, other than that "technology" controlled in Items 2007. and 2018.

Definitions for Terms in Groups 1 and 2

"Accuracy"
(Usually measured in terms of inaccuracy) is the maximum deviation, positive or negative, of an indicated value from an accepted standard or true value.

"Active flight control systems"
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"
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"
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.

"Adaptive control"
A control system that adjusts the response from conditions detected during the operation (Reference: ISO 2806-1980).

"Additives"
Substances used in explosove formulations to improve their properties.

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

"Angular position deviation"
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. (Reference: VDI/VDE 2617, Draft: 'Rotary tables on coordinate measuring machines').

"Asynchronous transfer mode" ("ATM")
A transfer mode in which the information is organised into cells; it is asynchronous in the sense that the recurrence of cells depends on the required or instantaneous bit rate. (CCITT Recommendation L.113)

"ATM"
"ATM" is equivalent to "Asynchronous transfer mode".

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

"Basic gate propagation delay time"
The propagation delay time value corresponding to the basic gate used within a "family" of "monolithic integrated circuits". This may be specified, for a given "family", either as the propagation delay time per typical gate or as the typical propagation delay time per gate.

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

"Basic scientific research"
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)
An accelerometer output when no acceleration is applied.

"Biocatalysts"
Enzymes or other biological compounds which bind to and accelerate the degradation of CW agents.

N.B.: *'Enzymes' means "biocatalysts" for specific chemical or biochemical reactions.*

"Biopolymers"
Biological macromolecules as follows:
a. Enzymes;
b. Antibodies, monoclonal, polyclonal or anti-idiotypic;
c. Specially designed or specially processed receptors;

N.B.1: *'Enzymes': means "biocatalysts" for specific chemical or biochemical reactions;*

N.B.2: *'Anti-idiotypic antibodies' means antibodies which bind to the specific antigen binding sites of other antibodies;*

N.B.3: *'Monoclonal antibodies' means proteins which bind to one antigenic site and are produced by a single clone of cells;*

N.B.4: *'Polyclonal antibodies' means A mixture of proteins which bind to the specific antigen and are produced by more than one clone of cells;*

N.B.5: *'Receptors' means Biological macromolecular structures capable of binding ligands, the binding of which affects physiological functions.*

"Camming" (axial displacement)
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).

"CE"
"CE" is equivalent to "computing element".

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

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

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

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

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

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

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

"Communications channel controller"

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

"Composite"

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

"Composite theoretical performance" ("CTP")

A measure of computational performance given in millions of theoretical operations per second (Mtops), calculated using the aggregation of "computing elements"

N.B.: See Category 1040, Technical Note.

"Compound rotary table"

A table allowing the workpiece to rotate and tilt about two non-parallel axes, which can be coordinated simultaneously for "contouring control".

"Computing element" ("CE")

The smallest computational unit that produces an arithmetic or logic result.

"Contouring control"

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

"Critical temperature"

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

"Cryptography"

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

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

"CTP"

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

"Data signalling rate"

The rate, as defined in ITU Recommendation 53-36, taking into account that, for non-binary modulation, baud and bit per second are not equal. Bits for coding, checking and synchronisation functions are to be included.

N.B.1: When determining the "data signalling rate", servicing and administrative channels shall be excluded.

N.B.2: It is the maximum one-way rate, i.e., the maximum rate in either transmission or reception.

"Deformable Mirrors"

Mirrors:

a. Having 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. Having 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.

"Deformable mirrors" are also known as adaptive optic mirrors.

"Development"

Is related to all stages prior to serial production, such as: design, design research, design analyses, design concepts, assembly and testing of prototypes, pilot production schemes, design data, process of transforming design data into a product, configuration design, integration design, layouts.

"Diffusion bonding"

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

"Digital computer"

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"

The total bit rate of the information that is directly transferred on any type of medium. (See also "total digital transfer rate").

"Direct-acting hydraulic pressing"

A deformation process which uses a fluid-filled flexible bladder in direct contact with the workpiece.

"Discrete component"

A separately packaged "circuit element" with its own external connections.

"Drift rate" (gyro)

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

"Dynamic adaptive routing"

Automatic rerouting of traffic based on sensing and analysis of current actual network conditions.

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

"Dynamic signal analysers"

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

"Effective gram"

"Effective gram" for plutonium isotope is defined as the isotope weight in grams.

"Electronically steerable phased array antenna"

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.

"Electronic assembly"

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

"End-effectors"

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

Technical Note:
'Active tooling units' are devices for applying motive power, process energy or sensing to a workpiece.

"Equivalent Density"

The mass of an optic per unit optical area projected onto the optical surface.

"Expert systems"

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

a. Modifying automatically the "source code" introduced by the user;
b. Providing knowledge linked to a class of problems in quasi-natural language; **or**
c. Acquiring the knowledge required for their development (symbolic training).

"Expression Vectors"

Carriers (e.g., plasmid or virus) used to introduce genetic material into host cells.

"FADEC"

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

"Family"

Consists of microprocessor or microcomputer microcircuits, having all of the following:

a. The same architecture;
b. The same basic instruction set; **and**
c. The same basic "technology" (e.g., only NMOS or only CMOS).

"Fault tolerance"

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

"Fibrous or filamentary materials"

Include:

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

"Film type integrated circuit"

An array of "circuit elements" and metallic interconnections formed by deposition of a thick or thin film on an insulating "substrate".

"First generation image intensifier tubes"

Electrostatically focused tubes, employing input and output fibre optic or glass face plates, multi-alkali photocathodes (S-20 or S-25), but not microchannel plate amplifiers.

"Fixed"

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"

A network of distributed optical sensors, using "laser" beams, to provide real-time flight control data for on-board processing.

"Flight path optimization"

A procedure that minimizes deviations from a four-dimensional (space and time) desired trajectory based on maximizing performance or effectiveness for mission tasks.

"Focal plane array"

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 definition does not 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.*

"Frequency agility" (frequency hopping)

A form of "spread spectrum" in which the transmission frequency of a single communication channel is made to change by discrete steps.

"Frequency switching time"

The maximum time (i.e., delay) taken by a signal, when switched from one selected output frequency to another selected output frequency, to reach any of the following:

a. A frequency within 100 Hz of the final frequency; **or**
b. An output level within 1 dB of the final output level.

"Frequency synthesiser"

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

"Gas Atomisation"

A process to reduce a molten stream of metal alloy to droplets of 500 µm diameter or less by a high pressure gas stream.

"Gateway"

The function, realised by any combination of equipment and "software", to carry out the conversion of conventions for representing, processing or communicating information used in one system into the corresponding but different conventions used in another system.

"Geographically dispersed"

Sensors are considered "geographically dispersed" when each location is distant from any other more than 1,500 m in any direction. Mobile sensors are always considered "geographically dispersed".

"Global interrupt latency time"

The time taken by the computer system to recognize an interrupt due to the event, service the interrupt and perform a context switch to an alternate memory-resident task waiting on the interrupt.

"Hot isostatic densification"

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

"Hybrid computer"

Equipment which can perform all of the following:

a. Accept data;
b. Process data, in both analogue and digital representations; **and**
c. Provide output of data.

"Hybrid integrated circuit"

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

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

"Image enhancement"

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.

"Information security"

All the means and functions ensuring the accessibility, confidentiality or integrity of information or communications, excluding the means and functions intended to safeguard against malfunctions. This includes "cryptography", cryptanalysis, protection against compromising emanations and computer security.

N.B.: *'Cryptanalysis': the analysis of a cryptographic system or its inputs and outputs to derive confidential variables or sensitive data, including clear text. (ISO 7498-2-1988 (E), paragraph 3.3.18).*

"Instantaneous bandwidth"

The bandwidth over which output power remains constant within 3 dB without adjustment of other operating parameters.

"Instrumented range"

The specified unambiguous display range of a radar.

"Integrated Services Digital Network" ("ISDN")

A unified end-to-end digital network, in which data originating from all types of communication (e.g., voice, text, data, still and moving pictures) are transmitted from one port (terminal) in the exchange (switch) over one access line to and from the subscriber.

"Interconnected radar sensors"

Two or more radar sensors are interconnected when they mutually exchange data in real time.

"In the public domain"

This means "technology" or "software" which has been made available without restrictions upon its further dissemination.

N.B.: *Copyright restrictions do not remove "technology" or "software" from being "in the public domain".*

"Intrinsic magnetic gradiometer"

A single magnetic field gradient sensing element and associated electronics the output of which is a measure of magnetic field gradient.

"ISDN"

"ISDN" is equivalent to "Integrated Services Digital Network".

"Isostatic presses"

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"

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

"Linearity"

(Usually measured in terms of non-linearity) is 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"

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).

Technical Note:

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

"Magnetic gradiometers"

Are 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. (See also "Intrinsic Magnetic Gradiometer")

"Magnetometers"

Are 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"

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.

"Matrix"

A substantially continuous phase that fills the space between particles, whiskers or fibres.

"Measurement uncertainty"

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 (Reference: ISO 10360-2, or VDI/VDE 2617).

"Mechanical alloying"

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.

"Media access unit"

Equipment which contains one or more communication interfaces ("network access controller", "communications channel controller", modem or computer bus) to connect terminal equipment to a network.

"Melt extraction"

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.

"Melt spinning"

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

"Microcomputer microcircuit"

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"

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 definition includes chip sets which are designed to operate together to provide the function of a "microprocessor microcircuit".

"Microprogramme"

A sequence of elementary instructions maintained in a special storage, the execution of which is initiated by the introduction of its reference instruction register.

"Military explosives"

Solid, liquid or gaseous substances or mixtures of substances which, in their application as primary, booster, or main charges in warheads, demolition and other military applications, are required to detonate.

"Military pyrotechnics"

Mixtures of solid or liquid fuels and oxidizers which, when ignited, undergo an energetic chemical reaction at a controlled rate intended to produce specific time delays, or quantities of heat, noise, smoke, visible light or infrared radiation. Pyrophorics are a subclass of pyrotechnics, which contain no oxidizers but ignite spontaneously on contact with air.

"Monolithic integrated circuit"

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.

"Monospectral imaging sensors"

Are capable of acquisition of imaging data from one discrete spectral band.

"Multichip integrated circuit"

Two or more "monolithic integrated circuits" bonded to a common "substrate".

"Multi-data-stream processing"

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

a. Single Instruction Multiple Data (SIMD) architectures such as vector or array processors;
b. Multiple Single Instruction Multiple Data (MSIMD) architectures;
c. Multiple Instruction Multiple Data (MIMD) architectures, including those which are tightly coupled, closely coupled or loosely coupled; or
d. Structured arrays of processing elements, including systolic arrays.

"Multilevel security"

A class of system containing information with different sensitivities that simultaneously permits access by users with different security clearances and needs-to-know, but prevents users from obtaining access to information for which they lack authorization.

N.B.: "Multilevel security" is computer security and not computer reliability which deals with equipment fault prevention or human error prevention in general.

"Multispectral imaging sensors"

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

"Network access controller"

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"

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

"Noise level"

An electrical signal given in terms of power spectral density. The relation between "noise level" expressed in peak-to-peak is given by $S^2_{pp} = 8N_0(f_2-f_1)$, where S_{pp} is the peak-to-peak value of the signal (e.g., nanoteslas), N_0 is the power spectral density (e.g., $(\text{nanotesla})^2/\text{Hz}$) and (f_2-f_1) defines the bandwidth of interest.

"Nuclear reactor"

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

"Numerical control"

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"

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

"Optical amplification"
In optical communications, 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"
A computer designed or modified to use light to represent data and whose computational logic elements are based on directly coupled optical devices.

"Optical fibre preforms"
Bars, ingots, or rods of glass, plastic or other materials which have been specially processed for use in fabricating optical fibres. The characteristics of the preform determine the basic parameters of the resultant drawn optical fibres.

"Optical integrated circuit"
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"
The routing of or switching of signals in optical form without conversion to electrical signals.

"Overall current density"
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.).

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

"Personalized smart card"
A smart card containing a microcircuit, in accordance with ISO/IEC 7816, which has been programmed by the issuer and cannot be changed by the user.

"Power management"
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.

"Precursors"
Speciality chemicals used in the manufacture of military explosives.

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

"Primary flight control"
"Aircraft" stability or manoeuvering control using force/moment generators, i.e., aerodynamic control surfaces or propulsive thrust vectoring.

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

"Production"
Means all production stages, such as: product engineering, manufacture, integration, assembly (mounting), inspection, testing, quality assurance.

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

"Pulse compression"
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"
Duration of a "laser" pulse measured at Full Width Half Intensity (FWHI) levels.

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

"Radar frequency agility"
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"
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.

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

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

"Required"
As applied to "technology", refers to only that portion of "technology" which is peculiarly GTN responsible for achieving or exceeding the controlled performance levels, characteristics or functions. Such "required" "technology" may be shared by different products.

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

"Riot control agents"
Substances which produce temporary irritating or disabling physical effects which disappear within minutes of removal from exposure. There is no significant risk of permanent injury and medical treatment is rarely required.

"Robot"

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

a. Is multifunctional;

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

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

d. Has "user-accessible programmability" by means of the 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"

A process to reduce a stream or pool of molten metal to droplets to a diameter of 500 µm or less by centrifugal force.

"Run out" (out-of-true running)

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)

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.

"SDH"

"SDH" is equivalent to "Synchronous Digital Hierarchy".

"Settling time"

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"

"SHPL" is equivalent to "Super High Power Laser".

"Signal analysers"

Apparatus capable of measuring and displaying basic properties of the single-frequency components of multi-frequency signals.

"Signal processing"

The processing of externally derived information-bearing signals byalgorithms such as time compression, filtering, extraction, selection, correlation, convolution or transformations between domains (e.g., fast Fourier transform or Walsh transform).

"Software"

A collection of one or more "programmes" or "microprogrammes" fixed in any tangible medium of expression.

"Solidify rapidly"

A process involving the solidification of molten material at cooling rates exceeding 1,000 K/sec.

"SONET"

"SONET" is equivalent to "Synchronous Optical Network"

"Source code"

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"

Active and passive satellites and space probes.

"Space qualified"

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

"Spectral efficiency"

A figure of merit parameterized to characterize the efficiency of .ransmission system which uses complex modulation schemes such as QAM, Trellis coding, QSPK (Q-phased shift key), etc. It is defined as follows:

$$\text{"Spectral efficency"} = \frac{\text{"Digital transfer rate"(bits/sec)}}{\text{6 dB spectrum bandwidth (Hz)}}$$

"Splat quenching"

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

"Spread spectrum"

The technique whereby energy in a relatively narrow-band communication channel is spread over a much wider energy spectrum.

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

"Stability"

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

"Stored programme controlled"

A control using instructions stored in an electronic storage which a processor can execute in order to direct the performance of predetermined functions.

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

"Substrate"

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

"Substrate blanks"

Monolithic compounds with dimensions suitable for the production of optical elements such as mirrors or optical windows.

"Superalloy"

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"

Refers to materials,(i.e., metals, alloys or compounds) which can lose all electrical resistance (i.e., which can attain infinite electrical conductivity and carry very large electrical currents without Joule heating).

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")

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"

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.

"Switch fabric"

That hardware and associated "software" which provides the physical or virtual connection path for in-transit message traffic being switched.

"Synchronous Digital Hierarchy"

A digital hierarchy providing a means to manage, multiplex and access various forms of digital traffic using a synchronous transmission format on different types of media. The format is based on the Synchronous Transport Module (STM) which is defined by CCITT Recommendation G.703, G.707, G.708, G.709 and others yet to published. The first level rate of "SDH" is 155.52 Mbit/s.

"Synchronous Optical Network"

A network providing a means to manage, multiplex and access various forms of digital traffic using a synchronous transmission format on fibre optics. The format is the North America version of "SDH" and also uses the Synchronous Transport Module (STM). However, it uses the Synchronous Transport Signal (STS) as the basic transport module with a first level rate of 51.81 Mbit/s. (The "SONET" standards are being integrated into those of "SDH").

"System tracks"

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"

A computer where the flow and modification of the data is dynamically controllable at the logic gate level by the user.

"Tear gases"

Gases which produce temporary irritating or disabling effects which disappear within minutes of removal from exposure.

"Technology"

Specific information necessary for the "development", "production" or "use" of a product. The information takes the form of "technical data" or "technical assistance". Controlled "technology" is defined in the General Technology Note and in the Dual-Use List.

N.B.1:

"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.

N.B.2:

"Technical assistance" may take forms such as instruction, skills, training, working knowledge, consulting services. "Technical assistance" may involve transfer of "technical data".

"Terminal interface equipment"

Equipment at which information enters or leaves the telecommunication system, e.g., telephone, data device, computer, facsimile device.

"Three dimensional Vector Rate"

The number of vectors generated per second which have 10 pixel poly line vectors, clip tested, randomly oriented, with either integer or floating point X-Y-Z coordinate values (whichever produces the maximum rate).

"Tilting spindle"

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"

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).

"Total control of flight"

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"

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

"Transfer laser"

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"

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".

"Use"

Operation, installation (including on-site installation), maintenance (checking), repair, overhaul and refurbishing.

"User-accessible programmability"

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.

"Vacuum atomisation"

A process to reduce a molten stream of metal to droplets of a diameter of 500 µm or less by the rapid evolution of a dissolved gas upon exposure to a vacuum.

"Variable geometry airfoils"

Use trailing edge flaps or tabs, or leading edge slats or pivoted nose droop, the position of which can be controlled in flight.

Acronyms and Abbreviations in Groups 1 and 2

ABEC	Annular Bearing Engineers Committee
AGMA	American Gear Manufacturers' Association
AHRS	attitude and heading reference systems
ALU	arithmetic logic unit
ATC	air traffic control
C^3I	command, communications, control & intelligence
CAD	computer-aided-design
CDU	control and display unit
CEP	circular error probable
CNTD	controlled nucleation thermal deposition
CVD	chemical vapour deposition
CW	chemical warfare
CW (for lasers)	continuous wave
DEW	directed energy weapon systems
DME	distance measuring equipment
DS	directionally solidified
EB-PVD	electron beam physical vapour deposition
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
EMCDB	elastomer modified cast double based propellants
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
IFOV	instantaneous-field-of-view
ILS	instrument landing system
IRIG	inter-range instrumentation group
ISAR	inverse synthetic aperture radar
ISO	International Standards Organization
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)
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
RPV	remotely piloted air vehicles
SACMA	Suppliers of Advanced Composite Materials Association
SAR	synthetic aperture radar
SC	single crystal
SLAR	sidelooking airborne radar
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
UTS	ultimate tensile strength
VOR	very high frequency omni-directional range
YAG	yttrium/aluminum garnet

Group 3 – Nuclear Non-Proliferation List

Note:
Terms in "double quotation marks" are defined terms. Refer to "Definition of the Terms used in Groups 3 and 4" on pages 78 and 79.

3000. "Technology"

"Technical data" including, but not limited to, technical drawings, models, photographic negatives and prints, recordings, design data and technical and operating manuals whether in written form or recorded on other media or devices such as disk, tape and read-only memories for the design, production, construction, operation or maintenance of any item in this Group, except data available to the public (e.g., in published books or periodicals, or that which has been made available without restrictions upon its further dissemination).

3001. Special fissionable material

Special fissionable materials, as follows:

1. plutonium and all isotopes, alloys and compounds and any material that contains any of the foregoing, other than plutonium 238 that is contained in heart pace-makers;
2. uranium 233, uranium enriched in the isotopes 235 or 233 and all alloys and compounds and any material that contains any of the foregoing.

3002. Source material

Source materials that are in any form, including ore, concentrate, compound, metal or alloy, or that are incorporated in any substance other than medicinals and in which the concentration of source material is greater than 0.05 weight per cent, as follows:

1. uranium that contains the mixture of isotopes that occurs in nature;
2. uranium that is depleted in the isotope 235; **and**
3. thorium.

3003. Deuterium

Deuterium and compounds, containing deuterium, including heavy water in which the ratio of deuterium atoms to hydrogen atoms is greater than 1 part to 5,000 parts by number.

3006. Nuclear-grade Graphite

Graphite having a purity level better than 5 parts per million boron equivalent and with a density greater than 1.50 g/cm^3.

3012. Tritium, tritium plants and especially designed and prepared equipment therefor, including:

1. Tritium and tritium compounds and mixtures containing tritium in which the ratio of tritium to hydrogen by atoms exceeds 1 part in 1000 and products that contain one or more of the foregoing.
2. Plants for the production, recovery, extraction, concentration, or handling of tritium and its compounds and mixtures and especially designed and prepared equipment therefor.

3100. Component parts for especially designed or prepared equipment included in Items 3101. to 3107.

3101. Nuclear reactors and especially designed or prepared equipment therefor including:

1. **Reactor pressure vessels**
   Metal vessels, as complete units or as major shop-fabricated parts therefor, which are especially designed or prepared to contain the core of a nuclear reactor and are capable of withstanding the operating pressure of the primary coolant;
2. **Reactor fuel charging and discharging machines**
   Manipulative equipment especially designed or prepared for inserting or removing fuel in a nuclear reactor and are capable of on-load operation or employing technically sophisticated positioning or alignment features to allow complex off-load fuelling operations such as those in which direct viewing of or access to the fuel is not normally available;
3. **Reactor control rods**
   Rods especially designed or prepared for the control of the reaction rate in a nuclear reactor;
4. **Reactor pressure tubes**
   Tubes which are especially designed or prepared to contain fuel elements and the primary coolant in a nuclear reactor at an operating pressure in excess of 5.1 MPa (740 psi);
5. **Zirconium tubes**
   Zirconium metal and alloys in the form of tubes or assemblies of tubes especially designed or prepared for use in a nuclear reactor, and in which the relation of hafnium to zirconium is less than 1:500 parts by weight;
6. **Primary coolant pumps**
   Pumps especially designed or prepared for circulating the primary coolant for nuclear reactors;
7. **Reactor internals**
   Reactor internals including core support structures, thermal shields, baffles, core grid plates and diffuser plates.

3103. Plants for the reprocessing of irradiated fuel elements, and equipment especially designed or prepared therefor including:

1. **Irradiated fuel element chopping machines**
   Remotely operated equipment especially designed or prepared for use in a reprocessing plant and intended to cut, chop or shear irradiated nuclear fuel assemblies, bundles or rods;
2. **Dissolvers**
   Critically safe tanks (e.g. small diameter, annular or slab tanks) especially designed or prepared for use in a reprocessing plant intended for dissolution of irradiated nuclear fuel and which are capable of withstanding hot, highly corrosive liquid, and which can be remotely loaded and maintained;
3. **Solvent extractors and solvent extraction equipment**
   Especially designed or prepared solvent extractors such as packed or pulse columns, mixer settlers or centrifugal contactors for use in a plant for the reprocessing of irradiated fuel;

3103. con't

4. **Chemical holding or storage vessels**
   Especially designed or prepared holding or storage vessels for use in a plant for the reprocessing of irradiated fuel;
5. **Plutonium nitrate to oxide conversion system**
   Complete systems especially designed or prepared for the conversion of plutonium nitrate to plutonium oxide, in particular adapted so as to avoid criticality and radiation effects and to minimize toxicity hazards;
6. **Plutonium oxide to metal production system**
   Complete systems especially designed or prepared for the production of plutonium metal, in particular adapted so as to avoid criticality and radiation effects and to minimize toxicity hazards.

3104. Plants for the fabrication of fuel elements and equipment especially designed or prepared therefor, including equipment that:

1. a. Normally comes in direct contact with, or directly processes, or controls, the production flow of nuclear material;
   b. Seals the nuclear material within the cladding;
   c. Checks the integrity of the cladding or the seal; **or**
   d. Checks the finish treatment of the solid fuel.

3105. Plants for the separation of isotopes of uranium and equipment, other than analytical instru-ments, especially designed or prepared therefor including:

1. **Gas centrifuges and assemblies and components especially designed or prepared for use in gas centrifuges including:**
   a. **Rotating components**
      1. Complete rotor assemblies:
         Thin-walled cylinders, or a number of interconnected thin-walled cylinders, manufac-tured from one or more high strength to density ratio materials;
      2. Rotor tubes:
         Especially designed or prepared thin-walled cylinders with thickness of 12 mm (0.5 in) or less, a diameter of between 75 mm (3 in) and 400 mm (16 in), and manufactured from one or more high strength to density ratio materials;
      3. Rings or Bellows:
         Especially designed or prepared components giving localized support to the rotor tube or to join together a number of rotor tubes. The bellows is a short cylinder of wall thickness 3 mm (0.12 in) or less, a diameter of between 75 mm (3 in) and 400 mm (16 in), having a convolute, and manufactured from high strength to density ratio materials;
      4. Baffles:
         Disc-shaped components of between 75 mm (3 in) and 400 mm (16 in) diameter especially designed or prepared to be mounted inside the centrifuge rotor tube, in order to isolate the take-off chamber from the main separation chamber and, in some cases, to assist the UF_6 gas circulation within the main separation chamber of the rotor tube, and manufactured high strength to density ratio materials;
      5. Top caps/Bottom caps:
         Disc-shaped components of between 75 mm (3 in) and 400 mm (16 in) diameter especially designed or prepared fit to the ends of the rotor tube, and so contain the UF_6 within the rotor tube, and in some cases to support, retain or contain as an integrated part an element of the upper bearing (top cap) or to carry the rotating elements of the motor and lower bearing (bottom cap), and manufactured from high strength to density ratio materials;
   b. **Static components**
      1. Magnetic suspension bearings:
         Especially designed or prepared bearing assemblies consisting of an annular magnet suspended within a housing containing a damping medium. The housing will be manufactured from a UF_6-resistant material. The magnet may be ring-shaped;
      2. Bearings/Dampers:
         Especially designed or prepared bearings comprising a pivot/cup assembly mounted on a damper. The pivot is normally a hardened steel shaft with a hemisphere at one end. The cup is pellet-shaped with a hemisphere indentation in one surface;
      3. Molecular pumps:
         Especially designed or prepared cylinders having internally machined or extruded helical grooves and internally machined bores. Typical dimensions are as follows: 75 mm (3 in) to 400 mm (16 in) internal diameter, 10 mm (0.4 in) or more wall thickness, with the length equal to or greater than the diameter;
      4. Motors stators:
         Especially designed or prepared ring-shaped stators for high speed multiphase AC hysteresis (or reluctance) motors for synchronous operation within a vacuum in the frequency range of 600-2000 Hz and a power range of 50-1000 VA;
      5. Centrifuge housing/recipients:
         Components especially designed or prepared for containing the rotor tube assembly of a gas centrifuge. The housing consists of a rigid cylinder of wall thickness up to 30 mm (1.2 in) with precision machined ends to locate the bearings and with one or more flanges for mounting;
      6. Scoops:
         Especially designed or prepared tubes of up to 12 mm (0.5 in) internal diameter for the extraction of UF_6 gas from within the rotor tube by a Pitot tube action (that is, with an aperture facing into the circumferential gas flow within the rotor tube, for example by bending the end of a radially disposed tube) and capable of being fixed to the central gas extraction system.

2. **Especially designed or prepared auxiliary systems, equipment and components for gas centrifuge enrichment plants including:**
   a. **Feed systems/product and tails withdrawal systems**
      Especially designed or prepared process systems including:
      1. Feed autoclaves (or stations), used for passing UF_6 to the centrifuge cascades at up to 100 kPa (15 psi) and at a rate of 1 kg/h or more;

2. Desublimers (or cold traps) used to remove UF_6 from the cascades at up to 3 kPa (0.5 psi) pressure. The desublimers are capable of being chilled to 203 K (-70°C) and heated to 343 K (70°C);
3. Product and tails stations used for trapping UF_6 into containers;

b. **Machine header piping systems**
Especially designed or prepared piping systems and header systems for handling UF_6 within the centrifuge cascades. The piping network is normally of the triple header system with each centrifuge connected to each of the headers;

c. **UF_6 mass spectrometers/ion sources**
Especially designed or prepared magnetic or quadrupole mass spectrometers capable of taking on-line samples of feed, product or tails, from UF_6 gas streams and having all of the following characteristics:
1. Unit resolution for atomic mass unit greater than 320;
2. Ion sources constructed of or lined with nichrome or monel or nickel-plated;
3. Electron bombardment ionization sources; **and**
4. A collector system suitable for isotopic analysis.

d. **Frequency changers**
Frequency changers (also known as converters or invertors) especially designed or prepared to supply motor stators as defined under 3105.a.2(d), or parts, components and sub-assemblies of such frequency changers having all of the following characteristics:
1. A multiphase output of 600 to 2000 Hz;
2. High stability (with frequency control better than 0.1%);
3. Low harmonic distortion (less than 2%); **and**
4. An efficiency of greater than 80%.

3. Especially designed or prepared assemblies and components for use in gaseous diffusion enrichment including:

a. 1. **Gaseous diffusion barriers**
Especially designed or prepared thin, porous filters, with a pore size of 100-1,000 A (angstroms), a thickness of 5 mm (0.2 in) or less and for tubular forms, a diameter of 25 mm (1 in) or less;

2. **Especially prepared compounds or powders for the manufacture of such filters**
Such compounds and powders include nickel or alloys containing 60 per cent or more nickel, aluminium oxide, or UF_6-resistant fully fluorinated hydrocarbon polymers having a purity of 99.9 per cent or more, a particle size less than 10 microns, and a high degree of particle size uniformity, which are especially prepared for the manufacture of gaseous diffusion barriers;

b. **Diffuser housings**
Especially designed or prepared hermetically sealed cylindrical vessels greater than 300 mm (12 in) in diameter and greater than 900 mm (35 in) in length, or rectangular vessels of comparable dimensions, which have an inlet connection and two outlet connections all of which are greater than 50 mm (2 in) in diameter, for containing the gaseous diffusion barrier and designed for horizontal or vertical installation;

c. **Compressors and gas blowers**
Especially designed or prepared axial, centrifugal, or positive displacement compressors, or gas blowers with a suction volume capacity of 1 m^3/min or more UF_6 and with a discharge pressure of up to several hundred kPa (100 psi), designed for long-term operation in the UF_6 environment with or without an electrical motor of appropriate power, as well separate assemblies of such compressors and gas blowers. These compressors and gas blowers have a pressure ratio between 2:1 and 6:1;

d. **Rotary shaft seals**
Especially designed or prepared vacuum seals, with seal feed and seal exhaust connections, for sealing the shaft connecting the compressor or the gas blower rotor with the driver motor so as to ensure a reliable seal against in-leaking of air into the inner chamber of the compressor or gas blower which is filled with UF_6. Such seals are normally designed for a buffer gas in-leakage rate of less than 1000 cm^3/min (60 in3/min);

e. **Heat exchangers for cooling UF_6**
Especially designed or prepared heat exchangers intended for a leakage pressure change rate of less than 10 Pa (0.0015 psi) per hour under a pressure difference of 100 kPa (15 psi).

4. Especially designed or prepared auxiliary systems, equipment and components for use in gaseous diffusion enrichment including:

a. **Feed systems/product and tails withdrawal systems**
Especially designed or prepared process systems, capable of operating at pressures of 300 kPa (45 psi) or less, including:
1. Feed autoclaves (or systems), used for passing UF_6 to the gaseous diffusion cascades;
2. Desublimers (or cold traps) used to remove UF_6 from diffusion cascades;
3. Liquefaction stations where UF_6 gas from the cascade is compressed and cooled to form liquid UF_6;
4. Products and tails stations used for transferring UF_6 into containers;

b. **Header piping systems**
Especially designed or prepared piping systems and header systems for handling UF6 within the gaseous diffusion cascades. This piping network is normally of the double header system with each cell connected to each of the headers;

c. **Vacuum systems**
1. Especially designed or prepared large vacuum manifolds, vacuum headers and vacuum pumps having a suction capacity of 5 m^3/min (175 ft3/min) or more;
2. Vacuum pumps especially designed or prepared for service in UF_6 bearing atmospheres. These pumps may be either rotary or positive, may have displacement and fluorocarbon seals, and may have special working fluids present;

d. **Special shut-off and control valves**
Especially designed or prepared manual or automated shut-off and control bellows valves with a diameter of 40 to 1500 mm (1.5 to 59 in) for installation in main and auxiliary systems of gaseous diffusion enrichment plants;

e. **UF_6 mass spectrometers/ion sources**
Especially designed or prepared magnetic or quadrupole mass spectrometers capable of taking on-line samples or feed, product or tails, from UF_6 gas streams and having all of the following characteristics:
1. Unit resolution for atomic mass unit greater than 320;
2. Ion sources constructed of or lined with nichrome or monel or nickel-plated;
3. Electron bombardment ionization sources; **and**
4. A collector system suitable for isotopic analysis.

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5. Especially designed or prepared systems, equipment and components for use in aerodynamic enrichment plants including

a. **Separation nozzles**
Especially designed or prepared separation nozzles and assemblies thereof. The separation nozzles consist of slit-shaped, curved channels having a radius of curvature less than 1 mm (typically 0.1 to 0.05 mm), and having a knife-edge within the nozzle that separates the gas flowing through the nozzle into two fractions;

b. **Vortex tubes**
Especially designed or prepared vortex tubes and assemblies thereof. The vortex tubes are cylindrical or tapered, having a diameter of between 0.5 cm and 4 cm, a length to diameter ratio of 20:1 or less, one or more tangential inlets and may be equipped with nozzle-type appendages;

c. **Compressors and gas blowers**
Especially designed or prepared axial, centrifugal or positive displacement compressors or gas blowers with a suction volume capacity of 2 m^3/min or more of UF_6/carrier gas (hydrogen or helium) mixture;

d. **Rotary shaft seals**
Especially designed or prepared rotary seals, with seal feed and seal exhaust connections, for sealing the shaft connecting the compressor rotor or the gas blower rotor with the driver motor so as to ensure a reliable seal against out-leakage of process gas or in-leakage of air or seal gas into the inner chamber of the compressor or gas blower which is filled with a UF_6/carrier gas mixture;

e. **Heat exchangers for gas cooling**
Heat exchangers made of or protected by materials resistant to corrosion by UF_6;

f. **Separation element housings**
Especially designed or prepared separation element housings containing vortex tubes or separation nozzles;

g. **Feed systems/product and tails withdrawal systems**
Especially designed or prepared process systems or equipment including:
1. Feed autoclaves, ovens, or systems used for passing UF_6 to the enrichment process;
2. Desublimers (or cold traps) used to remove UF_6 from the enrichment process for subsequent transfer upon heating;
3. Solidification or liquefaction stations used to remove UF_6 from the enrichment process by compressing and converting UF_6 to a liquid or solid form;
4. Product or tails stations used for transferring UF_6 into containers;

h. **Header piping systems**
Especially designed or prepared header piping systems for handling UF_6 within the aerodynamic cascades. This piping network is normally of the double header design with each stage or group of stages connected to each of the headers;

i. **Vacuum systems and pumps**
1. Especially designed or prepared vacuum systems having a suction capacity of 5 m^3/min or more, consisting of vacuum manifolds, vacuum headers and vacuum pumps;
2. Vacuum pumps especially designed or prepared for service in UF_6-bearing atmospheres and using fluorocarbon seals and special working fluids;

j. **Special shut-off and control valves**
Especially designed or prepared manual or automated shut-off and control bellows valves with a diameter of 40 to 1500 mm for installation in main and auxiliary systems of aerodynamic enrichment plants;

k. **UF_6 mass spectrometers/ion sources**
Especially designed or prepared magnetic or quadrupole mass spectrometers capable of taking on-line samples of feed, product or tails from UF_6 gas streams and having all of the following characteristics:
1. Unit resolution for mass greater than 320;
2. Ion sources constructed of or lined with nichrome or monel or nickel-plated;
3. Electron bombardment ionization sources; **and**
4. A collector system suitable for isotopic analysis;

l. **UF_6/carrier gas separation systems**
Especially designed or prepared process systems for separating UF_6 from carrier gas (hydrogen or helium).

6. Especially designed or prepared systems, equipment and components for use in chemical exchange or ion exchange enrichment plants including:

a. **Liquid-liquid exchange columns (Chemical exchange)**
Contercurrent liquid-liquid exchange columns having mechanical power input (i.e., pulsed columns with sieve plates, reciprocating plate columns, and columns with internal turbine mixers), especially designed or prepared for uranium enrichment using the chemical exchange process. The stage residence time of the columns is designed to be short (30 seconds or less);

b. **Liquid-liquid centrifugal contactors (Chemical exchange)**
Liquid-liquid centrifugal contactors especially designed or prepared for uranium enrichment using the chemical exchange process. Such contactors use rotation to achieve dispersion of the organic and aqueous streams and then centrifugal force to separate the phases. The stage residence time of the centrifugal contactors is designed to be short (30 seconds or less);

c. **Uranium reduction systems and equipment (Chemical exchange)**
1. Especially designed or prepared electrochemical reduction cells to reduce uranium from one valence state to another for uranium enrichment using the chemical exchange process;
2. Especially designed or prepared systems at the product end of the cascade for taking the U+4 out of the organic stream, adjusting the acid concentration and feeding to the electrochemical reduction cells;

d. **Feed preparation systems (Chemical exchange)**
Especially designed or prepared systems for producing high-purity uranium chloride feed solutions for chemical exchange uranium isotope separation plants;

e. **Uranium oxidation systems (Chemical exchange)**
Especially designed or prepared systems for oxidation of U+3 to U+4 for return to the uranium isotope separation cascade in the chemical exchange enrichment process;

f. **Fast-reacting ion exchange resins/adsorbents (ion exchange)**
Fast-reacting ion-exchange resins or adsorbents especially designed or prepared for uranium enrichment using the ion exchange process, including porous macroreticular resins, and/or pellicular structures in which the active chemical exchange groups are limited to a coating on the surface of an inactive porous support structure, and other composite structures in any suitable form including particles or fibers. These ion exchange resins/adsorbents have diameters of 0.2 mm or less and are physically strong enough so as not to degrade in the exchange columns. The resins/adsorbents are especially designed to achieve very fast uranium isotope exchange kinetics (exchange rate half-time of less than 10 seconds) and are capable of operating at a temperature in the range of 100° C to 200° C;

g. **Ion exchange columns (Ion exchange)**
Cylindrical columns greater than 1000 mm in diameter for containing and supporting packed beds of ion exchange resin/absorbent, especially designed or prepared for uranium enrichment using the ion exchange process. These columns are capable of operating at a temperature in the range of 100° C to 200° C and pressures above 0.7 MPa (102 psia);

h. **Ion exchange reflux systems (Ion exchange)**
1. Especially designed or prepared chemical or electrochemical reduction systems for regeneration of the chemical reducing agent(s) used in ion exchange uranium enrichment cascades;
2. Especially designed or prepared chemical or electrochemical oxidation systems for regeneration of the chemical oxidizing agent(s) used in ion exchange uranium enrichment cascades.

7. **Especially designed or prepared systems, equipment and components for use in laser-based enrichment plants including:**

a. **Uranium vaporization systems (AVLIS)**
Especially designed or prepared uranium vaporization systems which contain high-power strip or scanning electron beam guns with a delivered power on the target of more than 2.5 kW/cm;

b. **Liquid uranium metal handling systems (AVLIS)**
Especially designed or prepared liquid metal handling systems for molten uranium or uranium alloys, consisting of crucibles and cooling equipment for the crucibles;

c. **Uranium metal product and tails collector assemblies (AVLIS)**
Especially designed or prepared product and tails collector assemblies for uranium metal in liquid or solid form;

d. **Separator module housings (AVLIS)**
Especially designed or prepared cylindrical or rectangular vessels for containing the uranium metal vapor source, the electron beam gun, and the product and tails collectors;

e. **Supersonic expansion nozzles (MLIS)**
Especially designed or prepared supersonic expansion nozzles for cooling mixtures of UF_6 and carrier gas to 150 K or less;

f. **Uranium pentafluoride product collectors (MLIS)**
Especially designed or prepared uranium pentafluoride (UF_5) solid product collectors consisting of filter, impact, or cyclone-type collectors, or combinations thereof;

g. **UF_6/carrier gas compressors (MLIS)**
Especially designed or prepared compressors for UF_6/carrier gas mixtures, designed for long term operation in a UF_6 environment;

h. **Rotary shaft seals (MLIS)**
Especially designed or prepared rotary shaft seals, with seal feed and seal exhaust connections, for sealing the shaft connecting the compressor rotor with the driver motor so as to ensure a reliable seal against out-leakage of process gas or in-leakage of air or seal gas into the inner chamber of the compressor which is filled with a UF_6/carrier gas mixture;

i. **Fluorination systems (MLIS)**
Especially designed or prepared systems for fluorinating UF_5 (solid) to UF_6 (gas);

j. **UF_6 mass spectrometers/ion sources (MLIS)**
Especially designed or prepared magnetic or quadrupole mass spectrometers capable of taking on-line samples of feed, product or tails from UF_5 gas streams and having all of the following characteristics:
1. Unit resolution for mass greater than 320;
2. Ion sources constructed of or lined with nichrome or monel or nickel-plated;
3. Electron bombardment ionization sources; **and**
4. A collector system suitable for isotopic analysis;

k. **Feed systems/product and tails withdrawal systems (MLIS)**
Especially designed or prepared process systems or equipment including:
1. Feed autoclaves, ovens, or systems used for passing UF_6 to the enrichment process;
2. Desublimers (or cold traps) used to remove UF_6 from the enrichment process for subsequent transfer upon heating;
3. Solidification or liquefaction stations used to remove UF_6 from the enrichment process by compressing and converting UF_6 to a liquid or solid form;
4. Product or tails stations used for transferring UF_6 into containers;

l. **UF_6/carrier gas separation systems (MLIS)**
Especially designed or prepared process systems for separating UF_6 from carrier gas. The carrier gas may be nitrogen, argon, or other gas;

m. **Laser systems (AVLIS, MLIS and CRISLA)**
Lasers or laser systems especially designed or prepared for the separation of uranium isotopes.

8. **Especially designed or prepared systems, equipment and components for use in plasma separation enrichment plants including:**

a. **Microwave power sources and antennae**
Especially designed or prepared microwave power sources and antennae for producing or accelerating ions and having the following characteristics: greater than 30 GHz frequency and greater than 50 kW mean power output for ion production;

b. **Ion excitation coils**
Especially designed or prepared radio frequency ion excitation coils for frequencies of more than 100 kHz and capable of handling more than 40 kW mean power;

c. **Uranium plasma generation systems**
Especially designed or prepared systems for the generation of uranium plasma, which may contain high-power strip or scanning electron beam guns with a delivered power on the target of more than 2.5 kW/cm;

d. **Liquid uranium metal handling systems**
Especially designed or prepared liquid metal handling systems for molten uranium or uranium alloys, consisting of crucibles and cooling equipment for the crucibles;

e. **Uranium metal product and tails collector assemblies**
Especially designed or prepared product and tails collector assemblies for uranium metal in solid form;

f. **Separator module housings**
Especially designed or prepared cylindrical vessels for use in plasma separation enrichment plants for containing the uranium plasma source, radio-frequency drive coil and the product and tails collectors.

9. **Especially designed or prepared systems, equipment and components for use in electromagnetic enrichment plants including:**

a. **Electromagnetic isotope separators**
Especially designed or prepared electromagnetic isotope separators for the separation of uranium isotopes, and equipment and components therefor, including:

1. Ion sources
Especially designed or prepared single or multiple uranium ion sources consisting of a vapor source, ionizer, and beam accelerator, constructed of suitable materials such as graphite, stainless steel, or copper, and capable of providing a total ion beam current of 50 mA or greater;

2. Ion collectors
Collector plates consisting of two or more slits and pockets especially designed or prepared for collection of enriched and depleted uranium ion beams;

3. Vacuum housings
Especially designed or prepared vacuum housings for uranium electromagnetic separators and designed for operation at pressures of 0.1 Pa or lower;

4. Magnet pole pieces
Especially designed or prepared magnet pole pieces having a diameter greater than 2 m used to maintain a constant magnetic field within an electromagnetic isotope separator and to transfer the magnetic field between adjoining separators;

b. **High voltage power supplies**
Especially designed or prepared high-voltage power supplies for ion sources, having all of the following characteristics: capable of continuous operation, output voltage of 20,000 V or greater, output current of 1 A or greater, and voltage regulation of better than 0.01% over a time period of 8 hours;

c. **Magnet power supplies**
Especially designed or prepared high-power, direct current magnet power supplies having all of the following characteristics: capable of continuously producing a current output of 500 A or greater at a voltage of 100 V or greater and with a current or voltage regulation better than 0.01% over a period of 8 hours.

3106. Plants for the production of heavy water, deuterium and deuterium compounds and equipment especially designed or prepared therefor including:

1. **Water-Hydrogen Sulphide Exchange Towers**
Exchange towers fabricated from fine carbon steel (such as ASTM A516) with diameters of 6 m (20 ft) to 9 m (30 ft), capable of operating at pressures greater than or equal to 2 MPa (300 psi) and with a corrosion allowance of 6 mm or greater, especially designed or prepared for heavy water production utilizing the water-hydrogen sulphide exchange process;

2. **Blowers and Compressors**
Single stage, low head (i.e. 0.2 MPa or 30 psi) centrifugal blowers or compressors for hydrogen-sulphide gas circulation (i.e., gas containing more than 70% H_2S) especially designed or prepared for heavy water production utilizing the water-hydrogen sulphide exchange process. These blowers or compressors have a throughput capacity greater than or equal to 56 m^3/second (120,000 SCFM) while operating at pressures greater than or equal to 1.8 MPa (260 psi) suction and have seals designed for wet H_2S service;

3. **Ammonia-Hydrogen Exchange Towers**
Ammonia-hydrogen exchange towers greater than or equal to 35 m (114.3 ft) in height with diameters of 1.5 m (4.9 ft) to 2.5 m (8.2 ft) capable of operating at pressures greater than 15 MPa (2225 psi) especially designed or prepared for heavy water production utilizing the ammonia-hydrogen exchange process. These towers also have at least one flanged, axial opening of the same diameter as the cylindrical part through which the tower internals can be inserted or withdrawn;

4. **Tower Internals and Stage Pumps**
Tower internals and stage pumps especially designed or prepared for towers for heavy water production utilizing the ammonia-hydrogen exchange process. Tower internals include especially designed stage contactors which promote intimate gas/liquid contact. Stage pumps include especially designed submersible pumps for circulation of liquid ammonia within a contacting stage internal to the stage towers;

5. **Ammonia Crackers**
Ammonia crackers with operating pressures greater than or equal to 3 MPa (450 psi) especially designed or prepared for heavy water production utilizing the ammonia-hydrogen exchange process;

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

7. **Catalytic Burners**
Catalytic burners for the conversion of enriched deuterium gas into heavy water especially designed or prepared for heavy water production utilizing the ammonia-hydrogen exchange process.

3107. Plants for the conversion of uranium and equipment especially designed or prepared therefor including:

1. **Especially designed or prepared systems for the conversion of uranium ore concentrates to UO_3;**
2. **Especially designed or prepared systems for the conversion of UO_3 to UF_6;**
3. **Especially designed or prepare systems for the conversion of UO_3 to UO_2;**
4. **Especially designed or prepared systems for the conversion of UO_2 to UF_4;**
5. **Especially designed or prepared systems for the conversion of UF_4 to UF_6;**
6. **Especially designed or prepared systems for the conversion of UF_4 to U metal;**
7. **Especially designed or prepared systems for the conversion of UF_6 to UO_2;**
8. **Especially designed or prepared systems for the conversion of UF_6 to UF_4.**

Group 4 – Nuclear-Related Dual Use List

Note:
Terms in "double quotation marks" are defined terms. Refer to 'Definition of the Terms used in Groups 3 and 4' on pages 78 and 79.

4000. "Technology"

Specific information required for the "development", "production", or "use" of any item contained in the List, including "technical data" or "technical assistance" but excluding data available to the public (e.g., in published books or periodicals, or that which has been made available without restrictions upon its further dissemination).

4501. Industrial equipment

1. Flow-forming machines and spin-forming machines capable of flow-forming functions, and mandrels, as follows, and specially designed software therefor:
   a. 1. Having three or more rollers (active or guiding), **and**
      2. 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 (3 in.) and 400 mm (16 in.).
      Note:
      This entry 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.

2. "Numerical control" units, "numerical controlled" machine tools, and specially designed "software" as follows:
   a. "Numerical control" units containing "software" controlled by 4501.2.c.2.;
   b. Machine tools, as follows, for removing or cutting metals, ceramics, or composites, which, according to the manufacturer's technical specifications, can be equipped with electronic devices for simultaneous "contouring control" in two or more axes:
      1. Machine tools for turning, that have "positioning accuracies" with all compensations available less (better) than 0.006 mm along any linear axis (overall positioning) for machines capable of machining diameters greater than 35 mm;
         Note:
         Bar machines (Swissturn), limited to machining only bar feed thru, are excluded 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.

      2. Machine tools for milling, having any of the following characteristics:
         a) "Positioning accuracies" with all compensations available are less (better) than 0.006 mm along any linear axis (overall positioning); **or**
         b) Two or more contouring rotary axes;
         Note:
         This 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 0.030 mm.

      3. Machine tools for grinding, having any of the following characteristics:
         a) "Positioning accuracies" with all compensations available are less (better) than 0.004 mm along any linear axis (overall positioning); **or**
         b) Having two or more contouring rotary axes;
         Note:
         The following grinding machines are excluded:
         a) Cylindrical external, internal, and external-internal grinding machines having all the following characteristics:
            (1) Limited to cylindrical grinding
            (2) A maximum workpiece outside diameter or length of 150 mm
            *(3) Not more than two axes that can be coordinated simultaneously for "contouring control"; **and***
            (4) No contouring c axis
         b) Jig grinders with axes limited to x, y, c, and a, where c axis is used to maintain the grinding wheel normal to the work surface, and the a axis is configured to grind barrel cams.
         c) Tool or cutter grinding machines with "software" specially designed for the production of tools or cutters;
         d) Crankshaft or camshaft grinding machines.

      4. Non-wire type Electrical Discharge Machines (EDM) that have two or more contouring rotary axes and that can be coordinated simultaneously for "contouring control";
         Note:
         Guaranteed "positioning accuracy" levels instead of individual test protocols may be used for each machine tool model using the agreed ISO test procedure.
         Technical Notes:
         1. Axis nomenclature shall be in accordance with International Standard ISO 841,'Numerical Control Machines - Axis and Motion Nomenclature'.
         2. Not counted in the total number of contouring rotary axes are secondary parallel contouring rotary axes the center line of which is parallel to the primary rotary axis,
         *3. Rotary axes do not necessarily have to rotate over 360 degrees. A rotary axis can be driven by a linear device, **e.g.**, a screw or a rack-and-pinion.*

   c. "Software"
      1. "Software" specially designed or modified for the "development", "production", or "use" of equipment controlled by 4501.2 a. or b. above;
      2. "Software" for any combination of electronic devices or system enabling such device(s) to function as a "numerical control" unit capable of controlling 5 or more interpolating axes that can be coordinated simultaneously for "contouring control".
      Note 1:
      "Software" is controlled whether exported separately or residing in a "numerical control" unit or any electronic device or system.
      Note 2:
      "Software" specially designed or modified by the manufacturers of the control unit or machine tool to operate an uncontrolled machine tool is not controlled.

3. Dimensional inspection machines, devices, or systems, as follows, specially designed software therefor.
   a. Computer controlled or numerically controlled dimensional inspection machines having both of the following characteristics:
      1. two or more axes; **and**
      2. a one dimensional length "measurement un-certainty" equal to or less (better) than $(1.25 + L/1000)$ µm tested with a probe of an "accuracy" of less (better) than 0.2 µm (L is the measured length in millimetres) (Ref: VDI/VDE 2617 parts 1 and 2);

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b. Linear and angular displacement measuring devices, as follows:

1. linear measuring instruments having any of the following characteristics:
   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 both of the following characteristics:
      (1) "linearity" equal to or less (better) than 0.1% within a measuring range up to 5 mm, **and**
      (2) drift equal to or less (better) than 0.1% per day at a standard ambient test room temperature ± 1 K; **or**
   c) measuring systems that have both of the following characteristics:
      (1) contain a "laser"; **and**
      (2) maintain for at least 12 hours, over a temperature range of ±1 K around a standard temperature and a standard pressure:
         (a) a "resolution" over their full scale of 0.1 µm or better; **and**
         (b) with a "measurement uncer-tainty" equal to or less (better) than (0.2+ L/2000) µm (L is the measured length in milli-metres); *except* measuring interferometer systems, without closed or open loop feedback, containing a "laser" to measure slide movement errors of machine tools, dimensional inspection machines, or similar equipment;
2. angular measuring instruments having an "angular position deviation" equal to or less (better) than 0.00025°;

Note:
Item 4501.3.b.2. does not control optical instruments, such as autocollimators, using collimated light to detect angular displacement of a mirror.

3. c. Systems for simultaneously linear-angular inspection of hemishells, having both of the following characteristics:
   1. "measurement uncertainty" along any linear axis equal to or less (better) than 3.5 µm per 5 mm; **and**
   2. "angular position deviation" equal to or less than 0.02°.

Note:
Specially designed software for the systems described in paragraph (c) of this item includes software for simultaneous measurements of wall thickness and contour.

Technical Notes:
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.*
2. *A machine described in this section, 4501.3, is controlled if it exceeds the control threshold anywhere within its operating range.*
3. *The probe used in determining the measurement uncertainty of a dimensional inspection system shall be as described in VDI/VDE 2617 parts 2, 3, and 4.*
4. *All parameters of measurement values in this item represent plus/minus, i.e. not total band.*

4. Vacuum or controlled environment (inert gas) induction furnaces capable of operation above 850° C and having induction coils 600 mm (24 inches) or less in diameter, and designed for power inputs of 5 kW or more; and power supplies specially designed therefor with a specified power output of 5 kW or more.

Technical Note:
This entry does not control furnaces designed for the production of semiconductor wafers.

5. "Isostatic presses" capable of achieving a maximum working pressure of 69 MPa or greater having a chamber cavity with an inside diameter in excess of 152 mm and specially designed dies, molds, controls or "specially designed software" therefor.

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.

6. "Robots" or "end-effectors" having either of the following characteristics; and "specially designed software" or specially designed controllers therefor:
   a. Specially designed to comply with national safety standards applicable to handling high explosives (for example, meeting electrical code ratings for high explosives); **or**
   b. Specially designed or rated as radiation hardened to withstand greater than 5×10^4 grays (Silicon) (5×10^6 rad (Silicon)) without operational degradation.

Technical notes:
"Robot" as described in item 4501.6.a. does not include robots specially designed for non-nuclear industrial applications such as automobile paint-spraying booths.

7. Vibration test systems, equipment components and software therefor, as follows:
   a. Electrodynamic vibration test systems, employing feedback or closed loop control techniques and incorporating a digital controller, capable of vibrating at 10 g RMS or more between 20 Hz and 2000 Hz and imparting forces of 50 kN (11,250 lbs) measured bare table, or greater;
   b. Digital controllers, combined with "specially designed software" for vibration testing, with a real-time bandwidth greater than 5 kHz and being designed for use with the systems controlled in 4501.7.a. above;
   c. Vibration thrusters (shaker units), with or without associated amplifiers, capable of imparting a force of 50 kN (11,250 lbs), measured bare table, or greater, which are usable for the systems controlled in 4501.7.a. above;
   d. Test piece support structures and electronic units designed to combine multiple shaker units into a complete shaker system capable of providing an effective combined force of 50 kN, measured bare table, or greater, which are usable for the systems controlled in 4501.7.a. above;
   e. "Specially designed software" for use with the system controlled in 4501.7.a. above or for the electronic units controlled in 4501.7.d. above.
8. Vacuum and controlled atmosphere metallurgical melting and casting furnaces as follows, and specially configured computer control and monitoring system and "specially designed software" therefor:
   a. Arc remelt and casting furnaces with consumable electrode capacities between 1000 cm^3 and 20,000 cm^3 and capable of operation with melting temperatures above 1700° C;

b. Electron beam melting and plasma atomization and melting furnaces with a power of 50 kW or greater and capable of operating with melting temperatures above 1200° C.

4502. Nuclear-related Dual-use Materials

1. Aluminum alloys capable of an ultimate tensile strength of 460 Mpa (.46 x 10^9N/m^2)or more at 293K (20^0C),in the form of tubes or cylindrical solid forms (including forgings) with an outside diameter of more than 75 mm (3 in.).
   Note:
   'Capable of' encompasses aluminum alloys before or after heat treatment.

2. Beryllium metal, alloys that contain more than 50 weight per cent beryllium, compounds that contain beryllium and manufactures thereof, **except**:
   a. Beryllium metal windows for X-ray machines or bore-hole logging devices;
   b. Oxide shapes in fabricated or semi-fabricated forms especially designed for electronic component parts or as substrates for electronic circuits;
   c. Beryl (silicate of beryllium and aluminum) in the form of emeralds or aquamarines.
   Note:
   Item 4502.2. includes waste and scrap containing beryllium as defined above.

3. Bismuth (high-purity:99.99% or greater) with less than 10 parts per million silver content.
4. Boron and boron compounds, mixtures and loaded materials in which the boron-10 isotope content is more than 20 weight per cent of the total boron content.
5. Calcium (high-purity) containing both less than 1000 parts per million by weight of metallic impurities other than magnesium and less than 10 parts per million of boron.
6. Chlorine trifluoride (ClF_3).
7. Crucibles made of materials resistant to liquid actinide metals, as follows:
   a. Crucibles with a volume of between 150 ml and 8 liters and made of or coated with any of the following materials having a purity of 98% or greater:
      1. Calcium fluoride (CaF_2);
      2. Calcium zirconate (metazirconate) (Ca_2ZrO_3);
      3. Cerium sulfide (Ce_2S_3);
      4. Erbium oxide (erbia) (Er_2O_3);
      5. Hafnium oxide (hafnia) (HfO_2);
      6. Magnesium oxide (MgO);
      7. Nitrided niobium-titanium-tungsten alloy (approximately 50% Nb, 30%Ti, 20%W);
      8. Yttrium oxide (yttria) (Y_2O_3);
      9. Zirconium oxide (zirconia) (ZrO_2);
   b. Crucibles with a volume of between 50 ml and 2 liters and made of or lined with tantalum, having a purity of 99.9% or greater;
   c. Crucibles with a volume of between 50 ml and 2 liters and made of or lined with tantalum (having a purity of 98% or greater) coated with tantalum carbide, nitride, or boride (or any combination of these).
8. Fibrous and filamentary materials, prepregs and composite structures as follows:
   a. Carbon or aramid fibrous and filamentary materials having a specific modulus of 12.7 x 10^6m or greater or a specific tensile strength of 23.5 x 10^4 m or greater;
   b. Glass fibrous and filamentary materials having a specific modulus of 3.18 x 10^6 m or greater or a specific tensile strength of 7.62 x 10^4 m or greater;
   c. Thermoset resin impregnated continuous yarns, rovings, tows or tapes with a width no greater than 15 mm (prepregs), made of carbon or glass fibrous and filamentary materials specified in Item 4502.8.a. or 4502.8.b., above;
   d. Composite structures in the form of tubes with an inside diameter of between 75 mm (3 in.) and 400 mm (16 in.) made with fibrous and filamentary materials controlled in Item 4502.8.a. or carbon prepreg materials specified in Item 4502.8.c., above.
   Notes:
   a. 'Fibrous and filamentary' materials include continuous monofilaments, continuous yarns and tapes.
   b. 'Specific modulus' is the Young's modulus in N/m^2 divided by the specific weight in N/m^3 when measured at a temperature of 23±2°C and a relative humidity of 50±5%
   c. 'Specific tensile strength' is the ultimate tensile strength in N/m^2 divided by the specific weight in N/m^3 when measured at a temperature of 23±2°C and a relative humidity of 50±5%

9. Hafnium metal, alloys and compounds that contain more than 60 weight percent hafnium and manufactures thereof.
10. Lithium enriched in the lithium-6 isotope to greater than 7.5%, alloys, compounds, or mixtures containing lithium enriched in the lithium-6 isotope, and products and devices containing any of the foregoing; except thermoluminescent dosimeters.
11. Magnesium (high-purity) containing both less than 200 parts per million by weight of metallic impurities other than calcium and less than 10 parts per million of boron.
12. Maraging steel capable of an ultimate tensile strength of 2050 Mpa (2.050 x 10^9 N/m^2) (300,000 lb/$in.^2$) or more at 293K (20° C), except forms in which no linear dimension exceeds 75 mm.
    Note:
    'Capable of' encompasses maraging steel before or after heat treatment.

13. Radium-226, including compounds or mixtures containing radium-226, except radium contained in medical applicators or products or devices not more than 0.37 Gbq (10 millicuries) of radium-226 in any form.
14. Titanium alloys capable of an ultimate tensile strength of 900 MPa (0.9 x 10^9 N/m^2) (130,500 lb/$in.^2$) or more at 293K (20° C) in the form of tubes or cylindrical solid forms (including forgings) with an outside diameter of more than 75 mm (3 in.).
    Note:
    "Capable of" encompasses titanium alloys before or after heat treatment.

15. Tungsten as follows:
    Parts made of tungsten, tungsten carbide, or tungsten alloys containing more than 90 weight percent, having a mass greater than 20 kg and a hollow cylindrical symmetry (including cylinder segments) with an inside diameter greater than 100 mm (4 in.) but less than 300 mm (12 in.), except parts specifically designed for use as weights or gamma-ray collimators.
16. Zirconium in which the ratio of hafnium content to zirconium content is less than 1 part to 500 parts by weight including zirconium metal, alloys containing more than 50 weight percent zirconium and compounds and manufactures wholly thereof; except zirconium in the form of foil having a thickness not exceeding 0.10 mm (.004 in.)

4502.16. con't

Note:
Item 4502.16. includes waste and scrap containing zirconium as defined above.

17. Nickel powder and pourous nickel metal, as follows:
    a. Powder with a nickel purity of 99.0 % or greater and a mean particle size of less than 10 µm measured by the ASTM B 330 standard; except filamentary nickel powders;
    Note:
    Nickel powders which are especially prepared for the manufacture of gaseous diffusion barriers are controlled by 3105.3.a.2.

    b. Porous nickel metal produced from materials controlled by 4502.17.a., except single porous nickel sheets not exceeding 1000 cm^2 per sheet.
    Note:
    4502.17.b. refers to porous metal formed by compacting and sintering the material in 4502.17.a. to form a metal material with fine pores interconnected throughout the structure.

4503. Uranium isotope separation equipment and components (other than Group 3 Items)

1. Electrolytic cells for fluorine production with a production capacity greater than 250 g of fluorine per hour.
2. Rotor fabrication and assembly equipment and bellows-forming mandrels and dies, as follows:
    a. Rotor assembly equipment for assembly of gas centrifuge rotor tube sections, baffles and end caps. Such equipment includes precision mandrels, clamps and shrink fit machines;
    b. Rotor straightening equipment for alignment of gas centrifuge rotor tube sections to a common axis. (Note: Normally such equipment will consist 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 (bellows made of high-strength aluminum alloys, maraging steel, or high-strength filamentary materials). The bellows have all of the following dimensions:
        1. 75 mm to 400 mm (3 in. to 16 in.) inside diameter;
        2. 12.7 mm (0.5 in.) or more in length; **and**
        3. single convolution depth more than 2 mm (0.08 in.).
3. Centrifugal multiplane balancing machines, fixed or portable, horizontal or vertical, as follows and "specially designed software" therefor:
    a. Centrifugal balancing machines designed for balancing flexible rotors having a length of 600 mm or more and having all of the following characteristics and "specially designed software" therefor;
        1. a swing or journal diameter of 75 mm or more;
        2. mass capability of from 0.9 to 23 kg (2 to 50 lb); **and**
        3. capable of balancing speed of revolution more than 5000 rpm;
    b. Centrifugal balancing machines designed for balancing hollow cylindrical rotor components and having all of the following characteristics:
        1. a journal diameter of 75 mm or more;
        2. mass capability of from 0.9 to 23 kg (2 to 50 lb.);
        3. capable of balancing to a residual imbalance of 0.010 kg mm/kg per plane or better; **and**
        4. belt drive type.
4. Filament winding machines in which the motions for positioning, wrapping and winding fibres are coordinated and programmed in two or more axes, specially designed to fabricate composite structures or laminates from fibrous and filamentary materials and capable of winding cylindrical rotors of diameter between 75 mm (3 in.) and 400 mm (16 in.) and length of 600 mm (24 in.) or greater, coordinating and programming controls therefor; precision mandrels; and "specially designed software" therefor.
5. Frequency changers (also known as converters or inverters) or generators having all of the following characteristics:
    a. A multiphase output capable of providing a power of 40 W or more;
    b. Capable of operating in the frequency range between 600 and 2000 Hz;
    c. Total harmonic distortion below 10%; **and**
    d. Frequency control better than 0.1%**except** such frequency changers especially designed or prepared to supply motor stators (as defined below) and having the characteristics listed in 4503.5.b. and d. above, together with a total harmonic distortion of less than 2% and an efficiency of greater than 80%.
    Note:
    'Motor Stators': Specially designed or prepared ring-shaped stators for high-speed multiphase AC hysteresis (or reluctance) motors for synchronous operation within a vacuum in frequency range of 600-2000 Hz and a power range of 500-1000 VA. The stators consist of multiphase windings on a laminated low-loss iron core comprising thin layers typically 2.0 mm (0.008 in.) thick or less.

6. Lasers, laser amplifiers and oscillators as follows:
    a. Copper vapor lasers with 40 W or greater average output power operating at wavelengths between 500 nm and 600 nm;
    b. Argon ion lasers with greater than 40 W average output power operating at wavelengths between 400 nm and 515 nm;
    c. Neodymium-doped (other than glass) lasers as follows:
        1. having an output wavelength between 1000 nm and 1100 nm, being pulse-excited and Q-switched with a pulse duration equal to or greater than 1 ns and having either of the following:
            a) A single-transverse mode output having an average output power exceeding 40 W;
            b) A multiple-transverse mode output having an average output power exceeding 50 W;
        2. Operating at a wavelength between 1000 nm and 1100 nm and incorporating frequency doubling giving an output wavelength between 500 nm and 550 nm with an average power at the doubled frequency (new wavelength) of greater than 40 W;
    d. Tunable pulsed single-mode dye oscillators capable of an average power output of greater than 1 W, a repetition rate greater than 1 kHz, a pulse less than 100 ns and a wavelength between 300 nm and 800 nm;
    e. Tunable pulsed dye laser amplifiers and oscillators, *except single mode oscillators*, with an average power output of greater than 30 W, a repetition rate greater than 1 kHz, a pulse width less than 100 ns and a wavelength between 300 nm and 800 nm;

f. Alexandrite lasers with a bandwidth of 0.005 nm or less, a repetition rate of greater than 125 Hz and an average power output greater than 30 W operating at wavelengths between 720 nm and 800 nm;

g. Pulsed carbon dioxide lasers with a repetition rate greater than 250 Hz, an average power output of greater than 500 W and a pulse of less than 200 ns operating at wavelengths between 9,000 nm and 11,000 nm;

N.B.:
This Item 4503.6.g. does not include higher power (typically 1 to 5 kW) industrial CO_2 lasers used in applications such as cutting and welding, as these latter lasers are either continuous wave or are pulsed with a pulse width more than 200 ns.

h. Pulsed excimer lasers (XeF, XeCL, KrF) with a repetition rate greater than 250 Hz and an average power output of greater than 500 W operating at wavelengths of between 240 and 360 nm;

i. Para-hydrogen Raman shifters designed to operate at 16 µm output wavelength and at a repetition rate greater than 250 Hz.

Technical note:
Machine tools, measuring devices and associated technology that have the potential for use in the nuclear industry are included in items 4501.2. and 4501.3. of this list.

7. Mass spectrometers capable of measuring ions of 230 atomic mass units or greater and having a resolution of better than 2 parts in 230 and ion sources therefor as follows:
   a. Inductively coupled plasma mass spectrometers (ICP/MS);
   b. Glow discharge mass spectrometers (GDMS);
   c. Thermal ionization mass spectrometers (TIMS);
   d. Electron bombardment mass spectrometers which have a source chamber constructed from or lined with or plated with materials resistant to UF_6;
   e. Molecular beam mass spectrometers as follows:
      1. which have a source chamber constructed from or lined with or plated with stainless steel or molybdenum and have a cold trap capable of cooling to 193 K (-80°C) or less; **or**
      2. which have a source chamber constructed from or lined with or plated with materials resistant to UF_6;
   f. Mass spectrometers equipped with a microfluorination ion source designed for use with actinides or actinide fluorides; except especially designed or prepared magnetic or quadruple mass spectrometers capable of taking "on-line" samples of feed, product, or tails from UF_6 gas streams and having all of the following characteristics:
      1. Unit resolution for mass greater than 320;
      2. Ion sources constructed of or lined with nichrome or monel or nickel-plated;
      3. Electron bombardment ionization sources; **and**
      4. Having a collector system suitable for isotopic analysis.
8. Pressure transducers which are capable of measuring absolute pressure at any point in the range 0 to 13 kPa, with pressure sensing elements made of or protected by nickel, nickel alloys with more than 60% nickel by weight, aluminum or aluminum alloys as follows:
   a. Transducers with a full scale of less than 13 kPa and an accuracy of better than ±1% of full scale;
   b. Transducers with a full scale of 13 kPa or greater and an accuracy of better than ±130 Pa.

Technical Notes:
1. *Pressure transducers are devices that convert pressure measurements into an electrical signal.*
2. *For the purposes of this entry, "accuracy" includes non-linearity, hysteresis and repeatability at ambient temperature.*

9. Valves 5 mm (0.2 in.) or greater in diameter, with a bellows seal, wholly made of or lined with aluminum, aluminum alloy, nickel, or alloy containing 60% or more nickel, either manually or automatically operated.

Note:
For valves with different inlet and outlet diameters, the nominal size parameter above refers to the smallest diameter.

10. Superconducting solenoidal electromagnets with all of the following characteristics:
    a. capable of creating magnetic fields or more than 2 teslas (20 kilogauss);
    b. with an L/D (length divided by inner diameter) greater than 2;
    c. with an inner diameter of more than 300 mm; **and**
    d. with a magnetic field uniform to better than 1% over the central 50% of the inner volume.

Note:
Item 4503.10. does not include magnets especially designed for and exported as parts of medical nuclear magnetic resonance (NMR) imaging systems.'As part of' does not prohibit separate shipments from different sources provided the related export documents clearly specify the 'part of' relationship.

11. Vacuum pumps with an input throat size of 38 cm (15 in.) or greater with a pumping speed of 15,000 liters/second or greater and capable of producing an ultimate vacuum better than 10^{-4} Torr (0.76×10^{-4} mbar).

Technical note:
The ultimate vacuum is determined at the input of the pump with the input of the pump blocked off. The pumping speed is determined at the measurement point with nitrogen gas or air.

12. Direct current high-power supplies capable of continuously producing, over a time period of 8 hours, 100 V or greater with current output of 500 amps or greater and with current or voltage regulation better than 0.1%.

N.B.:
See also 3105.9.c.

13. High-voltage direct current power supplies capable of continuously producing, over a time period of 8 hours, 20,000 V or greater with current output of 1 amp or greater and with current or voltage regulation better than 0.1%.

N.B.:
See also 3105.9.b.

14. 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.

Notes:
1. *This entry will control separators capable of enriching stable isotopes as well as those for uranium. A separator capable of separating the isotopes of lead with a one-mass unit difference is inherently capable of enriching the isotopes of uranium with a three-unit mass difference.*
2. *This entry includes separators with the ion sources and collectors both in the magnetic field and those configurations in which they are external to the field.*
3. *A single 50 mA ion source will produce less than 3 g of separated HEU per year from natural abundance feed.*

4504. Heavy water production plant related equipment

1. Specialized packings for use in separating heavy water from ordinary water, made of phosphor bronze mesh (chemically treated to improve wettability) and designed for use in vacuum distillation towers.
2. Pumps circulating solutions of diluted or concentrated potassium amide catalyst in liquid ammonia (KNH_2 / NH_3), with all of the following characteristics:
   a. airtight (i.e. hermetically sealed);
   b. for concentrated potassium amide solutions (1% or greater), operating pressure of 1.5-60 MPa [15-600 atmospheres(atm)]; for dilute potassium amide solutions (less than 1%), operating pressure of 20-60 Mpa (200-600 atm); **and**
   c. a capacity greater than 8.5 m^3/h (5 cubic feet per minute).
3. Water-hydrogen sulfide exchange tray columns constructed from fine carbon steel (such as ASTM A.516) with a diameter of 1.8 m (6 ft.) or greater to operate at a nominal pressure of 2 MPa (300 psi) or greater and internal contactors therefor; (**except** columns controlled in Item 3106, which are especially designed or prepared for the production of heavy water). Internal contactors of the columns are segmented trays with an effective assembled diameter of 1.8 m (6 ft.) or greater, such as sieve trays, valve trays, bubble cap trays and turbogrid trays designed to facilitate countercurrent contacting and constructed of materials resistant to corrosion by hydrogen sulfide/water mixtures, such as stainless steel with a carbon content of 0.03% or less (304L or 316 stainless steel).
4. Hydrogen-cryogenic distillation columns having all of the following applications:
   a. designed to operate with internal temperatures of -238° C (35 K) or less;
   b. designed to operate at internal pressure of 0.5 to 5 MPa (5 to 50 atmospheres);
   c. constructed of fine-grain stainless steels of the 300 series with low sulphur content or equivalent cryogenic and H_2-compatible materials; **and**
   d. with internal diameters of 1 m or greater and effective lengths of 5 m or greater.

   Technical Note:
   Fine-grain stainless steels in this Item are defined to be fine-grain austenitic stainless steels with an ASTM (or equivalent standard) grain size number of 5 or greater.
5. Ammonia synthesis converters or synthesis units in which the synthesis gas (nitrogen and hydrogen) is withdrawn from an ammonia/hydrogen high-pressure exchange column and the synthesized ammonia is returned to said column.
6. Turboexpanders or turboexpander - compressor sets designed for operation below 35 K and a throughput of hydrogen gas of 1,000 kg/hr or greater.

4505. Implosion systems development equipment

1. Flash x-ray generators or pulsed electron accelerators with peak energy of 500 keV or greater, as follows, **except** accelerators that are component parts of devices designed for purposes other than electron beam or x-ray radiation (electron microscopy, for example) and those designed for medical purposes:
   a. Having an accelerator peak electron energy of 500 keV or greater but less than 25 MeV and with a figure of merit (K) of 0.25 or greater, where K is defined as:
      $K=1.7 \times 10^3 V^{2.65} Q$,
      where V is the peak electron energy in million electron volts and Q is the total accelerated charge in coulombs if the accelerator beam pulse duration is less than or equal to 1 μs; if the accelerator beam pulse duration is greater than 1 μs, 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 ($Q=\int i dt$), where i is beam current in amperes and t is time in seconds]; **or**
   b. Having an accelerator peak electron energy of 25 MeV or greater and a peak power greater than 50 MW. [Peak power = (peak potential in volts) x (peak beam current in amperes).]

   Technical Notes:
   'Time duration of the beam pulse' – 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.
   'Peak beam current' – In machines based on microwave accelerating cavities, the peak beam current is the average current in the time duration of a bunched beam packet.
2. Multistage light gas guns or other high-velocity gun systems (coil, electromagnetic, electrothermal, or other advanced systems) capable of accelerating projectiles to 2 km per second or greater.
3. Mechanical rotating mirror cameras, as follows, and especially designed components therefore:
   a. Mechanical framing cameras with recording rates greater than 225,000 frames per second;
   b. Streak cameras with writing speeds greater than 0.5 mm per microsecond.

   Technical Note:
   Components include synchronizing electronics units and rotor assemblies (consisting of turbines, mirrors and bearings).
4. Electronic streak and framing cameras and tubes as follows:
   a. Electronic streak cameras capable of 50 ns or less time resolution and streak tubes therefor;
   b. Electronic (or electronically shuttered) framing cameras capable of 50 ns or less frame exposure time;
   c. Framing tubes and solid-state imaging devices for use with cameras controlled in sub-item (b) above, as follows:
      1. proximity focused image intensifier tubes having the photocathode deposited on a transparent conductive coating to decrease photocathode sheet resistance;
      2. gate silicon intensifier target (SIT) vidicon tubes, where a fast system allows gating the photoelectrons from the photocathode before they impinge on the SIT plate;
      3. Kerr or pocket cell electro-optical shuttering; **or**
      4. Other framing tubes and solid-state imaging devices having a fast-image gating time of less than 50 ns specially designed for cameras controlled by sub-item 4505.4.b. above.
      5. Specialized instrumentation for hydrodynamic experiments as follows:
         a) Velocity interferometers for measuring velocities in excess of 1 km per second during time intervals less than 10 μs. (VISARSs, Doppler laser interferometers, DLIs, etc.);

b) manganin gauges for pressures greater than 100 kilobars;
c) quartz pressure transducers for pressures greater than 100 kilobars.

4506. Explosives and related equipment

1. Detonators and multipoint initiation systems (exploding bridge wire, slapper, etc.)
   a. Electrically driven explosive detonators as follows:
      1. exploding bridge (EB);
      2. exploding bridge wire (EBW);
      3. slapper; **and**
      4. exploding foil initiators (EFI).
   b. Arrangements using single or multiple detonators designed to nearly simultaneously initiate an explosive surface (over greater than 5,000 mm^2) from a single firing signal (with an initiation timing spread over the surface of less than 2.5 µs).

   Technical note:
   The detonators described in Item 4506.1. all utilize a small electrical conductor (bridge, bridge wire, or foil) that explosively vaporizes when a fast, high-current electrical pulse is passed through it. In nonslapper types, the exploding conductor starts a chemical detonation in a contacting high-explosive material such as PETN (pentaerythritoltetranitrate). In slapper detonators, the explosive 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. Also, the word "initiator" is sometimes used in place of the word "detonator."

   Note:
   Item 4506.1. does not include detonators using only primary explosives, such as lead azide.

2. Electronic components for firing sets (switching devices and pulse discharge capacitors)
   a. Switching devices
      1. Cold-cathode tubes (including gas krytron tubes and vacuum sprytron tubes), whether gas filled or not, operating similarly to a spark gap, containing three or more electrodes and having all of the following characteristics:
         a) Anode peak voltage rating of 2500 V or more;
         b) Anode peak current rating of 100 A or more; **and**
         c) Anode delay time of 10 µs or less;
      2. Triggered spark-gaps having an anode delay time of 15 µs or less and rated for a peak current of 500 A or more;
      3. Modules or assemblies with a fast switching function having all of the following characteristics:
         a) Anode peak voltage rating greater than 2000 V;
         b) Anode peak current rating of 500 A or more; **and**
         c) turn-on time of 1 µs or less;
   b. Capacitors with any of the following sets of characteristics:
      1. Voltage rating greater than 1.4 kV, energy storage greater than 10 J, capacitance greater than 0.5 µF and series inductance less than 50 nH, **or**
      2. Voltage rating greater than 750 V, capacitance greater than 0.25 µF and series inductance less than 10 nH.
3. Firing sets and equivalent high-current pulse generators (for controlled detonators), as follows:
   a. Explosive detonator firing sets designed to drive multiple controlled detonators covered under item 4506.1. above;
   b. Modular electrical pulse generators (pulsers) designed for portable, mobile, or ruggedized use (including xenon flash-lamp drivers) having all the following characteristics:
      1. capable of delivering their energy in less than 15 µs;
      2. having an output greater than 100 A;
      3. having a rise time of less than 10 µs into loads of less than 40 ohms. (Rise time is defined as the time interval from 10% to 90% current amplitude when driving a resistive load);
      4. enclosed in a dust-tight enclosure;
      5. no dimension greater than 25.4 cm (10 in.);
      6. weight less than 25 kg (55 lb.); **and**
      7. specified for use over an extended temperature range (-50°C to 100°C) or specified as suitable for aerospace use.
4. High explosives or substances or mixtures containing more than 2% of any of the following:
   a. Cyclotetramethylenetetranitramine (HMX);
   b. Cyclotrimethylenetrinitramine (RDX);
   c. Triaminotrinitrobenzene (TATB);
   d. Any explosive with a crystal density greater than 1.8 g/cm^3 and having a detonation velocity greater than 8000 m/s; **or**
   e. Hexanitrostilbene (HNS).

4507. Nuclear testing equipment and components

1. Oscilloscopes and transient recorders and especially designed components as follows: plug-in units, external amplifiers, pre-amplifiers, sampling devices and cathode ray tubes for analog oscilloscopes.
   a. Non-modular analog oscilloscopes having a bandwidth of 1 Ghz or greater;
   b. Modular analog oscilloscope systems having either of the following characteristics;
      1. a mainframe with a bandwidth of 1 GHz or greater; **or**
      2. Plus-in modules with an individual bandwidth of 4 GHz or greater;
   c. Analog sampling oscilloscopes for the analysis of recurring phenomena with an effective bandwidth greater than 4 GHz;
   d. Digital oscilloscopes and transient recorders, using analog-to-digital conversion techniques, capable of storing transients by sequentially sampling single-shot inputs at successive intervals of less than 1 ns (greater than 1 giga-sample per second), digitizing to 8 bits or greater resolution and storing 256 or more samples.

   Technical note:
   'Bandwidth' is defined as the band of frequencies over which the deflection on the cathode ray tube does not fall below 70.7% of that at the maximum point measured with a constant input voltage to the oscilloscope amplifier.

2. Photomultiplier tubes with a photocathode area of greater than 20 cm^2 having an anode pulse rise time of less than 1 ns.
3. High-speed pulse generators with output voltages greater than 6 V into a less than 55ohm resistive load and with pulse transition times less than 500 ps (defined as the time interval between 10% and 90% voltage amplitude).

4508. Other

1. Neutron generator systems, including tubes, designed for operation without an external vacuum system and utilizing electrostatic acceleration to induce a tritium-deuterium nuclear reaction.
2. Equipment related to nuclear material handling and processing and to nuclear reactors as follows:
   a. Remote manipulators that provide mechanical translation of human operator actions by electrical, hydraulic, or mechanical means to an operating arm and terminal fixture that can be used to provide remote actions in radiochemical separation operations and hot cells. The manipulators have a capability to penetrate 0.6 m or more (2 ft. or more) of cell wall or, alternatively, bridge over the top of a cell wall with a thickness of 0.6 m or more (2 ft. or more);
   b. High-density (lead glass or other) radiation shielding windows greater than 0.3 m (1 ft.) on a side and with a density greater than 3 g/cm^3 and a thickness of 100 mm or greater and especially designed frames therefor;
   c. Radiation-hardened TV cameras especially designed or rated as radiation hardened to withstand greater than 5×10^4 grays (Si) (5×10^6 rad (Si)) without operational degradation and especially designed lenses used therein.
3. Tritium, tritium compounds or mixtures containing tritium in which the ratio of tritium to hydrogen by atoms exceeds 1 part in 1000 and products or devices containing any of the foregoing; except a product or device containing not more than 1.48×10^3 GBq (40 Ci) of tritium in any form.
   N.B.:
   See item 3012. for additional controls.
4. Tritium facilities, plants and equipment, 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 watts;
      2. Hydrogen isotope storage and purification systems using metal hydrides as the storage, or purification medium.

   N.B.:
   See item 3012. for additional controls.
5. Platinized catalysts especially 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.
6. Helium in any form isotopically enriched in the helium-3 isotope, whether or not mixed with other materials or contained in any equipment, product or device, except products or devices containing less than 1 g of helium-3.
7. Alpha-emitting radionuclides and products or devices containing such radionuclides as follows:
   All alpha-emitting radionuclides having an alpha half-life of 10 days or greater but less than 200 years, including compounds and mixtures containing these radionuclides with a total alpha activity of 1 curie per kilogram (37 GBq/kg) or greater except for products or devices containing less than 100 millicuries (3.7 GBq) of alpha activity per device.
8. Lithium isotope separation facilities, plants and equipment, as follows:
   1. Facilities or plants for the seperation of lithium isotopes;
   2. Equipment for the seperation of lithium isotipes, as follows:
      a. Packed liquid-liquid exchange colums specially designed for lithium amalgams;
      b. Mercury and/or lithium amalgam pumps;
      c. Lithium amalgam electrolysis cells;
      d. Evaporators for concentraited lithium hydroxide solution.

Definitions of Terms used in Groups 3 and 4

"Accuracy"
Usually measured in terms of inaccuracy, defined as the maximum deviation, positive or negative, of an indicated value from an accepted standard or true value.

"Adaptive control"
A control system that adjusts the response from conditions detected during the operation (Ref. ISO 2806-1980).

"Angular position deviation"
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. (Reference: VID/VDE 2617. Draft: "Rotary table on coordinate measuring machines.")

"Contouring control"
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).

"Development"
Is related to all stages prior to "production", and includes: design, design research, design analysis, 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.

"End-effectors"
as described in Item 4501.6 include grippers, active tooling units, and any other tooling that is attached to the baseplate on the end of a "robot" manipulator arm.

"Isostatic Presses"
Is defined as equipment capable of pressurizing 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"
An assembly of components which produce coherent light that is amplified by stimulated emission of radiation.

"Linearity"
(Usually measured in terms of nonlinearity) is the maximum deviation of the actual characteristic (average of upscale and downscale readings), positive or negative, from a straight line so positioned as to equalize and minimize the maximum deviations.

"Measurement uncertainty"
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 (Reference: VDI/VDE 2617).

"Microprogram"
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.

"Numerical control"
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).

"Positioning accuracy"
Of "numerically controlled" machine tools is to be determined and presented in accordance with paragraph 2.13, in conjunction with the requirements below:

a. Test conditions (ISO/DIS/230/2, paragraph 3):
   1. For 12 hours before and during measurements, the machine tool and accuracy measuring equipment will be kept at the same ambient temperature. During the premeasurement time, the slides of the machine will be continuously cycled identically to the way they will be cycled during the accuracy measurements;
   2. The machine shall be equipped with any mechanical, electronic, or software compensation to be exported with the machine;
   3. Accuracy of measuring equipment for the measurements shall be at least four times more accurate than the expected machine tool accuracy;
   4. Power supply for slide drives shall be as follows:
      a. Line voltage variation shall not be greater than ±10% of nominal rated voltage;
      b. Frequency variation shall not be greater than ±2 Hz of normal frequency;
      c. Lineouts or interrupted service are not permitted.

b. Test Program (paragraph 4):
   1. Feed rate (velocity of slides) during measurement shall be the rapid traverse rate;
      N.B.:
      In the case of machine tools which generate optical quality surfaces, the feed rate shall be equal to or less than 50 mm per minute;
   2. Measurements shall be made in an incremental manner from one limit of the axis travel to the other without returning to the starting position for each move to the target position;
   3. Axes not being measured shall be retained at mid-travel during test of an axis.

c. Presentation of test results (paragraph 2): The results of the measurements must include:
   1."positioning accuracy" (A) **and**
   2.The mean reversal error (B).

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

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

"Real-time processing"
Processing of data by an electronic computer in response to an external event according to time requirements imposed by the external event.

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

"Robot"

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

a. Is multifunctional;
b. Is capable of positioning or orienting material, parts, tools or special devices through variable movements in three-dimensional space;
c. Incorporates three or more closed or open loop servo-devices which may include stepping motors; **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 controlled, i.e. without mechanical intervention.

N.B.:

The above definition does not include the following devices:

a. *Manipulation mechanisms which are only manually/teleoperator controllable;*
b. *Fixed sequence manipulation mechanisms which are automated moving devices operating according to mechanically fixed programmed motions. The program 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;*
c. *Mechanically controlled variable sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The program 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 program patterns. Variations or modifications of the program pattern (e.g. changes of pins or exchanges of cams) in one or more motion axes are accomplished only through mechanical operations;*
d. *Non-servo-controlled variable sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The program is variable, but the sequence proceeds only by the binary signal from mechanically fixed electrical binary devices or adjustable stops;*
e. *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.*

"Sensors"

Detectors of a physical phenomenon, the output of which (after conversion into a signal that can be interpreted by a controller) is able to generate "programs" or modify programmed instructions or numerical program data. This includes "sensors" with machine vision, infrared imaging, acoustical imaging, tactile feel, inertial position measuring, optical or acoustic ranging or force or torque measuring capabilities.

"Software"

A collection of one or more "programs" or "microprograms" fixed in any tangible medium of expression.

"Specially designed software"

The minimum "operating systems", "diagnostic systems", "maintenance systems" and "application software" necessary to be executed on particular equipment to perform the function for which it was designed. To make other, incompatible equipment perform the same function requires:

a. modification of this "software" **or**
b. addition of "programs."

"Technical assistance"

May take forms, such as: instruction, skills, training, working knowledge, consulting services.

N.B. #1:

"Technical assistance" may involve transfer of "technical data".

N.B. #2:

The Export and Import Permits Act *applies only to "technical assistance" in the form of "technical data".*

"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.

"Technology"

Specific information required for the "development", "production", or "use", of any item contained in the List. The information takes the form of "technical data" or "technical assistance".

"Use"

Operation, installation (including on-site installation), maintenance (checking), repair, overhaul and refurbishing.

"User-accessible programmability"

The facility allowing a user to insert, modify of replace "programs" by means other than:

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

Group 5 – Miscellaneous Goods

5001. **Pancreas glands of cattle and calves.** (*All destinations*)

5011. **Human serum albumin.** (*All destinations*)

5101. **Logs of all species of wood.** (*All destinations*)

5102. **Pulpwood of all species of wood.** (*All destinations*)

5103. **Blocks, bolts, blanks, boards and any other material or product of red cedar that is suitable for use in the manufacture of shakes or shingles.** (*All destinations*)

5104. **Softwood Lumber Products**

(1) The definition in this subsection applies in this item.
"province of first manufacture" means the province where the mill at which a softwood lumber product was first manufactured into such a product is situated, whether or not that product is further processed (for example, by planing or kiln-drying) or is transformed from one softwood lumber product into another such product (for example, a re-manufactured product) in another province. (*province de première transformation*)

(2) Softwood lumber products, as follows:
a) coniferous wood sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or finger-jointed, of a thickness exceeding 6 mm, that is classified under subheading 4407.10.00 of the *Harmonized Tariff Schedule of the United States (1996)* (United States International Trade Commission Pub. 2937, 19 U.S.C. 1202 (1988)) and in respect of which the province of first manufacture is the Province of Ontario, the Province of Quebec, the Province of British Columbia or the Province of Alberta; (*United States*) and
b) coniferous wood (including strips and friezes for parquet flooring, not assembled), continuously shaped (tongued, grooved, rebated, chamfered, V-jointed, beaded, moulded, rounded or the like) along any of its edges or faces (other than wood mouldings and wood dowel rods), whether or not planed, sanded or finger-jointed, that is classified under subheading 4409.10.10, 4409.10.20 or 4409.10.90 of the *Harmonized Tariff Schedule of the United States (1996)* (United States International Trade Commission Pub. 2937, 19 U.S.C. 1202 (1988)) and in respect of which the province of first manufacture is the Province of Ontario, the Province of Quebec, the Province of British Columbia or the Province of Alberta. (*United States*)

(3) This item ceases to be in force on March 31, 2001.

Agriculture and Food Products

5201. **Peanut Butter that is classified under tariff item No. 2008.11.10 of Schedule I to the *Customs Tariff*.** (*All destinations*)

5202. **Roe Herring**

1. In this item,
"fishing zones of Canada" has the same meaning as in subsection 4(1) of the Territorial Sea and Fishing Zones Act; (*zone de pêche du Canada*)
"internal waters of Canada" has the same meaning as in subsection 3(2) of the Territorial Sea and Fishing Zones Act; (*eaux intérieures du Canada*)
"territorial sea of Canada" has the same as in susbsection 3(1) of the Territorial Sea and Fishing Zones Act; (*mer territoriale du Canada*)
"unprocessed roe herring" means roe herring from which the roe has not been extracted. (*hareng rogué non traité*)
2. Unprocessed roe herring that are caught in:
a. those parts of the territorial sea of Canada that are adjacent to the coast of British Columbia;
b. those parts of the internal waters of Canada that are adjacent to the coast of British Columbia; **or**
c. those parts of the fishing zones of Canada that are adjacent to the coast of British Columbia.
(*All destinations*)

5203. **Sugar-containing Products**

Sugar-containing products that are classified under subheadings 1701.91.54, 1704.90.74, 1806.20.75, 1806.20.95, 1806.90.55, 1901.90.56, 2101.10.54, 2101.20.54, 2106.90.78 and 2106.90.95 of *Harmonized Tariff Schedule of the United States (1995)* (United States International Trade Commission Pub. 2831, 19 U.S.C. § 1202 (1988)). *(United States)*

5204. **Sugars, Syrups and Molasses**

Sugars, Syrups and Molasses that are classified under subheadings 1701.12.10, 1701.91.10, 1701.99.10, 1702.90.10, and 2106.90.44 of *Harmonized Tariff Schedule of the United States (1995)* (United States International Trade Commission Pub. 2831, 19 U.S.C. § 1202 (1988)). *(United States)*

United States Origin Goods

5400. United States Origin Goods

All goods that originate in the United States, unless they are included elsewhere in this List, whether in bond or cleared by Canadian Customs, other than goods that have been further processed or manufactured outside the United States so as to result in a substantial change in value, form or use of the goods or in the production of new goods. (*All destinations other than the United States*)

Goods in Transit

5401. Goods in Transit

1. All goods that originate outside Canada that are included in this List, whether in bond or cleared by Canadian Customs, other than goods that are in transit in bond on a through journey on a billing that originates outside Canada where the billing
   a. indicates that the ultimate destination of the goods is a country other than Canada; (*All destinations other than the United States*) **and**
   b. in the case of goods that are shipped from the United States,
      1. is accompanied by a certified true copy of the United States *Shipper's Export Declaration*, where the export declaration does not contain terms which conflict with those of the billing and is presented to the Canadian Collector of Customs,
      2. cites from a *Shipper's Export Declaration*, **or**
      3. cites a summary Authorization Number or Symbol, assigned to the United States exporter by the United States Bureau of the Census. (*All destinations other than the United States)*

Prohibited weapons

5500. Prohibited weapons, as follows:

1. prohibited weapons described in paragraph (c), (e) or (f) of the definition "prohibited weapon" in subsection 84(1) of the *Criminal Code.*
2. any component of a prohibited weapon referred to in paragraph (a), that is an assembly or subassembly that contains one or more parts described in paragraph (c);
3. any part that is a piece of the action of a prohibited weapon referred to in paragraph (a), including the bolt or bolt carrier, that is designed to enable the prohibited weapon to discharge bullets in rapid succession during one pressure of the trigger, whether or not the part permits the discharge to be limited to a single bullet for each such pressure. (*All destinations*)

Group 6 – Missile Technology Control Regime List

Note:
Terms in "double quotation marks" are defined terms. Refer to "Group 6 - Definitions" on page 87.

6000. **The export of "technology" for the "development", "production" or "use" of products controlled in Group 6 is controlled except that "technology" which is the minimum necessary for the installation, operation, maintenance (checking) and repair of those products whose export has been authorised.**

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

6001. **Complete rocket systems (including ballistic missile systems, space launch vehicles, and sounding rockets) and unmanned air vehicle systems (including cruise missile systems, target drones and reconnaissance drones) capable of delivering at least a 500 kg payload to a range of at least 300 km as well as the specially designed "production facilities" for these systems.**

6002. **Complete subsystems "usable in" the systems in Item 6001., as follows, as well as the specially designed "production facilities", and "produc-tion equipment" therefor:**

a. Individual rocket stages;
b. Reentry vehicles, and equipment designed or modified therefor, as follows, except as provided in Note 1 below for those designed for non-weapon payloads:
   1. Heat shields, and components thereof, fabricated of ceramic or ablative materials;
   2. Heat sinks and components thereof fabricated of light-weight, high heat capacity materials;
   3. Electronic equipment specially designed for reentry vehicles;
c. Solid or liquid propellant rocket engines, having a total impulse capacity of 1.1 x 10^6 N.sec (2.5 x 10^5 lb-sec) or greater;
d. "Guidance sets" capable of achieving system accuracy of 3.33 percent or less of the range (e.g., a CEP of 10 km or less at a range of 300 km), except as provided in Note 1 below for those designed for missiles with a range under 300 km or manned aircraft;
e. Thrust vector control sub-systems, except as provided in Note 1 below for those designed for rocket systems that do not exceed the range/payload capability of Item 6001.;
f. Weapon or warhead safing, arming, fuzing, and firing mechanisms, except as provided in Note 1 below for those designed for systems other than those in Item 6001.

Notes to Item 6002.:

1. *Governments may permit the export of items identified as exceptions in b., d., e, and f. above if the subsystem is exported subject to end use statements and quantity limits appropriate for the excepted end-use stated above.*
2. *CEP (circle of equal probability) is a measure of accuracy; and is defined as the radius of the circle centered at the target, at a specific range, in which 50 percent of the payloads impact.*
3. *A 'guidance set' integrates the process of measuring and computing a vehicle's position and velocity (i.e. navigation) with that of computing and sending commands to the vehicle's flight control systems to correct the trajectory.*
4. *Examples of methods of achieving thrust vector control which are covered by 6002.e. include:*
   a. *Flexible nozzle;*
   b. *Fluid or secondary gas injection;*
   c. *Movable engine or nozzle;*
   d. *Deflection of exhaust gas stream (jet vanes or probes);*
   e. *Use of thrust tabs.*

6003. **Propulsion components and equipment "usable in" the systems in Item 6001., as follows, as well as the specially designed "production facilities" and "production equipment" therefor, and flow-forming machines specified in Note 1:**

a. Lightweight turbojet and turbofan engines (including turbocompound engines) that are small and fuel efficient;
b. Ramjet/scramjet/pulse jet/combined cycle engines, including devices to regulate combustion and specially designed components therefor;
c. Rocket motor cases, 'interior lining', 'insulation' and nozzles therefor;
d. Staging mechanisms, separation mechanisms, and interstages therefor;
e. Liquid and slurry propellant (including oxidizers) control systems, and specially designed components therefor, designed or modified to operate in vibration environments of more than 10 g RMS between 20 Hz and 2,000 Hz;
f. Hybrid rocket motors and specially designed components therefor.

Notes to Item 6003.:

1. *Flow-forming machines, and specially designed components and specially designed software therefor, which:*
   a. *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 at delivery; **and***
   b. *with more than two axes which can be coordinated simultaneously for contouring control.*

   Technical Notes:
   1. *Machines combining the function of spin-forming and flow-forming are for the purpose of this item regarded as flow-forming machines.*
   2. *This item does not include machines that are not usable in the production of propulsion components and equipments (e.g., motor cases) for systems in Item 6001.*
2. a. *The only engines covered in this subitem 6003.a. above, are the following:*
      1. *Engines having both the following characteristics:*
         a. *Maximum thrust value greater than 1000N (achieved un-installed) excluding civil certified engines with a maximum thrust value greater than 8,890N (achieved un-installed), **and***
         b. *Specific fuel consumption of 0.13 kg/N/hr or less (at sea level static and standard conditions); **or***
      2. *Engines designed and modified for systems in Item 6001., regardless of thrust or specific fuel consumption.*
   b. *Governments may permit the export of engines identified in Item 6003.a. as part of a manned aircraft or in quantities appropriate for replacement parts in manned aircraft.*
3. *In Item 6003.c.,'interior lining' suited for the bond interface between the solid propellant and the case or insulating liner is usually a liquid polymer based dispersion of refractory or insulating materials. e.g., carbon filled HTPB or other polymer with added curing agents to be sprayed or screeded over a case interior.*

4. In Item 6003.c., 'insulation' intended to be applied to the components of a rocket motor, i.e. the case, nozzle inlets, case closures, includes cured or semi-cured compounded rubber sheet stock containing an insulating or refractory material. It may also be incorporated as stress relief boots or flaps.

5. The only servo valves and pumps covered in 6003.e. above, are the following:

a. Servo valves designed for flow rates of 24 litres per minute or greater, at an absolute pressure of 7,000 kPa (1,000 psi) or greater, that have an actuator response time of less than 100 msec;

b. Pumps, for liquid propellants, with shaft speeds equal or greater than 8,000 RPM or with discharge pressures equal to or greater than 7,000 kPa (1,000 psi).

6. Governments may permit the shipment of equipment in Item 6003.e. which is exported as part of a satellite.

6004. Propellants and constituent chemicals for propellants as follows:

a. Composite propellants:
   1. Composite and composite modified double base propellants;

b. Fuel substances:
   1. Hydrazine with a concentration of more than 70 percent and its derivatives including monomethylhydrazine (MMH);
   2. Unsymmetric dimethylhydrazine (UDMH);
   3. Spherical aluminium powder with particles of uniform diameter of less than 500 x 10^{-6} m (500 micrometer) and an aluminium content of 97 percent by weight or greater;
   4. Metal with particle sizes less than 500 x 10^{-6} m (500 micrometer), whether spherical, atomised, spheroidal, flaked or ground, consisting of 97 percent by weight or more of any of the following: beryllium, boron, magnesium, zirconium and alloys of these;
   5. High energy density materials such as boron slurry, having an energy density of 40 x 10^{6} J/kg or greater.

c. Oxidizers/Fuels:
   1. Perchlorates, chlorates or chromates mixed with powdered metals or other high energy fuel components.

d. Oxidizer substances:
   1. Liquid:
      a. Dinitrogen tetroxide;
      b. Nitrogen dioxide/dinitrogen tetroxide;
      c. Dinitrogen pentoxide;
      d. Inhibited Red Fuming Nitric Acid (IRFNA);
      e. Compounds composed of fluorine and one or more of other halogens, oxygen or nitrogen.
   2. Solid:
      a. Ammonium perchlorate;
      b. Ammonium Dinitramide (ADN)
      c. Nitro-amines (cyclotetramethylenetetranitramine (HMX), cyclotrimethylene-trinitramine (RDX);

e. Polymeric substances:
   1. Carboxl-terminated polybutadiene (CTPB);
   2. Hydroxy-terminated polybutadiene (HTPB):
   3. Glycidyl azide polymer (GAP);
   4. Polybutadiene-acrylic acid (PBAA);
   5. Polybutadiene-acrylic acid-acrylonitrile (PBAN).

f. Other propellant additives and agents:
   1. Bonding agents:
      a. tris (1-(2-methyl)aziridinyl phosphine oxide (MAPO);
      b. trimesoyl-1(2-ethyl)aziridine (HX-868, BITA);
      c. "Tepanol" (HX-878), reaction product of tetraethylenepentramine, acrylonitrile and glycidol;
      d. "Tepan" (HX-879), reaction product of tetraethylenepentamine and acrylonitrile;
      e. Polyfunctional aziridine amides with iso-phthalic, trimesic, isocyanuric, or trimeth-yladipic backbone and also having a 2-methyl or 2-ethyl aziridine group (HX-752, HX-874 and HX-877).
   2. Curing agents and catalysts:
      a. Triphenyl bismuth (TPB);
   3. Burning rate modifiers:
      a. Catocene;
      b. N-butyl-ferrocene;
      c. Butacene;
      d. Other ferrocene derivatives;
      e. Carboranes, decarboranes, pentaboranes and derivatives thereof;
   4. Nitrate esters and nitrated plasticizers:
      a. Triethylene glycol dinitrate (TEGDN);
      b. Trimethylolethane trinitrate (TMETN);
      c. 1,2,4-Butanetriol trinitrate (BTTN);
      d. Diethylene glycol dinitrate (DEGDN);
   5. Stabilizers, as follows:
      a. 2-Nitrodiphenylamine;
      b. N-methyl-p-nitroaniline.

6005. Production technology, or "production equipment" (including its specially designed components) for:

a. Production, handling or acceptance testing of liquid propellants or propellant constituents described in Item 6004.;

b. Production, handling, mixing, curing, casting, pressing, machining, extruding or acceptance testing of solid propellants or propellant constituents described in Item 6004.

Notes to Item 6005.:

1. Batch mixers or continuous mixers covered by 6005.b. above, both with provision for mixing under vacuum in the range of zero to 13.326 kPa and with temperature control capability of the mixing chamber, are the following:

a. Batch mixers having:

*1. A total volumetric capacity of 110 litres (30 gallons) or more; **and***

2. At least one mixing/kneading shaft mounted off centre;

b. Continuous mixers having:

*1. Two or more mixing/kneading shafts; **and***

2. Capability to open the mixing chamber.

2. The following equipment is included in 6005.b. above:

a. Equipment for the production of atomised or spherical metallic powder in a controlled environment;

b. Fluid energy mills for grinding or milling ammonium perchlorate, RDX or HMX.

6006. Equipment, "technical data" and procedures for the production of structural composites "usable in" the systems in Item 6001., as follows, and specially designed components, and accessories and specially designed software therefor:

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

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

c. Multi-directional, multi-dimensional weaving machines or interlacing machines, including adapters and modification kits for weaving, interlacing or braiding fibres to manufacture composite structures, except textile machinery not modified for the above end uses;
d. Equipment designed or modified for the production of fibrous or filamentary materials as follows:
   1. Equipment for converting polymeric fibers (such as polyacrylonitrile, rayon or polycarbosilane) including special provision to strain the fibre during heating;
   2. Equipment for the vapour deposition of elements or compounds on heated filament substrates; **and**
   3. Equipment for the wet-spinning of refractory ceramics (such as aluminum oxide);
e. Equipment designed or modified for special fibre surface treatment or for producing prepregs and preforms;
f. "Technical data" (including processing conditions) and procedures for the regulation of temperature, pressures or atmosphere in autoclaves or hydroclaves when used for the production of composites or partially precessed composites.

Notes to Item 6006.:

1. *Examples of components and accessories for the machines covered by this entry are: moulds, mandrels, dies, fixtures and tooling for the preform pressing, curing, casting, sintering or bonding of composite structures, laminates and manufactures thereof.*
2. *Equipment covered by sub-item 6006.e. includes but is not limited to rollers, tension stretchers, coating equipment, cutting equipment and clicker dies.*

6007. Pyrolytic deposition and densification equipment and "technology" as follows:

a. "Technology" for producing pyrolytically derived materials formed on a mould, mandrel or other substrate from precursor gases which decompose in the 1,300°C to 2,900°C temperature range at pressures of 130 Pa (1mm Hg) to 20 kPa (150mm Hg) including technology for the composition of precursor gases, flow-rates, and process control schedules and parameters;
b. Specially designed nozzles for the above processes;
c. Equipment and process controls, and specially designed software therefor, designed or modified for densification and pyrolysis of structural composite rocket nozzles and reentry vehicle nose tips.

Notes to Item 6007.:

1. *Equipment included under 6007.c. above are isostatic presses having all of the following characteristics:*
   a. *Maximum working pressure of 69 MPa (10,000 psi) or greater;*
   b. *Designed to achieve and maintain a controlled thermal environment of 600°C or greater; **and***
   c. *Possessing a chamber cavity with an inside diameter of 254 mm (10 inches) or greater.*
2. *Equipment included under 6007.c. above are chemical vapour deposition furnaces designed or modified for the densification of carbon-carbon composites.*

6008. Structural materials "usable in" the systems in Item 6001., as follows:

a. Composite structures, laminates, and manufactures thereof, specially designed for use in systems in Item 6001. and in subsystems in Item 6002., and resin impregnated fibre prepregs and metal coated fibre preforms therefor, made either with organic matrix or metal matrix utilizing fibrous or filamentary reinforcements having a specific tensile strength greater than 7.62×10^4 m (3×10^6 inches) and a specific modulus greater than 3.18×10^6 m (1.25×10^8 inches);
b. Resaturated pyrolized (i.e. carbon-carbon) materials designed for rocket systems;
c. Fine grain recrystallized bulk graphites (with a bulk density of at least 1.72 g/cc measured at 15°C) and having a particle size of 100×10^{-6} m (100 microns) or less, a pyrolytic, or fibrous reinforced graphites usable for rocket nozzles and reentry vehicle nose tips;
d. Ceramic composite materials (dielectric constant less than 6 at frequencies from 100 Hz to 10,000 MHz) for use in missile radomes, and bulk machinable silicon-carbide reinforced unfired ceramic useable for nose tips;
e. Tungsten, molybdenum and alloys of these metals in the form of uniform spherical or atomized particles of 500 micrometer diameter or less with a purity of 97 percent or higher for fabrication of rocket motor components: i.e. heat shields, nozzle substrates, nozzle throats, and thrust vector control surfaces;
f. Maraging steels (steels generally characterized by high nickel, very low carbon content and the use of substitutional elements or precipitates to produce age-hardening) having an Ultimate Tensile Strength of 1.5×10^9 Pa or greater, measured at 20°C.

Note to Item 6008.:

1. *Maraging steels are only covered by 6008.f. above, for the purpose of Group 6, in the form of sheet, plate or tubing with a wall or plate thickness equal to or less than 5.0 mm (0.2 inch).*
2. *The only resin impregnated fibre prepregs specified in 6008.a. above are those using resins with a glass transition temperature T_g, after cure, exceeding 145°C as determined by ASTM D4065 or national equivalents.*

6009. Instrumentation, navigation and direction finding equipment and systems, and associated production and test equipment, as follows; and specially designed components and software therefor:

a. Integrated flight instrument systems, which include gyrostabilizers or automatic pilots and integration software therefor, designed or modified for use in the systems in Item 6001.;
b. Gyro-astro compasses and other devices which derive position or orientation by means of automatically tracking celestial bodies or satellites;
c. Accelerometers with a threshold of 0.05 g or less, or a linearity error within 0.25 percent of full scale output, or both, which are designed for use in inertial navigation systems or in guidance systems of all types;
d. All types of gyros usable in the systems in Item 6001., with a rated drift rate stability of less than 0.5 degree (1 sigma or rms) per hour in a 1 g environment;
e. Continuous output accelerometers or gyros of any type, specified to function at acceleration levels greater than 100 g;
f. Inertial or other equipment using accelerometers described by subitems 6009.c. or 6009.e. above or gyros described by subitems 6009.d. or 6009.e. above, and systems incorporating such equipment, and specially designed integration software therefor;
g. Specially designed test, calibration, and alignment equipment, and "production equipment" for the above, including the following:

1. For laser gyro equipment, the following equipment used to characterize mirrors, having the threshold accuracy shown or better:
   a. Scatterometer (10 ppm);
   b. Reflectometer (50 ppm);
   c. Profilometer (5 Angstroms);
2. For other inertial equipment:
   a. Inertial Measurement Unit (IMU Module) Tester;
   b. IMU Platform Tester;
   c. IMU Stable Element Handling Fixture;
   d. IMU Platform Balance Fixture;
   e. Gyro Tuning Test Station.;
   f. Gyro Dynamic Balance Station;
   g. Gyro Run-In/Motor Test Station;
   h. Gyro Evacuation and Filling Station;
   i. Centrifuge Fixture for Gyro Bearings;
   j. Accelerometer Axis Align Station;
   k. Accelerometer Test Station.

Notes to Item 6009.:

1. *Governments may permit the shipment of Items 6009.a. through 6009.f. exported as part of a manned aircraft, satellite ,land vehicle or marine vessel or in quantities appropriate for replacement parts for such applications.*
2. *In subitem 6009.d.:*
   a. *Drift rate is defined as the time rate of output deviation from the desired output. It consists of random and systematic components and is expressed as an equivalent angular displacement per unit time with respect to inertial space;*
   b. *Stability is defined as 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.*
3. *Accelerometers which are specially designed and developed as Measurement While Drilling (MWD) sensors for use in downhole well service operations are not specified in Item 6009.c.*

6010. Flight control systems and "technology", as follows; "designed or modified" for the systems in Item 6001. as well as the specially designed test, calibration, and alignment equipment therefor:

a. Hydraulic, mechanical, electro-optical, or electro-mechanical flight control systems (including fly-by-wire systems);
b. Attitude control equipment;
c. Design technology for integration of air vehicle fuselage, propulsion system and lifting control surfaces to optimize aerodynamic performance throughout the flight regime of an unmanned air vehicle;
d. Design technology for integration of the flight control, guidance, and propulsion data into a flight management system for optimization of rocket system trajectory.

Note to Item 6010.:

Governments may permit the shipment of sub-items 6010.a. and 6010.b. equipment exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

6011. Avionics equipment, "technology" and components as follows: "designed or modified" for use in the systems in Item 6001., and specially designed software therefor:

a. Radar and laser radar systems, including altimeters;
b. Passive sensors for determining bearings to specific electromagnetic sources (direction finding equipment) or terrain characteristics;
c. Global Positioning System (GPS) or similar satellite receivers:
   1. Capable of providing navigation information under the following operational conditions:
      a. At speeds in excess of 515 m/sec (1,000 nautical miles/hour); **and**
      b. At altitudes in excess of 18 km (60,000 feet); **or**
   2. Designed or modified for use with unmanned air vehicles covered by Item 6001.;
d. Electronic assemblies and components specially designed for military use and operation at temperatures in excess of 125°C;
e. Design technology for protection of avionics and electrical subsystems against electromagnetic pulse (EMP) and electromagnetic interference (EMI) hazards from external sources, as follows:
   1. Design technology for shielding systems;
   2. Design technology for the configuration of hardened electrical circuits and subsystems;
   3. Determination of hardening criteria for the above.

Notes to Item 6011.:

1. *Governments may permit the shipment of equipment exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.*
2. *Examples of equipment included in this Item:*
   a. *Terrain contour mapping equipment;*
   b. *Scene mapping and correlation (both digital and analog) equipment;*
   c. *Doppler navigation radar equipment;*
   d. *Passive interferometer equipment;*
   e. *Imaging sensor equipment (both active and passive);*
3. *In subitem 6011.a., laser radar systems embody specialized transmission, scanning, receiving and signal processing techniques for utilization of lasers for echo ranging, direction finding and discrimination of targets by location, radial speed and body reflection characteristics.*

6012. Launch support equipment, facilities and software for the systems in Item 6001., as follows:

a. Apparatus and devices designed or modified for the handling, control, activation and launching of the systems in Item 6001.;
b. Vehicles designed or modified for the transport, handling, control, activation and launching of the systems in Item 6001.;
c. Gravity meters (gravimeters), gravity gradiometers, and specially designed components therefor, designed or modified for airborne or marine use, and having a static or operational accuracy of 7×10^{-6} m/sec² (0.7 milligal) or better, with a time to steady-state registration of two minutes or less;
d. Telemetering and telecontrol equipment usable for unmanned air vehicles or rocket systems;
e. Precision tracking systems:
   1. Tracking systems which use a code translator installed on the rocket or unmanned air vehicle in conjunction with either surface or airborne references or navigation satellite systems to provide real-time measurements of in-flight position and velocity;
   2. Range instrumentation radars including associated optical infrared trackers and the specially designed software therefor with all of the following capabilities:
      a. angular resolution better than 3 milli-radians (0.5 mils);
      b. range of 30 km or greater with a range resolution better than 10 meters RMS; **and**
      c. velocity resolution better than 3 meters per second;
   3. Software which processes, post-flight, recorded data, enabling determination of vehicle position throughout its flight path.

6013. Analog computers, digital computers, or digital differential analyzers "designed or modified" for use in the systems in Item 6001. having either of the following characteristics:

a. Rated for continuous operation at temperatures from below minus 45°C to above plus 55°C; **or**
b. Designed as ruggedized or "radiation hardened".

Note to Item 6013.:
Governments may permit the shipment of equipment exported as part of a manned aircraft or satellite or in quantities appropriate for replacement parts for manned aircraft.

6014. Analog-to-digital converters, usable in the systems in Item 6001. having either of the following characteristics:

a. Designed to meet military specifications for ruggedized equipment; **or**
b. Designed or modified for military use; and being one of the following types:
   1. Analog-to-digital converter "microcircuits", which are "radiation hardened" or have all of the following characteristics:
      a. Having a resolution of 8 bits or more;
      b. Rated for operation in the temperature range from below minus 54°C to above plus 125°C; **and**
      c. Hermetically sealed.
   2. Electrical input type analog-to-digital converter printed circuit boards or modules, with all of the following characteristics:
      a. Having a resolution of 8 bits or more;
      b. Rated for operation in the temperature range from below minus 45°C to above plus 55°C; **and**
      c. Incorporating "microcircuits" listed in 6014.b.1., above.

6015. Test facilities and test equipment usable for the systems in Item 6001. and Item 6002., as follows, and specially designed software therefor:

a. Vibration test systems and components therefor, the following:
   1. Vibration test systems employing feedback or closed loop techniques and incorporating a digital controller, capable of vibrating a system at 10 g RMS or more over the entire range 20 Hz and 2,000 Hz and imparting forces of 50 kN (11,250 lbs), measured bare table, or greater;
   2. Digital controllers, combined with specially designed vibration test software, with a real-time bandwidth greater than 5 kHz and designed for use with vibration test systems in 6015.a.1. above;
   3. Vibration thrusters (shaker units), with or without associated amplifiers, capable of imparting a force of 50kN (11,250 lbs), measured bare table, or greater, and usable in vibration test systems in 6015.a.1. above;
   4. Test piece support structures and electronic units designed to combine multiple shaker units into a complete shaker system capable of providing an effective combined force of 50kN, measured bare table, or greater, and usable in vibration test systems in 6015.a.1. above;
b. Wind-tunnels for speeds of Mach 0.9 or more;
c. Test benches/stands which have the capacity to handle solid or liquid propellant rockets or rocket motors of more than 90 kN (20,000 lbs) of thrust, or which are capable of simultaneously measuring the three axial thrust components;
d. Environmental chambers and anechoic chambers capable of simulating the following flight conditions:
   1. Altitude of 15,000 meters or greater; **or**
   2. Temperature of at least minus 50°C to plus 125°C; **and either**
   3. Vibration environments of 10 g RMS or greater between 20 Hz and 2,000 Hz imparting forces of 5 kN or greater, for environmental chambers; **or**
   4. Acoustic environments at an overall sound pressure level of 140 dB or greater (referenced to 2×10^{-5} N per square meter) or with a rated power output of 4 kiloWatts or greater, for anechoic chambers;
e. Accelerators capable of delivering electromagnetic radiation produced by 'bremsstrahlung' from accelerated electrons of 2 MeV or greater, and systems containing those accelerators.

Note:
The above equipment does not include that specially designed for medical purposes.

Note:
In 6015.a., the term 'digital control' refers to equipment, the functions of which are, partly or entirely, automatically controlled by stored and digitally coded electrical signals.

6016. "Specially designed" software, or "specially designed" software with related specially designed hybrid (combined analog/digital) computers, for modeling, simulation, or design integration of the systems in Item 6001. and Item 6002.

Note to Item 6016.:
The modeling includes in particular the aerodynamic and thermodynamic analysis of the systems.

6017. Materials, devices, and "specially designed" software for reduced observables such as radar reflectivity, ultraviolet/infrared signatures and acoustic signatures (i.e. stealth technology), for applications usable for the systems in Item 6001. or Item 6002., for example:

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 spectra, except when specially used for thermal control of satellites;
c. Specially designed software or databases for analysis of signature reduction;
d. Specially designed radar cross section measurement systems.

6018. Devices for use in protecting rocket systems and unmanned air vehicles against nuclear effects (e.g., Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for the systems in Item 6001., as follows:

a. "Radiation Hardened" "microcircuits" and detectors;

b. Radomes designed to withstand a combined thermal shock greater than 100 cal/sq cm accompanied by a peak over pressure of greater than 50 kPa (7 pounds per square inch).

Note:
In 6018.a., 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.

6019. Complete rocket systems (including ballistic missile systems, space launch vehicles and sounding rockets) and unmanned air vehicles (including cruise missile systems, target drones and reconnaissance drones), not covered in Item 6001., capable of a maximum range equal to or superior to 300 km.

6020. Complete subsystems, as follows, usable in systems in Item 6019., but not in systems in Item 6001., as well as specially designed "production facilities" and "production equipment" therefor:

a. Individual rocket stages;
b. Solid or liquid propellant rocket engines, having a total impulse capacity of 8.41×10^5 Ns (1.91×10^5 lb.s) or greater, but less than 1.1×10^6 Ns (2.5×10^5 lbs).

Group 6 - Definitions

"Basic scientific research"
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.

"Designed or Modified"
Equipment, part, components or software which, as a result of "development", or modification, have specified properties that make them fit for a particular application. "Designed or Modified" equipment, parts, components or software can be used for other applications. For example, a titanium coated pump designed for a missile may be used with corrosive fluids other than propellants.

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

"In the public domain"
Means "technology" or "software" which has been made available without restrictions upon its further dissemination.
N.B.: Copyright restrictions do not remove "technology" or "software" from being "in the public domain".

"Microcircuit"
A device in which a number of passive and/or active elements are considered as indivisibly associated on or within a continuous structure to perform the function of a circuit.

"Production"
Means all production stages, such as: product engineering, manufacture, integration, assembly (mounting), inspection, testing, quality assurance.

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

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

"Radiation Hardened"
Components or equipment capable of withstanding radiation levels which meet or exceed a total irradiation dose of 5×10^5 rads (Si).

"Software"
A collection of one or more "programmes" or "micro-programmes" fixed in any tangible medium of expression.

"Specially Designed"
Equipment, parts, components or software which, as a result of "development" have unique properties that distinguish them for certain predetermined purposes. For example, a piece of equipment that is "specially designed" for use in a missile will only be considered so if it has no other function or use. Similarly, a piece of manufacturing equipment that is "specially designed" to product a certain type of component will only be considered such if it is not capable of producing other types of components.

"Technical assistance"
May take forms, such as: instruction, skills, training, working knowledge, consulting services.
N.B.: "Technical assistance" may involve transfer of "technical data".

"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.

"Technology"
Specific information necessary for the "development", "production" or "use" of a product. The information takes the form of "technical data" or "technical assistance". "Technology" includes "software", in any medium or form, "specially designed" to facilitate the "development", "production" or "use" of items embargoed in this group. "Technology" also includes "software", in any medium or form, which is "specially designed" and incorporated in any items embargoed in this group.

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

"Usable In" or "Capable Of"
Equipment, parts, components or software which are suitable for a particular purpose. There is no need for the equipment, parts, components or software to have been configured, modified or specified for the particular purpose. For example, any military specification memory circuit would be "capable of" operation in a guidance system.

Group 7 – Chemical and Biological Weapons
Non-Proliferation List

Note:
Terms in "double quotation marks" are defined terms. Refer to "Group 7 - Definitions" on page 92.

7000. The export of "technology", including licenses, directly associated with CW agents, precursors and dual-use equipment Items listed below, is controlled.

Controls do not apply to that "technology" which is the minimum necessary for the installation, operation, maintenance, and repair of those products for which the export has been authorized.

Controls do not apply to information "in the public domain" or to "basic scientific research".
(*All destinations other than the United States*)

Items 7001. to 7006. will come into effect upon the Entry Into Force of the "Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction" (otherwise referred to as the "Chemical Weapons Convention" or CWC). Canada has signed and ratified the CWC, but it will not enter into force until 180 days after sixty-five signatories have deposited their Instruments of Ratification. Under the authority of the "Chemical Weapons Convention Implementation Act" of 1995 (cf. Chapter 25 in Part III of the Canada Gazette of August 11, 1995), Regulations respecting Items 7001 to 7006 are being prepared, for implementation at the time of the CWC's Entry Into Force.

7001. CWC Schedule 1 A Toxic Chemicals:

1. O-Alkyl (equal to or less than C_{10}, including cycloalkyl) alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) - phosphonofluoridate;
   e.g. ***Sarin*** (GB):O-Isopropyl methyl-phosphonofluoridate, (CAS 107-44-8);
   Soman (GD):O-Pinacolyl methylphosphono-fluoridate, (CAS 96-64-0);
2. O-Alkyl (equal to or less than C10, including cycloalkyl) N,N-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphoramidocyanidates, e.g., Tabun: O-Ethyl N,N-dimethylphosphoramidocyanidate, (CAS 77-81-6);
3. O-Alkyl (H or equal to or less than C10, including cycloalkyl) S-2-dialkyl (Methyl, Ethyl, n-Propyl or Isopropyl)-aminoethyl alkyl (Methyl, Ethyl, n-Propyl or Isopropyl) phosphonothiolates and corresponding alkylated and protonated salts, e.g., VX: O-Ethyl S-2-diiso-propylaminoethyl methylphosphonothiolate, (CAS 50782-69-9);
4. ***Sulphur mustards:***
   2-Chloroethylchloromethylsulphide, (CAS 2625-76-5);
   Mustard gas: Bis(2-chloroethyl) sulphide, (CAS 505-60-2);
   Bis(2-chloroethylthio) methane, (CAS 63869-13-6);
   Sesquimustard: 1,2-Bis (2-chloroethylthio) ethane, (CAS 3563-36-8);
   1,3-Bis (2-chloroethylthio) -n-propane, (CAS 63905-10-2);
   1,4-Bis (2-chloroethylthio) -n-butane, (CAS 142868-93-7);
   1,5-Bis (2-chloroethylthio) -n-pentane, (CAS 142868-94-8);
   Bis (2-chloroethylthiomethyl) ether; (CAS 63918-90-1);
   O-Mustard: Bis (2-chloroethylthioethyl) ether, (CAS 63918-89-8);
5. ***Lewisites:***
   Lewisite 1: 2-chlorovinyldichloroarsine, (CAS 541-25-3);
   Lewisite 2: Bis (2-chlorovinyl) chloroarsine, (CAS 40334-69-8);
   Lewisite 3: Tris (2-chlorovinyl) arsine, (CAS 40334-70-1);
6. ***Nitrogen mustards***:
   HN1: bis (2-chloroethyl) ethylamine, (CAS 538-07-8);
   HN2: bis (2-chloroethyl) methylamine, (CAS 51-75-2);
   HN3: tris (2-chloroethyl) amine, (CAS 555-77-1);
7. ***Saxitoxin,*** (CAS 35523-89-8);
8. ***Ricin,*** (CAS 9009-86-3).

7002. CWC Schedule 1 B Precursors:

9. Alkyl(Me,Et,n-Pr or i-Pr)phosphonyldifluorides
   e.g. DF: Methyl Phosphonyldifluoride, (CAS 676-99-3); also see 7011.4.;
10. O-Alkyl (H or equal to or less than C10, including cycloalkyl) O-2-dialkyl (Methyl, Ethyl, n-Propyl or isopropyl)-aminoethyl alkyl (Methyl, Ethyln-Propyl or Isopropyl)phosphonites and corresponding alkylated or protonated salts;
    e.g. QL: O-Ethyl O-2-diisopropylamino ethyl methyl-phosphonite, (CAS 57856-11-8); also see 7011.29.;
11. Chlorosarin: O-Isopropyl methylphosphonochloridate, (CAS 1445-76-7);
12. Chlorosoman: O-Pinacolyl methylphosphonochloridate, (CAS 7040-57-5).

7003. CWC Schedule 2 A Toxic Chemicals:

1. Amiton: O,O-Diethyl S-[2-(diethylamino)ethyl] phosphor-othiolate, (CAS 78-53-5) and corresponding protonated salts;
2. PFIB: 1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene, (CAS 382-21-8);
3. BZ: 3-Quinuclidinyl benzilate, (CAS6581-06-2).

7004. CWC Schedule 2 B Precursors:

4. Chemicals, except for those listed in item 7001., or 7002., containing a phosphorus atom to which is bonded one methly, ethyl or propyl (normal or iso) group but not further carbon atoms, such as:
   a. dimethyl methylphosphonate, (CAS 756-79-6); also see 7011.3;
   b. methyl phosphonyl dichloride, (CAS 676-97-1); also see 7011.5;

   Note:
   This Item does not control Fonofos: 0-Ethyl S-phenyl ethylphosphonothionate, (CAS 944-22-9).

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5. N,N-Dialkyl (Me, Et, n-Pr or i-Pr) phosphoramidic dihalides;
6. Dialkyl (Me, Et, n-Pr or i-Pr) N,N-Dialkyl (Me, Et, n-Pr or i-Pr)-phosphoramidates;
7. arsenic trichloride, (CAS 7784-34-1); also see 7011.31;
8. 2,2-diphenyl-2-hydroxyacetic acid, (CAS 76-93-7); also see 7011.32.;
9. Quinuclidin-3-ol, (CAS 1619-34-7);
10. N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethyl-2-chlorides and corresponding protonated salts;
11. N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethane-2-ols and corresponding protonated salts;

Note:
This Item does not control:
- a. *N,N-Dimethylaminoethanol, (CAS 108-01-0) and corresponding protonated salts.*
- b. *N,N-Diethylaminoethanol, (CAS 100-37-8); (however, see 7011.49.)*

12. N,N-Dialkyl (Me, Et, n-Pr or i-Pr)aminoethane-2-thiols and corresponding protonated salts;
13. Thiodiglycol: Bis(2-hydroxyethyl)sulfide, (CAS 111-48-8); also see 7011.1.;
14. Pinacolyl alcohol: 3,3-Dimethylbutan-2-ol, (CAS 464-07-3); also see 7011.28.;

7005. CWC Schedule 3 A Toxic Chemicals:

1. Phosgene: Carbonyl dichloride, (CAS 75-44-5);
2. Cyanogen chloride, (CAS 506-77-4);
3. Hydrogen cyanide, (CAS 74-90-8);
4. Chloropicrin: Trichloronitromethane, (CAS 76-06-2).

7006. CWC Schedule 3 B Precursors:

5. Phosphorus oxychloride, (CAS10025-87-3); also see 7011.2.;
6. Phosphorus trichloride, (CAS 7719-12-2); also see 7011.7.;
7. Phosphorus pentachloride, (CAS10026-13-8); also see 7011.38.;
8. Trimethyl phosphite, (CAS 121-45-9); also see 7011.8.;
9. Triethyl phosphite, (CAS 122-52-1); also see 7011.30.;
10. Dimethyl phosphite, (CAS 868-85-9); also see 7011.6.;
11. Diethyl phosphite, (CAS 762-04-9); also see 7011.19.;
12. Sulphur monochloride, (CAS10025-67-9); also see 7011.51.;
13. Sulphur dichloride, (CAS 10545-99-0); also see 7011.52.;
14. Thionyl chloride, (CAS 7719-09-7); also see 7011.9.;
15. Ethyl diethanolamine, (CAS 139-87-7);
16. Methyldiethanolamine, (CAS 105-59-9);
17. Tri-ethanolamine, (CAS 102-71-6); also see 7011.46.

7011. Chemical Weapon Agent Precursor Chemicals, as follows:

1. Thiodiglycol, 111-48-8;
2. phosphorus oxychloride, 10025-87-3;
3. dimethyl methylphosphonate, 756-79-6;
4. methyl phosphonyl difluoride, 676-99-3;
5. methyl phosphonyl dichloride, 676-97-1;
6. dimethyl phosphite, 868-85-9;
7. phosphorus trichloride, 7719-12-2;
8. trimethyl phosphite, 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. 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, 986-80-0;
28. pinacolyl alcohol, 464-07-3;
29. QL(O-ethyl-2- diisopropylaminoethyl methylphosphonite, 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 bifluoride, 1341-49-7;
43. sodium bifluoride, 1333-83-1;
44. sodium fluoride, 7681-49-4;
45. sodium cyanide, 143-33-9;
46. tri-ethanolamine, 102-71-6;
47. phosphorous 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-2-aminoethyl chloride hydrochloride, 4261-68-1.

(*All destinations other than the United States*)

Notes:
1. *In Item 7011. the number following the chemical name in each paragraph is the Chemical Abstracts Service Registry Number for that chemical as listed in the Chemical Abstracts Service Registry Handbook published by the American Chemical Society, Washington, D.C..*
2. *Chemical mixtures containing any of the chemicals included in Item 7011. are also covered by Item 7011., except when the chemical is merely an impurity that was not intentionally added or is a normal ingredient in consumer goods intended for retail sales.*
3. *Chemical compounds created with any chemicals listed in Item 7011. are not covered in Item 7011. unless the compound itself is listed in Item 7011.*

7012. Chemical Test, Inspection and Production Equipment, as follows:

1. Reaction Vessels, Reactors or Agitators, Storage Tanks, Containers or Receivers, Heat Exchangers or Condensers, Distillation or Absorption Columns, Valves, Multi-walled Piping, and, Pumps, as follows:
   a. Reaction Vessels or Reactors, with or without agitators, with a total internal (geometric) volume greater than 0.1 m^3 (100 l) and less than 20 m^3 (20,000 l);
   b. Agitators for use in reaction vessels or reactors listed in Item 7012.1.a..;
   c. Storage Tanks, Containers or Receivers, with a total internal (geometric) volume greater than 0.1 m^3 (100 L);
   d. Heat exchangers or Condensers with a heat transfer surface area of less than 20 m^2;
   e. Distillation or Absorption Columns of internal diameter greater than 0.1 m;
   f. Multiple-seal valves incorporating a leak detection port, bellows-seal valves, non-return (check) valves or diaphragm valves;
   g. Multi-walled Piping incorporating a leak detection port;
   h. Multi-seal, canned drive, magnetic drive, bellows or diaphragm pumps, with manufacturer's specified maximum flow-rate greater than 0.6 m^3/h, or vacuum pumps with the manufacturer's specified maximum flow-rate greater than 5 m^3/h (under standard temperature (0°C) and pressure (101.30 kPa) conditions);

   Technical Note:
   Items listed in 7012.1.a. through h. are considered to be included in this Item only if all surfaces of any of the Items coming in direct contact with the chemical(s) being processed or contained are made from any of the following materials:
   1. *nickel or alloys with more than 40% nickel by weight;*
   2. *alloys with more than 25% nickel and 20% chromium by weight;*
   3. *fluoropolymers;*
   4. *glass or glass-lined(including vitrified or enamelled coating);*
   5. *graphite (applies only to heat exchangers, condensers, distillation and absorption columns, multi-walled piping and pumps);*
   6. *tantalum or tantalum alloys;*
   7. *titanium or titanium alloys;*
   8. *zirconium or zirconium alloys;*
   9. *ceramics (applies only to pumps); **or***
   10. *ferrosilicon (applies only to pumps).*

2. Remotely operated filling equipment 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:
   a. nickel or alloys with more than 40% nickel by weight;**or**
   b. alloys with more than 25% nickel and 20% chromium by weight;
3. Incinerators designed to destroy CW agents, AG-controlled precursors or chemical munitions, possessing all of the following characteristics:
   a. specially designed waste supply systems;
   b. special handling facilities; **and**
   c. average combustion chamber temperature greater than 1000 °C;

   Technical Note:
   Items listed in 7012.3.a. through 7012.3.c. are considered to be included only if 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. *nickel or alloys with more than 40% nickel by weight;*
   2. *alloys with more than 25% nickel and 20% chromium by weight; **or***
   3. *ceramics.*
4. Toxic gas monitoring systems and dedicated detectors
   a. designed for continuous operation and useable for the detection of CW agents, AG-controlled precursors or organic compounds containing phosphorus, sulphur, fluorine or chlorine at concentrations of less than 0.3 mg/m^3; **or**
   b. designed for the detection of cholinesterase-inhibiting activity.

Note:
Governments may permit the shipment of equipment (identified in Item 7012.) which is specially designed for use in civil applications such as food processing, pulp and paper processing, or water purification and is, by the nature of its design, inappropriate for use in storing, processing, producing or conducting and controlling the flow of chemical weapon agents or any of the precursors chemicals which are included in Item 7011. or Item 2007.

*(Item 7012. applies to all destinations **except** Argentina, Australia, Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom and United States.)*

7021. Biological Weapon Agents

1. **Human pathogens**

   Note:
   Except where the agent is in the form of a vaccine.

   a. Viruses:
      1. Chikungunya virus;
      2. Congo-Crimean haemorrhagic fever virus;
      3. Dengue fever virus;
      4. Eastern equine encephalitis virus;
      5. Ebola virus;
      6. Hantaan virus;
      7. Junin virus;
      8. Lassa fever virus;
      9. Lymphocytic choriomeningitis virus;
      10. Machupo virus;
      11. Marburg virus;
      12. Monkey pox virus;
      13. Rift Valley fever virus;
      14. Tick-borne encephalitis virus (Russian Spring Summer encephalitis virus);
      15. Variola virus;
      16. Venezuelan equine encephalitis virus;
      17. Western equine encephalitis virus;
      18. White pox;
      19. Yellow fever virus;
      20. Japanese encephalitis virus;
   b. Rickettsiae:
      1. Coxiella burnetii;
      2. Bartonella Qintana (Rickettsiae quintana, Rochalimea quintana);
      3. Rickettsiae prowazeki;
      4. Rickettsiae rickettsii;
   c. Bacteria:
      1. Bacillus anthracis;
      2. Brucella abortus;
      3. Brucella melitensis;
      4. Brucella suis;
      5. Chlamydia psittaci;
      6. Clostridium botulinum;
      7. Francisella tularensis;
      8. Burkholderia Mallei (Pseudomonas mallei);

7021.1.c. con't.

9. Burkholderia pseudomallei (Pseudomonas pseudo-mallei);
10. Salmonella typhi;
11. Shigella dysenteriae;
12. Vibrio cholerae;
13. Yersinia pestis;

d. Genetically Modified Microorganisms:
1. Genetically modified microorganisms or genetic elements that contain nucleic acid sequences associated with pathogenicity and are derived from organisms in the above list of human pathogens;
2. Genetically modified microorganisms or genetic elements that contain nucleic acid sequences coding for any of the human toxins in the list below;

e. Toxins:
Note:
Excluding Immunotoxins.
1. Botulinum toxins;
2. Clostridium perfringens toxins;
3. Conotoxin;
4. Ricin;
5. Saxitoxin;
6. Shiga toxin;
7. Staphylococcus aureus toxins;
8. Tretodotoxin;
9. Verotoxin;
10. Microcystin (Cyanginosin).

2. Animal pathogens
Note:
Except where the agent is in the form of a vaccine.

a. Viruses:
1. African swine fever virus;
2. Avian influenza virus;
Note:
This includes only those Avian influenza viruses of high pathogenicity as defined in EC Directive 92/40/EC:
*a. "Type A viruses with an IVPI(intravenous pathogenicity index) in 6 week old chickens of greater than 1.2; **or***
b. Type A viruses H5 or H7 subtype for which nucleotide sequencing has demonstrated multiple basic amino acids at the cleavage site of haemegglutinin.
3. Bluetongue virus;
4. Foot and mouth disease virus;
5. Goat pox virus;
6. Herpes virus (Aujeszky's disease);
7. Hog cholera virus (syn. swine fever virus);
8. Lyssa virus;
9. Newcastle disease virus;
10. Peste des petits ruminants virus;
11. Porcine enterovirus type 9 (syn. swine vesicular disease virus);
12. Rinderpest virus;
13. Sheep pox virus;
14. Teschen disease virus;
15. Vesicular stomatitis virus;

b. Rickettsiae – None;
c. Bacteria:
1. Mycoplasma mycoides;
d. Genetically modified microorganisms or genetic elements that contain nucleic acid sequences associated with pathogenicity and are derived from organisms in the above list of animal pathogens.

3. Plant Pathogens
a. Virus – none;
b. Rickettsiae – none;
c. Bacteria:
1. Xanthomonas albilineans;
2. Xanthomonas campestris pv citri;
d. Genetically modified microorganisms or genetic elements that contain nucleic acid sequences associated with pathogenicity derived from the plant pathogens identified on this list;
e. Toxins – none;
f. Fungi:
1. Colletotrichum coffeanum var. virulans (Colletotrichum kahawae);
2. Cochliobulus miyabeanus (Helminthosporium oryzae);
3. Microcyclus ulei (syn. Dothidella ulei);
4. Puccinia graminis (syn. Puccinia graminis f.sp. tritici);
5. Puccinia striiformis (syn. Puccinia glumarum);
6. Pyricularia grisea/Pyricularia oryzae.

*(Item 7021. applies to all destinations **except** Argentina, Australia, Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom and United States.)*

7022. Biological Test, Inspection and Production Equipment as follows:

1. Complete containment facilities at P3, P4 containment level;
Technical Note:
Complete containment facilities that meet the criteria for P3 or P4 (BL3, BL4, L3, L4, BSL3, BSL4) containment as specified in the WHO Laboratory Biosafety Manual (Geneva, 1993 - 2nd Edition)

2. Fermenters capable of cultivation of pathogenic micro-organisms, viruses or for toxin production, without the propagation of aerosols, and having a capacity equal to or greater than 100 litres;
Technical Note:
For the purposes of Item 7022.2., sub-groups of fermenters include bioreactors, chemostats and continuous-flow systems.

3. Centrifugal separators capable of the continuous separation of pathogenic microorganisms, without the propagation of aerosols, and having all the following characteristics:
a. flow rate greater than 100 litres/h;
b. component of polished steel or titanium;
c. double or multiple sealing joints within the steam containment area;
d. capable of in-situ steam sterilisation in a closed state;
Technical Note:
For the purposes of Item 7022.3., centrifugal separators include decanters.

7022. con't.

4. Cross-flow filtration equipment designed for continuous separation of pathogenic microorganisms, viruses, toxins and cell cultures without the propagation of aerosols, and having all the following characteristics:
   a. equal to or greater than 5 square metres; **and**
   b. capable of in-situ sterilization;
5. Steam sterilizable freeze-drying equipment with a condenser capacity greater than 50 kg of ice in 24 hours and less than 1000 kg of ice in 24 hours;
6. Equipment that incorporates or is contained in P3 or P4 (BL3, BL4, L3, L4, BSL3, BSL4) containment housing, as follows:
   a. Independently ventilated protective full or half suits;
   b. Class III biological safety cabinets or isolators with similar performance standards.
7. Aerosol inhalation chambers designed for aerosol challenge testing with pathogenic microorganisms, viruses or toxins and having a capacity of 1 cubic meter or greater.

(Item 7022. applies to all destinations ***except*** *Argentina, Australia, Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom and United States.)*

Group 7 Definitions

"Basic scientific research"
: 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.

"Development"
: Development is related to all phases before "production" such as: design,design research, design analysis, design concepts, assembly of prototypes, pilot production schemes design data, process or transforming design data into a product, configuration design, integration design, layouts.

"In the public domain"
: "In the public domain", as it applies herein, means "technology" that has been made available without restrictions upon it's further dessemination. (copyright restrictions do not remove technology from being in the public domain)

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

"Technical assistance"
: May take forms, such as: instruction, skills, training, working knowledge, consulting services.
  N.B. #1:
  "Technical assistance" may involve transfer of "technical data".
  N.B. #2:
  The Export and Import Permits Act *applies only to technical assistance in the form of technical data.*

"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, road-only memories.

"Technology"
: Specific information necessary for the "development", "production" or "use" of a product. The information takes the form of "technical data" or "technical assistance".

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

Group 8 – Chemicals for the Production of Illicit Drugs

8011. Chemicals in excess of the indicated quantities, as follows:

1. Ephedrine (1 kg) *(all destinations);*
2. Ergometrine (10 g);
3. Ergotamine (10 g);
4. Lysergic acid (10 g);
5. 1-phenyl-2-propanone (20 kg);
6. Pseudoephedrine (1 kg) *(all destinations);*
7. N-Acetylanthranilic acid (40 kg);
8. 3,4-Methylenedioxyphenyl-2-propanone (4 kg).

8021. Chemicals in excess of the indicated quantities, as follows:

1. Piperidine (0.5 kg);
2. Safrole (4 kg);
3. Isosafrole (4 kg);
4. Piperonal (4 kg);
5. Anthranilic acid (30 kg);
6. Phenylacetic acid (1 kg).

8031. Chemicals in excess of the indicated quantities, as follows:

1. Acetone (2000 l);
2. Ethyl ether (2000 l);
3. Methyl ethyl keytone (2000 l);
4. Toluene (2000 l);
5. Potassium permanganate (500 kg);
6. Sulfuric acid (2000 l);
7. Hydrochloric acid (2000 l);
8. Acetic anhydride (1000 l).

Note:

Mixtures of chemicals where at least one of the chemicals is not listed in Items 8011, 8021 or 8031 are not included in those Items provided that the mixture was not created solely to avoid inclusion.

Index

NOTES

NOTES

HOW TO COMPLETE THE APPLICATION

DATE: Enter the date on which the application has been completed. (Top right hand corner).

EXPORTER: Indicate full name, street address, city, province, country, postal code, telephone number and name of the person that should be contacted regarding this application.

APPLICANT: Complete this area if the person applying for the individual export permit is different from the exporter, or if the exporter is a non-resident of Canada. THE APPLICANT MUST BE A RESIDENT OF CANADA. Print or type full name, street address, city, province, country, postal code, telephone number and the name of the person who becomes legally responsible for the use of the export permit, if issued.

CONSIGNEE: Insert the full name, street address, city and country of final destination. The country of final destination is the country in which the goods are to be consumed or finally remain. MAXIMUM THREE CONSIGNEES PER APPLICATION.

CANADIAN PORT: Indicate the Canadian Customs Port where the Customs entry form B-13 or equivalent export documentation covering the goods will be validated.

PERCENTAGE OF U.S. CONTENT: COLUMN 1(A): Specify what percentage of the total value of each good being exported is U.S. content as defined by ECL item 5400. If items vary in U.S. content, indicate the U.S. content for each item.

COUNTRY OF ORIGIN: Column 1(B): If not of U.S. origin, indicate the country of origin.

ECL ITEM NO.: Column 2: Indicate the Export Control List Item number which controls your goods proposed for export.

COMMODITY CODE: If known, please provide the Harmonized System (HS) code for each line item.

DESCRIPTION: Column 3: Describe the goods concerned in sufficient detail so as to disclose their true identity and avoid the use of trade names, generic names or general terms that do not adequately describe the goods. Where there is insufficient space on the application form, an annex may be attached. All annex documents that are submitted become part of the export permit. Each page of the annex should include the application I.D. number and be seqentially numbered.

TOTAL QUANTITY: Column 4: Specify the total quantity of each line item identified in the description column.

UNIT VALUE: Column 5: Specify in Canadian dollars the selling price of each of the items listed.

TOTAL VALUE: Column 6: For each line item identified in the description column 3, specify in Canadian dollars the total value derived by multiplying column 4 and 5 for that line.

APPROX. NET WEIGHT: Column 7: Specify the total weight of each line item identified in the description column.

TOTAL VALUE OF ALL GOODS PROPOSED FOR EXPORT: Total column 6 and enter the total value of all goods to be exported in the space provided.

IIC/EUC: In certain instances International Import Certificates (IIC), End Use Certificates (EUC), etc., are required prior to issuance of an export permit. If you have included one of these documents with your application, please indicate by marking an X in the appropriate box.

TECHNICAL INFORMATION/DESCRIPTION: In order to determine if the goods are controlled, under what ECL item the goods are controlled, and at what level the goods are controlled, full technical specifications must accompany each application. Mark (x) the appropriate box if this information accompanies the application.

PERMIT TO BE SENT TO/BY: Indicate by marking the appropriate box who the export permit is to be returned to (i.e. exporter or applicant) and how the export permit is to be returned. NOTE: Export permits requested to be returned by courier are at the expense of the exporter/applicant, whichever the case may be.

CERTIFICATION: The exporter or applicant must sign and date the application form.

DEPARTMENTAL USE ONLY: Do not complete or enter any information in the bottom part of this application which is indicated FOR **DEPARTMENTAL USE ONLY.**

REMEMBER TO SIGN THE APPLICATION FO

INCOMPLETE OR IMPROPERLY COMPLETED FORMS WILL BE RETURNED WITHOU

External Affairs and International Trade Canada | Affaires extérieures et Commerce extérieur Canada

APPLICATION FOR PERMIT TO EXPORT GOODS
DEMANDE DE LICENCE D'EXPORTATION DE MARCHANDISES

(PLEASE PRINT OR TYPE/S.V.P. IMPRIMER OU DACTYLOGRAPHIER)

Quote this Application I.D. Number for all Enquiries/ Citer ce numéro pour toute demande de renseignements: **307600**

Date of Application/Date de la demande:

EXPORTER/EXPORTATEUR

Name/Nom:

Address/Adresse:

City/Ville: | Province: | Country/Pays:

Postal Code/Code postal: | Telephone No./N° de téléphone: ( ) | Facsimilier/Télécopieur ( )

Contact/Responsable:

APPLICANT (if other than exporter)/REQUÉRANT (si autre que l'exportateur)

Name/Nom:

Address/Adresse:

City/Ville: | Province: | Country/Pays:

Postal Code/Code postal: | Telephone No./N° de téléphone: ( ) | Facsimilier/Télécopieur ( )

Contact/Responsable:

CONSIGNEE(S) AT FINAL DESTINATION / DESTINATAIRE(S) ULTIME(S)

Maximum three / maximum trois

Name/Nom: 1.

Address/Adresse:

Country of Final Destination/ P

Name/Nom: 2.

Address/Adresse: | City/Ville:

Country of Final Destination/ Pays de destination finale:

Name/Nom: 3.

Address/Adresse: | City/Ville:

Country of Final Destination/ Pays de destination finale:

CANADIAN PORT WHERE CUSTOMS EXPORT DECLARATION FORM WILL BE PRESENTED
PORT CANADIEN OÙ SERA PRÉSENTÉE LA FORMULE DE DÉCLARATION D'EXPORTATION

% of U.S. % des E.U.	Country of origin Pays d'origine	ECL Item No. N° d'article de la LMEC / Commodity Code Code de commodité	DESCRIPTION	Total Quantity Quantité Totale	Unit Value/ Valeur unitaire	Total Value Valeur Totale ($ Can)	Approx. Net Wgt./ Poids net approx.
Col. 1(A)	Col. 1(B)	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							

THE TOTAL VALUE OF ALL GOODS PROPOSED FOR EXPORT AGAINST THIS APPLICATION IS: ($ CAN)
LA VALEUR TOTALE DE TOUTES LES MARCHANDISES À EXPORTER VISÉES PAR CETTE DEMANDE: ($ CAN)

$

ADDITIONAL INFORMATION ATTACHED
RENSEIGNEMENTS COMPLÉMENTAIRES CI-JOINT

IIC/EUC CII/CUF — Yes Oui ☐ No Non ☐

Technical Information / Description Renseignement / Description Technique — Yes Oui ☐ No Non ☐

PERMIT TO BE SENT TO / LICENCE À ENVOYER À: Exporter Exportateur ☐ Applicant Requérant ☐

By/Par: Mail Poste ☐ Hold for Pickup Retenue pour ramassage ☐

Courrier Collect/ Messagerie (port dû) ☐

CERTIFICATION

The undersigned hereby certifies that:
1. All information given in this form is true and correct.
2. The applicant is a resident of Canada.

ATTESTATION

Le soussigné certifie que:
1. Tous les renseignements donnés dans cette formule sont exacts:
2. Le requérant est un résident du Canada.

Signature _____ Date _____

FOR DEPARTMENTAL USE ONLY - À USAGE DU MINISTÈRE SEULEMENT

PERMIT
1. The export of goods described above is permitted subject to all conditions described herein in accordance with the Export and Import Permits Act and any regulations made thereunder.
2. This permit is valid only for use of the applicant or indicated exporter.
3. Export documents must agree with this permit.

LICENCE
1. L'exportation des marchandises décrites ci-dessus est autorisée sous réserve des conditions indiquées aux présentes conformément à la Loi et au Règlement sur les licences d'exportation et d'importation.
2. Cette licence ne peut être utilisée que par le requérant ou l'exportateur indiqué.
3. Les documents d'exportation doivent être conformes à cette licence.

for Secretary of State for External Affairs/pour le Secrétaire d'État aux Affaires extérieures

Permit Number: N° de la licence:

Date of issue: Date d'émission:

Expiry Date: Date d'expiration:

Expiry Date Extended to: Date d'expiration prolongée au:

File Number: N° du dossier:

Date of Receipt/ Date de réception

Send completed applications to/Soumettre les demandes complétées à:
Export Controls Division (EPE)/Direction du contrôle des exportations(EPE)
External Affairs and International Trade/Affaires extérieure et Commerce extérieur
P.O. Box 481, Station A/C.P. 481, Succursale "A"
Ottawa, Ontario
K1N 9K6

DISTRIBUTION: **WHITE/BLANC** - Departmental copy (Legal)/Copie ministérielle (Juridique) **YELLOW/JAUNE** - Exporter's copy (To be presented to customs at port of validation)/Copie de l'exportateur (Présenter aux douanes au port de validation) **PINK/ROSE** - Departmental copy (Working)/Copie ministérielle (Document de travail) **GREEN/VERT** - Departmental copy (To be returned to AECB when necessary)/Copie du ministère (Retourner à CCEA si nécessaire) **WHITE/BLANC** - Applicants file copy (To be kept by the applicant)/Copie du requérant (À retenir par le requérant)

EXT 1042 (09/93)

September 1996

A Guide to Canada's Export Controls

Additional copies of this guide and the form, **"Application for Permit to Export Goods" (FORM EXT-1042)**, *can be obtained at the following locations:*

VANCOUVER

INTERNATIONAL TRADE CENTRE
2000 - 300 West Georgia Street
Vancouver, British Columbia
V6B 6E1
Tel: (604) 666-0434
Fax: (604) 666-0954

EDMONTON

INTERNATIONAL TRADE CENTRE
Canada Place
Suite 540
9700 Jasper Avenue
Edmonton, Alberta
T5J 4C3
Tel: (403) 495-2944
Fax: (403) 495-4507

CALGARY

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Calgary, Alberta
T2P 0M9
Tel: (403) 292-4575
Fax: (403) 292-4578

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7th Floor, PrincetonTower
123-2nd Avenue South
Saskatoon, Saskatchewan
S7K 7E6
Tel: (306) 975-5315
Fax: (306) 975-5334

WINNIPEG

INTERNATIONAL TRADE CENTRE
4th Floor,
400 St. Mary Avenue
Winnipeg, Manitoba
R3C 4K5

P.O. Box 981
Winnipeg, Manitoba
R3C 2V2

Tel: (204) 983-4540
Fax: (204) 983-3182

TORONTO

INTERNATIONAL TRADE CENTRE
Dominion Public Building
4th Floor
1 Front Street West
Toronto, Ontario
M5J 1A4
Tel: (416) 973-5053
Fax: (416) 973-8161

OTTAWA

FOREIGN AFFAIRS AND INTERNATIONAL TRADE CANADA
Export Controls Division
125 Sussex Drive, C-4
P.O. Box 481, Station "A"
Ottawa, Ontario
K1N 9K6
Tel: (613) 996-2387
Fax: (613) 996-9933

MONTREAL

INTERNATIONAL TRADE CENTRE
5, Place Ville Marie
7th Floor
Montréal, Québec
H3B 2G2
Tel: (514) 283-6328
Fax: (514) 283-8794

MONCTON

INTERNATIONAL TRADE CENTRE
1045 Main Street
Unit 103
Moncton, New Brunswick
E1C 1H1
Tel: (506) 851-6452
Fax: (506) 851-6429

HALIFAX

INTERNATIONAL TRADE CENTRE
1801 Hollis Street
5th Floor
P.O. Box 940, Station "M"
Halifax, Nova Scotia
B3J 2V9
Tel: (902) 426-7540
Fax: (902) 426-2624

CHARLOTTETOWN

INTERNATIONAL TRADE CENTRE
75 Fitzroy Street,
P.O. Box 1115
Charlottetown
Prince Edward Island
C1A 7M8
Tel: (902) 566-7443
Fax: (902) 566-7450

ST. JOHN'S

INTERNATIONAL TRADE CENTRE, INDUSTRY CANADA
Atlantic Place
P.O. Box 8950
215 Water Street
Suite 504
St. John's, Newfoundland
A1B 3R9
Tel: (709) 772-4782
Fax: (709) 772-5093