

Goodfellow

Serving The Needs of Science and Industry Worldwide

Au service de la Science et de l'Industrie dans le monde entier

Weltweiter Lieferant für Wissenschaft und Industrie

Metals and Alloys
Métaux et Alliages
Metalle und Legierungen

Ceramics
Céramiques
Keramiken

Polymers
Polymères
Polymere

Composites
Composites
Verbundwerkstoffe



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Standard Price List for Vanadium

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Introduction

Goodfellow is well known as a specialist supplier of small to medium size quantities of metals, alloys, ceramics, polymers and other materials to meet the research, development and specialist production requirements of science and industry worldwide. We realise that "small" means different things to different people, but we consider small to mean any quantity from a few grammes to a few kilos.

Goodfellow offers two distinct services to meet the requirements of our customers:

- The first meets the needs of our customers who need small quantities of products from our standard range of materials within 24-48 hours.
- The second service is for those who require larger quantities or further processing of our standard products or who need an item which falls within our general area of supply expertise.

The range of materials offered by Goodfellow is extensive, as are the forms in which the various products are available. This Catalogue provides a detailed overview of our standard products which are available from stock. Full details of all of these items, including prices and technical information, can be found in our web Catalogue at www.goodfellow.com.

Materials

Metals and Alloys

Goodfellow supplies virtually all of the pure metals from Aluminium to Zirconium as well as a comprehensive range of alloys. Most are available in a variety of forms, including rod, wire and foil. The Catalog details those materials which are available as standard products from stock. Custom-made items are also available, so please contact us if you are unable to identify the item you require.

Ceramics

The ceramic materials offered by Goodfellow have been carefully chosen, and include both the established as well as more recently developed products. All are available as either standard or custom-made products in a variety of forms and sizes. The Catalog details those items which are

available from stock. For ceramic components made to customer drawings, our Ceramic and Glass Division would be delighted to help. Please visit www.goodfellow-ceramics.com for further information.

Polymers

The range of polymers supplied by Goodfellow is broad and includes both the familiar as well as some of the more unusual or recently developed materials. The Catalog details those items which are available from stock; please contact us if you are unable to find the item you specifically require.

Compounds & Intermetallics

Goodfellow can supply aluminides, borides and silicides as well as other intermetallics and compounds. The majority of these items are made to order and the Catalog details those which are available. Please contact us with details of your requirements.

Composites

Some examples of these materials are listed in the Catalog. As some of these are manufactured on a custom-made basis, please contact us with details of your requirements.

Glasses

Goodfellow offers two distinct types of glass products. The first are generally silica-based and transparent. Generally, these products are made to order for customers, so we do not list them in our Catalog, however, they are available through the Goodfellow Ceramic and Glass Division. Please contact us with your requirements.

The second type of glass product is commonly referred to as "metallic glasses" or "glassy metals". In contrast to crystalline metals and alloys with highly ordered atomic structures, these are non-crystalline (amorphous) metals or, more usually, alloys. Our Catalogue details those glassy metals which are available from stock; please contact us if you are unable to find the item you specifically require.

Product Descriptions



Bar

A straight length of rectangular, square or oval section material.

Tolerances

Section dimensions:	≤ 10mm	± 10%
	> 10mm	± 1mm
Length:	< 100mm	± 1mm
	≥ 100mm	+ 5% / - 1%



Bolt

A threaded pin that can be screwed into a nut or a tapped hole to fasten items together. Bolts are available with different head styles and also in metric and inch-threaded sizes.

Tolerances

Ceramics: ANSI B18.6.7M-1985



Chopped Fibre

Fibres cut into short lengths called cut, staple or chopped fibre.

Tolerances

Fibre diameter:	± 25%
Number of strands:	± 10%
Tex number:	± 10%
Length:	+ 5% / - 1%



Crucible

A vessel in which other materials may be heated or melted, usually at high temperatures.

Tolerances

Height:	± 10%
Inside Dimensions:	± 10%
Outside Dimensions:	± 10%



Fabric

Woven fabrics are made by the regular interlacing of two arrays of yarns at right angles to each other, these being referred to as the warp and weft (see also Non-woven fabric).

Tolerances

Fabric thickness:	± 25%
Number of yarns:	± 10%
Tex number:	± 10%
Size (linear dimension):	< 100mm ± 5mm
	≥ 100mm ± 5%



Fibre

Yarns or tows consisting of several approximately parallel individual filaments, each filament usually being smaller in diameter than a monofilament. Yarns contain a defined number of filaments, typically three to several hundred; tows contain thousands of filaments whose number is only defined approximately. Both are primarily specified by their linear density measured in "tex", the weight in grams of a 1km length of material.

Tolerances

Fibre diameter:	± 25%
Number of strands:	± 10%
Tex number:	± 10%
Length:	+ 5% / - 1%



Film

A non-metallic sheet material with a thickness < 0.5mm.

Tolerances

Thickness:	± 20%
Size (linear dimension):	< 100mm ± 1mm
	≥ 100mm + 2% / - 1%



Flake

Flat, irregularly shaped pieces of material. A maximum flake size is indicated but individual flakes may vary greatly in size.

Tolerances

Dimensions shown are nominal

Product Descriptions



Foam

A low density, permeable structure of cells and continuous ligaments offering a high surface area to volume ratio, and also a high strength to weight ratio. Owing to the nature of this material, dimensions are nominal.



Foil

Thin sheets of pure metal and metal alloys. Due to their fragile nature, some foils are coated on one side with an acrylic or polyester support. Where foils are supported they are indicated in the detailed item description.

Tolerances

Thickness: < 0.010mm ± 25%
 0.01-0.05mm ± 15%
 > 0.050mm ± 10%
 Size (linear dimension): < 100mm ± 1mm
 ≥ 100mm + 2% / -1%



Granule

Pellets of an approximately regular shape. Granules may vary in size and, therefore, the dimensions stated are nominal. In addition, the shape of a granule may vary from item to item.

Tolerances

Dimensions shown are nominal



Honeycomb

A cellular structure similar in appearance to natural honeycomb. Owing to the nature of this material, dimensions are nominal.



Insulated Wire

A single or multiple flexible strand of metal or alloy with an insulating sheath.

Tolerances

Wire diameter: ± 10%
 Length: + 5% / -1%
 Insulation thickness: Nominal values only



Laminate

Layers of material which have been bonded together by the use of heat, pressure and, possibly, adhesive.

Tolerances

Thickness: ± 10%
 Size (linear dimension): ≤ 100mm ± 1mm
 > 100mm + 2% / -1%



Lump

A solid piece of material with no defined shape.

Tolerances

Dimensions shown are nominal



Mesh

Mesh is available as either a woven wire or electroformed product; in all cases, the quoted aperture sizes are nominal. Wire mesh: a material which is woven from metal wires to provide a thin grid with a regular series of holes. Electroformed mesh: a product made by electroplating the mesh geometry through a mask onto a substrate which is subsequently etched away.

Tolerances

Thickness: woven: ± 10%
 electroformed: ± 20%
 Wire diameter: ± 10%
 Size (linear dimension): < 100mm ± 1mm
 ≥ 100mm + 2% / -1%

Product Descriptions



Metallised Film

Film which is coated with a metal. The thickness of the metal is measured and described in terms of the material's specific electrical resistance in ohms per square.

Tolerances

Thickness: $\pm 10\%$
 Size (linear dimension): $< 100\text{mm}$ $\pm 1\text{mm}$
 $\geq 100\text{mm}$ $+2\% / -1\%$



Microfoil

An extremely thin sheet of metal or alloy mounted on a permanent support. This support **cannot** be removed without destroying the Microfoil.

Tolerances

Thickness: $\pm 30\%$
 Size: $\pm 20\%$



Microleaf

An extremely thin sheet of metal mounted on a removable support. Microleaf is not available for metals which are too brittle to be free standing.

Tolerances

Thickness: $\pm 30\%$
 Size: $\pm 20\%$



Monofilament

A single strand of a non-metallic material.

Tolerances

Diameter: $\pm 20\%$
 Length: $+5\% / -1\%$



Non-Woven Fabric

Non-woven fabrics are made by methods other than weaving or knitting, the yarns and fibres being held together, often quite loosely, by means other than geometric interlacing. Due to the open and porous nature of this material, all other dimensions are nominal. conventional textile fabrics. Due to the open and porous nature of this material, all other dimensions are nominal.

Tolerances

Size (linear dimension): $< 100\text{mm}$ $\pm 5\text{mm}$
 $> 100\text{mm}$ $\pm 5\%$



Nut

Generally a flat piece of material with a threaded hole which can be screwed onto a bolt to fasten items together. Nuts typically have a hexagonal external shape. Nuts are available in metric and inch-threaded sizes.

Tolerances

Ceramics: ANSI B18.2.4.1M-1979
 (R1995)



Powder

Small particles with an approximately defined size range. Those materials described as alloy precursors are not true alloys - they are made by sintering a blend of powders of the component metals to achieve alloying by diffusion. The resultant cake is ground and sieved to the required particle size range. Unless otherwise stated, the particle sizes shown are for guidance only. We do not guarantee either any particular size distribution between the quoted minimum and maximum sizes, or a specific particle shape.

Tolerances

Dimensions shown are nominal

Product Descriptions



Rod

A straight length of circular section material.

Tolerances

Diameter:	≤ 10mm	± 10%
	Polymer	+ 20%/-10%
	Ceramic	+ 20%/-10%
> 10mm	± 5%	
	Ceramic	+ 20%/-10%
	Polymer	+ 20%/-10%
Length:	< 100mm	± 1mm
	≥ 100mm	+ 5% / -1%



Sheet

Flat material with a thickness > 0.5mm.

Tolerances

Thickness:		± 10%
	Ceramic	± 20%
	Composite	± 20%
	Polymer	± 20%
Size (linear dimension):	< 100mm	± 1mm
	≥ 100mm	+ 2% / -1%



Single Crystal

A material grown as a monocrystal, generally to a specific orientation, dimension and surface finish. It may contain a dopant. Single crystals are usually made to order.

Tolerances

Orientation:	± 3°
Size:	Sizes shown are nominal



Sphere

A regular solid or hollow three-dimensional form in which every cross-section is a circle. Spheres are available with standard or precision tolerances, and can be supplied with different surface finishes depending on the material.

Tolerances

Diameter (standard):	± 5%
Diameter (precision):	see item



Sputtering Target

A high purity material used as a source for sputtering, a cold vapourisation process in which atoms are physically removed from the target surface by ion bombardment.

Tolerances

Thickness:	± 0.5mm
Size:	± 0.5mm



Tube

A hollow length of material normally circular in section. Most tubes are straight except those made of flexible polymer.

Tolerances

Outside diameter:	≤ 2mm	± 0.05mm
	Polymer	± 10%
	Ceramic	± 10%
≤ 5mm	± 0.1mm	
	Polymer	± 10%
	Ceramic	± 10%
> 5mm	± 5%	
	Polymer	± 10%
	Ceramic	± 10%
Wall thickness:	± 10%	
	Polymer	± 20%
	Ceramic	± 20%
Length:	< 100mm	± 1mm
	≥ 100mm	+ 5% / -1%



Washer

A thin, flat piece of material with a hole in the middle, used in conjunction with bolts and nuts to distribute the load of a threaded fastener.

Tolerances

Ceramics:	see item
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Product Descriptions



Wire

A single or multiple flexible strand of pure metal or alloy.

Tolerances

Wire diameter: $\pm 10\%$
Length: $+5\% / -1\%$

Hazards Information

HAZARDS

All materials listed in this catalogue, whatever the quantity supplied, are sold for research or development purposes. We make no warranty that the materials are fit for a particular purpose. In purchasing materials from this catalogue, customers should be aware that there may be hazards associated with their use and in the handling of them. Complete toxicological or hazard investigations are the responsibility of the customer. Ingestion or contact with the human body may be harmful. The responsibility for the safe use of our products rests with the customer. All materials should be handled by qualified personnel familiar with laboratory procedures and who are familiar with the nature of the material and any necessary precautions which should be taken in the handling, use and storage of the products. The customer shall be responsible for the control and use of the products offered in this catalogue whether alone or in combination with other articles or substances or in any other manner whatsoever.

HAZARD SYMBOLS



C

Corrosive

Chemicals which may destroy living tissue when in contact with them.



D

Dangerous when wet

Chemicals which, in contact with water or damp air, evolve highly flammable or toxic gases and vapours in dangerous quantities.



E

Explosive

Chemicals which may react exothermically without atmospheric oxygen, quickly evolving gases, and which under defined test conditions detonate, quickly deflagrate or upon heating explode when partially confined.



F+

Extremely Flammable

Chemicals which when finely divided (small particle size) are liable to ignite spontaneously.



Xn

Harmful

Chemicals which may cause death or acute or chronic damage to health when inhaled, ingested or absorbed via the skin.



F

Highly flammable

Chemicals which will ignite after contact with flame, or which will evolve highly flammable gases in contact with water.



Xi

Irritant

Non-corrosive chemicals which, through immediate, prolonged or repeated contact with the skin or mucous membrane may cause inflammation.



R

Radioactive

Chemicals which will emit ionising radiation without being subject to irradiation. General precautions for Toxic chemicals apply to those of low activity. For chemicals of medium or high activity special regulations apply.



T

Toxic

Chemicals which may cause death or acute or chronic damage to health when inhaled, ingested or absorbed via the skin.



T+

Very Toxic

Chemicals which in low quantities cause death or acute or chronic damage to health when inhaled, ingested or absorbed via the skin.

General Information

Analyses

Typical Analysis :

Where appropriate a typical analysis is given. All figures are parts per million (ppm) by weight unless otherwise stated. It must be emphasised that this data is "typical" and no guarantee is given that the material supplied will conform to these analyses. The compositions shown under alloy headings are generally weight percent. Exceptions are the glassy alloys and the rare earth magnets where the convention of using atomic ratio is followed.

Purity

Purities listed are quoted with respect to total metallic impurities. Typical analyses may give additional information about likely non-metallic impurities.

High Purity

For materials described as High Purity, the actual analysis of metallic impurities will be supplied free of charge. For other items, an actual analysis can be supplied and a charge will be made for the analysis and for the sample used.

If you require an analysis please tell us whether you require analysis of metallic impurities only or metallic and gaseous. Where an analysis is required the shipment of your order may be delayed.

Supports

Some items from our range of foils need to be supported on one side of the foil to enable both you and us to handle these very delicate materials. Two types of support can be used, the choice being governed by the material. Wherever possible we use a temporary support, a permanent support only being used when the material is brittle (for example Chromium or Manganese).

The temporary support is Acrylic, approximately 0.2mm thick. This may be removed by dissolving in 2-Propanone (Acetone).

Our permanent support is Polyester, thickness 0.125mm, which is hot-press laminated to one face of the foil. It **cannot** be removed without destroying the foil.

Microfoil is mounted on a permanent 3.5µm polyester support. This support **cannot** be removed without destroying the Microfoil.

Microleaf is mounted on a specially treated support which allows separation of the metal film from the support. Full instructions on the method of removal are issued with each Microleaf supplied.

Light Tight (LT) & Not Light Tested (NLT)

Light tight (LT) foils are supplied without visible pinholes after examination without magnification. Foils 0.025mm or more in thickness are supplied LT unless otherwise stated.

Foils less than 0.025mm thick are normally supplied Not-Light Tested (NLT), and will normally contain pinholes but may occasionally be free from pinholes. Foils less than 0.025mm in thickness can often be supplied LT but may incur additional charges. Please specify if you require LT foils

Vacuum tight

Vacuum tight foils show no detectable leakage when tested with a helium mass spectrometer with a sensitivity of 10^{-9} atm-cm³.s⁻¹.

Continuous Lengths

If you require material in continuous lengths please tell us when you place your order. Unless otherwise specified, we reserve the right to supply in more than one length.

Technical Data and Information

All information and technical data are given as a guide only. Although every effort has been made to ensure that the information is correct, no warranty is given as to its completeness or accuracy.

Tolerances

For details of our standard tolerances, please refer to the Product Description section. In many cases, closer tolerances are available but may be subject to an extra charge. If you have any special requirements it is important that you tell us at the time of ordering. This includes special tolerances, dimensional uniformity or any other special requirement which you may have (for example edge finish, packaging, labelling etc.). Please indicate precisely what is required and we shall do our best to meet your specification.

Order information

General Information

There are over 70,000 stock packs listed and if you cannot find what you need amongst them, please ask for special sizes, thicknesses, tolerances, dimensions or larger quantities. We are also able to offer many other pure metals, alloys, polymers and ceramics to special order.

Prices

All the prices listed are total (lot) prices for the sizes and quantities listed. Prices are subject to change without notice.

Prices shown include delivery except for those items marked as "special offer" or dangerous goods with transport restriction. They do not include value added tax, any import duties or local taxes.

Transport Restriction

Some of the materials supplied by Goodfellow are subject to special transport restrictions. Additional shipment charges may apply which are dependent on destination. Please check the individual item on our website or contact us for details of the charges.

If you intend to have the material transported or sent onwards please ensure that you are aware of the relevant transport restrictions.

Delivery

Split shipment

All orders are accepted for one shipment on one date to one address. A charge will be made for split shipments made at the customer's request.

Special Analysis, Supports or Tolerances

An extra charge is made for non-standard supports, alternative tolerances and certificates of analysis. The analysis is free of charge for items marked "High Purity".

Cancellations

A charge for cancellation of orders may be made. The amount will depend on the circumstances.

Express Service

An administration charge of £10 will be made for any order received for which same day shipment within the UK is requested.

Shipment

We aim to have all items listed in this catalogue in stock in the quantities and sizes listed. We can only undertake to despatch an order on a particular date. The date of delivery at the customer's address is subject to the normal variations of the delivery service used.

Despatch

Orders will normally be despatched within 48 hours of receipt.

Non delivery

If we have notified you of despatch of goods and you have not received delivery within 7 days, please contact us.

Insurance

All consignments will be insured by us against the usual risks unless we are instructed in writing to the contrary.

Export Restrictions

A UK Government export licence may be required for some items to some destinations. If the item you require needs a special export licence or an end-use statement we will inform you at the time you order.

Materials Handling

Many of our materials are extremely delicate and it is essential every care is taken when handling them. Special attention is drawn to the extreme fragility of Microfoil, Microleaf and thinner and finer materials.

All materials are carefully packed to ensure safe transport of goods to your address. We do not accept responsibility for damage caused by mishandling once the outer transit packaging has been removed.

Terms of payment

Our normal terms of payment are net 30 days from date of invoice. Any alternative terms of payment are to be agreed with us in writing at the time of placing an order. Customers may be asked to pay cash with order or cash against pro-forma invoice with their first order. In order to establish a credit account we will require details of your bankers, along with two trade references.

Order information

Credit account

We endeavour to keep our costs down and customers are requested to pay our invoices on time. We reserve the right to delay delivery if there are overdue invoices on the account. Accounts which remain unpaid beyond the due date may incur an interest charge at a rate of 2% per month.

Credit card payments

We also accept payment using the following credit and charge cards:

Mastercard, VISA, American Express, DELTA and Switch.

VAT

VAT number: GB 212 8527 79

UK

VAT will be added to the invoice at the rate ruling at the date of invoice. Where a customer is exempt, VAT will be charged unless we receive a copy of the exemption form at the time the order is placed.

EU

Customers registered for VAT who provide their local registration number will not be charged UK VAT.

Customers who are exempt from VAT will not be charged UK VAT provided we are given a copy of their exemption form at the time the goods are ordered.

Customers not registered for VAT or who fail to give us their registration number will be charged UK VAT at the current rate.

Export

All exports to countries outside the EU are zero-rated for UK VAT unless the invoice is being paid from within the EU.

Return of goods

We will only accept return of goods provided we are contacted BEFORE the goods are returned. When we agree to the return we will issue a Goods Return Number and give instructions for the method of return of the goods. Goods will not be accepted for return without a valid Goods Return Number. Due to the nature of some of our materials, it is imperative that you check any possible transport restrictions with your proposed freight company.

Claims

Great care is taken during manufacture and packing and all items are carefully inspected before shipment. Any claim in respect of short delivery, incorrect material or defective quality must be notified to us in writing within three days of delivery. Please retain ALL packaging for our inspection. Our liability for any such claim shall not exceed the cost of replacement of the goods free of charge, or crediting the customer with the invoice value thereof.

Goods ordered in error

We do not accept responsibility for customers' errors in ordering. The amount of credit for returned goods will be at our discretion. Where we accept returned goods a restocking charge will be made.

Conditions of sale

All orders, contracts and quotations are subject to our standard terms and conditions of sale.

Information and statements provided are indicative only and do not form part of any offer or contract.

Exclusions

We supply materials according to our specification. All conditions warranties and representations regarding the quality, fitness for purpose or state, size, shape, capacity or colour of goods supplied whether expressed or implied by common law or statute or otherwise are hereby expressly excluded. We shall not be liable for any damage direct or consequential arising from the use of goods supplied by us however such damage is caused, nor for delay in delivery.

Law

Customers in the USA: Contracts between Goodfellow Corporation and the customer shall be deemed to be subject in all respects to the laws of the Commonwealth of Pennsylvania, or the United States of America.

Customers in France: Contracts between Goodfellow SARL and the customer shall be deemed to be subject in all respects to French law unless otherwise agreed in writing

Customers in Germany: Contracts between Goodfellow GmbH and the customer shall be deemed to be subject in all respects to German law unless otherwise agreed in writing

Order information

Customers in the UK and all other countries: Contracts between Goodfellow Cambridge Limited and the customer shall be deemed to be subject in all respects to English law unless otherwise agreed in writing.

Copies of our General Terms and Conditions are available upon request or can be downloaded from our websites at www.goodfellow.com or www.goodfellowusa.com.

Company Details

Company Structure

The Goodfellow Group consists of five companies:

Goodfellow Cambridge Limited

Goodfellow was established in the City of London in 1946. The Company now has subsidiary operations in France, Germany and North America with the Group's research laboratories, workshop facilities & central administration located in Huntingdon, England.

Goodfellow Corporation

Established at the same time as our associate company in Germany, Goodfellow Corporation was set up to service the requirements of our customers in the USA.

Goodfellow GmbH

Since 1989, this member of the Goodfellow group of companies has been serving the needs of our German speaking customers within Europe.

Goodfellow SARL

Goodfellow established an operation in France in 1993 to meet the needs of our French-speaking customers in Europe.

Goodfellow (Shanghai) Trading Co., Ltd

Goodfellow established a representative office in Shanghai in 2006, and in 2012 followed this with the creation of a fully-fledged trading company, servicing the research and specialist manufacturing requirements of the Chinese market.

COMPANY DETAILS

Goodfellow Cambridge Limited

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USA
A Pennsylvania corporation
EIN 23-2557381

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Import VAT number DE112610478

Goodfellow (Shanghai) Trading Co., Ltd

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SHANGHAI
200070
The People's Republic of China

Conditions of Sale

1 GENERAL

1.1 In these Conditions:

1.1.1 the following expressions shall have the following meanings:-

- "Buyer" the individual firm company or other party from whom an order to supply Goods and/or Services is received by the Seller;
- "Conditions" the standard terms and conditions of sale of the Seller as set out herein and includes any additional terms and conditions of sale agreed in writing by the Seller;
- "Contract" a contract for the Supply of Goods and/or Services by the Seller to the Buyer;
- "Date of Delivery" the date on which delivery of the Goods or Services takes place pursuant to Condition 7;
- "Goods" the goods which the Seller is to supply (or, in relation to Condition 11, the goods in respect of which the Seller is to provide Services) under the Contract and includes any of them or any part of them and where the context so admits includes raw materials, processed materials and/or manufactured products whether processed or manufactured by the Seller or not;
- "Prepayment" a payment to be made by the Buyer pursuant to Condition 6.2 to be used at the Seller's discretion for the purchase of materials and/or towards the costs of labour and other costs relating to the supply of Goods;
- "Recommendations for Use" the recommendations (if any) relating to the storage, handling, application and/or use of the Goods contained in the published literature of the Seller (or, if relevant, a Supplier) or any recommendations made in Writing by an authorised representative of the Seller (or, if relevant, a Supplier);
- "Seller" Goodfellow Cambridge Limited and any subsidiary or holding company or associate (as such terms are defined in the Companies Act 1985 (as amended)) of the said company;
- "Services" the work or services or any of them to be provided by the Seller under the Contract;
- "Supplier" any person, firm or company who or which supplies materials to the Seller which make up the Goods which are to be supplied to the Buyer;

1.1.2 words importing the singular number shall include the plural and vice versa, words importing one gender shall include all genders, and words importing persons shall include bodies corporate, unincorporated associations and partnerships

- 1.2 If satisfactory references and information on the Buyer are not provided within seven days of a request therefore by the Seller, or if, following the provision of such information, the Seller is unable to obtain satisfactory trade indemnity or similar cover in respect of its dealings with the Buyer, the Seller may terminate the Contract and the rights and liabilities of the parties shall be the same as if the Contract had been cancelled in accordance with the provisions of Condition 10.2
- 1.3 The seller reserves the right to assign, sub-contract the Contract or any part thereof. The Buyer shall not be entitled to assign the benefit or burden of the Contract without the consent in writing of the Seller
- 1.4 In relation to all obligations of the Buyer under these Conditions, the time of performance is of the essence
- 1.5 The legal construction of these Conditions shall not be effected by their headings which are for convenience of reference only

2 ORDERS

- 2.1 Notwithstanding that the Seller may have given a detailed quotation or estimate either verbally or in writing no order shall be binding on the Seller unless and until it has been acknowledged in writing by the Seller or the Goods are delivered or the Services are provided by the Seller to the Buyer pursuant to the order
- 2.2 In order to avoid duplication of orders the Buyer shall be responsible for ensuring that any confirmation of an order previously placed is prominently marked as being a confirmation and not a new order. The Buyer acknowledges that any order or confirmation of order which is not so marked may be treated and accepted by the Seller as a new order to create a Contract in addition to any Contract arising out of the previously placed order
- 2.3 These Conditions are incorporated in the Contract and together with any matter set out in the Seller's quotation or acceptance/acknowledgement of order contain the entire obligations between the Seller and the Buyer. In the case of any inconsistency between any letter or quotation incorporating or referring to these Conditions and any order, letter or form of contract sent by the Buyer to the Seller, whatever may be their respective dates, the provisions of these Conditions shall prevail. In the event of the Seller entering into the Contract without the Seller having submitted a written quotation or other letter or document incorporating or referring to these Conditions but in circumstances where the Buyer has had prior notice of these Conditions then all Goods or Services supplied shall be subject to these Conditions
- 2.4 No variation of the Contract by the Buyer shall be binding upon the Seller unless made in Writing and signed on behalf of the Seller. In the event of such variation the Buyer shall indemnify and keep indemnified the Seller in full against all loss, which term shall include (but without prejudice to the generality thereof) loss of profit, costs (including the cost of labour and materials), damages, charges and expenses incurred (directly or indirectly) by the Seller as a result of such variation

2.5 Any representations (except fraudulent misrepresentations) or warranties made by or on behalf of the Seller prior to the Contract (whether verbally or in writing) are hereby expressly excluded and shall be of no effect

3 DESCRIPTION

- 3.1 Any figures, statements, descriptions, illustrations, photographs, drawings, weights or any other matters contained in the Seller's catalogues, pamphlets, price lists or advertising literature are not guaranteed to be accurate and are intended merely to represent a general picture of the Seller's products and shall not form part of the Contract nor be regarded as a warranty or representation relating to the Goods or Services
- 3.2 The Seller reserves the right to amend the specification of its products and services from time to time so that the descriptions thereof as set out in its catalogues, pamphlets, price lists or advertising literature may not be identical with those set out in the Seller's quotation and the Buyer is advised to check the specification set out in the Seller's quotation before placing an order

4 SPECIFICATIONS AND INTELLECTUAL PROPERTY

- 4.1 Where goods are supplied to the Buyer's own specification, or where standard goods of the Seller are altered in accordance with the Buyer's instructions the Buyer warrants and undertakes full responsibility for the suitability and fitness of the specification, pattern or design but also that such specification, pattern or design does not infringe any patent, trade mark, registered design, copyright or any other proprietary right of any third party and the Buyer shall indemnify and keep the Seller indemnified in full against any loss, damage or expense whatsoever (including costs) which the Seller may incur in or arising from the performance of the Contract by reason of any infringement of any such patent, trade mark, registered design, copyright or any other proprietary right
- 4.2 The Seller reserves the right to change the Buyer's specification as required to ensure that the Goods comply with any health, safety or other statutory requirement or provision and no such change by the Seller will constitute a breach of contract or impose upon the Seller any liability whatsoever
- 4.3 Unless otherwise agreed in writing, the Seller will be the sole owner of all inventions, formulations, tools, patterns, designs or other similar items and the copyright in all documents and drawings made or produced by it in preparing a quotation for the Buyer or in the course of work on any Contract with the Buyer

5 QUOTATIONS

5.1 The Seller's quotations are provisional in so far as they are subject to alteration by reference to any changes in the price of raw materials, any item to be acquired by the Seller from a third party, rates of wages, other costs of production and any other circumstances beyond the Seller's control taking place between the date of the quotation and the Buyer's placing of an order in respect thereof

6 PRICE

- 6.1 The Seller shall be entitled to adjust the Contract price of the Goods or Services whether before or after the making of the Contract in the event of any variation in the cost to the Seller of supplying the same or any part thereof caused by:-
- 6.1.1 any increase in the cost of materials required by the Seller for the completion of the Contract; or
- 6.1.2 any increase in wages or production and manufacturing costs or other overheads; or
- 6.1.3 any other reason whatsoever beyond the control of the Seller including (but without prejudice to the generality of the foregoing) fluctuations in exchange rates between monetary currencies the action of any government or any other authority or any labour problems
- 6.2 In the Seller's absolute discretion, a Prepayment in respect of the Contract may be required to be paid by the Buyer to the Seller on the terms set out in this Condition. The Prepayment shall be applied as follows:-
- 6.2.1 in the event that the Contract is performed in full by both parties the Prepayment shall be retained by the Seller in reduction of the total price payable by the Buyer under the Contract;
- 6.2.2 in the event that the Buyer is either in default of any of its obligations under the Contract or cancels or suspends the Contract in accordance with Condition 10 the Prepayment shall be set off by the Seller against its proper costs losses or damages arising in connection with the default and/or cancellation or suspension
- 6.3 Unless otherwise stated, the price set out in the Seller's quotation includes the cost of packaging, carriage, and (save as provided in Condition 6.4) insurance. In respect of supplies of Goods in the United States of America, Canada and Japan the price also includes import duties and sales taxes (if any). In respect of supplies of Goods in other countries the price does not include import duties or VAT or sales taxes which will be extra charges based on prevailing rates
- 6.4 Where the Buyer requests a particular means of delivery, the price set out in the Seller's quotation does not include insurance, which is to be arranged at the responsibility of the Buyer.

7 DELIVERY

- 7.1 Delivery of Goods shall be deemed to be effected by the Seller at the following times:-
- 7.1.1 where Goods are collected by or on behalf of the Buyer by its servants or agents, or where Goods are collected in

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- accordance with a means of delivery specifically requested by the Buyer, when the same are collected;
- 7.1.2 where delivery of the Goods is to be the responsibility of the Seller, when they arrive prior to unloading at the Buyer's premises;
- 7.1.3 where Goods are sold FOB or CIF, when they pass the ship's rail or are loaded onto the aircraft
- 7.2 Delivery of Services shall be deemed to be effected by the Seller at the time of completion by the Seller of the Services
- 7.3 Whilst the Seller will make every reasonable effort to complete the Contract by the date or dates therein specified for delivery of Goods or provision of Services such date or dates shall only constitute the times by which the Seller expects to effect such delivery and if no time is agreed delivery will be within a reasonable time but the performance of the Contract by the Seller shall not be the essence of the Contract, the Seller's failure to so deliver by the due date or dates shall not constitute a breach of Contract and the Seller shall not in any circumstances be responsible for any direct or consequential loss or damage of any kind whatsoever resulting therefrom. The Seller may wholly or partly suspend deliveries of Goods or provision of Services and the Buyer shall accept late delivery of such Goods or Services unless the Buyer has cancelled the Contract in accordance with the provisions of Condition 10.3
- 8 QUANTITIES INSTALMENTS AND STORAGE**
- 8.1 Where Goods are delivered or Services are by instalment each instalment shall be deemed to be sold under a separate Contract and the party in default in respect of any instalment shall be liable accordingly, but no default in respect of any one instalment shall effect due performance of the Contract as regards other instalments
- 8.2 The Seller will endeavour to deliver the quantity of Goods ordered and every delivery shall be deemed to comply with the order. If there is a surplus or shortage of Goods which is no more than 10% of the quantity specified in the order the Buyer shall be deemed to have accepted the Goods and shall pay for the actual quantity delivered
- 8.3 If Goods or Services are to be delivered by instalments, the Seller shall be entitled to invoice each instalment as and when delivery is made and payment for all delivered instalments shall be due notwithstanding the non-delivery of other instalments or other default by the Seller. Failure by the Buyer to make payment by the due date for any one instalment for whatever reason shall entitle the Seller to suspend deliveries of Goods or provision of Services under the Contract but without prejudice to any other right the Seller may have under any of the other provisions of these Conditions
- 8.4 Notwithstanding that risk shall have passed to the Buyer pursuant to Condition 15 the Seller may in its absolute discretion arrange for storage of the Goods either at the request of the Buyer or as a result of the failure by the Buyer to take delivery of the Goods under Condition 7. The Seller may insure the goods whilst in storage and the Buyer shall indemnify and keep indemnified the Seller in full against all costs, losses, damages and expenses whatsoever arising in connection with the storage provided for hereunder and such costs, losses, damages and expenses will be added to and form part of the price of the Goods
- 8.5 Unless otherwise agreed between the Buyer and the Seller, the Seller shall be entitled in its absolute discretion and without giving prior notice to the Buyer at the expiration of 3 months to sell or otherwise dispose of Goods kept in storage as provided in Condition 8.4
- 9 TERMS OF PAYMENT**
- 9.1 Unless otherwise agreed the price shall be due and payable at the Seller's offices 30 days after the date of the Seller's invoice
- 9.2 If the Buyer does not pay the whole or any part of the price on the required day then the Buyer shall pay to the Seller on request interest on the amount outstanding from the required day until the actual date of payment at the rate of 2% p.a. over the base rate of Barclays Bank plc from time to time in force which shall accrue on a daily basis
- 9.3 Condition 12 shall apply in the event of any alleged defect or failure in or of the Goods or Services and the Buyer shall not delay or refuse to make payment in any such event
- 9.4 The Buyer shall not be entitled to withhold payment of any amount due to the Seller by reason of any disputed claim by the Buyer in connection with the Contract nor shall the Buyer be entitled to set off against any amount payable under the Contract to the Seller any amount which is not then due and payable by the Seller or for which the Seller disputes liability
- 9.5 All payments payable to the Seller under the Contract shall become due immediately upon termination of the Contract despite any other provision.
- 10 SUSPENSION AND CANCELLATION**
- 10.1 If the Buyer shall commit any breach of the Contract and fail to remedy the same within 7 days of receiving the Seller's request in writing so to do or any distress or execution is levied upon any goods or property of the Buyer or the Buyer makes any voluntary arrangement with its creditors or becomes subject to an administration order or (being an individual or firm) becomes bankrupt or (being an incorporated company) passes a resolution for winding up (otherwise than for the purpose of amalgamation or reconstruction), or a Court makes an order to that effect, or an encumbrancer takes possession, or an administrative receiver or receiver is appointed, of any of the property or assets of the Buyer, or the Buyer ceases, or threatens to cease, to carry on business or is unable to pay its debts within the meaning of section 123 Insolvency Act, 1986, or the Seller reasonably apprehends that any of the events mentioned above is about to occur in relation to the Buyer and notifies the Buyer accordingly, the Seller may:-
- 10.1.1 stop any Goods in transit and suspend any further deliveries;

and/or

- 10.1.2 suspend work on the Contract; and/or
- 10.1.3 determine the Contract forthwith and if the Goods or Services, or any part of them have been delivered but not paid for, the price shall become immediately due and payable notwithstanding any previous agreement to the contrary but without prejudice to the Seller's right to any unpaid price for Goods or Services delivered under the Contract and to damages for loss (both direct and consequential) suffered in consequence of such determination
- 10.2 If the Buyer requires cancellation of the Contract this will only be accepted at the sole discretion of the Seller and unless otherwise agreed in writing only upon condition that any costs, charges or expenses (both direct and consequential) incurred by the Seller up to the date of cancellation and the value of all loss or damage (both direct and consequential) incurred by the Seller by reason of such cancellation will be reimbursed by the Buyer to the Seller forthwith. Acceptance by the Seller of any cancellation by the Buyer will only be binding upon the Seller if it is made in writing
- 10.3 In the event of the Seller other than in any of the circumstances set out in Condition 10.1 being prevented or hindered from completing the Contract either wholly or in part in accordance with the terms thereof for any reason whatsoever beyond its reasonable control which, for the avoidance of doubt and without prejudice to the generality of the foregoing, shall include governmental action, war, riot, civil commotion, fire, flood, epidemic, labour disputes (including labour disputes involving the work force or any part thereof of the Seller or Supplier), restraints or delays affecting shipping or carriers, licensing, exporting or importing restrictions, currency restrictions and Acts of God then further performance of the Contract shall be suspended for the period during which the Seller is so prevented provided that in the event of the Contract being suspended for a continuous period of more than 3 months then either party may give the other notice in writing to terminate the Contract forthwith and in such circumstances the Buyer shall pay for all Goods or Services supplied to the date of such termination such payment to be made on or before the last day following the month during which termination was effected. The Seller shall be under no liability whatsoever to the Buyer for any direct or consequential loss or damage suffered by the Buyer as a result of the Seller's inability to perform its obligations under the Contract in these circumstances
- 10.4 The Seller's rights contained in Condition 17 (but not the Buyer's rights) shall continue beyond the discharge of the parties' primary obligations under the Contract consequent upon its termination
- 10.5 The termination of the Contract for whatever reason will be without prejudice to the rights and duties of either party accrued prior to termination
- 11 INSPECTION AND CLAIMS FOR DEFECTS**
- 11.1 The Goods are of a highly specialised nature and must be treated with the utmost care. It is essential that the Buyer checks that they correspond in all respects with the Buyer's requirements. Any discrepancies should be notified to the Seller immediately. The Buyer undertakes to ensure that all Goods are unpacked and handled only by persons qualified to deal with such specialised products, to safeguard against injury to the Goods or to the Buyer's personnel
- 11.2 The Buyer shall inspect the Goods and carry out tests to ensure the Goods conform with the description of the Goods or Services in the Buyer's orders within 7 days of Delivery and whether or not the Buyer carries out such obligation to inspect and test no claims for non-delivery, shortages in quantity of units delivered, defective Goods or Services, non-conformity to description or partial loss or damage to Goods will be accepted by the Seller unless:-
- 11.2.1 they are notified in writing by the Buyer to the Seller within 10 days after the Date of Delivery (in the case of partial loss, damage, non-conforming or defective Goods or Services) or 14 days after the date of the invoice (in the case of non-delivery);
- 11.2.2 the Goods in respect of which a claim is made together with all the relevant packing are preserved intact as received for a period of 35 days from notification of any such claim and the Buyer permits the Seller or its servants or agents full and free right of access to inspect the Goods and investigate the claim; and
- 11.2.3 if the Buyer fails to give the appropriate notice as specified in Condition 11.2.1, the Buyer's claim will be deemed to have been waived and will be absolutely barred
- 11.3 It is in all cases the responsibility of the Buyer to ensure by testing or otherwise that the Goods are fit and suitable for the purposes for which the Buyer requires them in the conditions in which they will be used. The Buyer acknowledges that the Seller shall be under no liability of any description to the Buyer if the Goods prove to be unsuitable for whatever reason for application or use notwithstanding that the Seller may, at the request of the Buyer, have given in good faith technical or other advice in relation to the proposed application or use of the Goods and the Buyer shall indemnify and keep indemnified the Seller in full against any and all liability of any kind arising out of or connected with the application or use of the Goods
- 11.4 Section 3 Sale and Supply of Goods Act 1994 shall not apply
- 11.5 The Seller will not accept the return of Goods in any circumstances unless it has first issued a Goods return number and such number is quoted with the returned Goods
- 12 WARRANTY**
- 12.1 In substitution for all and any other rights which the Buyer might or would have had but for these Conditions and subject to Condition 11,

Conditions of Sale

the Seller shall make good by replacement any failure in the Goods or Services which results from defects in the Seller's materials or workmanship and which appear not later than 2 months after the Date of Delivery and shall replace any Goods or Services which do not conform with the description in the Buyer's order

- 12.2 Notwithstanding the provisions of Condition 12.1, in the case of a claim falling within Condition 12.1, the Seller reserves the right at its sole discretion to credit the Buyer in full the price paid by the Buyer to the Seller
- 12.3 The Seller's liability under this Condition shall automatically cease if:
- 12.3.1 the Buyer has not paid for all Goods or Services supplied under any Contract by the due date or is otherwise in breach of this or any other Contract made with the Seller; or
- 12.3.2 the Seller or its servants or agents are denied full and free right of access to the allegedly defective Goods; or
- 12.3.3 the Buyer has not properly maintained the Goods or has not complied with any Recommendations for Use; or
- 12.3.4 the defect or failure is caused by a breach by the Buyer of its undertakings and warranties contained in Condition 17; or
- 12.3.5 the Buyer has failed to notify the Seller in writing of any defect or suspected defect within 14 days of the same coming to the knowledge of the Buyer
- 12.4 The warranty set out in Condition 12.1 shall be in lieu of any warranties conditions or undertakings whether express or implied by statute, common law or otherwise howsoever which warranties, conditions and undertakings are hereby expressly excluded, except that such exclusions will not apply to any implied condition that the Seller has or will have the right to sell the Goods when the property is to pass
- 12.5 Nothing in these Conditions excludes or limits the liability of the Seller for death or personal injury caused by the Seller's negligence or fraudulent misrepresentation
- 12.6 SUBJECT TO CONDITIONS 12.4 AND 12.5
- 12.6.1 the seller's total liability in contract, tort (including negligence or breach of statutory duty), misrepresentation or otherwise, arising in connection with the performance or contemplated performance of the contract shall be limited to the price paid for the goods or services under the contract; and
- 12.6.2 the seller shall not be liable to the buyer for any indirect or consequential loss or damage (whether for loss of profit, loss of business, depletion of goodwill or otherwise), costs, expenses or other claims for consequential compensation whatsoever (however caused) which arise out of or in connection with the contract

13 CONSUMER SALES

- 13.1 Where the Goods are sold under a consumer sale (as defined by the Sale of Goods Act 1979) the statutory rights of the Buyer are not affected by these conditions

14 TITLE TO GOODS

- 14.1 Full legal and beneficial ownership of the Goods shall be retained by the Seller notwithstanding that the risk in the same shall pass to the Buyer at the time of delivery until the Seller has received payment in full in respect of
- 14.1.1 The Goods; and
- 14.1.2 All other sums which become due and owing by the Buyer to the Seller on any account whatsoever
- 14.2 Until ownership of the Goods has passed to the Buyer the Buyer shall hold the Goods in a fiduciary capacity and as bailee of the Seller and shall at all times take proper care of the same and will not obliterate or obscure any identifying mark or their packaging and will keep the Goods separate from any other goods and in such manner that they may be clearly identified as belonging to the Seller and the Buyer hereby grants to the Seller the right to enter on the Buyer's premises at any time during the continuation of the Contract to check that the Buyer is complying with the obligation contained in this Condition. The Buyer will return the Goods to the Seller if it receives a request whether verbally or in Writing so to do prior to payment in full as aforesaid having been made and the Seller will then repay any part of the purchase price it has already received in respect of the Goods less a reasonable amount in respect of its costs and expenses in connection with the Contract
- 14.3 For the purposes of Condition 14.1, the expression "the Buyer" includes any subsidiary or holding company or associate of the Buyer (as such terms are defined in the Companies Act 1985 (as amended))
- 14.4 The Seller will have the right to maintain an action against the Buyer for the price of the Goods notwithstanding that property in the Goods has not been passed

15 RISK AND INSURANCE

- 15.1 The risk in the Goods shall pass to the Buyer at the time of delivery as provided for in Condition 7
- 15.2 Notwithstanding the reservation of title contained in Condition 14, the Buyer shall insure the Goods and/or any products made wholly or partly therefrom for the full amount of the price payable under the Contract with an insurance office of repute from the time of delivery of the Goods until the date title in the Goods passes to the Buyer pursuant to Condition 14.1

16 EXPORT TERMS

- 16.1 In these Conditions "Incoterms" means the international rules for the interpretation of trade terms of the International Chamber of Commerce

as in force at the date when the Contract is made. Unless the context otherwise requires, any term or expression which is defined in or given a particular meaning by the provisions of Incoterms has the same meaning in the Contract

- 16.2 Where the Goods are supplied for export from the United Kingdom then unless otherwise agreed in writing between the Buyer and the Seller

- 16.2.1 the provisions of Incoterms shall (subject to any special terms agreed in writing between the Buyer and the Seller) apply but if there is any conflict between the provisions of Incoterms and these Conditions, the latter shall prevail.
- 16.2.2 the Buyer shall be responsible for complying with any legislation or regulations governing the importation of the Goods into the country of destination and (save in respect of the United States of America, Canada and Japan) for the payment of any duties and taxes thereon unless payment for these is included in the Contract
- 16.2.3 the Buyer shall be deemed to have satisfied itself that such Goods comply with the safety regulations of any country or state in which the Goods are to be used outside the United Kingdom and the Buyer shall indemnify and keep indemnified the Seller in full for any loss or damage whatsoever which the Seller may incur if such Goods do not comply with such safety regulations

- 16.3 The Goods shall not be used in any country other than that for which the Seller was aware they were originally ordered without the Seller's consent in writing

- 16.4 The Buyer undertakes not to offer the Goods for resale in any country notified by the Seller at or before the time the Buyer's order is placed, or to sell the Goods to any person if the Buyer knows or has reason to believe that person intends to resell the Goods in any such country

17 BUYER'S WARRANTIES

- 17.1 The Buyer warrants to the Seller that:
- 17.1.1 the Buyer will install, operate or otherwise use or store the Goods strictly in accordance with the Recommendations for Use and with all relevant or applicable statutory or other regulations governing the installation, operation, use or storage of the Goods; and
- 17.1.2 any collection vehicle, container, ship or other means of transport provided by the Buyer or any agent of the Buyer will comply with all relevant legislation and regulations relating to health and safety requirements; and
- 17.1.3 the storage and transport facilities and all parts thereof and all equipment used in connection therewith is suitable for storage (both short term and long term) and transport of the Goods and complies with any statute, regulation, bye law or other rule having the force of law and relating to the storage of goods of the nature of the Goods; and
- 17.1.4 the Buyer will ensure that the Goods are stored in conditions appropriate to goods of that nature and will comply with any recommendations as to the storage of Goods notified to it by the Seller from time to time; and
- 17.2 The Buyer shall indemnify and keep indemnified the Seller in full against any claim, loss or damage (including, without limitation, damage to the reputation of the Seller) arising directly or indirectly from any breach of the warranty contained in Condition 17.1

18 SEVERANCE

- 18.1 If at any time any one or more of the provisions or part thereof of these Conditions becomes or is invalid, illegal or unenforceable in any respect under any law or is held by a court to be invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions hereof and the remainder of such provision shall not in any way be affected or impaired thereby

19 JURISDICTION

- 19.1 These Conditions and each and every Contract made pursuant to them shall be governed by and construed in all respects in accordance with the laws of England and the Seller and the Buyer hereby agree to submit to the non-exclusive jurisdiction of the English Courts

20 NOTICES

- 20.1 Any notice required or permitted to be given by either party to the other under these Conditions shall be in writing addressed to that other party at its registered office or principal place of business or such other address as may at the relevant time have been notified pursuant to this provision to the party giving notice
- 20.2 Any notice given pursuant to clause 20.1 shall be deemed to have been served:
- 20.2.1 if delivered by hand, on the first Business Day following delivery;
- 20.2.2 if sent by post, on the third Business Day after posting if the address of the recipient is in the country of despatch, otherwise on the seventh Business Day after posting;
- 20.2.3 if sent by facsimile transmission, on the first Business Day following successful transmission
- 20.3 In proving service it shall be sufficient proof in the case of a notice sent by post, that the envelope containing the same was properly stamped, addressed and placed in the post and, in the case of facsimile transmission, that it was properly addressed and successfully transmitted
- 20.4 In this Condition 20, "Business Day" shall mean any day other than Saturday, Sunday or any other day which is a public holiday in the place at which the notice is left or to which such notice is despatched

21 WAIVER

Conditions of Sale

21.1 No waiver by the Seller of any breach of any provision of the Contract by the Buyer shall be considered as a waiver of any subsequent breach

of the same or any other provision and the Seller shall not be prejudiced by any forbearance or indulgence granted by it to the Buyer

Vanadium

V

Vanadium was discovered in Mexico City in 1801 by A.M. del Rio, and was rediscovered in 1831 by N.G. Selfström in Falun, Sweden.

Vanadium is a soft, shiny, silvery metal which can be found in many different minerals, including some crude oils. It has an abundance of 160 ppm in the earth's crust and can be isolated after conversion to the pentoxide, V_2O_5 , followed by direct reduction with aluminium. High purity metal can be obtained by the van Arkel process in which the iodide is decomposed on a hot filament under vacuum. Pure vanadium resists corrosion due to the formation of a protective oxide film on its surface; it is attacked by concentrated acids but not by fused alkalis.

The principal use for vanadium is as an alloying constituent, particularly in steels where it is introduced as ferrovanadium, an alloy of iron and vanadium. The addition of vanadium to steels removes occluded oxygen and nitrogen, thus improving the materials' strength. A typical vanadium content would be 0.5% max.

Atomic Properties

Atomic number	23
Atomic radius - Goldschmidt	0.136 nm
Atomic weight	50.9415 amu
Crystal structure	Body centred cubic
Electronic structure	Ar 3d ³ 4s ²
Photo-electric work function	4.3 eV
Thermal neutron absorption cross-section	5.06 Barns
Valences shown	2, 3, 4, 5

Natural isotope distribution	Mass No.	%
	50	0.25
	51	99.75

Ionisation potential	No.	eV
	1	6.74
	2	14.6
	3	29.3
	4	46.7
	5	65.2
	6	128

Physical Properties

Boiling point	3380 C
Density @20C	6.1 g cm ⁻³
Melting point	1890 C

Electrical Properties

Electrical resistivity @20C	19.6 μOhmcm
Temperature coefficient @0-100C	0.0039 K ⁻¹
Superconductivity critical temperature	5.40 K
Thermal emf against Pt (cold 0C - hot 100C)	0.63 mV

Thermal Properties

Coefficient of thermal expansion @0-100C	8.3 x10 ⁻⁶ K ⁻¹
Latent heat of evaporation	8975 J g ⁻¹
Latent heat of fusion	345 J g ⁻¹
Specific heat @25C	486 J K ⁻¹ kg ⁻¹
Thermal conductivity @0-100C	30.7 W m ⁻¹ K ⁻¹

Mechanical Properties

Material condition	Soft	Hard	Polycrystalline
Bulk modulus			158 GPa
Hardness - Vickers	80	150	
Izod toughness	10-136 J m ⁻¹		
Poisson's ratio			0.365
Tensile modulus			127.6 GPa
Tensile strength	260-585	530-730	MPa
Yield strength	170-450	515-690	MPa



Microfoil

CONTRACT COATING of customers' own components or assemblies is available to special order.

V 004500	Thickness..... 0.1μm	Area density..... 60.8μg.cm⁻²			
	Purity..... 99.8+%	Support..... Permanent Mylar 3.5μm			
	Quantity				
Web Code	Disc diam.	1 disc	2discs	5discs	10discs
987-853-882	10 mm	YEN 31600	YEN 43000	YEN 77000	YEN 122000
216-971-068	25 mm	YEN 46800	YEN 65500	YEN 122000	YEN 198000

Typical Analysis : Starting Material : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.
 This item is normally made to order for delivery within 4-5 weeks.

V 004600	Thickness..... 0.25μm	Area density..... 140.4μg.cm⁻²			
	Purity..... 99.8+%	Support..... Permanent Mylar 3.5μm			
	Quantity				
Web Code	Disc diam.	1 disc	2discs	5discs	10discs
511-537-249	10 mm	YEN 35000	YEN 48000	YEN 87000	YEN 139000
769-570-046	25 mm	YEN 52500	YEN 74000	YEN 139000	YEN 226000

Typical Analysis : Starting Material : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.
 This item is normally made to order for delivery within 4-5 weeks.

V 004850	Thickness..... 1.0μm	Area density..... 611μg.cm⁻²			
	Purity..... 99.8+%	Support..... Permanent Mylar 3.5μm			
	Quantity				
Web Code	Disc diam.	1 disc	2discs	5discs	10discs
465-486-923	10 mm	YEN 43000	YEN 60000	YEN 111000	YEN 179000
233-559-964	25 mm	YEN 65500	YEN 94000	YEN 179000	YEN 292000

Typical Analysis : Starting Material : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.
 This item is normally made to order for delivery within 4-5 weeks.



Foil

V 000080	Thickness..... 0.001mm	Purity..... 99.8%		
	Quantity			
Web Code	Size	1pc	2pcs	5pcs
843-670-532	25 x 25 mm	YEN 66500	YEN 89500	YEN 137000
126-638-951	50 x 50 mm	YEN 120000	YEN 184000	

Typical Analysis : Ag <1, Al 200, B <1, Ca 5, Co <10, Cr 3, Cu <40, Fe 60, Mg 20, Mn 5, Mo <20, Nb <250, Pb <20, Si 300, Sn <20, Ta <250, Ti <50, W <500, C 120, H 3, N 50, O 50.

Vanadium

V



Foil

V 000090

Thickness 0.002mm

Purity..... 99.8%

Sizes LT

Web Code
 912-489-702
 702-343-435

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 61000	YEN 82000	YEN 124000
50 x 50 mm	YEN 109000	YEN 150000	

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

V 000100

Thickness 0.003mm

Purity..... 99.8%

Sizes LT

Web Code
 142-199-957
 180-893-324

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 54000	YEN 71500	YEN 108000
50 x 50 mm	YEN 94500	YEN 129000	

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

V 000110

Thickness 0.004mm

Purity..... 99.8%

Sizes LT

Web Code
 074-473-166
 931-506-044

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 52500	YEN 69500	YEN 105000
50 x 50 mm	YEN 91000	YEN 125000	

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

V 000120

Thickness 0.005mm

Purity..... 99.8%

Sizes LT

Web Code
 097-870-013
 161-506-984
 295-830-964

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 49800	YEN 66000	YEN 99000
50 x 50 mm	YEN 86500	YEN 118000	
100 x 100 mm	YEN 193000		

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

V 000130

Thickness 0.006mm

Purity..... 99.8%

Sizes LT

Web Code
 831-632-706
 632-892-004
 077-250-561

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 49600	YEN 65500	YEN 98500
50 x 50 mm	YEN 85500	YEN 117000	
100 x 100 mm	YEN 190000		

Discs

Web Code
 050-291-416
 286-426-648
 803-328-609
 416-082-010
 010-261-776

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 49400	YEN 61500	YEN 90000
6 mm	YEN 59500	YEN 76500	YEN 113000
8 mm	YEN 70000	YEN 91000	YEN 137000
10 mm	YEN 80500	YEN 106000	YEN 161000
15 mm	YEN 106000	YEN 142000	

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

V 000140

Thickness 0.007mm

Purity..... 99.8%

Sizes LT

Web Code
 898-063-485
 418-643-953
 969-264-284

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 48800	YEN 64500	YEN 97000
50 x 50 mm	YEN 84500	YEN 115000	
100 x 100 mm	YEN 195000		

Discs

Web Code
 339-956-722
 494-589-980
 823-748-139
 968-516-509
 064-573-941

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 49000	YEN 61000	YEN 89500
6 mm	YEN 59000	YEN 75500	YEN 112000
8 mm	YEN 69000	YEN 90000	YEN 136000
10 mm	YEN 79500	YEN 105000	YEN 159000
15 mm	YEN 104000	YEN 140000	

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

Metal – Vanadium

Vanadium

V



Foil

V 000150

Thickness 0.008mm

Purity 99.8%

Sizes LT

Web Code
 501-047-418
 876-853-528
 081-496-204

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 48600	YEN 64000	YEN 96000
50 x 50 mm	YEN 83500	YEN 114000	
100 x 100 mm	YEN 191000		

Discs

Web Code
 179-454-447
 431-803-094
 975-381-926
 922-746-661
 343-333-432

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 48800	YEN 61000	YEN 89000
6 mm	YEN 59000	YEN 75000	YEN 112000
8 mm	YEN 69000	YEN 89500	YEN 135000
10 mm	YEN 79000	YEN 104000	YEN 158000
15 mm	YEN 104000	YEN 139000	

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

V 000170

Thickness 0.01mm

Purity 99.8%

NLT Sizes

Web Code
 263-360-223
 626-636-433
 992-869-470

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 45600	YEN 60000	YEN 89500
50 x 50 mm	YEN 77500	YEN 105000	
100 x 100 mm	YEN 184000		

Sizes LT

Web Code
 585-509-245

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 50000	YEN 66000	YEN 98500

Discs

Web Code
 664-864-822
 108-102-355
 512-788-565
 098-574-039
 321-753-898

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 47200	YEN 58500	YEN 85000
6 mm	YEN 56500	YEN 71500	YEN 106000
8 mm	YEN 65500	YEN 84500	YEN 127000
10 mm	YEN 75000	YEN 98000	YEN 149000
15 mm	YEN 97500	YEN 130000	

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

V 000251

Thickness 0.0125mm

Purity 99.8%

NLT Sizes

Web Code
 869-294-082
 042-056-296
 325-374-594

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 42800	YEN 51000	YEN 81000
50 x 50 mm	YEN 65500	YEN 101000	
100 x 100 mm	YEN 165000		

Sizes LT

Web Code
 181-981-200
 043-951-465

Size	Quantity		
	1pc	2pcs	5pcs
25 x 25 mm	YEN 47200	YEN 56000	YEN 89000
50 x 50 mm	YEN 79000	YEN 121000	

Discs

Web Code
 485-765-276
 915-699-659
 945-443-325
 816-092-952
 042-639-602

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 60000	YEN 81500	YEN 121000
6 mm	YEN 63000	YEN 85500	YEN 134000
8 mm	YEN 66000	YEN 92500	YEN 156000
10 mm	YEN 69000	YEN 103000	YEN 183000
15 mm	YEN 87500	YEN 140000	

Typical Analysis : Ag 1, Al 2, Ca < 1, Cr 15, Cu < 1, Fe 70, Mg < 1, Mn 1, Si 300.

Metal – Vanadium

Vanadium

V



Foil

V 000180

Thickness 0.015mm

Purity 99.8%

NLT Sizes

Web Code
 407-237-690
 262-460-774
 057-879-952

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
50 x 50 mm	YEN 64500	YEN 86500	YEN 198000	
100 x 100 mm	YEN 158000	YEN 304000		
150 x 150 mm	YEN 339000			

Sizes LT

Web Code
 829-286-614
 988-913-422
 362-578-237
 560-093-256

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
25 x 25 mm	YEN 39000	YEN 50500	YEN 74500	YEN 110000
50 x 50 mm	YEN 67500	YEN 91000	YEN 208000	
100 x 100 mm	YEN 174000	YEN 334000		
150 x 150 mm	YEN 407000			

Discs

Web Code
 909-124-945
 640-622-661
 077-832-301
 729-041-477
 130-186-104
 273-273-046

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 43400	YEN 53500	YEN 77000
6 mm	YEN 50500	YEN 63500	YEN 93500
8 mm	YEN 58000	YEN 74000	YEN 110000
10 mm	YEN 65500	YEN 84500	YEN 128000
15 mm	YEN 83500	YEN 110000	YEN 228000
25 mm	YEN 130000		

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

V 000190

Thickness 0.02mm

Purity 99.8%

NLT Sizes

Web Code
 931-336-729
 767-252-327
 061-696-643

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
50 x 50 mm	YEN 56000	YEN 80000	YEN 182000	
100 x 100 mm	YEN 145000	YEN 277000		
150 x 150 mm	POA			

Sizes LT

Web Code
 739-501-943
 302-488-495
 237-903-483
 327-608-735

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
25 x 25 mm	YEN 34800	YEN 44800	YEN 65500	YEN 101000
50 x 50 mm	YEN 59000	YEN 84000	YEN 191000	
100 x 100 mm	YEN 159000	YEN 305000		
150 x 150 mm	POA			

Discs

Web Code
 618-042-347
 255-299-467
 912-427-384
 053-414-528
 676-822-124
 602-763-153

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 41200	YEN 50000	YEN 71500
6 mm	YEN 47200	YEN 58500	YEN 85500
8 mm	YEN 53500	YEN 67500	YEN 100000
10 mm	YEN 59500	YEN 76500	YEN 120000
15 mm	YEN 75000	YEN 99500	YEN 211000
25 mm	YEN 121000	YEN 217000	

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

V 000270

Thickness 0.025mm

Purity 99.8%

Temper As rolled

NLT Sizes

Web Code
 478-510-167

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
300 x 300 mm	YEN 74000			

Sizes LT

Web Code
 629-351-395
 041-462-859
 850-691-540
 893-266-159

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
25 x 25 mm	YEN 20000	YEN 23200	YEN 30200	YEN 40000
50 x 50 mm	YEN 25000	YEN 30000	YEN 41200	YEN 55500
100 x 100 mm	YEN 34800	YEN 44000	YEN 63500	
150 x 150 mm	YEN 44600	YEN 58000		

Coil

Web Code
 621-863-281

Length	Quantity	
	1 Reel	
0.5 m	YEN	POA

Discs

Web Code
 613-922-585
 740-315-339
 539-418-663
 427-329-181
 416-141-414
 017-682-598
 210-318-727

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 39600	YEN 53500	YEN 88500
6 mm	YEN 41000	YEN 55500	YEN 92000
8 mm	YEN 42600	YEN 57500	YEN 95500
10 mm	YEN 44000	YEN 59500	YEN 98500
15 mm	YEN 47800	YEN 65000	YEN 107000
25 mm	YEN 55500	YEN 75500	YEN 124000
50 mm	YEN 74000		

Typical Analysis : Ag < 1, Al 200, B < 1, Ca 5, Co < 10, Cr 3, Cu < 40, Fe 60, Mg 20, Mn 5, Mo < 20, Nb < 250, Pb < 20, Si 300, Sn < 20, Ta < 250, Ti < 50, W < 500, C 120, H 3, N 50, O 50.

Metal - Vanadium

Vanadium

V



Foil

V 000300

Thickness **0.040mm**
 Temper **As rolled**

Purity **99.8%**

Size

Web Code
 401-464-103
 734-795-057
 611-893-420
 028-152-203

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
25 x 25 mm	YEN 21200	YEN 24600	YEN 32400	YEN 42400
50 x 50 mm	YEN 27600	YEN 33800	YEN 47000	
100 x 100 mm	YEN 40800	YEN 52500		
150 x 150 mm	YEN 54000			

Discs

Web Code
 660-514-246
 564-284-431
 535-561-943
 945-246-889
 155-852-737
 481-597-048

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 37400	YEN 48600	YEN 61500
6 mm	YEN 39400	YEN 51500	YEN 66000
8 mm	YEN 41400	YEN 54500	YEN 70500
10 mm	YEN 43400	YEN 57000	YEN 75000
15 mm	YEN 48400	YEN 64000	YEN 86500
25 mm	YEN 58500		

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 000310

Thickness **0.125mm**
 Temper **As rolled**

Purity **99.8%**

Size

Web Code
 827-358-697
 637-022-111
 892-784-194
 094-933-313
 822-154-919

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
25 x 25 mm	YEN 26600	YEN 31400	YEN 41400	YEN 53000
35 x 100 mm	YEN 41400	YEN 52500	YEN 74500	
35 x 200 mm	YEN 52000	YEN 67000		
35 x 500 mm	YEN 73000			
50 x 50 mm	YEN 37400	YEN 46600	YEN 65500	YEN 87000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 000315

Thickness **0.2mm**
 Temper **As rolled**

Purity **99.8%**

Size

Web Code
 638-644-121
 901-063-218
 807-689-203
 232-843-134
 835-909-379

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
25 x 25 mm	YEN 26800	YEN 33200	YEN 47600	YEN 66500
50 x 50 mm	YEN 38000	YEN 48800	YEN 72500	YEN 101000
100 x 100 mm	YEN 60000	YEN 80000	YEN 122000	
150 x 150 mm	YEN 82500	YEN 112000		
150 x 300 mm	YEN 110000			

Discs

Web Code
 207-071-960
 282-604-688
 549-021-568
 669-883-777
 607-218-485
 978-637-440

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 51500	YEN 67000	YEN 110000
6 mm	YEN 55000	YEN 71500	YEN 117000
8 mm	YEN 58500	YEN 76500	YEN 125000
10 mm	YEN 62000	YEN 81500	YEN 133000
15 mm	YEN 70000	YEN 93000	YEN 151000
25 mm	YEN 87000	YEN 117000	

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 000320

Thickness **0.25mm**
 Temper **As rolled**

Purity **99.8%**

Size

Web Code
 015-694-837
 961-856-831
 232-105-818
 013-227-946

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
25 x 25 mm	YEN 28200	YEN 35000	YEN 50500	YEN 70500
50 x 50 mm	YEN 40600	YEN 52500	YEN 78000	YEN 110000
100 x 100 mm	YEN 65500	YEN 87500	YEN 134000	
150 x 150 mm	YEN 90000	YEN 123000		

Discs

Web Code
 816-462-524
 057-817-316
 227-166-606
 395-828-167
 478-524-997
 815-623-161

Diameter	Quantity		
	10 discs	20 discs	50 discs
4 mm	YEN 52500	YEN 68000	YEN 112000
6 mm	YEN 56000	YEN 73500	YEN 120000
8 mm	YEN 60000	YEN 78500	YEN 129000
10 mm	YEN 64000	YEN 84000	YEN 137000
15 mm	YEN 73000	YEN 97500	YEN 158000
25 mm	YEN 92000	YEN 124000	

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

Metal – Vanadium

Vanadium

V



Foil

V 000330

Thickness **0.5mm**
 Temper **As rolled**

Purity **99.8%**

Size

Web Code

112-283-639
 035-461-658
 432-707-474
 088-437-003
 054-633-780

Size
 25 x 25 mm
 50 x 50 mm
 100 x 100 mm
 150 x 150 mm
 300 x 300 mm

Quantity
1pc
 YEN 31800
 YEN 47200
 YEN 78000
 YEN 109000
 POA

2pcs
 YEN 39000
 YEN 61000
 YEN 104000
 POA

5pcs
 YEN 54500
 YEN 89000
 POA

10pcs
 YEN 73500
 POA

20pcs
 YEN 103000

Discs

Web Code

829-216-206
 652-032-758
 504-096-821
 012-100-608
 512-586-858
 073-361-220
 170-158-680

Diameter
 4 mm
 6 mm
 8 mm
 10 mm
 15 mm
 25 mm
 50 mm

Quantity
10 discs
 YEN 46200
 YEN 51000
 YEN 55500
 YEN 60000
 YEN 72000
 YEN 95500
 YEN 154000

20 discs
 YEN 61000
 YEN 67500
 YEN 74500
 YEN 81000
 YEN 97500
 YEN 131000

50 discs
 YEN 90500
 YEN 101000
 YEN 112000
 YEN 122000
 YEN 148000
 YEN 201000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 000340

Thickness **1.0mm**
 Temper **As rolled**

Purity **99.8%**

Size

Web Code

269-825-578
 728-193-116
 024-149-555
 018-691-721
 336-471-937

Size
 25 x 25 mm
 50 x 50 mm
 100 x 100 mm
 150 x 150 mm
 300 x 300 mm

Quantity
1pc
 YEN 40600
 YEN 65500
 YEN 115000
 YEN 165000
 POA

2pcs
 YEN 51000
 YEN 86500
 YEN 157000
 POA

5pcs
 YEN 72500
 YEN 128000
 POA

10pcs
 YEN 96500
 POA

20pcs
 YEN 132000

Discs

Web Code

058-999-220
 374-911-612
 863-952-699
 994-081-670
 260-202-131
 525-267-296
 658-412-409

Diameter
 4 mm
 6 mm
 8 mm
 10 mm
 15 mm
 25 mm
 50 mm

Quantity
10 discs
 YEN 44000
 YEN 51500
 YEN 59000
 YEN 67000
 YEN 85500
 YEN 124000
 YEN 228000

20 discs
 YEN 53500
 YEN 64000
 YEN 75000
 YEN 85500
 YEN 112000
 YEN 166000

50 discs
 YEN 73500
 YEN 90500
 YEN 107000
 YEN 125000
 YEN 167000
 YEN 288000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 000360

Thickness **2.0mm**
 Temper **As rolled**

Purity **99.8%**

Size

Web Code

301-562-184
 695-269-297
 908-657-945

Size
 25 x 25 mm
 50 x 50 mm
 100 x 100 mm

Quantity
1pc
 YEN 44200
 YEN 74000
 YEN 133000

2pcs
 YEN 57500
 YEN 100000

5pcs
 YEN 86000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 000370

Thickness **3.15mm**
 Temper **As rolled**

Purity **99.8%**

Size

Web Code

937-445-356
 670-343-701
 074-001-020

Size
 25 x 25 mm
 50 x 50 mm
 100 x 100 mm

Quantity
1pc
 YEN 52500
 YEN 91000
 YEN 167000

2pcs
 YEN 69500
 YEN 124000

5pcs
 YEN 105000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.



Sheet

V 000306

Thickness **6mm**

Purity **99.8%**

Size

Web Code

495-381-888

Size
 127 x 381 mm

Quantity
1pc
 POA

2pcs
5pcs

10pcs
20pcs

YEN
 16032000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

Metal – Vanadium

Vanadium

V



Sputtering Target

V 009200	Thickness 2.0mm	Purity..... 99.8%
Size	Quantity	
Web Code	Disc diam.	1disc
630-817-508	75 mm	POA

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.
 These targets are normally available for immediate shipment from stock. Other sizes are available to special order.

V 009300	Thickness 3.0mm	Purity..... 99.8%
Size	Quantity	
Web Code	Disc diam.	1disc
798-464-974	25 mm	POA
245-377-758	50 mm	POA
672-218-730	75 mm	POA

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.
 These targets are normally available for immediate shipment from stock. Other sizes are available to special order.

V 009600	Thickness 6.0mm	Purity..... 99.8%
Size	Quantity	
Web Code	Disc diam.	1disc
134-877-114	25 mm	POA
027-339-936	50 mm	POA
417-491-510	75 mm	POA

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.
 These targets are normally available for immediate shipment from stock. Other sizes are available to special order.



Wire

V 005105	Diameter 0.1mm	Purity..... 99.8%
	Temper..... As drawn	
Length	Quantity	
Web Code	Length	1 Reel
697-639-777	0.2 m	YEN 17200
397-232-397	0.5 m	YEN 21400
576-563-918	1 m	YEN 26600
782-889-463	2 m	YEN 34400
884-324-326	5 m	YEN 58000

Typical Analysis : Ag 2, Al 25, Ca 10, Cr 40, Cu <1000, Fe 200, Mg 1, Mn 10, Ni 20, Pb 2, Si 500, Y <1.6%, Impurity content very variable.

V 005110	Diameter 0.25mm	Purity..... 99.8%
	Temper..... Hard	
Length	Quantity	
Web Code	Length	1 Reel
754-384-454	0.2 m	YEN 17000
298-053-412	0.5 m	YEN 21000
256-683-447	1 m	YEN 26000
085-429-755	2 m	YEN 33600
678-722-134	5 m	YEN 55500

Typical Analysis : Ag 2, Al 25, Ca 10, Cr 40, Cu <1000, Fe 200, Mg 1, Mn 10, Ni 20, Pb 2, Si 500, Y <1.6%, Impurity content very variable.

V 005120	Diameter 0.5mm	Purity..... 99.8%
	Temper..... As drawn	
Length	Quantity	
Web Code	Length	1 Reel
840-272-697	0.2 m	YEN 17900
034-085-552	0.5 m	YEN 22600
260-688-554	1 m	YEN 28200
586-064-097	2 m	YEN 36600
258-003-860	5 m	YEN 67000

Typical Analysis : Ag 2, Al 25, Ca 10, Cr 40, Cu <1000, Fe 200, Mg 1, Mn 10, Ni 20, Pb 2, Si 500, Y <1.6%, Impurity content very variable.

V 005130	Diameter 1.0mm	Purity..... 99.8%
	Temper..... Stress relieved	
Length	Quantity	
Web Code	Length	1 Reel
250-475-039	0.2 m	YEN 20400
309-377-326	0.5 m	YEN 26600
672-174-303	1 m	YEN 33800
021-796-723	2 m	YEN 49000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

Metal – Vanadium

Vanadium

V



Rod

V 007901	Diameter 1.2mm	Purity 99.8%
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs
014-531-606	100 mm	YEN 23800 YEN 29600 YEN 36400
210-951-867	200 mm	YEN 26800 YEN 33800 YEN 51500
733-617-859	500 mm	YEN 32800 YEN 50500
221-553-424	1000 mm	YEN 47800

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 007904	Diameter 1.3mm	Purity 99.8%
	Temper As drawn	
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs
386-613-967	100 mm	YEN 24200 YEN 30200 YEN 38600
310-750-289	200 mm	YEN 27600 YEN 35000 YEN 57500
940-805-518	500 mm	YEN 35000 YEN 56500
772-260-933	1000 mm	YEN 54000 YEN 94500 YEN 209000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 007905	Diameter 1.3mm	Purity 99.8%
	Temper Stress relieved	
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs
852-522-374	100 mm	YEN 24200 YEN 30200 YEN 38600
268-528-123	200 mm	YEN 27600 YEN 35000 YEN 57500
628-414-940	500 mm	YEN 35000 YEN 56500
694-771-156	1000 mm	YEN 54000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 007903	Diameter 1.4mm	Purity 99.8%
	Temper As drawn	
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs
742-338-741	100 mm	YEN 24600 YEN 30600 YEN 39000
520-338-010	200 mm	YEN 27800 YEN 35200
987-415-826	500 mm	YEN 35400

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 007902	Diameter 2.0mm	Purity 99.8%
	Temper As drawn	
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs
286-723-427	100 mm	YEN 26800 YEN 33800 YEN 51500
840-432-569	200 mm	YEN 31200 YEN 44200
054-067-911	500 mm	YEN 47800

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 007910	Diameter 3.5mm	Purity 99.8%
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs
811-919-988	100 mm	YEN 35800 YEN 46200 YEN 68000
489-993-797	200 mm	YEN 43000 YEN 56500
249-219-070	500 mm	YEN 60000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 007930	Diameter 5.0mm	Purity 99.8%
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs
956-253-112	50 mm	YEN 35800 YEN 45800 YEN 64000
047-347-498	100 mm	YEN 42000 YEN 54500 YEN 92500
918-427-566	200 mm	YEN 51000 YEN 74000
803-449-533	500 mm	YEN 82500

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 007935	Diameter 8.0mm	Purity 99.8%
Size	Quantity	
Web Code	Length	1pc 2pcs
591-706-080	50 mm	YEN 38400 YEN 52000
789-634-745	100 mm	YEN 50500 YEN 81500
307-460-558	200 mm	YEN 80000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

Metal – Vanadium

Vanadium

V



Rod

V 007937

Diameter 11mm Purity 99.8%

Size	Quantity	
Web Code	Length	1pc 2pcs
443-088-858	25 mm	YEN 38600 YEN 52500
199-650-002	50 mm	YEN 51000 YEN 83000
898-983-726	100 mm	YEN 81000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 007960

Diameter 20.0mm Purity 99.8%

Size	Quantity	
Web Code	Length	1pc 2pcs
806-156-738	25 mm	YEN 56000 YEN 90000
769-597-256	50 mm	YEN 88500 YEN 155000
464-550-608	100 mm	YEN 153000

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 007965

Diameter 25.0mm Purity 99.8%

Size	Quantity		
Web Code	Length	1pc	2pcs 5pcs
713-029-578	25 mm	YEN 74500	YEN 126000 POA
172-800-978	50 mm	YEN 125000	POA
043-957-200	100 mm	POA	

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.

V 007980

Diameter 50.0mm Purity 99.8%

Size	Quantity	
Web Code	Length	1pc
531-253-108	25 mm	POA
597-061-867	50 mm	POA
215-207-855	100 mm	POA

Typical Analysis : Ag 1, Al 2, Ca <1, Cr 15, Cu <1, Fe 70, Mg <1, Mn 1, Si 300.



Powder

V 006030

Max. Particle size 45micron Purity 99.7+%



Web Code	Quantity	Weight	1 Pot
422-354-887		20 g	YEN 28600
794-360-766		50 g	YEN 40000
295-097-682		100 g	YEN 68500

Typical Analysis : Al 100, Fe 1000, Si 1000, C 340.

Typically 5-15 micron average.

Hazardous goods, additional shipment charges apply which are dependent on destination. Please check the individual item on our website or contact us for further details.



Lump

V 006101

Max. Lump size 4mm Purity 99.6%

Condition	Quantity	
Web Code	Weight	1 Pot
539-704-196	20 g	YEN 34000
411-232-251	50 g	YEN 65500

Typical Analysis : Al 1100, Cr <100, Cu <50, Fe 750, Hf <100, Mo 250, Nb <100, Ni <50, Si 1200, Sn <100, Ta <100, Ti <50, W <50, Zr <100.
 Nominally 3mm diameter x 3mm length pellets.

V 006105

Max. Lump size 10mm Purity 99.6%

Condition	Quantity	
Web Code	Weight	1 Pot
839-901-664	20 g	YEN 30800
044-522-741	50 g	YEN 57500

Typical Analysis : Al 1100, Cr <100, Cu <50, Fe 750, Hf <100, Mo 250, Nb <100, Ni <50, Si 1200, Sn <100, Ta <100, Ti <50, W <50, Zr <100.
 Nominally 6.35mm diameter x 6.35mm length pellets.

Metal – Vanadium

Vanadium

V



Lump

V 006100

Max. Lump size **50mm**
 Condition **Turnings**

Purity **99.6%**

Web Code	Quantity	Weight	1 Pot
901-148-816		20 g	YEN 20400
643-600-982		50 g	YEN 27600
450-122-824		100 g	YEN 36600
265-362-376		200 g	YEN 50500

Typical Analysis : Al 1100, Cr < 100, Cu < 50, Fe 750, Hf < 100, Mo 250, Nb < 100, Ni < 50, Si 1200, Sn < 100, Ta < 100, Ti < 50, W < 50, Zr < 100.



Single Crystal

Although this crystal is normally held in stock ready for immediate shipment it is an example of crystals which may be grown to order with a delivery forecast of 4-10 weeks. When requesting a quotation please specify the material, dimensions, orientation, type and concentration of dopants, surface finish and quantity required.

V 002111

Oriented **(100)** Thickness **2mm**
 Diameter **12mm** Purity **99.99%**
 Condition **Polished on 1 side to 1 micron**

Web Code	Quantity	1pc
088-585-260		YEN POA

Typical Analysis : Not applicable.

V 002110

Oriented **(100)** Thickness **2mm**
 Diameter **12mm** Purity **99.99%**
 Condition **Unpolished**

Web Code	Quantity	1pc
676-937-530		YEN POA

Typical Analysis : Not applicable.

V 002122

Oriented **(110)** Diameter **12mm**
 Length **4mm** Purity **99.99%**

Web Code	Quantity	1pc
646-936-370		YEN POA

Typical Analysis : Not applicable.

V 002059

Oriented **(110)** Diameter **6mm**
 Length **10mm** Purity **99.99%**

Web Code	Quantity	1pc
933-101-304		YEN POA

Typical Analysis : Not applicable.

V 002119

Oriented **(110)** Diameter **12mm**
 Length **10mm** Purity **99.99%**

Web Code	Quantity	1pc
481-315-917		YEN POA

Typical Analysis : Not applicable.

V 002113

Oriented **(110)** Thickness **2mm**
 Diameter **12mm** Purity **99.99%**
 Condition **Polished on 1 side to 1 micron**

Web Code	Quantity	1pc
958-436-380		YEN POA

Typical Analysis : Not applicable.

V 002112

Oriented **(110)** Thickness **2mm**
 Diameter **12mm** Purity **99.99%**
 Condition **Unpolished**

Web Code	Quantity	1pc
747-413-845		YEN POA

Typical Analysis : Not applicable.

Metal – Vanadium

Vanadium

V



Single Crystal

V 002060

Oriented (110)
 Length..... 25mm

Diameter..... 6mm
 Purity..... 99.99%

Quantity

Web Code
 290-945-987

1pc
 YEN POA

Typical Analysis : Not applicable.

V 002120

Oriented (110)
 Length..... 25mm

Diameter..... 12mm
 Purity..... 99.99%

Quantity

Web Code
 368-246-549

1pc
 YEN POA

Typical Analysis : Not applicable.

V 002061

Oriented (110)
 Length..... 50mm

Diameter..... 6mm
 Purity..... 99.99%

Quantity

Web Code
 823-713-715

1pc
 YEN POA

Typical Analysis : Not applicable.

V 002121

Oriented (110)
 Length..... 50mm

Diameter..... 12mm
 Purity..... 99.99%

Quantity

Web Code
 164-489-139

1pc
 YEN POA

Typical Analysis : Not applicable.

Metal – Vanadium

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