هيئة الرقابة النووية والإشعاعية
Nuclear and Radiological Regulatory Commission

NRRC Information Document

Identification of Items Specified

in the National Nuclear Regulatory Controlled Items List

دليل التعرف على الأصناف المقيدة في القائمة الوطنية في المجالات النووية

NRRC-IG-69 2026

Identification of Items Specified in the National Nuclear Regulatory Controlled Items List

2026

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Preface

This Internal Guideline (IG) has been developed to be consistent with other Internal Guidelines of the Nuclear and Radiological Regulatory Commission (NRRC) in order to improve the quality and consistency of NRRC operations. The NRRC IGs are developed to assist and guide NRRC's staff through its processes. These IGs provide support and guidance on how to perform a task. This IG is a written document with step-by-step instructions for the Write the Document Title Here. Approved by the Chief Executive Officer (CEO) of the NRRC by resolution number No. (0310027) dated 04/01/2026.

المقدمة

يعرف نظام الرقابة على الاستخدامات النووية والإشعاعية الصادر بالمرسوم الملكي رقم (م/82) وتاريخ 25/01/1439هـ المتعلقات النووية بأنها "ما يتعلق بأي مادة أو بضاعة أو تقنية أو برامج حاسوبية أو بيانات ترتبط بالجانب النووي أو الإشعاعي، وكذلك المواد ذات الاستخدام المزدوج النووي وغير النووي، والتي تخضع استخداماتها لشروط محددة؛ كونها عرضة لإساءة الاستخدام"

أعدت هذه الوثيقة وفقًا للأنظمة واللوائح الوطنية التالية:

- نظام الرقابة على الاستخدامات النووية والإشعاعية، الصادر بالمرسوم الملكي رقم (م/82)، بتاريخ 11 أبريل 2018م (25/07/1439 هـ).
- اللوائح الفنية لنظام الرقابة على الاستخدامات النووية والإشعاعية، الموافق عليها بموجب قرار مجلس إدارة هيئة الرقابة النووية والإشعاعية رقم (ق/1/1/2022) وتاريخ 19/9/1443هـ، ومنها على وجه الخصوص اللوائح التالية:
  - لائحة الأمان الإشعاعي (NRRC-R-01).
  - لائحة الإشعار والأذن للمرافق والأنشطة ذات المصادر الإشعاعية (NRRC-R-02).
  - لائحة حصر ومراقبة المواد النووية (NR-RC-R-12).
  - لائحة الأذن والتحكم الرقابي في المتعلقات النووية (NRRC-R-18).
  - اللائحة الفنية الخاصة "القائمة الوطنية للأصناف المقيدة في المجالات النووية (NR-RC-R-18-SR01 Rev.01)"، الموافق عليها بقرار الرئيس التنفيذي رقم (1607) وتاريخ 9/07/1445هـ، وملحقها (NRRC-R-18-SR01-Annex Rev.02)"، الموافق عليها بقرار الرئيس التنفيذي رقم (0311536) وتاريخ 24/11/1446هـ.
  - وقد أُعدت هذه الوثيقة للمساعدة في التعرف على أي من الأصناف ذات الاستخدام النووي وغير النووي المدرجة في القائمة الوطنية للأصناف المقيدة في المجالات النووية.

Preface

The Law of Nuclear and Radiological Control issued pursuant to Royal Decree No. M/82 dated 25/07/1439 AH (corresponding to 11 April, 2018) defines the nuclear-related items as "Any nuclear or radiological-related substance, commodity, technology, software or data as well as the nuclear and non-nuclear dual-use materials and components that are subject, when used, to specific restrictions, as they are susceptible to b misused".
With the aim of fostering non-proliferation efforts.

This manual is developed in accordance with the following national laws and regulations:

- The Law of Nuclear and Radiological Control, promulgated by Royal Decree No. (M/82), dated 11 April 2018 (25/07/1439 AH).
- Regulations of the Law of Nuclear and Radiological Control, approved by the NRRC's Board of Directors in resolution No. (R/1/1/2022), dated 19/9/1443 AH, in particular,
- the following regulations:
  - Radiation Safety (NRRC-R-01).
  - Notification on and Authorization of Facilities and Activities with Radiation Sources (NRRC-R-02).
  - Nuclear Material Accountancy and Control (NRRC-R-12).
  - Authorization and Regulatory Control of Nuclear-Related Items (NRRC-R-18 Rev01).
  - The specific regulation "National Nuclear Controlled Items (NRRC-R-18-SR01 Rev.01)" and its annex (NRRC-R-18-SR01-Annex Rev.02), approved by the NRRC's CEO in resolution No. (1607), dated 09/07/1445 AH.
  - The IG is developed to assist in identifying any nuclear and non-nuclear items from National Nuclear Regulatory Controlled Items.

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1. Introduction

1.1 Purpose

The purpose of this IG is to establish official guidance to identify items specified in the National Nuclear Regulatory Controlled Items list (NRRC-R-18-SR01 Rev.01) by NRRC staff. This IG is developed to support fulfilling the Kingdom's international obligations related to nuclear non-proliferation.

1.2 Scope

This IG focuses on elaborating the various identification methods to assist in identifying any nuclear and non-nuclear items from the National Nuclear Regulatory Controlled Items list (NRRC-R-18-SR01 Rev.01) subject to national regulatory control, as they are susceptible to be misused. Each item has an information card to help with the identification process.

1.3 Definitions

TERMINOLOGY	DEFINITION
CAS Number	A unique numerical identifier for chemical substances.
H.S Code	A Harmonized System Code(s), in accordance with nationally approved H.S code(s), where one or more are assigned to an item.
Identification	Information that assists in identifying an item, e.g., packaging details, labels, dimensions, weight, color, shape, UN number, CAS number, and other information.
NRRC Index	A unique numerical identifier assigned for each item, developed by NRRC in accordance with "NRRC-R-18-SR01 Rev.02" specific regulation, each item could be assigned one or more index.
Nuclear-Related Items	Any nuclear or radiological-related substance, commodity, technology, software or data as well as the nuclear and non-nuclear dual-use materials and components that are subject, when used, to specific restrictions, as they are susceptible to be misused.
Nuclear Uses	Possible nuclear application(s) for the strategic and nuclear uses of dual use items, and why it is subject to specific restrictions.
Other Uses (Non-Nuclear)	Possible non-nuclear application(s) for dual use item, other than nuclear.
Technical Specifications	The technical specifications of an item that are subject to regulatory control by NRRC, which would help in identifying the item. Items should meet these technical specifications to be considered strategic.
UN Number	A unique numerical identifier assigned to hazardous materials.
Visual Appearance	A display of the visual characteristics of an item to facilitate its identification visually, when it is applicable.

1.4 Abbreviations

ABBREVIATION	DEFINITION
CEO	Chief Executive Officer of the NRRC
IG	Internal Guideline
NRRC	Nuclear and Radiological Regulatory Commission
CAS	Chemical Abstracts Service
UN Number	United Nations number

2. References for Identification of nuclear and non-nuclear dual-use items

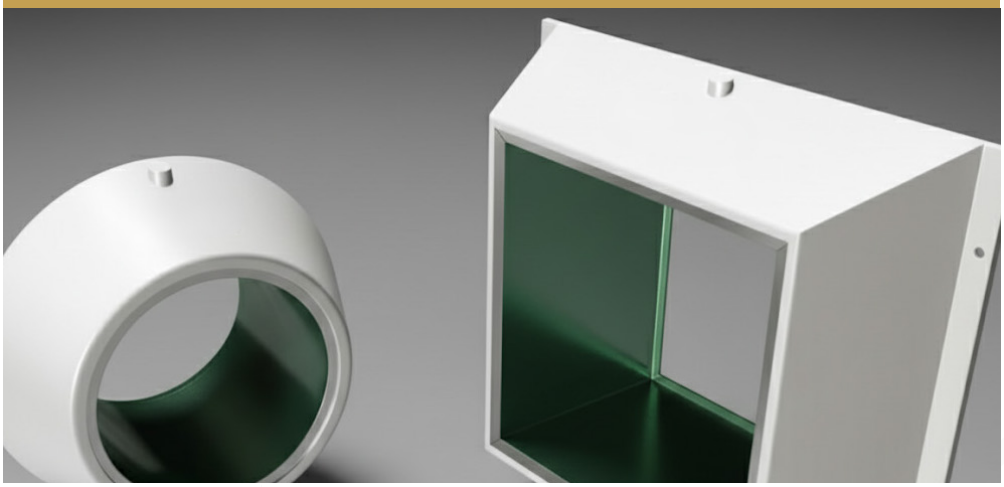
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- Regulations of the Law of Nuclear and Radiological Control, approved by the NRRC's Board of Directors in resolution No. (R/1/1/2022), dated 19/9/1443 AH, in particular,
- the following regulations:
- Radiation Safety (NRRC-R-01).
- Notification on and Authorization of Facilities and Activities with Radiation Sources (NRRC-R-02).
- Nuclear Material Accountancy and Control (NRRC-R-12).
- Authorization and Regulatory Control of Nuclear-Related Items (NRRC-R-18 Rev.01).
- The specific regulation "National Nuclear Controlled Items (NRRC-R-18-SR01 Rev.01)", approved by the NRRC's CEO in resolution No. (1607), dated 09/07/1445 AH, and its annex (NRRC-R-18-SR01-Anne Rev.02), approved by the NRRC's CEO in resolution No. (0311536), dated 24/11/1446 AH.

3. Method for Identifications for Nuclear and Non-nuclear Item

3.1 Non-Nuclear Dual-Use Identification Method

High-density (lead glass or other) radiation shielding windows, and specially designed frames therefor



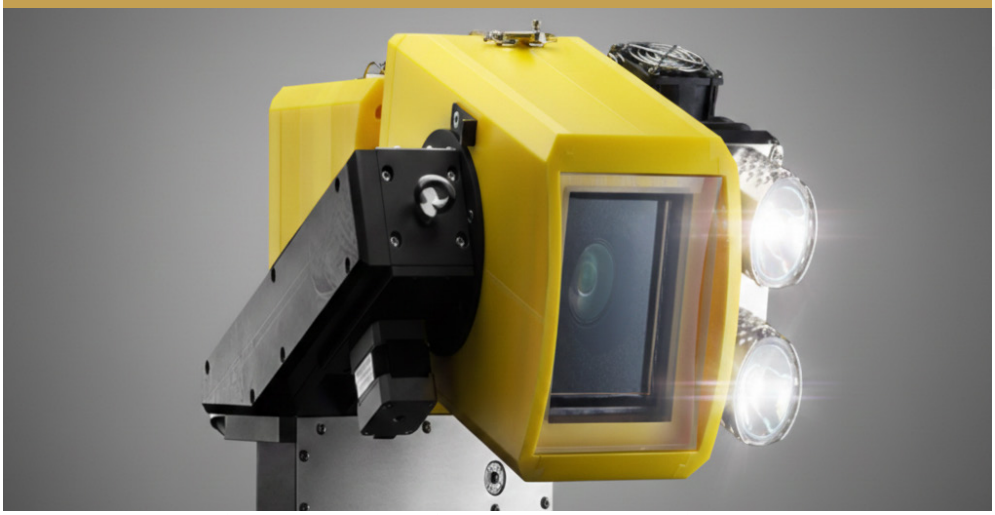
H.S Code	702000900001
NRRC Index	040101010000
NRRC Classification	Dual-Use
Definition	Shielded windows prevent exposure to harmful radiation by stopping X-rays and gamma rays and are commonly used for medical, scientific, industrial, and nuclear applications. The radiation shielding requirements for lead windows can vary depending on the type of radiation, radiation exposure time, and distance from the radiation source.
Technical Specification	• Having all of the following characteristics: 1. A cold area greater than 0.09 m^2; 2. A density greater than 3 g/cm^3; and 3. A thickness of 100 mm or greater.
Nuclear Uses	Used to block radiation while observing operations in "hot cells", where the radiation levels are high, such as those used for reprocessing of nuclear fuels.
Other Uses (non-nuclear)	Used to block radiation while observing operations in "hot cells" – laboratory areas for handling radioactive materials.

الصـــور المستخدمـــة فـــي هذه الوثيقـــة هي للأغراض التوضيحية. لا تدعـم هيـئة الرقـابة النـــووية والإشعاعيـة أي من العلامات التجارية أو تنتقدها

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Identification	• Radiation-shielding windows will be heavier and thicker than normal windows. • Radiation-shielding glass typically has a yellow-green tint, and the windows are typically tapered (with one side smaller than the other). • Generally, radiation-shielded glass less than 10 cm thick is not considered strategic. • Radiation-shielding windows are very heavy. Large windows are packaged for shipping with wooden sheets over the glass surfaces for protection and the assembly is tied down on a pallet or inside a wooden crate.

Radiation-hardened TV cameras, or lense



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H.S Code	852582300000	852582900000	900219000001
NRRC Index	040101020000		
NRRC Classification	Dual-Use		
Definition	Radiation-hardened cameras are designed or shielded to enable it to operate in a high-radiation environment..		
Technical Specification	Specially designed or rated as radiation hardened to withstand radiation without operational degradation.		
Nuclear Uses	Used to enable processing of highly-radioactive materials, especially the separation of plutonium in reprocessing facilities.		
Other Uses (non-nuclear)	Used as a tool in some medical applications such as X-ray therapy and cancer treatment.		
Identification	• Radiation-hardened cameras are typically cylindrical with stainless steel or aluminum housings. • They can be recognized as cameras by their lens at one end and electrical connection at the other. • They can be distinguished from other cameras by their high unit value (tens of thousands of USD), shielded housings and thick lead-glass lens covers. • Radiation-hardened cameras are generally shipped in commercial-grade plastic containers with cushioning. • Labels and nameplates should give manufacturer name, model number, and a serial number.		

Robots, end-effectors and control units



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H.S Code	842870000001		
NRRC Index	040101030000	040101030100	040101030101
	040101030102	040101030200	
NRRC Classification	Dual-Use		
Definition	Robots are programmable mechanisms that are capable of positioning or moving in three dimensions. Robot means a manipulation mechanism, which may be of the continuous path or of the point-to-point variety and may use sensors.		
Technical Specification	• Robots or end-effectors having either of the following characteristics: ◦ Specially designed to comply with national safety standards applicable to handling high explosives (for example, meeting electrical code ratings for high explosives); or Specially designed or rated as radiation hardened to withstand radiation without operational degradation. • Control units specially designed for any of the robots or end-effectors. • Robots having all of the following characteristics: ◦ Multifunctional; ◦ Capable of positioning or orienting material, parts, tools, or special devices through variable movements in three-dimensional space; ◦ Incorporates three or more closed or open loop servo-devices which may include stepping motors; and ◦ User-accessible programmability by means of teach/playback method or by means of an electronic computer which may be a programmable logic controller.		
Nuclear Uses	Used to enable processing of highly-radioactive materials, especially the separation of plutonium in reprocessing facilities.		

Other Uses (non-nuclear)	Used as a tool in some medical applications such as X-ray therapy and cancer treatment.
Identification	• They are usually shipped intact and shipped separately from the end-effectors, associated control unit, and power supply. • To distinguish strategic robots from more common industrial robots, indications on associated paperwork of: ◦ "Radiation-hardening" designs; or ◦ "Explosion-proof" designs.

Remote manipulators that can be used to provide remote actions in radiochemical separation operations or hot cell

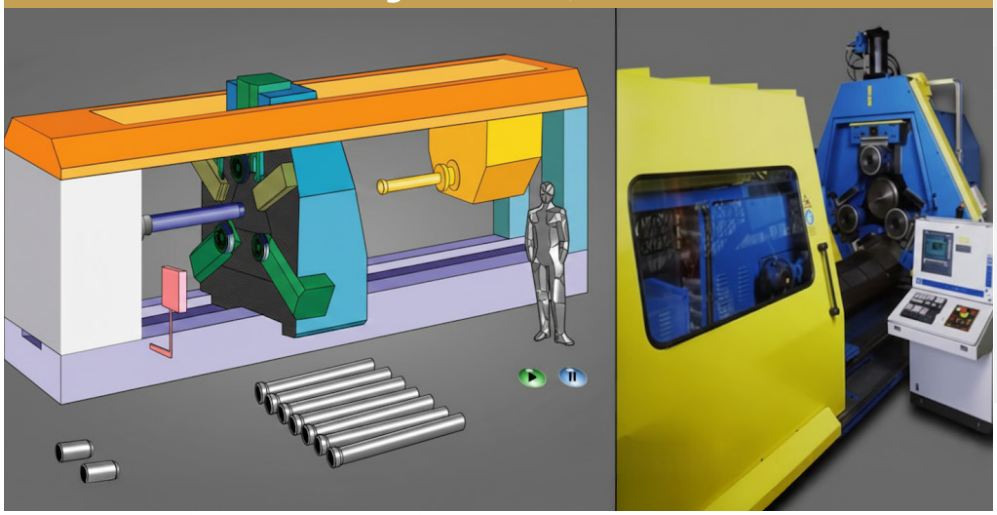


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H.S Code	842890500000
NRRC Index	040101040000
NRRC Classification	Dual-Use
Definition	Remote manipulators are a hand-like mechanism controlled mechanically or by a human operator.
Technical Specification	• Having either of the following characteristics: • A capability of penetrating 0.6 m or more of hot cell wall (through-the-wall operation); or • A capability of bridging over the top of a hot cell wall with a thickness of 0.6 m or more (over-the-wall operation).
Nuclear Uses	Used in handling highly radioactive materials in a nuclear hot cell shielded facility.
Other Uses (non-nuclear)	Used to safely move or manipulate hazardous materials.
Identification	• Mechanical remote manipulators are typically shipped as a single unit packaged on a support block and wrapped with plastic to prevent motion. • The strategic remote manipulators are large-sized, sophisticated, and expensive machines

Flow-forming machines, spin-forming machines capable of flow-forming definitions, and mandrels



H.S Code	846219000001		
NRRC Index	040102010000	040102010100	040102010200
NRRC Classification	Dual-Use		
Definition	The flow-forming machines (and spin-forming machines with flow-forming definitions) are used to manufacture hollow, symmetrical, relatively thin-walled shapes from conical, disk, or ring-shaped preforms. The preform is spun and pressed against a mandrel with rollers to give it the desired shape. Flow forming applies extremely high forces to reduce the thickness of the material.		
Technical Specification	• Machines having both of the following characteristics . Three or more rollers (active or guiding). . Could be equipped with numerical control units or a computer control. • Rotor-forming mandrels designed to form cylindrical rotors of inside diameter between 75 and 650 mm.		
Nuclear Uses	Used in handling highly radioactive materials in a nuclear hot cell shielded facility.		
Other Uses (non-nuclear)	Used in producing high precision machined pieces for the aerospace industry.		

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Identification	• Spinning lathes are shipped in large crates. • Large vertical machines are shipped separately from roller arms, vertical columns, mandrels, control unit, and hydraulic supply and power unit. • Smaller vertical machines as well as horizontal machines are shipped in a large container. • The roller arms are shipped in the assembled configuration. • Larger vertical machines, the control unit, and the hydraulic power supply are shipped separately. • The flow forming machines are strategic if they meet the above technical capabilities. • Machines with three or more rollers or two or more axes are of particular interest. • Manufacturer's name plates, manufacturer names, and model numbers are particularly valuable for identification. • Used machines can pose a significant risk, as compliance with licensing or permitting requirements is often less common in the secondary market.

Machine tools for turning



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H.S Code	845811000001		845891000001
NRRC Index	040102020000	040102020100	040102020200
	040102020201	040102020202	040102020203
	040102020300	040102020301	040102020302
	040102020303	040102020400	
NRRC Classification	Dual-Use		
Definition	Turning machines rotate a metal part being machined and remove material using a cutting tool that does not spin.		
Technical Specification	• Positioning accuracies with all compensations available better (less) than 6 µm. • Provide any compensations along any linear axis.		
Nuclear Uses	Used in the production of certain nuclear weapons and machines for uranium enrichment.		
Other Uses (non-nuclear)	Used to shape metal or wood by rotating the workpiece.		
Identification	• They are likely to be shipped as a unit in a large crate, but the control unit and the console containing the electronics and electrical power supplies might be packaged in a separate box. • Turning machines have a spindle for holding the part to be machined. • Used machines can pose a significant risk, as compliance with licensing or permitting requirements is often less common in the secondary market.		

Machine tools for milling



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H.S Code	845931000001		845951000001
NRRC Index	040102020000	040102020100	040102020200
	040102020201	040102020202	040102020203
	040102020300	040102020301	040102020302
	040102020303	040102020400	
NRRC Classification	Dual-Use		
Definition	Milling machines work a metal surface by means of rotating tools combined with a traversing movement of the article fixed on the machine table.		
Technical Specification	• Having any of the following characteristics: ◦ Positioning accuracies with all compensations available better (less) than 6 µm along any linear axis; ◦ Two or more contouring rotary axes; or ◦ Five or more axes which can be coordinated simultaneously for contouring control.		
Nuclear Uses	For cutting critical components for nuclear weapons and certain uranium enrichment equipment components.		
Other Uses (non-nuclear)	Used to remove materials from the workpiece by rotating a cutting tool.		

Identification	• Grinding machines are shipped as units in a large crate. • The control unit might be in a separate box. • The console containing the electronics and electrical power supplies for the machine tool may also be packaged separately. • They use abrasive disks, wheels, or drums as their cutting tools. • Used machines can pose a significant risk, since proper licensing or permitting requirements are less common in the secondary market.

Machine tools for grinding



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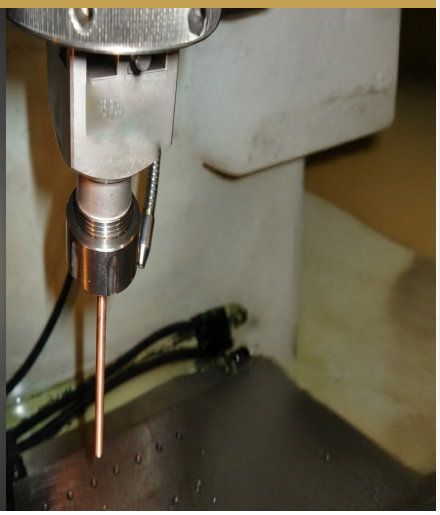
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H.S Code	846029000001		846012000001
NRRC Index	040102020000	040102020100	040102020200
	040102020201	040102020202	040102020203
	040102020300	040102020301	040102020303
	040102020302	040102020400	
NRRC Classification	Dual-Use		
Definition	It is a power tool used for grinding; it uses an abrasive wheel as the cutting tool. Each grain of abrasive on the wheel's surface cuts a small chip from the workpiece via shear deformation.		
Technical Specification	• Having any of the following characteristics: ◦ Positioning accuracies with all compensations available less (better) than 4 µm along any linear axis (overall positioning); ◦ Two or more contouring rotary axes; or ◦ Five or more axes which can be coordinated simultaneously for contouring control.		
Nuclear Uses	Used in the production of nuclear reactor fuel rods.		
Other Uses (non-nuclear)	Used in automotive, industrial, and other applications.		

Identification	• Grinding machines are shipped as units in a large crate. • The control unit might be in a separate box. • The console containing the electronics and electrical power supplies for the machine tool may also be packaged separately. • They use abrasive disks, wheels, or drums as their cutting tools. • Used machines can pose a significant risk, since proper licensing or permitting requirements are less common in the secondary market.

Machine tools: non-wire type Electrical Discharge Machines (EDMs)





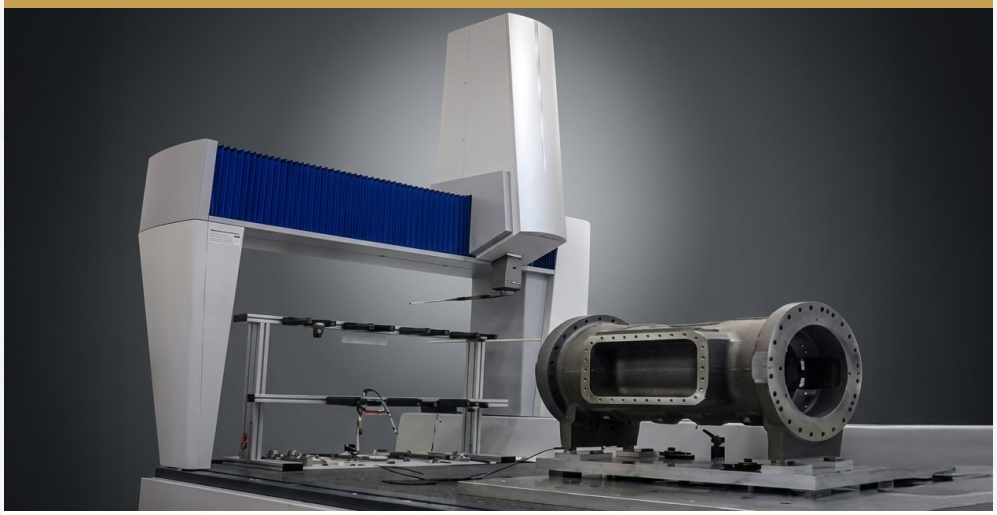
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H.S Code	845630000001		
NRRC Index	040102020000	040102020100	040102020200
	040102020201	040102020202	040102020203
	040102020300	040102020301	040102020302
	040102020303	040102020400	
NRRC Classification	Dual-Use		
Definition	An electrode with pre-shaped geometry of a desired cavity shape, used to create cavities in a workpiece by and electrical discharge (the electro-discharge process). Common names are die-sinker EDM and cavity-type EDM.		
Technical Specification	EDMs have two or more contouring rotary axes and that can be coordinated simultaneously for contouring control.		
Nuclear Uses	Used to cut critical components for nuclear weapons and certain uranium enrichment equipment components.		
Other Uses (non-nuclear)	Used to create dies which are tools used to cut or shape materials into a solid product.		

Identification	• EDMs are shipped as a unit in a large crate. • The control unit and the console containing the electronics and electrical power supplies might be packaged in a separate box. • The wire type EDMs are not strategic. • The plunge type EDMs are considered strategic if they meet the above technical capabilities. • The plunge type EDMs do not have a rotating spindle for a cutting tool. • Used machines can pose a significant risk, as compliance with licensing or permitting requirements are often less common in the secondary market.

Dimensional inspection machines, instruments, or systems



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H.S Code	903149200000	903180900001	903180900002
	903180900003	903149300000	903180900004
NRRC Index	040102030000	040102030100	040102030101
	040102030102	040102030200	040102030201
	040102030202	040102030300	040102030400
	040102030500		
NRRC Classification	Dual-Use		
Definition	Computer controlled coordinate measuring machines use a probe to precisely measure the physical geometry of objects by sensing points on the surface of the object.		
Technical Specification	• A. Computer controlled or numerically controlled coordinate measuring machines (CMM) having either of the following characteristics: ◦ Having only two axes and having a maximum permissible error of length measurement along any axis (one dimensional), identified as any combination of E0x MPE, E 0y MPE or E0z MPE , equal to or less (better) than (1.25 + L/1000) µm (where L is the measured length in mm) at any point within the operating range of the machine. ◦ Three or more axes and having a three-dimensional (volumetric) maximum permissible error of length measurement (E0, MPE equal to or less (better) than (1.7 + L/800) µm (where L is the measured length in mm) at any point within the operating range of the machine. • B. Linear displacement measuring instruments, as follows: ◦ 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; ◦ Linear variable differential transformer (LVDT) systems having both of the following characteristics: a. - Linearity equal to or less (better) than 0.1% measured from 0 to the full operating range, for LVDTs with an operating range up to 5 mm; or - Linearity equal to or less (better) than 0.1% measured from 0 to 5 mm for LVDTs with an operating range greater than 5 mm; and		

	b. Drift equal to or less (better) than 0.1% per day at a standard ambient test room temperature ± 1 K (± 1°C); Measuring systems having both of the following characteristics: a. Containing a laser; and b. Capable of maintaining for at least 12 h, over a temperature range of ± 1 K (± 1°C) around a standard temperature and a standard pressure: - A resolution over their full scale of 0.1 µm or better; and - With a measurement uncertainty equal to or better (less) than (0.2 + L/2000) µm (L is the measured length in mm); • C. Angular displacement measuring instruments having an angular position deviation equal to or less (better) than 0.00025°; • D. Systems for simultaneous linear-angular inspection of semi shells, having both of the following characteristics: ◦ Measurement uncertainty along any linear axis equal to or less (better) than 3.5 µm per 5 mm; and ◦ Angular position deviation equal to or less than 0.02°.
Nuclear Uses	Used in highly precise measurement for producing centrifuge rotors and nuclear weapons parts.
Other Uses (non-nuclear)	Used in testing the assembly parts, in the manufacturing and assembly process, against the design intent.
Identification	• The measuring machines are shipped as a unit in a large crate. • The control unit and the console containing the electronics and electrical power supplies might be packaged in a separate box. • The measuring machines are strategic if they meet the above technical capabilities.

Controlled atmosphere (vacuum or inert gas) induction furnaces, and power supplies



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H.S Code	851420000003		850440190005
NRRC Index	040102040000	040102040100	040102040200
NRRC Classification	Dual-Use		
Definition	• Induction furnaces are essential tools to produce special alloys that meet specialized industries' requirements, and other products that require processing in a vacuum or in inert gas atmosphere settings (to avoid reacting with oxygen). • Vacuum furnaces are ideally suited for metals with a high degree of purification without the presence of oxidation impurities.		
Technical Specification	• A. Furnaces having all of the following characteristics: ◦ Operation at temperatures above 1123 K (850 °C); ◦ Induction coils diameter of 600 mm or less; and ◦ Power input of 5 kW or more. • B. Power supplies: ◦ Output power of 5 kW or more.		
Nuclear Uses	Used in the production of nuclear-explosive components, re-entry vehicle nose tips, and nozzle inserts for ballistic missiles.		
Other Uses (non-nuclear)	Used to melt and cast iron, nickel, cobalt, and their alloys.		

Identification	• Wooden crater supported by banding iron is used to ship cylindrical furnaces and its components. • The furnace housings ports are labelled and covered during shipping, to prevent contamination. • Plasma torches, crucibles, e-beam guns, and induction heating coils could be installed or packaged separately. • Support equipment such as vacuum pumps, power supplies, hydraulic pumps, and control consoles are shipped in separate wooden crates.

Isostatic presses and related equipment



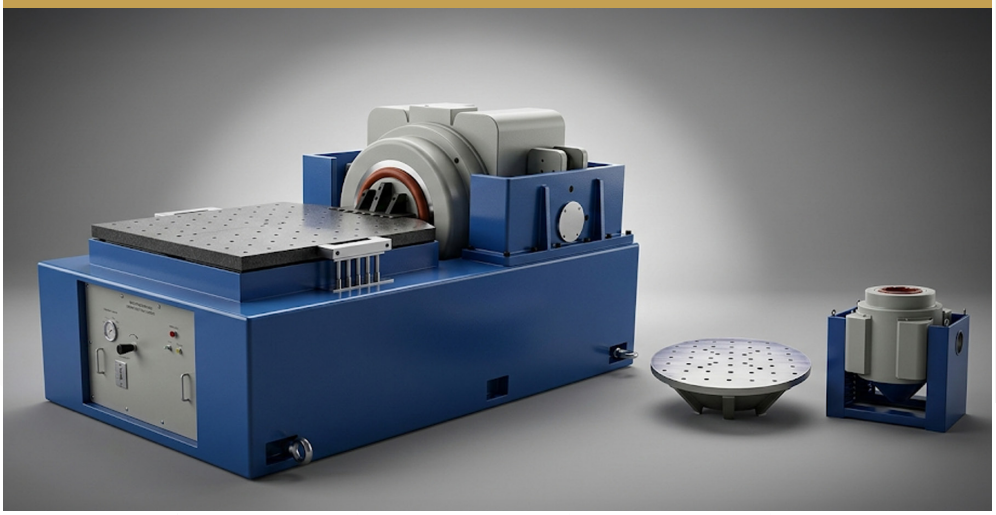
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H.S Code	851411000001	847983000001	847990000002	851490000004
NRRC Index	040102050000	040102050100	040102050200	
NRRC Classification	Dual-Use			
Definition	• Cold isostatic presses use a fluid to apply pressure to a mold in a pressure chamber to compact powders to form solid parts with uniform density. • Hot isostatic presses are a furnace utilized to provide heat at high temperatures.			
Technical Specification	• A. Isostatic presses having both of the following characteristics: ◦ Maximum working pressure of 69 MPa or greater; and ◦ Chamber cavity with an inside diameter in excess of 152 mm. • B. Dies, molds, and controls specially designed for the isostatic presses.			
Nuclear Uses	Used in the production of nuclear-explosive components, re-entry vehicle nose tips, and nozzle inserts for ballistic missiles.			
Other Uses (non-nuclear)	• Cold isostatic presses are used to consolidate ceramic powders, and electrical insulators. • Hot isostatic presses are used to estimate the mineral content of food in the food industry.			

Identification	• Cold isostatic presses:
	  ◦ It requires wood pallets and steel banding to ship them.
	  ◦ They are typically shipped individually.
	  ◦ It has a thick-walled pressure chamber closed on one end and having a threaded closure plug on the other end.
	  ◦ These machines typically cost hundreds of thousands of USD.
	• Hot isostatic presses:
	  ◦ Cylindrical furnaces and components are usually shipped in wooden crates held by banding iron.
	  ◦ Ports on furnace housings are labelled and covered during shipping to prevent foreign matter from entering the furnace system.
	  ◦ Crucibles, induction heating coils, plasma torches, and e-beam guns are packaged separately.
	  ◦ Support equipment such as vacuum pumps, power supplies, hydraulic pumps, and control consoles are shipped in separate wooden crates.

Vibration test systems, equipment, and components



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H.S Code	903180300000	903190600000	903190700000	903190800000
NRRC Index	040102060000	040102060100	040102060200	
	040102060400	040102060300		
NRRC Classification	Dual-Use			
Definition	Vibration test systems are heavy-duty pieces of equipment used to simulate forces of vibration and mechanical shock. They are sometimes called “shaker tables”.			
Technical Specification	• A. Electrodynamic vibration test systems, having all of the following characteristics: ◦ Employing feedback or closed loop control techniques and incorporating a digital control unit; ◦ Capable of vibrating at 10 g0 root mean square (RMS) or more between 20 and 2000 Hz; and ◦ Capable of imparting forces of 50 kN or greater measures bare table. • B. Digital control units, combined with software special-ly designed for vibration testing, with a real-time bandwidth greater than 5 kHz. • C. Vibration thrusters (shaker units), with or without associated amplifiers, capable of imparting a force of 50 kN or greater measured bare table. • D. Test piece support structures and electronic units designed to combine multiple shaker units into a complete shaker system capable of providing an ef-fective combined force of 50 kN or greater measured bare table. • E. Electron beam guns specially designed for the fur-naces operating at a power greater than 50 kW.			

Nuclear Uses	Used to simulate conditions of atmospheric re-entry for nuclear weapons and missile subsystem testing.
Other Uses (non-nuclear)	Used by some manufacturers to test their products and ensure that their products are up to the task of withstanding real-world use.
Identification	• Vibration test systems are so large and heavy (typically several tons) that they must be packaged in custom-built crates of extremely robust construction. • The vibration table may be secured with a temporary brace for shipment to prevent its movement. • The vibration test systems are quite unique in appearance and easily recognized. Notable features are a massive cylindrical exciter supported on bushings in a steel frame. Also, one end of the exciter will be a test table with threaded holes used to mount the test object.

Vacuum or other controlled atmosphere metallurgical melting and casting furnaces and related equipment



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H.S Code	851431000001	851432000001	851490000005
	851432000002	851490000006	851490000007
NRRC Index	040102070000	040102070100	040102070200
	040102070300	040102070400	040102070500
NRRC Classification	Dual-Use		
Definition	A vacuum furnace is used to treat materials through heat either in vacuum and/or in a nonoxidizing atmosphere, it could perform quenching, tempering, vacuum brazing, metal powder sintering, degassing during casting and any other heat treatment.		
Technical Specification	• A. Arc remelt furnaces, arc melt furnaces and arc melt and casting furnaces having both of the following characteristics: ◦ Consumable electrode capacities between 1000 and 20000 cm3; and ◦ Capable of operating with melting temperatures above 1973 K (1700 °C). • B. Electron beam melting furnaces, plasma atomization furnaces and plasma melting furnaces having both of the following characteristics: ◦ A power of 50 kW or greater; and ◦ Capable of operating with melting temperatures above 1473 K (1200 °C). • C. Computer control and monitoring systems specially configured for any of the furnaces specified in A and B. • D. Plasma torches having both of the following characteristics: ◦ Operating at a power greater than 50 kW; and ◦ Capable of operating above 1473 K (1200°C). • E. Electron beam guns: ◦ Operates at a power greater than 50 kW.		

Nuclear Uses	Used in the production of nuclear-explosive components, re-entry vehicle nose tips, and nozzle inserts for ballistic missiles.
Other Uses (non-nuclear)	Used in the manufacturing in aerospace, medical laboratories, and chemical industries.
Identification	• Cylindrical furnaces and components are shipped in wooden crates and held by banding iron. • Furnace housing ports are labelled and covered during shipping to protect the furnace system. • Crucibles, induction heating coils, plasma torches, and e-beam guns may be installed or packaged separately. • Support equipment such as vacuum pumps, power supplies, hydraulic pumps, and control consoles are shipped in separate wooden crates.

Crucibles made of materials resistant to liquid actinide metals



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H.S Code	690390000001		690390000002
NRRC Index	040201010000	040201010100	040201010200
	040201010300		
NRRC Classification	Dual-Use		
Definition	Vessels used to melt and process materials at high temperatures. Made of materials resistant to liquid actinide metals.		
Technical Specification	• A. Crucibles having both of the following characteristics: ◦ A volume of between 150 cm3 (150 mL) and 8000 cm3 (8 L); and ◦ Made or coated with any of the following materials, or combination of the following materials, having an overall impurity level of 2% or less by weight: - Calcium fluoride (CaF2); - Calcium zirconate (metazirconate) (CaZrO3); - Cerium sulphide (Ce2S3); - Erbium oxide (erbia) (Er2O3); - Hafnium oxide (hafnia) (HfO2); - Magnesium oxide (MgO); - Nitrided niobium-titanium-tungsten alloy (approximately 50% Nb, 30% Ti, 20% W); - ttrium oxide (yttria) (Y2O3); or - Zirconium oxide (zirconia) (ZrO2). • B. Crucibles having both of the following characteristics: ◦ A volume of between 50 cm3 (50 mL) and 2000 cm3 (2 L); and ◦ Made of or lined with tantalum, having a purity of 99.9% or greater by weight.		

	• C. Crucibles having all of the following characteristics:
	  ◦ A volume of between 50 cm3 (50 mL) and 2000 cm3 (2 L);
	  ◦ Made or lined with tantalum, having a purity of 98% or greater by weight; and
	  ◦ Coated with tantalum carbide, nitride, boride, or any combination thereof.

Nuclear Uses	Used to cast and melt nuclear materials in the production of nuclear weapon components.
Other Uses (non-nuclear)	The cup-shaped vessel is used to contain chemicals when they are heated usually in a laboratory setting.
Identification	• Inductively Coupled Plasma Mass Spectrometry (ICPMS). • X-ray diffraction (XRD). • X-ray Fluorescence (XRF). • Ceramic crucibles are packaged like glassware. • Individual crucibles may be individually packaged in cardboard boxes surrounded by protective material and marked as fragile. • Larger crucibles may be wrapped in bubble-wrap and boxed individually. • Strategic crucibles are small in sized and made of, or lined with, Calcium fluoride, Calcium zirconate, or Cerium sulfate. • Crucibles are considered more expensive than typical laboratory equipment, it costs around several hundred USD.

Platinized catalysts



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H.S Code	381512000001	711510000001
NRRC Index	040201020000	
NRRC Classification	Dual-Use	
Definition	Platinized catalysts are catalytic materials impregnated with platinum.	
Technical Specification	Promoting hydrogen isotope exchange reaction between hydrogen and water for the recovery of tritium from heavy water or for the production of heavy water.	
Nuclear Uses	Used in heavy water production plants and tritium separation facilities.	
Other Uses (non-nuclear)	Automotive catalytic converters.	
Identification	• Instrument for identification: ◦ Test for the catalyst to affirm the content of platinum (Pt) using Inductively Coupled Plasma Mass Spectrometry (ICPMS) or X-ray Fluorescence (XRF). ◦ Test with Nuclear Magnetic Resonance (NMR) for the performance of the catalyst and examine for water enrichment. • Packed in sealed drums. • Only platinized catalysts specially designed for promoting hydrogen isotope exchange are considered strategic. • Catalysts of interest may be fabricated in small tubular forms called Raschig rings.	

Composite structures in the form of tubes



H.S Code	681513100001
NRRC Index	040201030000
NRRC Classification	Dual-Use
Definition	Composite structures in the form of tubes are made from a combination of two or more materials with specific properties, such as strength, lightness, and corrosion resistance.
Technical Specification	• Having both of the following characteristics: ◦ An inside diameter of between 75 and 400 mm. ◦ Made with any of the fibrous or filamentary materials specified in Item 2-C-7-A, or carbon prepreg materials specified in Item 2-C-7-C from the National Nuclear Regulatory Controlled Items.
Nuclear Uses	Used as nuclear fuel cladding tube in nuclear reactor.
Other Uses (non-nuclear)	Used as a cooling channel in the engine of aerospace application.
Identification	• Composite structures in the form of tubes. • Stress or tensile strength measurements. • Quantitive FTIR or NMR measurement for the ester content.

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Target Assemblies and Components for the Production of Tritium

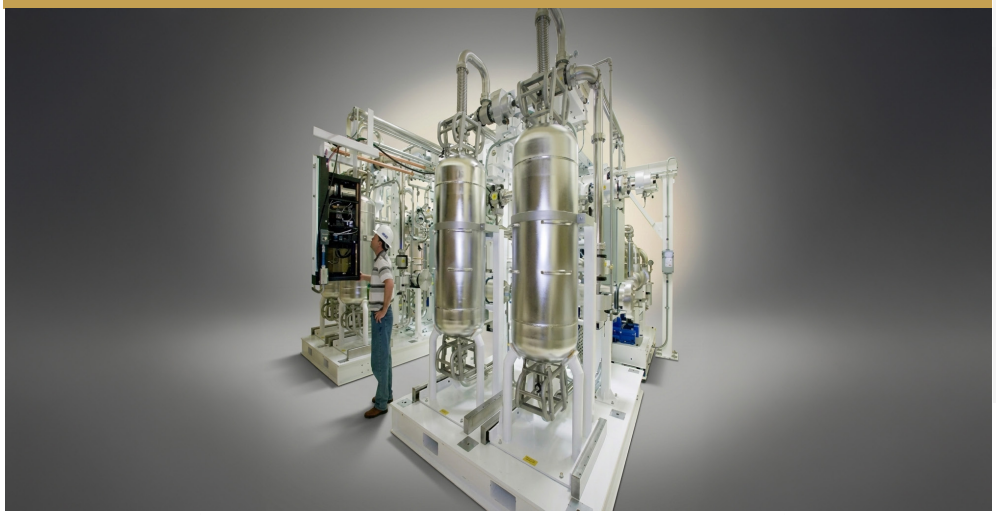


H.S Code	840120300010		
NRRC Index	040201040000	040201040100	040201040200
NRRC Classification	Dual-Use		
Definition	Components specially designed for target assemblies for the production of tritium may include lithium pellets, tritium getters, and specially-coated cladding.		
Technical Specification	Target assemblies made of or containing lith¬ium enriched in the lithium-6 isotope.		
Nuclear Uses	Lithium pellets are used in the making of tritium producing burnable absorber rods used in pressurized water reactors.		
Other Uses (non-nuclear)	Used in hospitals, food processing facilities, and cleanrooms.		
Identification	• Target assemblies and components for the production of tritium as follows: ◦ Target assemblies made of or containing lithium enriched in the lithium-6 isotope specially designed for the production of tritium through irradiation, including insertion in a nuclear reactor. ◦ Components specially designed for the target assemblies.		

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Tritium facilities or plants, and equipment

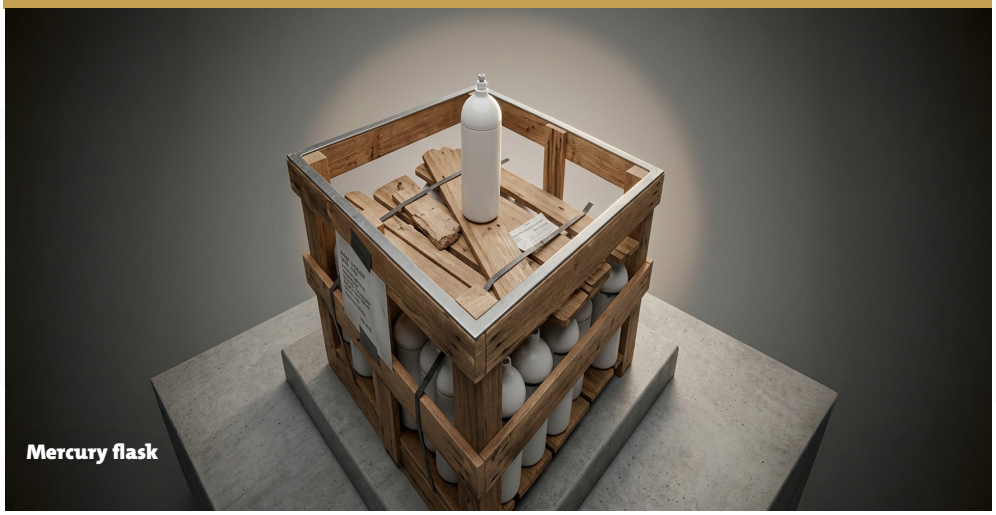


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H.S Code	840120300009		
NRRC Index	040202010000	040202010100	040202010200
NRRC Classification	Dual-Use		
Definition	Facilities or plants for the production, recovery, extraction, concentration or handling of tritium.		
Technical Specification	• Equipment for tritium facilities or plants, as follows: ◦ Hydrogen or helium refrigeration units capable of cooling to 23 K (-250 °C) or less, with heat removal capacity greater than 150 W. ◦ Hydrogen isotope storage or hydrogen isotope purification systems using metal hydrides as the storage or purification medium.		
Nuclear Uses	Tritium is used in boosted fission weapons.		
Other Uses (non-nuclear)	Tritium is used as a tracer for biochemical research, animal metabolism studies and ground water transport measurements.		
Identification	• Tritium, tritium compounds, and tritium mixtures can be identified by the ratio of tritium to hydrogen atoms exceeding one part in 1000 and using the following instrument: ◦ **Liquid scintillation spectrometry. Excluding products or devices containing less than 1.48 x 10^3 GBq of tritium.**		

Lithium isotope separation Facilities or plants, and systems and equipment therefor



H.S Code	840120400000		
NRRC Index	040202020000	040202020100	040202020200
		040202020300	040202020400
NRRC Classification	Dual-Use		
Definition	Facilities or plants for the separation of lithium isotopes.		
Technical Specification	Equipment for the separation of lithium isotopes based on lithium-mercury amalgam process.		
Nuclear Uses	liquid-liquid exchange columns (solvent extraction) are used in separation and purification of uranium and plutonium.		
Other Uses (non-nuclear)	Liquid-liquid extraction could be used in the production of fine organic compounds.		
Identification	• Packed liquid-liquid exchange columns specially designed for lithium amalgams. • Mercury or lithium amalgam pumps. • Lithium amalgam electrolysis cells. • Evaporators for concentrated lithium hydroxide solution.		

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Aluminum alloys



H.S Code	760421000001	760820000001
NRRC Index	040203010000	
NRRC Classification	Dual-Use	
Definition	Alloy where aluminum is the predominant metal combined with alloying elements, typically copper, magnesium, manganese, silicon, tin, nickel, and zinc.	
Technical Specification	• Having both of the following characteristics: ◦ Ultimate tensile strength of 460 MPa or more at 293 K (20 °C). ◦ In the form of tubes or cylindrical solid forms (including forgings) with an outside diameter of more than 75 mm.	
Nuclear Uses	High-strength aluminum alloys, particularly in the form of tubes or cylinders, are considered strategic because they can be used to manufacture rotating components for uranium enrichment gas centrifuge machines.	
Other Uses (non-nuclear)	Used in electric module packaging and wind and solar energy management.	
Identification	• Measurements of the material's tensile strength. • Shipments of specialty metals are normally accompanied by certificates providing exact composition, labels, and markings on the metal itself. • Shipments of alloys in the 2000 series or the 7000 series (ANSI) are typically capable of the high tensile strengths of concern. • Hollow profiles, tubes and pipes of aluminum alloys are of particular interest. • Unalloyed aluminum is not of strategic concern.	

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



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H.S Code	811212000001	811212000004	811213000001
		811213000002	811219000000
NRRC Index	040203020000		
NRRC Classification	Dual-Use		
Definition	Light metal with stiffness properties, and transparency to X-ray radiation.		
Technical Specification	• Alloys with more than 50% beryllium. • Beryllium-Aluminum Grades 120, 130, 140, and 150 all contain 50% or more beryllium. • Beryllium-Aluminum Grades 160, 162, and 562 have less than 50% beryllium.		
Nuclear Uses	Used to fabricate nuclear reactors and nuclear weapon components, and it is also used as a metal fuel material in missile propellants.		
Other Uses (non-nuclear)	Used in gears and components particularly in the aviation industry.		

Identification	• Inductively Coupled Plasma Mass Spectrometry (ICPMS).
	• X-ray Fluorescence (XRF).
	• Beryllium metal is expensive.
	• Beryllium metal would be protected from contamination and damage.
	• Shipped in metal drums.
	• Shipments of specialty metals are normally accompanied by certificates providing exact composition as well as labels and markings on the metal itself.
	• Expected labels:
	  ◦ "Poison"; and
	  ◦ "Flammable solid".
	• CAS 7440-41-7.
	• UN: 1567.		

Bismuth



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H.S Code	810690000001	810610000001
NRRC Index	040203030000	
NRRC Classification	Dual-Use	
Definition	It is a high-density chemical white with silver-pink hue brittle metal	
Technical Specification	• Having both of the following characteristics: ◦ Purity of 99.99% or greater by weight; and ◦ Containing less than 10 ppm (parts per million) by weight of silver.	
Nuclear Uses	Used to produce polonium (Po-210), and as a coolant when incorporated with lead in a nuclear reactor.	
Other Uses (non-nuclear)	Used in fire detectors and extinguishers.	
Identification	• Inductively Coupled Plasma Mass Spectrometry (ICPMS). • X-ray Fluorescence (XRF). • Shipped as a powder or metal needles, or as ingots or pellets. • If shipped as a powder, it will be packaged in glass, plastic bags, or plastic jars. • Small quantities of pellets are packaged in plastic bottles. • Large quantities of ingots are packaged in woodened crates. • Large quantities of needles could be packaged in drums lined with sealed plastic bags. • CAS 7440-69-9. • These technical specifications will result in a strategic shipment having higher unit values than typical shipments under this H.S. code.	

Boron enriched in the boron-10 (^{10}B)

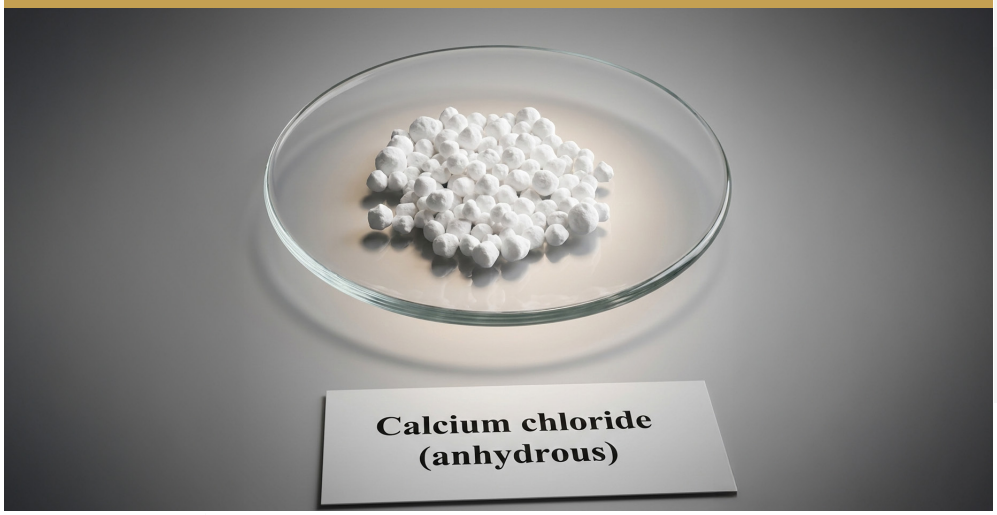


الصـــور المستخدمـــة فـــي هذه الوثيقـــة هي للأغراض التوضيحيـة. لا تدعـم هيـئة الرقـابة النـــووية والإشعاعيـة أي من العلامات التجارية أو تنتقدها

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H.S Code	284520000000
NRRC Index	040203040000
NRRC Classification	Dual-Use
Definition	Boron-10 (10B) is a stable (non-radioactive) isotope of boron. It is both naturally occurring and produced by fission. The term “isotopes” includes elements of which the natural isotopic composition has been artificially modified, that is, elements enriched in a particular isotope.
Technical Specification	• The natural isotopic abundance of boron-10 (10B) is approximately 18.5 weight percent (20% atom). • Appearance: Crystalline solid..
Nuclear Uses	Used as control rods in nuclear reactors.
Other Uses (non-nuclear)	Used as an absorbent in radiation therapy for treating cancer.
Identification	• Inductively Coupled Plasma Mass Spectrometry (ICPMS). • Boron is shipped in paper sacks, plastic bags in metal cans, plastic containers, or larger drums. • Boron enriched in the boron-10 (10B) isotope to greater than its natural isotopic abundance, as follow: elemental boron, compounds, mixtures containing boron, manufactures thereof, waste or scrap of any of the foregoing. • CAS 7440-42-8.

Calcium



H.S Code	280512000001
NRRC Index	040203050000
NRRC Classification	Dual-Use
Definition	It is one of the alkaline-earth metals, and it is the third most abundant metal on earth.

Technical Specification	• Having both of the following characteristics:
	  ◦ Containing less than 1000 ppm by weight of metallic impurities other than magnesium.
	  ◦ Containing less than 10 ppm by weight of boron.

Nuclear Uses	Used in the production of uranium and thorium and to regulate the reaction rate of nuclear fission or reactors in a nuclear reactor by absorbing neutrons.
Other Uses (non-nuclear)	Used in fire detectors and extinguishers.
Identification	• Instrument for identification: ◦ Inductively Coupled Plasma Mass Spectrometry (ICPMS). • Usually packed in High Density Polyethylene (HDPE) bags. • Low chemical reactivity than other alkaline metal. • UN: 1401. • CAS: 7440-70-2.

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Chlorine trifluoride (ClF3)



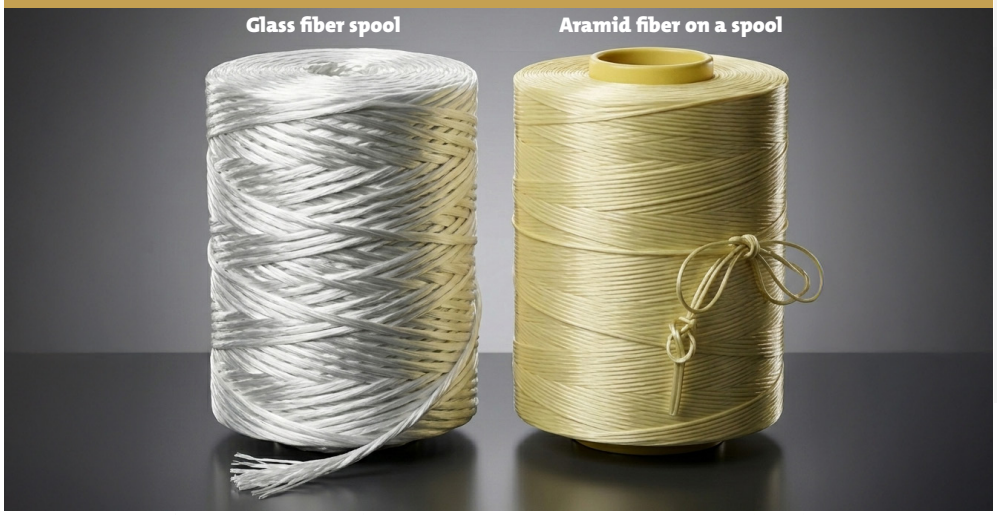
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H.S Code	281290000006
NRRC Index	040203060000
NRRC Classification	Dual-Use
Definition	It is a colorless, toxic, corrosive, and highly reactive gas. It is condensed to pale greenish-yellow liquid.
Technical Specification	• Molecular mass 92.448 g/mol. • Density 1.77 g/cm3. • Melting point -76.34 OC.
Nuclear Uses	ClF3 is used in the preparation process of UF6.
Other Uses (non-nuclear)	Used to clean chemical vapor deposition chambers in the semiconductor industry.

Identification	• Instrument for identification:
	  ◦ Gas chromatography/mass spectrometry.Usually packed in High Density Polyethylene (HDPE) bags.
	• Chloride trifluoride is available in condensed form in the market.
	• Shipped in a cylinder equipped with one or two shut-off valves.
	• It changes into a pale-greenish yellow liquid when compressed at normal temperature.
	• It requires special hazard labels:
	  ◦ Inhalation Hazard;
	  ◦ Corrosive;
	  ◦ Oxidizer;
	• UN: 1749.
	• CAS 7790-91-2.

Fibrous or filamentary materials



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H.S Code	550111000001	550311000001	681511000001
	701911000001	701912000001	701919000001
	550290000001	681513500000	701913000001
	701914000001	701915000001	701990990001
	701961000001		
NRRC Index	040203070000	040203070100	040203070101
	040203070102	040203070200	040203070201
	040203070202		040203070300
NRRC Classification	Dual-Use		
Definition	• Aramid fibers are long-chain synthetic polyamides with extremely high tensile strength and heat resistance. • Thermoset resin impregnated continuous yarns, rovings, tows or tapes. • Glass fibrous or filamentary materials have the ability to produce strong and fiber-reinforced composite. Special high strength glass fibers, such as S-glass, are of particular interest .		
Technical Specification	• A. Carbon or aramid fibrous or filamentary materials having either of the following: ◦ specific modulus of 12.7 x 106 m or greater; or ◦ Specific tensile strength of 23.5 x 104 m or greater. • B. Thermoset resin impregnated continuous yarns, rovings, tows or tapes having the following: ◦ A width of 15 mm or less (prepregs); and ◦ Made from carbon or glass fibrous or carbon or aramid filamentary materials. ◦ Having both of the following characteristics: - Specific modulus of 3.18 x 106 m or greater; and - Specific tensile strength of 7.62 x 104 m or greater		

Nuclear Uses	• Carbon or Aramid fibers are used in nuclear cartridge filters for nuclear applications. • Glass fibers are used as a thermal insulation in nuclear power plants.
Other Uses (non-nuclear)	• Carbon or Aramid fibers are used in protective apparel such as gloves, motorcycle protective clothing, and pants. • Carbon or Aramid fibers are used in armor and ballistic protection applications and advanced composite products which require high-strength and light-weight properties. • Glass fibers are used as electrical insulators.
Identification	• For materials from group (A) in the technical specifications: ◦ Measurements of the material's mechanical properties such as stress (σ), strain (ε), and tensile strength. • For materials from group (B) in the technical specifications: ◦ Measurements of the material's mechanical properties such as stress (σ), strain (ε), and tensile strength. Excluded are aramid fibrous or filamentary materials having 0.25% or more by weight of an ester-based fiber surface modifier. • For glass fibrous or filamentary materials: ◦ Measurements of the material's mechanical properties such as stress (σ), strain (ε), and tensile strength.. • Carbon or Aramid fibers: ◦ Aramid fibers are wounded around a spool and wrapped in plastic. ◦ Packed in sturdy boxes with spaces or end supports to prevent movement. ◦ Prepreg are shipped in refrigerated containers cooled with dry ice. ◦ The fibers are shipped impregnated in resin (prepreg) and are kept cold. ◦ Labels: - Spools are labeled on the inside with details specifying the fiber type. - Prepreg labels consistent with shipments of nonhazardous goods on dry ice. • Aramid fibers are naturally yellow color, but colored fibers and yarns are available. ◦ Trade names include KevlarTM and NomexTM, and TwaronTM. ◦ UN: 1845.

- Glass fibers:
  - Glass fibrous are wounded around a spool and wrapped in plastic.
  - Packed in sturdy boxes with spaces or end supports to prevent movement.
  - Prepreg are shipped in refrigerated containers cooled with dry ice.
  - They are shipped impregnated in resin (prepreg) and are kept cold.
  - Labels:
    - Spools are labeled on the inside with details specifying the fiber type.
    - Prepreg labels consistent with shipments of nonhazardous goods on dry ice.
  - UN: 1845.
  - Glass fiber has a shiny white satin appearance when viewed on the spool

Magnesium



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H.S Code	810419000001	810430100001	810490900001
NRRC Index	040203080000		
NRRC Classification	Dual-Use		
Definition	It is a silvery-white and light metal that is used to make strong lightweight alloys. It burns with a brilliant white flame.		
Technical Specification	• Having both of the following characteristics: ◦ Containing less than 200 ppm by weight of metallic impurities other than calcium; and ◦ Containing less than 10 ppm by weight of boron.		
Nuclear Uses	Used in the production of plutonium and uranium metal. It can also be used as a fuel substance in missile propellants.		
Other Uses (non-nuclear)	Used in the construction of car seats, laptops, and power tools.		
Identification	• Inductively Coupled Plasma Mass Spectrometry (ICPMS). • Powder or granulated magnesium is very flammable, and it has to be shipped in sealed containers. • Larger forms (ingots, castings, forgings, sheets, plates, etc.) of the metal may be shipped without containers. • CAS 7439-95-4. • UN: 1418 or 1869. • Labels: ◦ "Dangerous when wet". ◦ "Flammable solid".		

Lithium enriched in the lithium-6 (6Li)



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H.S Code	284530000000
NRRC Index	040203090000
NRRC Classification	Dual-Use
Definition	Lithium-6 (6Li) is a stable (non-radioactive) isotope of lithium. It is both naturally occurring and produced by fission. The term "isotopes" includes elements of which the natural isotopic composition has been artificially modified, that is, elements enriched in a particular isotope.
Technical Specification	• The natural isotopic abundance of lithium-6 (6Li) is approximately 6.5 weight percent (7.5 atom percent). • Appearance: soft silver-white metal.
Nuclear Uses	When used as a target element in a reactor or a nuclear weapon, lithium-6 (6Li) reacts with a neutron to produce tritium (T), the most important thermonuclear material for weapons. It is also used as a neutron absorber in nuclear fusion.
Other Uses (non-nuclear)	Used as a label for biological and biomedical application.

Identification	• Inductively Coupled Plasma Mass Spectrometry (ICPMS).
	• Shipped in a fused solid ingot in dry air to minimize risk of fire.
	• Shipped in a cylinder equipped with one or two shut-off valves.
	• Other metal forms may be coated with heavy mineral oil or grease then contained in an airtight sealed metal container, placed in drums with cushioning for shock absorption.
	• Many lithium compounds require special hazard labels:Inhalation Hazard;
	  ◦ Dangerous when wet;
	  ◦ Corrosive;
	  ◦ Oxidizer;
	  ◦ Lithium hydroxide requires a shipping label of "Corrosive".
	• UN: 1415.
	• CAS: 7439-93-2.

Maraging steel



الصـــور المستخدمـــة فـــي هذه الوثيقـــة هي للأغراض التوضيحية. لا تدعـم هيـئة الرقـابة النـــووية والإشعاعية أي من العلامات التجارية أو تنتقدها

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H.S Code	722599000001	722691000001	722692000001
	722699000001	722410100001	730451100001
	730650100001	730650200001	730650300001
	722410200001	730459000001	730490000001
	730690000001		
NRRC Index	040203100000		
NRRC Classification	Dual-Use		
Definition	Maraging steel is a class of ultra-high-strength, low-carbon steels that achieve their exceptional strength and toughness not from carbon content (like conventional steels) but from the precipitation of intermetallic compounds during a process called age hardening.		
Technical Specification	Maraging steel capable of an ultimate tensile strength of 1.95 GPa or more.		
Nuclear Uses	To produce the rotor in uranium enrichment gas centrifuges.		
Other Uses (non-nuclear)	Commonly used to manufacture pipes.		

Identification	• Measurements of the material's tensile strength. Excludes forms in which all linear dimensions are 75 mm or less. • H.S. Code 72 and 73 • Specialty steels of interest include maraging steel • Alloys M300, M350, and M400 are of strategic interest. • Exploiting the maraging steel's magnetic property to distinguish it from stainless steel. • Trade names include Vascomax®, NiMark® • Titanium-stabilized duplex stainless steel (Ti-DSS) • It is a duplex stainless steel that contains small amounts of titanium. • These specialty steels will be much more expensive than typical steels.

Radium-226 (226Ra)



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H.S Code	284444900001	284443900002
NRRC Index	40203110000	
NRRC Classification	Dual-Use	
Definition	Radium-226 (^{226}Ra) is a naturally occurring radioactive isotope of radium with an atomic number of 88 and a half-life of about 1,600 years. It is part of the uranium-238 decay series, produced from the decay of uranium through several intermediate radionuclides.	
Technical Specification	Radium-226 (^{226}Ra), radium-226 alloys, radium-226 compounds, mixtures containing radium-226, manufactures thereof, and products or devices containing any of the foregoing.	
Nuclear Uses	Used in dirty bomb.	
Other Uses (non-nuclear)	Historically radium-226 was used in luminous paint, brachytherapy and radiography.	
Identification	• Alpha spectrometry. • Liquid scintillation spectrometry. • Inductively Coupled Plasma Mass Spectrometry (ICPMS). • Excludes medical applications, and product or device containing less than 0.37 GBq of radium-226.	

Titanium alloys



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H.S Code	810890000001
NRRC Index	040203120000
NRRC Classification	Dual-Use
Definition	Titanium is a metal known for its high strength and durability under elevated temperature..
Technical Specification	• Having both of the following characteristics: ◦ Ultimate tensile strength of 900 MPa or more at 293 K (20 °C); and ◦ outer diameter of more than 75 mm.
Nuclear Uses	Used in aircraft industry, shipbuilding, equipment in the chemical industry, sea-water desalination.
Other Uses (non-nuclear)	Used in fire detectors and extinguishers.
Identification	• Measurements of the material's tensile strength. • The specialty metal is shipped with certificate disclosing the exact composition, labels, and markings on the metal itself. • Only certain alloys capable of very high ultimate tensile strength are considered strategic.

Tungsten, tungsten carbide, and alloys containing more than 90% tungsten by weight



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H.S Code	284990100001	810194000004	810199000001
NRRC Index	040203130000		
NRRC Classification	Dual-Use		
Definition	A strong metal that can withstand temperatures over 1650 ^{O}C and maintain high strength and operations.		
Technical Specification	• Having both of the following characteristics: ◦ Inside diameter between 100 and 300 mm; and ◦ Mass greater than 20 kg.		
Nuclear Uses	Used in the fabrication of certain nuclear weapon components and various high-temperature missile parts.		
Other Uses (non-nuclear)	Used as a filament for bulbs, a heating element, and as an electrode.		
Identification	• Inductively Coupled Plasma Mass Spectrometry (ICPMS). • X-ray Fluorescence (XRF). • Packaging must be secure and made out of strong materials. • In forms with a hollow cylindrical symmetry. • CAS 1207-12-1. • Also known as wolfram.		

Zirconium



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H.S Code	810991000001	810921000001	810931000000
NRRC Index	040203140000		
NRRC Classification	Dual-Use		
Definition	Zirconium is a lustrous chemical element that is a hard, silver-grey metal.		
Technical Specification	• Zirconium with a hafnium content of less than 1 part hafnium to 500 parts zirconium by weight. • Metal, alloys containing more than 50% zirconium by weight, compounds, manufactures thereof, waste or scrap of any of the foregoing.		
Nuclear Uses	Used in nuclear reactors and for production of nuclear fuels. Tubes especially designed or prepared to serve as cladding for nuclear fuel.		
Other Uses (non-nuclear)	Used in the fabrication of some chemical industry equipment.		

Identification	• nductively Coupled Plasma Mass Spectrometry (ICPMS).
	• X-ray Fluorescence (XRF).
	• Solid ingots and unfinished products are shipped unprotected on pallets.
	• Low hafnium zircon in the form of tubes and other structural shapes is shipped protected from contamination and damage.
	• Zirconium metal structural shapes, ingots, and most compounds are not classified as hazardous and require no special markings.
	• Zirconium metal powder would be shipped in metal drums and require shipping labels:
	  ◦ "Flammable solid";
	  ◦ "Spontaneous combustible".
	• CAS 7440-67-7.
	• Also known as Zircaloy
	• Brand names include Zirlo®.		

Nickel powder and porous nickel metal



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H.S Code	750400100001		750610000005
NRRC Index	040203150000	040203150100	040203150200
NRRC Classification	Dual-Use		
Definition	It is a black lustrous metal powder which is hard and ductile in nature.		
Technical Specification	• Nickel powder having both of the following characteristics: ◦ Purity content of 99.0% or greater by weight; and ◦ Mean particle size of less than 10 µm.		
Nuclear Uses	Used to make porous materials that act as filters for separating uranium isotopes in the gaseous diffusion uranium enrichment process.		
Other Uses (non-nuclear)	Used in the construction or architectural industries such as ship building, rechargeable batteries, manufacturing, and powder metallurgy. In some cases, nickel powders are used to add a magnetic feature to a particular material.		
Identification	• Instrument for identification: ◦ Inductively Coupled Plasma Mass Spectrometry (ICPMS) and X-ray Fluorescence (XRF) for purity measurements. ◦ Scanning electron microscopy (SEM) for size distribution measurements • Nickel powder is typically packaged in metal drums lined with polyethylene or with internal plastic bags. • Porous nickel metal may be shipped in the form of sheets. • CAS 7440-02-0. • Porous nickel is more expensive than typical nickel shipments under this HS code.		

Grounded and ungrounded natural calcium phosphate and natural lime aluminum phosphate



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H.S Code	251010000001	251010000002	251010000003
	251020000001	251020000002	251020000003
NRRC Index	040203160000		
NRRC Classification	Dual-Use		
Definition	Natural calcium phosphate naturally occurring Calcium Phosphate and free from visible foreign matter		
Technical Specification			
Nuclear Uses	Used as an alternative cementing system for radioactive waste		
Other Uses (non-nuclear)	Used in the construction of car seats, laptops, and power tools.		
Identification	• Instrument for identification: ◦ Inductively Coupled Plasma Mass Spectrometry (ICPMS). • Usually packed in High Density Polyethylene (HDPE) bags..		

Rhenium



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H.S Code	811249000001	811241000001
NRRC Index	040203170000	
NRRC Classification	Dual-Use	
Definition	It is a silver-grey strong metal that can maintain high strength and maintain operations.	

Technical Specification	• Alloys containing 90% by weight or more rhenium.
	• Alloys of rhenium and tungsten containing 90% by weight or more of any combination of rhenium and tungsten.
	• Having both of the following characteristics
	  ◦ In forms with a hollow cylindrical symmetry (including cylinder segments) with an inside diameter between 100 and 300 mm; and
	  ◦ A mass greater than 20 kg.	

Nuclear Uses	Used in fabrication of certain nuclear weapon components.	
Other Uses (non-nuclear)	Used as an additive to tungsten alloys for oven filaments and x-ray machines.	

Identification	• Instrument for identification:
	  ◦ Inductively Coupled Plasma Mass Spectrometry (ICPMS).
	  ◦ A mass greater than 20 kg.
	• Packaging must be secure and made out of strong materials.
	• Hollow cylindrical symmetry (including cylinder segments).
	• CAS 7440-15-5.	

Hafnium



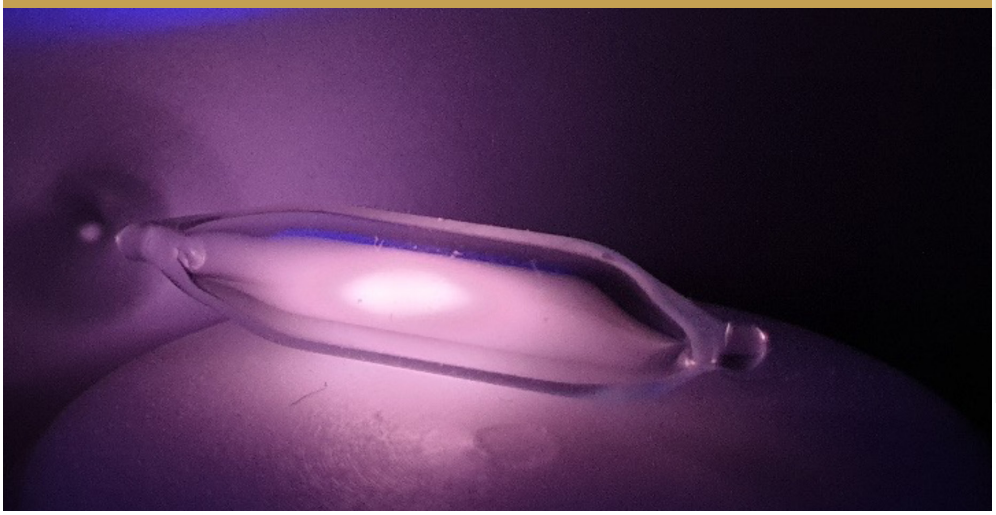
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H.S Code	811231000000	811239000000
NRRC Index	040203180000	
NRRC Classification	Dual-Use	
Definition	It is a nonferrous lustrous, and silvery-gray special metal, and highly resistance to radiation and corrosion.	
Technical Specification	• Hafnium metal, alloys containing more than 60% hafnium by weight. • Hafnium compounds containing more than 60% hafnium by weight. • Manufactures thereof, and waste or scrap of any of the foregoing.	
Nuclear Uses	Used as a control rod in nuclear power plants.	
Other Uses (non-nuclear)	Used in electronics as cathodes and capacitors.	

Identification	• Instrument for identification:
	  ◦ Inductively Coupled Plasma Mass Spectrometry (ICPMS).
	  ◦ X-ray Fluorescence (XRF).
	• Main procedures of hafnium are the Unit State and France.
	• Powder, thin sheets, or coiled wires of the metal are flame hazard and require international shipping labels as “flammable solid” or “spontaneous combustible”.
	• Metal powder or chip is shipped in tightly closed metal drums, wooden barrels, or boxes.
	• Hafnium as solids is shipped on pallets much like steel.
	• Hafnium ingots, rods, and bars are packed in strong wooden crates or metal cans surrounded by cushioning materials.
	• CAS 7440-58-6.	

Helium-3 (^{3}He), mixtures containing helium-3



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H.S Code	284540000000
NRRC Index	040203190000
NRRC Classification	Dual-Use
Definition	Helium-3 (^{3}He) is a light non-radioactive isotope of Helium. The element could be obtained as a by-product from nuclear weapon programs or as a by-product of maintenance of nuclear weapons.
Technical Specification	• Stable Isotope. • Isotopic purity level of 99.8%. • Chemical purity level of 99.99%.
Nuclear Uses	Used to produce tritium.
Other Uses (non-nuclear)	Hyperpolarized helium-3 (3He) gas is used for MRI of the lung.

Identification	• Instrument for identification:
	  ◦ Gas chromatography/mass spectrometry (GC-MS) with special chromatographic column materials for the separation of He-3 and special detector design. Excluding products or devices containing less than 1 g of helium-3
	• Helium-3 is shipped as a compressed gas (unlike natural helium, which is often shipped as a cryogenic liquid) in forged steel or aluminum alloy cylinders at high pressure.
	• Labels:
	  ◦ "Non-flammable Gas"
	  ◦ Hazard Class 2.2

Frequency changers or generators, usable as a variable frequency or fixed frequency motor drive



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H.S Code	850440900005
NRRC Index	040301010000
NRRC Classification	Dual-Use
Definition	Inverter or frequency changer converts alternating current (AC), single or polyphase, to a different frequency.
Technical Specification	• Having both of the following characteristics: ◦ Multiphase output providing a power of 40 VA or greater; ◦ Operating at a frequency of 600 Hz or more; and ◦ Frequency control better (less) than 0.2%.
Nuclear Uses	Used to provide high-frequency power to spin uranium enrichment gas centrifuge machines at high speed.
Other Uses (non-nuclear)	Used to test electrical equipment, aircraft guidance and navigation equipment.
Identification	Frequency changers are typically wrapped in plastic and packaged in sturdy cardboard boxes with material to absorb shock and vibration.

Lasers, laser amplifiers and oscillators



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H.S Code	901320900002	901320900003	901320900004
	901320900009	901320900010	901320900005
	901320900006	901320900007	901390900001
	901320900008		
NRRC Index	040301020000	040301020100	040301020200
	040301020300	040301020301	040301020302
	040301020303	040301020400	040301020500
	040301020600	040301020700	040301020800
	040301020900		040301021000
NRRC Classification	Dual-Use		
Definition	Lasers produce or amplify coherent electro-magnetic radiation in the wave-length range between 1 nm and 1 mm (ultra-violet, visible, and infra-red regions of the spectrum).		

Technical Specification	• A. Copper vapor lasers having both of the following characteristics:
	  ◦ Operating at wavelengths between 500 and 600 nm; and
	  ◦ An average output power equal to or greater than 30 W.
	• B. Argon ion lasers having both of the following characteristics:
	  ◦ Operating at wavelengths between 400 and 515 nm; and
	  ◦ An average output power greater than 40 W.
	• C. Neodymium-doped (other than glass) lasers with an output wavelength between 1000 and 1100 nm having either of the following:
	  1. 1. Pulse-excited and Q-switched with a pulse duration equal to or greater than 1 ns, and having either of the following:
	  ◦ A single-transverse mode output with an average output power greater than 40 W; or
	  ◦ A multiple-transverse mode output with an average output power greater than 50 W; or
	  ◦ 2. Incorporating frequency doubling to give an output wavelength between 500 and 550 nm with an average output power of greater than 40 W;
	• D. Tunable pulsed single-mode dye laser oscillators having all of the following characteristics:
	  ◦ Operating at wavelengths between 300 and 800 nm;
	  ◦ An average output power greater than 1 W;
	  ◦ A repetition rate greater than 1 kHz; and
	  ◦ Pulse width less than 100 ns.
	• E. Tunable pulsed dye laser amplifiers and oscillators having all of the following characteristics:
	  ◦ Operating at wavelengths between 300 and 800 nm;
	  ◦ An average output power greater than 30 W;
	  ◦ A repetition rate greater than 1 kHz; and
	  ◦ Pulse width less than 100 ns.
	• F. Alexandrite lasers having all of the following characteristics:
	  ◦ Operating at wavelengths between 720 and 800 nm;
	  ◦ A bandwidth of 0.005 nm or less;
	  ◦ A repetition rate greater than 125 Hz; and
	  ◦ An average output power greater than 30 W.
	• G. Pulsed carbon dioxide (CO2) lasers having all of the following characteristics:
	  ◦ Operating at wavelengths between 9000 and 11000 nm;
	  ◦ A repetition rate greater than 250 Hz;
	  ◦ An average output power greater than 500 W; and
	  ◦ Pulse width of less than 200 ns.

	• H. Pulsed excimer lasers (XeF, XeCl, KrF) having all of the following characteristics:
	  ◦ Operating at wavelengths between 240 and 360 nm;
	  ◦ A repetition rate greater than 250 Hz; and
	  ◦ An average output power greater than 500 W.
	• I. Para-hydrogen Raman shifters designed to operate at 16 μm output wavelength and at a repetition rate greater than 250 Hz.
	• J. Pulsed carbon monoxide (CO) lasers having all of the following characteristics:
	  ◦ Operating at wavelengths between 5000 and 6000 nm;
	  ◦ A repetition rate greater than 250 Hz;
	  ◦ An average output power greater than 200 W; and
	  ◦ Pulse width of less than 200 ns.

Nuclear Uses	Used in laser-based uranium enrichment or in military applications.
Other Uses (non-nuclear)	Used in medical diagnosis, therapy, and treatment.

Identification	• The following are general guidelines to determine further investigation:
	  ◦ Class IV lasers may produce enough power to make them strategically significant.
	  ◦ Producing less than 1 W of power won't meet control requirements.
	• Controlled lasers tend to be large and expensive. They will be packed in shock-instrumented wooden crates or specially designed cases.
	• Expected label:
	  ◦ "Laser's logo"

Superconducting solenoidal electromagnets



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H.S Code	850590000001
NRRC Index	040301030000
NRRC Classification	Dual-Use
Definition	Superconducting electromagnets are capable of producing high magnetic fields and have negligible electrical resistance.
Technical Specification	• Having all of the following characteristics: ◦ Create magnetic fields greater than 2 Tesla (T). ◦ Length to inner diameter ratio greater than 2. ◦ Inner diameter greater than 300 mm. ◦ Magnetic field uniform to better than 1% over the central 50% of the inner volume.
Nuclear Uses	Used in nuclear fusion reactors.
Other Uses (non-nuclear)	Provide High-resolution images in medical applications.
Identification	The magnet comes in a cryogenic dewar-like housing with helium/nitrogen ports, is labeled with superconducting or cryogenic hazard warnings, and is significantly bulkier than a standard electromagnet.

High-power direct current power supplies



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H.S Code	850440190001
NRRC Index	040301040000
NRRC Classification	Dual-Use
Definition	An electrical device which converts alternating current (AC) to direct current (DC).
Technical Specification	• High-power direct current power supplies having the following characteristics: ◦ Continuously producing, over a time period of 8 h, 100 V or greater; ◦ Current output of 500 A or greater; and ◦ Current or voltage stability better than 0.1% over a time period of 8 h.
Nuclear Uses	Used in creating a steady magnetic field in the electromagnetic isotope separation process.
Other Uses (non-nuclear)	Used in many applications such as medical industry, telecommunications, energy spectrum analysis.
Identification	• High-voltage DC power supplies are typically packaged in reinforced and heavy plywood crates. • They weigh from 1000s kg up to 10,000s kg and they may be from 1 to 3 meters on a side. • Power supplies are typically shipped dry but could be shipped filled with oil. They will have nameplates indicating both dry and wet weights.

High-voltage direct current power supplies



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H.S Code	850440190002
NRRC Index	040301050000
NRRC Classification	Dual-Use
Definition	An electrical device designed to provide a high level of direct voltage (DC) to power equipment or processes.
Technical Specification	• High-voltage direct current power supplies having both of the following characteristics: ◦ Capable of continuously producing, over a time period of 8 h, 20 kV or greater. ◦ Current output of 1 A or greater. ◦ Current or voltage stability better than 0.1% over a time period of 8 h.
Nuclear Uses	Used in the production of high-flux neutrons in compact neutron generators.
Other Uses (non-nuclear)	Use in electron-beam systems.
Identification	• High-voltage DC power supplies are typically packaged in reinforced and heavy plywood crates. • They weigh from 1000s of kg up to 10,000s of kg and they may be • from 1 to 3 meters on a side • The power supplies are typically shipped dry but could be shipped filled with oil. They will have nameplates indicating both dry and wet weights.

All types of pressure transducers capable of measuring absolute pressures



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H.S Code	902620000001		
NRRC Index	040301060000	040301060100	040301060200
NRRC Classification	Dual-Use		
Definition	Pressure transducers measure liquid or gas pressure in a system and convert the measurement to an electronic signal that can be transmitted to recording equipment.		
Technical Specification	• Pressure sensing elements made of or protected by aluminum, aluminum alloy, aluminum oxide (alumina or sapphire), nickel, nickel alloy with more than 60% nickel by weight, or fully fluorinated hydrocarbon polymers; • Seals, if any, essential for sealing the pressure sensing element, and in direct contact with the process medium, made of or protected by aluminum, aluminum alloy, aluminum oxide (alumina or sapphire), nickel, nickel alloy with more than 60% nickel by weight, or fully fluorinated hydrocarbon polymers; and • Having either of the following characteristics: Hydrogen or helium refrigeration units capable of cooling to 23 K (-250 °C) or less, with heat removal capacity greater than 150 W. ◦ Hydrogen isotope storage or hydrogen isotope purification systems using metal hydrides as the storage or purification medium. ◦ A full scale of 13 kPa or greater and an accuracy of better than 130 Pa when measuring at 13 kPa.		
Nuclear Uses	Used for process control in uranium enrichment facilities.		
Other Uses (non-nuclear)	Used in many industrial applications such as measuring water level in a tank, monitoring flow rates...etc.		

Identification	• Pressure transducers are typically sealed in plastic and well packed individually in sturdy cardboard boxes. When more than one is shipped, these individual boxes are placed in a larger box for a single shipment. • Pressure transducers tend to be expensive, cost in the range of thousands of USD. • The pressure measuring instruments of significant characteristics are resistant to corrosion. • Measurement of absolute pressure (rather than differential) is used as an identifier. • Absolute pressure-measurement instruments will have a single fluid connection, while differential pressure transducers will have two (usually marked low and high). • Pressure transducers will have an electronic connection.

Vacuum pumps



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H.S Code	841410000001
NRRC Index	040301070000
NRRC Classification	Dual-Use
Definition	Vacuum pumps are used to remove air and other gases to create vacuum.

Technical Specification	• Having all of the following characteristics:
	  ◦ Input throat size equal to or greater than 380 mm;
	  ◦ Pumping speed equal to or greater than 15 m3/s; and
	  ◦ Capable of producing an ultimate vacuum better than 13.3 mPa.

Nuclear Uses	Used in uranium enrichment and chemical weapons agent production processes.
Other Uses (non-nuclear)	Used in laboratory sittings to aid the motion of solutions through filter papers.
Identification	• Vacuum pumps are shipped like ordinary pumps. • Vacuum pumps are often combined into two-stage pumping systems and shipped as a single unit. • The capacity and material of construction of the vacuum pumps determine if the vacuum pumps are strategic or not.

Bellows-sealed scroll-type compressors and bellows-sealed scroll-type vacuum pumps



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H.S Code	841480900002	841410000002
NRRC Index	040301080000	
NRRC Classification	Dual-Use	
Definition	• Bellow-sealed scroll is a type of vacuum pumps that is used to remove air and other gases to create vacuum. • Metal bellows isolate the process gas from other parts of the pump as well as from the surrounding atmosphere. • One of the ends is coupled with the moving scroll and the other is coupled to the stationary housing of the pump.	
Technical Specification	• Capable of an inlet volume flow rate of 50 m3 /h or greater. • Capable of a pressure ratio of 1:2 or greater. CAS 7440-15-5. • Having all surfaces that come in contact with the process gas made from any of the following materials: ◦ Aluminum or aluminum alloy; ◦ Aluminum oxide; ◦ Stainless steel; ◦ Nickel or nickel alloy; ◦ Phosphor bronze; or ◦ Fluoropolymers.	
Nuclear Uses	Used in uranium enrichment and chemical weapons agent production processes.	
Other Uses (non-nuclear)	Used in the industrial and mechanical as a rod boot to protect rods, bearings and seals from outer contamination (e.g., dirt).	

Identification	• Having all surfaces that come in contact with the process gas made from any of the following materials:
	  ◦ Aluminum or aluminum alloy;
	  ◦ Aluminum oxide;
	  ◦ Stainless steel;
	  ◦ Nickel or nickel alloy;
	  ◦ Phosphor bronze; or
	  ◦ Fluoropolymers.
	• Vacuum pumps are shipped like other pumps.
	• Vacuum pumps are often combined into two-stage pumping systems and shipped as a single unit.

Valves



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H.S Code	848180900003
NRRC Index	040301090000
NRRC Classification	Dual-Use
Definition	Valves are used for controlling and regulating the flow of gases and liquids.
Technical Specification	• Valves having all of the following characteristics: ◦ A nominal size of 5 mm or greater. ◦ Having a bellows seal. ◦ Wholly made of or lined with aluminum, aluminum alloy, nickel, or nickel alloy containing more than 60% nickel by weight.
Nuclear Uses	Used to process uranium hexafluoride gas in a uranium enrichment facility.
Other Uses (non-nuclear)	Used in chemical processing, pharmaceuticals, and food and beverage production.
Identification	• Corrosion-resistant materials lining the wetted surfaces of the valve may be visually distinctive. • Valves especially designed or prepared for nuclear use indicator is "N-stamp".

Electrolytic cells

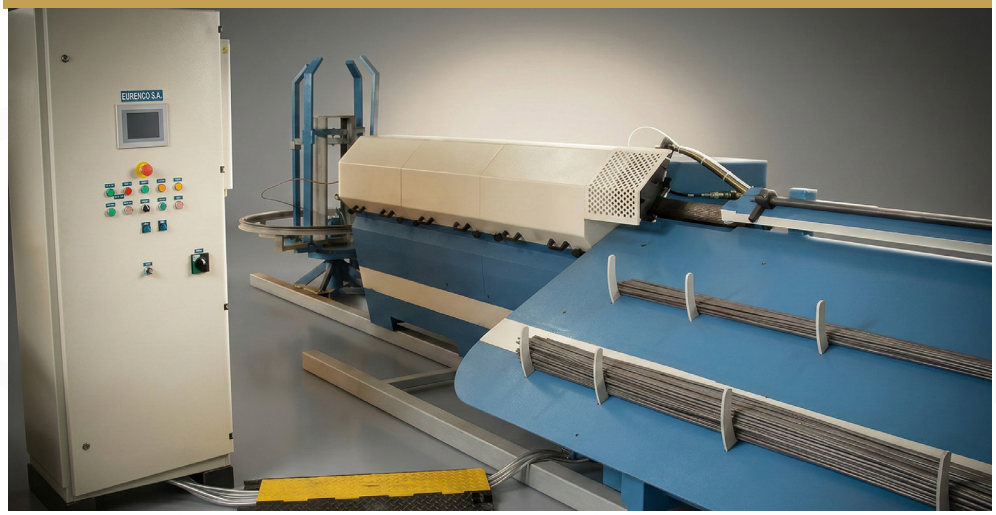


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H.S Code	854330000001
NRRC Index	040302010000
NRRC Classification	Dual-Use
Definition	Electrolytic cells utilize electrical energy to drive a nonspontaneous chemical reaction through the application of an external voltage.
Technical Specification	An output capacity greater than 250 g of fluorine per hour.
Nuclear Uses	Used in fluorine production.
Other Uses (non-nuclear)	Used in recharging batteries and separating pure metals from metallic compounds.
Identification	Shipping crates usually contain a stacked plate device with fluid ports, bus bars, and corrosive/gas hazard labels.

Rotor fabrication or assembly equipment, rotor straightening equipment, bellows-forming mandrels and dies



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H.S Code	846229000001	846594000004	681519600000	
NRRC Index	040302020000	040302020100	040302020200	040302020300
NRRC Classification	Dual-Use			
Definition	It is precision manufacturing equipment used in the production of rotor assemblies for gas centrifuges, which are critical in uranium enrichment processes.			
Technical Specification	• Bellows-forming mandrels and dies for producing single-convolution bellow. ◦ Inside diameter between 75 and 400 mm. ◦ Length equal to or greater than 12.7 mm. ◦ Single convolution depth greater than 2 mm. ◦ Made of high-strength aluminum alloys, maraging steel, or high strength fibrous or filamentary materials.			
Nuclear Uses	Used gas centrifuge rotor tube sections, baffles, and end caps. Rotor straightening equipment for alignment of gas centrifuge rotor tube sections to a common axis.			
Other Uses (non-nuclear)	Used in the production of long, symmetrical, hollow forgings.			
Identification	Precision tooling designed for thin-walled tubes (rotors), straightening jigs with micrometer alignment, or corrugated mandrels/dies for bellows.			

Centrifugal multiplane balancing machines fixed or portable, horizontal or vertical



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H.S Code	903110000001	903110000002	
NRRC Index	040302030000	040302030100	040302030200
NRRC Classification	Dual-Use		
Definition	It is a machine that balances rotating machines such as rotors for electric motors, fans, and turbines.		
Technical Specification	• Centrifugal balancing machines designed for balancing flexible rotors having a length of 600 mm or more and having all of the following characteristics: ◦ Hydrogen isotope storage or hydrogen isotope purification systems using metal hydrides as the storage or purification medium. ◦ Swing or journal diameter greater than 75 mm; ◦ Mass capability of from 0.9 to 23 kg; and ◦ Capable of balancing speed of revolution greater than 5000 rpm. • Centrifugal balancing machines designed for balancing hollow cylindrical rotor components and having all of the following characteristics: ◦ Journal diameter greater than 75 mm; ◦ Mass capability of from 0.9 to 23 kg; ◦ A minimum achievable residual specific unbalance equal to or less than 10 g mm/kg per plane; and ◦ Belt drive type.		
Nuclear Uses	Used for balancing uranium enrichment gas centrifuge rotors and/or spinning masses for certain gyroscopes.		

Other Uses (non-nuclear)	Used for balancing some mechanical parts.
Identification	• Large balancing machines are shipped on pallets due to weight and ruggedness. • Smaller balancing machines are shipped in desk-size crates. • Nuclear-related balancing machines can be horizontal or vertical and may be belt-driven.

Filament winding machines and related equipment



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H.S Code	844590000001		844839000001	
NRRC Index	040302040000	040302040100	040302040200	040302040300
NRRC Classification	Dual-Use			
Definition	Filament winding machines produce Fiber-Reinforced Plastics (FRP) by winding continuous resin-impregnated fibers onto a rotating mandrel in a precise geometric pattern to produce strong, durable, and lightweight composite materials that are often stronger and lighter than steel.			
Technical Specification	• Filament winding machines having all of the following characteristics: ◦ Having motions for positioning, wrapping, and winding fibers coordinated and programmed in two or more axes. ◦ Specially designed to fabricate composite structures or laminates from fibrous or filamentary materials. ◦ Capable of winding cylindrical tubes with an internal diameter between 75 and 650 mm and lengths of 300 mm or greater • Coordinating and programming controls for the filament winding machines. • Precision mandrels for the filament winding machines.			
Nuclear Uses	Used to produce composite rotors for uranium enrichment gas centrifuge machines			

Other Uses (non-nuclear)	Used to produce aerospace composite components, sporting goods, storage tanks, and pipes.
Identification	• Machines are generally shipped in crates or in plastic film cocoon wraps. Control panels will usually be wrapped in plastic. • Smaller machines (tabletop or freestanding) are usually shipped in one piece. Larger machines may be shipped as separate components, and long carriage bed structures may be disassembled into sections for shipment. • Filament winding machines have numerical control panels, a steel frame or structure for holding the ends of the mandrel(s), drive spindles for turning the mandrel(s), and a feed-eye rail and carriage with spools for fiber. They will also have flanged feet for bolting them to the floor.

Electromagnetic isotope separators



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H.S Code	840120270001	840120270002
NRRC Index	040302050000	
NRRC Classification	Dual-Use	
Definition	Designed for, or equipped with, single or multiple ion sources, including separators with the ion sources and collectors both in the magnetic field and those configurations in which they are external to the field.	
Technical Specification	• Capable of providing a total ion beam current of 50 mA or greater. • 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.	
Nuclear Uses	Used in enriching stable isotopes as well as those for uranium.	
Other Uses (non-nuclear)	Used to produce stable isotopes for research and medical applications.	
Identification	• Large, heavy-duty crates — often reinforced, on pallets. • Labels: “scientific equipment,” “mass spectrometer,” or “vacuum parts.” • Visible components: copper coils, magnets, vacuum tubes, or stainless-steel parts. • Special packaging: anti-static wrap, foam inserts, sealed bags.	

Mass spectrometers



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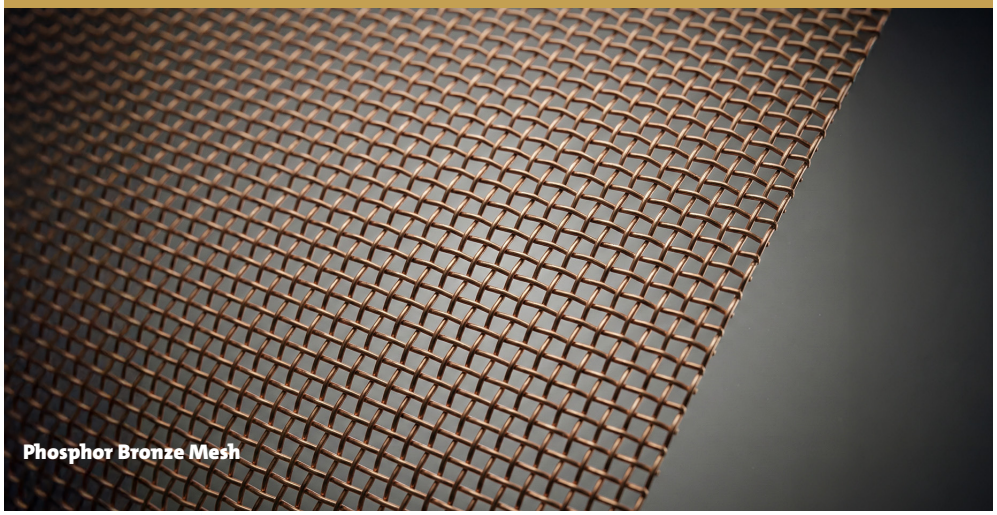
H.S Code	902781000001		
NRRC Index	040302060000	040302060100	040302060200
	040302060300	040302060400	040302060500
NRRC Classification	Dual-Use		
Definition	Mass spectrometer is an analytical instrument that is capable of determining the isotopic content.		

Technical Specification	• Capable of measuring ions of 230 atomic mass units or greater.
	• Having a resolution of better than 2 parts in 230.
	• Inductively Coupled Plasma Mass Spectrometers (ICPMS);
	• Glow discharge mass spectrometers (GDMS);
	• Thermal ionization mass spectrometers (TIMS);
	• Electron bombardment mass spectrometers having both of the following features:
	  ◦ A molecular beam inlet system that injects a collimated beam of analyte molecules into a region of the ion source where the molecules are ionized by an electron beam; and
	  ◦ One or more cold traps that can be cooled to a temperature of 193 K (-80 °C) or less in order to trap analyte molecules that are not ionized by the electron beam;
	• Mass spectrometers equipped with a micro fluorination ion source designed for actinides or actinide fluorides.		

Nuclear Uses	Used to monitor the performance of uranium enrichment processes.		

Other Uses (non-nuclear)	Used for both qualitative and quantitative study of chemical substances.
Identification	• Complete mass spectrometers consist of several subsystems (mass analyzer, vacuum system, computer, power supply, etc.) are packaged separately in wooded crates marked as fragile. • Strategic mass spectrometers tend to be large (1-2 meters on a side) and very expensive (hundreds of thousands to millions of USD).

Specialized packings


Phosphor Bronze Mesh

H.S Code	840120300006
NRRC Index	040401010000
NRRC Classification	Dual-Use
Definition	Specialized packings made from a non-ferrous copper alloy woven Phosphor bronze mesh.
Technical Specification	Made of phosphor bronze mesh chemically treated to improve wettability, and it is designed to be used in vacuum distillation towers.
Nuclear Uses	Used in separating heavy water from ordinary water.
Other Uses (non-nuclear)	Used in paper industry for embossing, electromagnetic shielding applications, testing aerodynamics in airplanes.
Identification	Phosphor bronze is a non-ferrous copper alloy primarily known for Its toughness, strength, low coefficient of friction, excellent formability, solderability and fine grain.

Pumps



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H.S Code	841350000001	841360000001	841370000003	841381400000
NRRC Index	040401020000		040401020100	040401020200
NRRC Classification	Dual-Use			
Definition	Hermetically sealed pumps are a type of centrifugal pump capable of operating in harsh environments.			

Technical Specification	• Airtight (i.e., hermetically sealed).
	• A capacity greater than 8.5 m3 /h.
	• Either of the following characteristics:
	  ◦ For concentrated potassium amide solutions (1% or greater), an operating pressure of 1.5 to 60 MPa.
	  ◦ For dilute potassium amide solutions (less than 1%), an operating pressure of 20 to 60 MPa
	• Capable of circulating solutions of concentrated or dilute potassium amide catalyst in liquid ammonia (KNH2 / NH3).			

Nuclear Uses	Used in tritium gas transfer pump.			
Other Uses (non-nuclear)	Used in chemical industry to handle liquids leakage to the atmosphere.			

Identification	• Labels: model number, brand name, and handling instructions (e.g. "This Side Up", "Fragile").
	• Packaging Type:
	  ◦ Small pumps: Cardboard boxes with foam inserts.
	  ◦ Large pumps: Wooden crates or pallets, possibly with plastic wrap or metal straps.
	• Shape & Weight: box is usually heavy, bulky, and may have an uneven weight distribution.

Turboexpanders or turboexpander-compressor sets



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H.S Code	841181000001	841182000001	841480900003
NRRC Index	040401030000		
NRRC Classification	Dual-Use		
Definition	A centrifugal turbine through which a high-pressure gas is expanded to produce work used to drive a compressor or generator.		
Technical Specification	• Designed for operation with an outlet temperature of 35 K (-238 °C) or less. • Designed for a throughput of hydrogen gas of 1000 kg/h or greater.		
Nuclear Uses	Used in hydrogen liquefaction systems.		
Other Uses (non-nuclear)	Used in the extraction of hydrocarbon liquids from natural gas.		
Identification	• Large, heavy-duty crates: usually wood or metal-reinforced, due to the weight and sensitivity. • Shock and tilt indicators: stickers or devices that show if the crate has been mishandled. • Labels: clearly marked as “Turboexpander,” “Machinery,” or with manufacturer/model info. • Protective materials packaging: foam, vapor barrier bags, or anti-corrosion packaging inside.		

Hydrogen-cryogenic distillation columns



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H.S Code	841990000002		
NRRC Index	040402010000	040402010100	040402010200
NRRC Classification	Dual-Use		
Definition	Hydrogen-cryogenic distillation columns are used to separate hydrogen from gas mixtures through the process of cryogenic distillation at high pressure and low temperatures.		
Technical Specification	• Designed for operation at internal temperatures of 35 K (-238 °C) or less. • Designed for operation at internal pressures of 0.5 to 5 MPa. • With internal diameters of 30 cm or greater and effective lengths of 4 m or greater.		
Nuclear Uses	Used for the purification of synthetic natural gas from coke oven gas.		
Other Uses (non-nuclear)	Used for the purification of synthetic natural gas from coke oven gas..		
Identification	• Constructed of either: ◦ Stainless steel. ◦ Equivalent materials which are both cryogenic and hydrogen (H2)-compatible.		

Photomultiplier tubes (PMT)



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H.S Code	854089000001
NRRC Index	040501010000
NRRC Classification	Dual-Use
Definition	It is a photosensitive vacuum tube comprising a photo-emissive cathode and an electron multiplier. They are extremely sensitive light detectors that multiply the current produced by incident light, enabling individual photons to be detected.

Technical Specification	• Having both of the following characteristics:
	  ◦ Photocathode area of greater than 20 cm2.
	  ◦ Anode pulse rise time of less than 1 ns.

Nuclear Uses	Used in nuclear testing.
Other Uses (non-nuclear)	Used in television cameras, detection, and recording of extremely fast events.
Identification	• PMTs are shipped in individual cardboard boxes with shock absorbing material. • Windows may be covered with an opaque layer for protection. • A protective cap may be slipped over exposed leads. • The PMTs can be recognized by their glass vacuum tubes, reflective mirror-like surface near the window, and large number of electrical leads (11 or more). • The label should include the manufacturer and model number. • Specification sheet indicating photocathode dimensions and pulse rise time should be included.

High-velocity gun systems (propellant, gas, coil, electromagnetic, and electrothermal types, and other advanced systems)



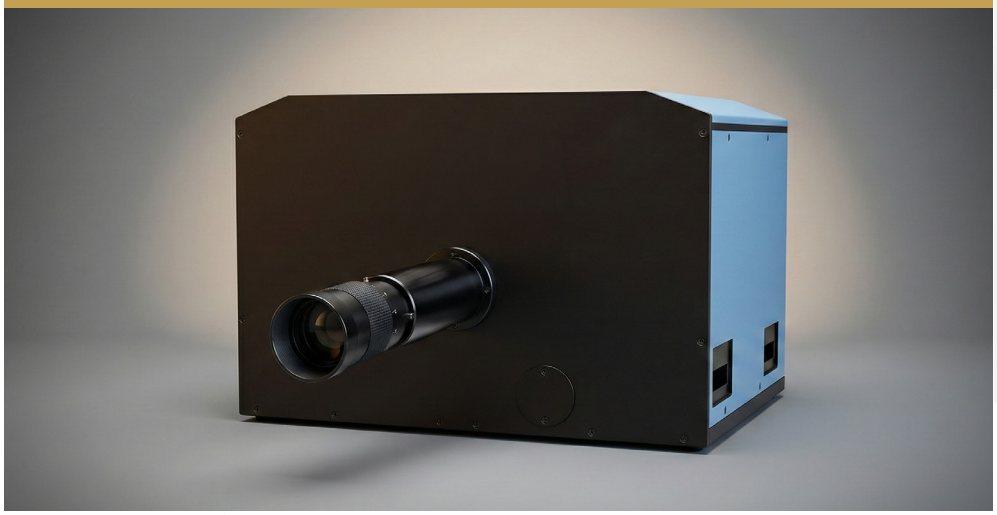
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H.S Code	360350000001
NRRC Index	040502010000
NRRC Classification	Dual-Use
Definition	They are precisely fabricated from high strength steel and are manufactured by industrial firms that can handle large pieces of such steel.
Technical Specification	• Capable of accelerating projectiles to 1.5 km/s or greater.
Nuclear Uses	Used in the determination of equation of state data for various nuclear explosive materials under extreme pressure and temperature condition
Other Uses (non-nuclear)	Used to study material processes at extreme temperatures and pressures inaccessible by other means, such as studying the equation of state and material properties.

Identification	• The gun is dismantled into its major components and must be carefully supported in a wooden box.
	• to protect against bending. A crane or large forklift is required for lifting.
	• Because each gun system is custom manufactured for the individual customer, the following dimensions are to be considered:
	  ◦ The barrel of each stage might be about 10 m long with an outside diameter of about 20 cm.
	  ◦ The bore diameter would be about 10 cm in the first stage and 5 cm in the second stage.

High-speed cameras and imaging devices and components therefor



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H.S Code	852581900001	852581900002	852581900003
	900691000001	900691000002	900691000003
NRRC Index	040502020000	040502020100	040502020101
	040502020102	040502020103	040502020104
	040502020105	040502020200	040502020201
	040502020202	040502020203	040502020204
	040502020205	040502020300	040502020301
	040502020302	040502020303	040502020304
NRRC Classification	Dual-Use		
Definition	High speed cameras are a feature-specific type of video camera meant to capture events with minute, fleeting details that could not be captured by cameras with a standard frame rate		

Technical Specification	• Streak cameras, and specially designed components therefor, as follows:
	  ◦ Streak cameras with writing speeds greater than 0.5 mm/μs.
	  ◦ Electronic streak cameras capable of 50 ns or less time resolution.
	  ◦ Plug-ins specially designed for use with streak cameras.
	  ◦ Synchronizing electronics units, rotor assemblies consisting of turbines, mirrors and bearings.
	• Framing cameras and specially designed components therefor as follows:
	  ◦ Framing cameras with recording rates greater than 225,000 frames per second.
	  ◦ Framing cameras capable of 50 ns or less frame exposure time.
	  ◦ Framing tubes and solid-state imaging devices having a fast image gating (shutter) time of 50ns or less.
	  ◦ Plug-ins specially designed for use with framing cameras.
	  ◦ Synchronizing electronics units, rotor assemblies consisting of turbines, mirrors and bearings.

Nuclear Uses	Used in developing and testing nuclear explosive devices.
Other Uses (non-nuclear)	Used to record and analyze manufacturing and industrial events in slow motion such as machinery troubleshooting and production line improvements.

Identification	• They will be very well packaged as expensive delicate instruments. They are generally shipped individually.
	• These cameras tend to be:
	  ◦ Large (approximately 1 m on a side);
	  ◦ Heavy (hundreds of kg); and
	  ◦ Extremely expensive (more than USD 100,000).
	• Rotating-mirror cameras often have metallic housings, an input for high-pressure gas (to drive the rotating mirror), a large high-quality lens, and (for older film-based rotating-mirror cameras) a distinctive circular or semi-circular shape.
	• Electronic streak and framing cameras resemble ordinary large video camera, with a large high quality lens and box-shaped electronic cabinet.

Specialized instrumentation for hydrodynamic experiments



Quartz Pressure Transducer

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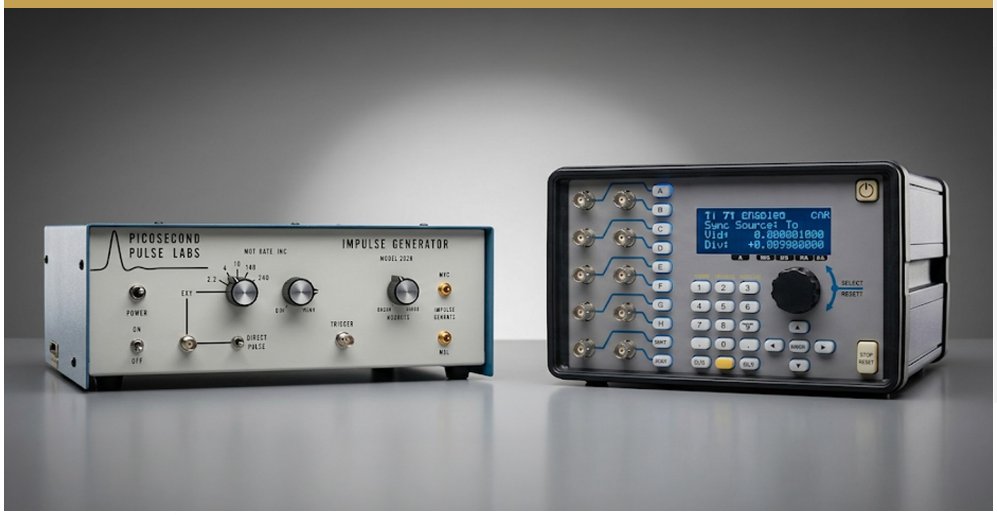
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H.S Code	902620000002		902620000003	903180400000
NRRC Index	040502030000	040502030100	040502030200	040502030300
NRRC Classification	Dual-Use			
Definition	Velocity interferometers make precise-velocity measurements. There are two commonly used optical velocity interferometer systems for any reflector (VISAR) and the Fabry-Perot interferometer. The pressure gauges are typically fabricated as printed circuits of manganin metal, which is semitransparent amber to brown in appearance.			

Technical Specification	• Velocity interferometers:
	  ◦ For measuring velocities exceeding 1 km/s during time intervals of less than 10 us.
	• Shock pressure gauges:
	  ◦ Capable of measuring pressures greater than 10 GPa, including gauges made with manganin, ytterbium, and polyvinylidene fluoride (PVDF, PVF2).
	  ◦ The manganin is printed in a back-and-forth pattern; to maximize the length of the circuit in the small area, typically 1 cm2 or less makes up the actual sensing element.
	  ◦ Two copper output leads are attached to the manganin and will probably be about 25 cm long.
	  ◦ The whole assembly is about 2.5 cm wide and 0.05 mm thick.
	• Quartz pressure transducers:
	  ◦ Pressures greater than 10 GPa.			

Nuclear Uses	• Velocity interferometers are used in detonator development for nuclear explosives. • Pressure transducers are used for gun barrel pressure measurements in the development of gun-type nuclear explosive devices.
Other Uses (non-nuclear)	Used in some hydrodynamic testing.
Identification	• The VISAR velocity interferometers component may be shipped separately in cardboard boxes. • The optical bench may be shipped in a sturdy box or a crate. • The input laser and the output transient digitizer are packaged separately. • The Fabry-Perot interferometer comes in external housing. • The instrument requires special padding and insulation. • The input laser and output camera are packaged separately. • The pressure gauges are attached to a sheet of corrugated or a stiff cardboard to keep them flat and prevent them from curling or wrinkling. • There will probably be several gauges attached to a single sheet of cardboard and several sheets of cardboard could be packaged in a small box. • A traditional VISAR is composed of a set of lenses, mirrors, beam splitters, optical delays, and photomultiplier tubes are mounted on an optical bench. • The Fabry-Perot interferometer consists of two plane-parallel, partially reflecting mirrors usually mounted in a box.

High-speed pulse generators, and pulse heads therefor

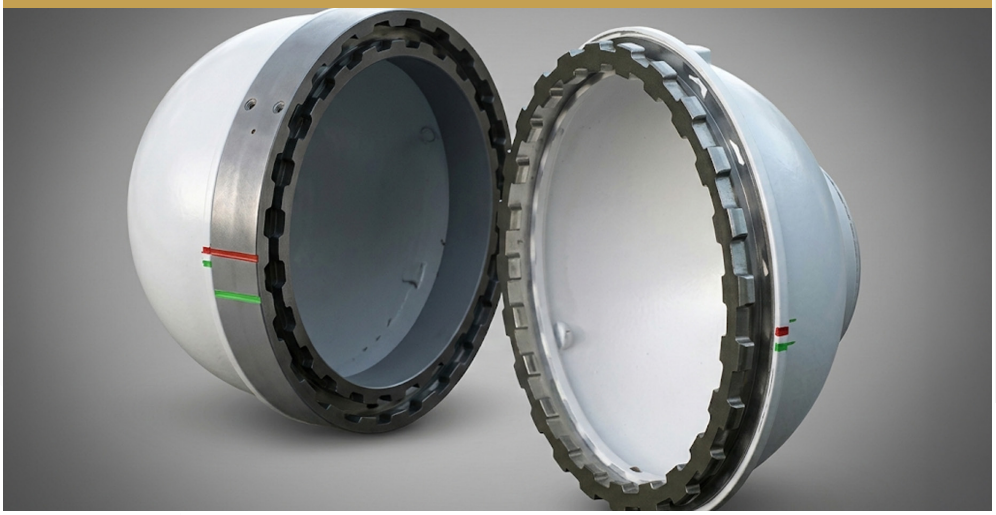


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H.S Code	854320000001
NRRC Index	040502040000
NRRC Classification	Dual-Use
Definition	Signal generators are apparatus used for the production of electrical signals of a known waveform, magnitude, and frequency, etc.
Technical Specification	• Having both of the following characteristics: ◦ Output voltage greater than 6 V into a resistive load of less than 55Ω. ◦ Pulse transition time less than 500 ps.
Nuclear Uses	Used to characterize the performance of high-speed recording equipment used in nuclear testing.
Other Uses (non-nuclear)	Used to check amplifiers, loudspeakers, and antennas response.
Identification	• Pulse generators are typically packed into cardboard boxes with form-fitting polystyrene plastic surrounding the unit to absorb the shock and vibration incurred during transportation. • Pulse generators typically have electronic cabinets, approximately 10 cm x 20 cm x 30 cm, weighing ~3 kg. They usually have connectors for coaxial cables often labelled as: ◦ “trigger”; and ◦ “out”; or ◦ “ext”.

High explosive containment vessels, chambers, containers, and other similar containment devices



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H.S Code	902789200000
NRRC Index	040502050000
NRRC Classification	Dual-Use
Definition	The vessels are thin-wall shell structure designed with the intention of repetitive usage. It is made from materials possessing elastic properties.
Technical Specification	• Having both of the following characteristics: ◦ Containing an explosion equivalent to 2 kg of TNT or greater. ◦ Real time or delayed transfer of diagnostic or measurement information.
Nuclear Uses	Used in hydrodynamic experiments to mimic the first stages of a nuclear explosion.
Other Uses (non-nuclear)	Used to safely secure, transport, and test explosive or chemical devices.
Identification	The vessels are designed for the testing of high explosives or explosive devices.

Firing sets and equivalent high-current pulse generators



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H.S Code	360350000002		854320000002	360350000003
NRRC Index	040601020000	040601020100	040601020200	040601020300
NRRC Classification	Dual-Use			
Definition	Firing sets have compact, rugged electronic boxes with connectors for attaching detonators.			
Technical Specification	• Detonator firing sets (initiation systems, fire sets), including electronically-charged, explo¬sively-driven and optically-driven firing sets. • Modular electrical pulse generators (pulsers) having all of the following characteristics: ◦ Energy delivery in less than 15 µs into loads of less than 40 Ω; ◦ Having an output greater than 100 A; ◦ No dimension greater than 30 cm; ◦ Weight less than 30 kg ; and ◦ Specified to operate over an extended temperature range of 223 to 373 K (-50 to 100 OC) or specified as suitable for aerospace applications. • Micro-firing units having all of the following characteristics: ◦ No dimension greater than 35 mm; ◦ Voltage rating of equal to or greater than 1 kV; and ◦ Capacitance of equal to or greater than 100 nF.			
Nuclear Uses	• Used to trigger nuclear weapon detonators with precise timing. • Pressure transducers are used for gun barrel pressure measurements in the development of gun-type nuclear explosive devices.			
Other Uses (non-nuclear)	Used in mining and demolition activities.			

Identification	• Modular electrical pulse generators (pulsers) are designed for portable, mobile, or ruggedized-use. • The sets are packed into cardboard boxes lined with polystyrene plastic. • For firing sets are considered strategic if they are designed to fire multiple strategic detonators. Often indicated by the term "parallel firing capability." • Manual units will also have arming switches often with a key lock for safety and a firing button. • Firing sets may be called "capacitive discharge units" or "capacitive discharge initiators" or simply "blasting machines".

Switching devices: cold-cathode tubes, whether gas filled or not, operating similarly to a spark gap



H.S Code	854060000001			
NRRC Index	040601030000	040601030100	040601030200	040601030300
NRRC Classification	Dual-Use			
Definition	A cold-cathode is a gas-filled tube used as a very high-speed switch. It consists of a sealed glass tube with three or more electrodes. A small triggering pulse on the grid electrode switches the tube on, allowing a large current to flow between the cathode and anode electrodes.			
Technical Specification	• Having both of the following characteristics: ◦ Containing three or more electrodes; ◦ Anode peak voltage rating reaching or exceeding 2.5 kV; ◦ Anode peak current rating reaching or exceeding 100 A; and ◦ Anode delay time of 10 µs or less.			
Nuclear Uses	Used as a primary component in nuclear weapons firing sets.			
Other Uses (non-nuclear)	Used in power distribution systems.			
Identification	• No unusual or distinctive packaging is identified for this commodity. These switches are small electronic components, typically just a few centimeters on a side. • Sprytrons and krytrons are small glass cylindrical bulbs. • They carry a warning label indicating that they contain radioactive materials.			

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Switching devices: triggered spark-gaps



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H.S Code	853590000002			
NRRC Index	040601030000	040601030100	040601030200	040601030300
NRRC Classification	Dual-Use			
Definition	Triggered spark-gaps are high energy, voltage-controlled switching devices, unique in their ability to repeatedly switch currents of thousands of amperes.			
Technical Specification	• Having both of the following characteristics: ◦ Anode delay time of 15 µs or less; and ◦ Rated for a peak current of 500 A or more.			
Nuclear Uses	Used as a primary component in nuclear weapon firing sets.			
Other Uses (non-nuclear)	Used as high-power impulse switching for medical applications. Also, used as high voltage pulse generator for pasteurization by pulse electric field and pulse generator for semiconductor components cleaning equipment.			
Identification	• No unusual or distinctive packaging is identified for this commodity. • These switches are small electronic components, typically just a few centimeters on a side. • Triggered spark gaps are typically ceramic cylinders with three external metal connectors (two flat plates and one central trigger).			

Switching devices: modules or assemblies with a fast-switching function



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H.S Code	853590000003			
NRRC Index	040601030000	040601030100	040601030200	040601030300
NRRC Classification	Dual-Use			
Definition	It is an electrical device designed to open or close an electrical circuit.			
Technical Specification	• Modules or assemblies with a fast-switching function having all of the following characteristics: ◦ Anode peak voltage rating exceeding 2 kV. ◦ Anode peak current rating reaching or exceeding 500 A. ◦ Turn-on time of 1 µs or more.			
Nuclear Uses	Used as a primary component in nuclear weapons firing sets.			
Other Uses (non-nuclear)	Used in power distribution systems.			
Identification	• No unusual or distinctive packaging is identified for this commodity. These switches are small. • electronic components, typically just a few centimeters on a side.			

Pulse discharge capacitors



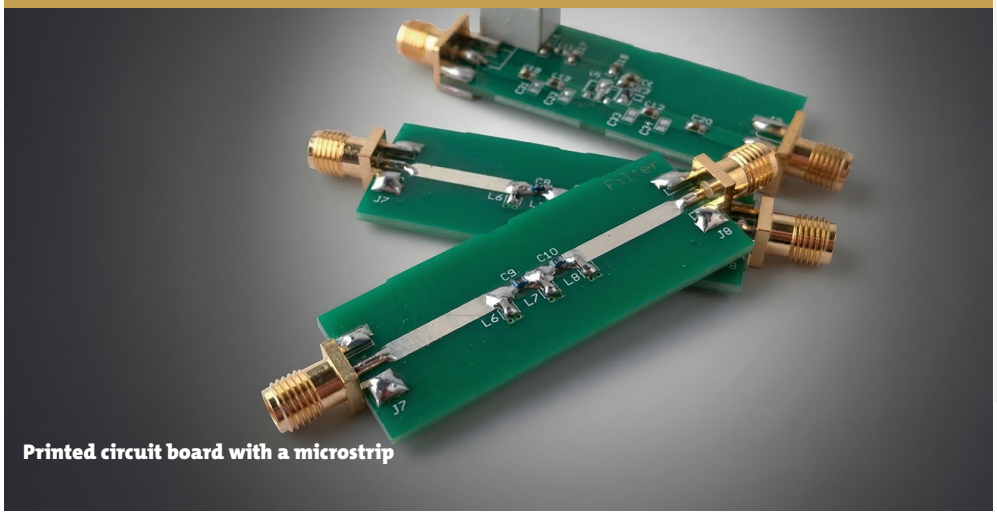
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H.S Code	853229000001	853229000002	
NRRC Index	040601040000	040601040100	040601040200
NRRC Classification	Dual-Use		
Definition	A device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator.		
Technical Specification	• Having either of the following sets of characteristics: ◦ First Group: ▪ 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; ◦ Second Group: ▪ Voltage rating greater than 750 V; ▪ Capacitance greater than 0.25 µF; and ▪ Series inductance less than 10 nH.		
Nuclear Uses	Used as a key component of nuclear weapon firing sets.		
Other Uses (non-nuclear)	Used in most electrical circuits and electronics to store electric energy.		

Identification	• Pulse discharge capacitors are usually shipped in quantities between 10 and 100, with unit values of hundreds of dollars each, and they are considerably bigger (on the scale of several centimeters and weighing hundreds of grams each). • If a shipment of capacitors is suspected of being strategic, Technical Specifications would need to be checked. • Pulse discharge capacitors are more commonly shipped in sturdy boxes in smaller quantities.

Striplines to provide low inductance path to detonators



Printed circuit board with a microstrip

H.S Code	360320000001
NRRC Index	040601050000
NRRC Classification	Dual-Use
Definition	It is a transverse electromagnetic transmission line made from flat strip of metal sandwiched between wo planar ground planes. It provides a low inductance path to detonators.
Technical Specification	• Having both of the following characteristics: ◦ Voltage rating greater than 2 kV. ◦ nductance of less than 20 nH.
Nuclear Uses	Used as a part of nuclear explosive devices.
Other Uses (non-nuclear)	Used in high-speed printed circuit board designs
Identification	• The striplines provide low inductance path to detonators.

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High explosive substances or mixtures, containing more than 2% by weight



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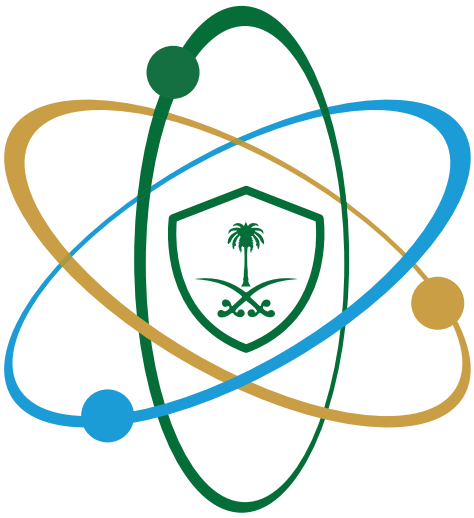
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H.S Code	360200000003	360200000004	360200009999	
NRRC Index	040603010000	040603010100	040603010200	040603010300
	040603010400	040603010500	040603010600	040603010700
	040603010800	040603010900	040603011000	040603011100
	040603011200	040603011300	040603011400	040603011500
NRRC Classification	Dual-Use			
Definition	Explosive materials produce a sudden expansion of the material usually accompanied by the production of heat and large changes in pressure upon initiation. Low explosives burn rapidly (or deflagrate), while high explosives detonate.			
Technical Specification	• Crystal density greater than 1.8 g/cm3. • Detonation velocity greater than 8000 m/s. • High explosive substances or mixtures, containing more than 2% by weight of any of the following: ◦ Cyclotetramethylenetetranitramine (HMX) (CAS 2691-41-0). ◦ Cyclotrimethylenetrinitramine (RDX) (CAS 121-82-4). ◦ Triaminotrinitrobenzene (TATB) (CAS 3058-38-6). ◦ Aminodinitrobenzo-furoxan or 7-amino4,6 nitrobenzofurazane -1- oxide (ADBNF) (CAS 97096-78-1). ◦ 1,1 diamino-2,2-dinitroethylene (DADE or FOX7) (CAS 145250-81-3). ◦ dinitroimidazole – 2,4 (DNI) (CAS 5213-49-0). ◦ Diaminoazoxyfurazan (DAAOF or DAAF) (CAS 78644-89-0). ◦ Diaminotrinitrobenzene (DATB) (CAS 1630-08-6). ◦ Dinitroglycoluril (DNGU or DINGU) (CAS 55510-04-8). ◦ 2,6 - Bis (picrylamino)-3,5-dinitropyridine (PYX) (CAS 38082-89-2). ◦ 3,3 - diamino-2,2',4,4',6,6'-hexanitrobiphenyl or dipicramide DIPAM (CAS 17215-44-0).			

	◦ Diaminoazofurazan (DAAzF) (CAS 78644-90-3). ◦ 1,4,5,8 tetranitro-pyridazino [4,5-d] pyridazine (TNP) (CAS 229176-04). ◦ Hexanitrostilbene (HNS) (CAS 0-22-20062).
Nuclear Uses	Used in nuclear explosive devices
Other Uses (non-nuclear)	Used in the construction industry for road development, and for underground mining.
Identification	• Instrument for identification: ◦ Gas chromatography/mass spectrometry (GC-MS). • Explosives are hazard class 1. • Shipped with a hazard placard. • The UN numbers start with 0. • Require special packaging regulations. • Nested inner packaging and outer packaging. The packaging layers: ◦ Inner layer: plastic or rubberized cloth bags. ◦ Outer layer: Steel drums, plastic drums, steel boxes, aluminum boxes, or wood boxes. • Explosive materials forms may be powders, granules, moldable solids, or rigid masses resembling dense plastic

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SN	Date	.Revision No		Revision Details
		Old	New	
69	06-01-2026	NA	00	New document



هيئة الرقابة النووية والإشعاعية

Nuclear and Radiological Regulatory Commission

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