

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 All Composites

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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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Goodfellow Corporation

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USA
A Pennsylvania corporation
EIN 23-2557381

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Siren : 381486836
Numéro de TVA Intracommunitaire :
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Import VAT number DE112610478

Goodfellow (Shanghai) Trading Co., Ltd

Room 803, Centro Build, No. 568 Hengfeng Road
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

Conditions of Sale

- 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

Aluminium/Copper Metal Matrix Composite

Al177.9/SiC17.8/Cu 3.3/Mg 1.2/Mn 0.4

Mechanical Properties	
Density	2.85 g cm ⁻³
Elongation at break	6 %
Tensile modulus	100 GPa
Tensile strength - longitudinal	610 MPa
Volume fraction of SiC	17 %
Yield strength	400 MPa



Sheet

AL423200 Thickness **2.0mm** Condition..... **Metal Matrix Composite**
 Reinforced with **Silicon Carbide particles**

Size	Quantity		
Web Code	1pc	2pcs	3pcs
818-332-494	45 x 50 mm YEN 31200	YEN 51000	YEN 71500
059-007-453	47 x 100 mm YEN 50000		
397-970-161	48 x 250 mm YEN 107000		
077-740-272	50 x 97 mm YEN 51000		
635-818-120	50 x 250 mm YEN 111000		
407-464-275	52 x 100 mm YEN 54000		
225-141-496	52 x 155 mm YEN 76000		



Rod

AL427915 Diameter **15mm** Condition..... **Metal Matrix Composite**
 Reinforced with **Silicon Carbide particles**

Size	Quantity				
Web Code	Length	1pc	2pcs	5pcs	10pcs
236-513-995	50 mm	YEN 31800	YEN 42600	YEN 60500	YEN 87500
564-243-045	100 mm	YEN 39200	YEN 53000	YEN 82000	
530-376-373	200 mm	YEN 49600	YEN 68000		
297-046-313	500 mm	YEN 75500			



Tube

AL427250 Outside Diameter..... **25.4mm** Wall Thickness..... **1.0mm**
 Inside Diameter **23.4mm** Condition..... **Metal Matrix Composite**
 Reinforced with **Silicon Carbide particles**

Size	Quantity				
Web Code	Length	1pc	2pcs	5pcs	10pcs
753-355-193	100 mm	YEN 43600	YEN 58000	YEN 102000	YEN 183000
169-396-828	200 mm	YEN 55000	YEN 78000	YEN 176000	
174-607-169	500 mm	YEN 90000	YEN 166000		
825-892-156	1000 mm	YEN 163000	YEN 314000		

Aluminium/Lithium Metal Matrix Composite

Al181/SiC15/Li 2/Cu 1.2/Mg 0.8

Mechanical Properties	
Density	2.62 g cm ⁻³
Elongation at break	2.3 %
Tensile modulus	100 GPa
Tensile strength - longitudinal	550 MPa
Volume fraction of SiC	13 %
Yield strength	500 MPa



Tube

AL417250 Outside Diameter..... **24.0mm** Wall Thickness..... **1.0mm**
 Inside Diameter **22mm** Condition..... **Metal Matrix Composite**
 Reinforced with **Silicon Carbide particles**

Size	Quantity			
Web Code	Length	1pc	2pcs	5pcs
737-634-552	100 mm	YEN 37400	YEN 49400	YEN 81500
204-321-351	200 mm	YEN 46200	YEN 63500	YEN 137000
540-170-076	500 mm	YEN 72000	YEN 130000	
521-251-178	1000 mm	YEN 127000		

Composite – Aluminium/Copper Metal Matrix Composite

Carbon-Carbon Composite

Carbon fibre - Carbon matrix

Electrical Properties
 Volume resistivity

3000 μOhmcm



Sheet

Coefficient of thermal expansion (20-1000C)-para. to plane	$\times 10^{-6} \text{ K}^{-1}$	1.5
Coefficient of thermal expansion (20-1000C)-perp. to plane	$\times 10^{-6} \text{ K}^{-1}$	6
Compressive Strength - parallel to plane	MPa	120-200
Compressive Strength - perp. to plane	MPa	60 - 150
Density	g cm^{-3}	1.3-1.8
Flexural modulus - parallel to plane	GPa	10 - 20
Flexural strength - parallel to plane	MPa	80 - 200
Shear strength - in-plane	MPa	20 - 30
Tensile modulus - parallel to plane	GPa	20 - 30
Tensile strength - Longitudinal	MPa	40 - 70
Tensile strength - Transverse	MPa	< 10
Thermal Conductivity - parallel to plane	$\text{W m}^{-1} \text{ K}^{-1}$	250 - 300
Thermal Conductivity - perp. to plane	$\text{W m}^{-1} \text{ K}^{-1}$	50 - 100

C 413010 Thickness 1.25mm

Size

Web Code
 579-462-587
 102-786-821

Size	Quantity	
	1pc	2pcs
50 x 50 mm	YEN 25400	YEN 31400
150 x 150 mm	YEN 53000	

Made from high-performance thick cloth densified by CVD.

C 413020 Thickness 1.6mm

Size

Web Code
 383-138-174
 041-909-812

Size	Quantity	
	1pc	2pcs
50 x 50 mm	YEN 22000	YEN 26800
150 x 150 mm	YEN 38600	

Made from high-performance thick cloth densified by CVD.

C 413022 Thickness 2mm

Size

Web Code
 021-814-175
 904-838-686
 888-121-644

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
50 x 50 mm	YEN 25200	YEN 31200	YEN 44600	YEN 68000
150 x 150 mm	YEN 51500	YEN 91000	YEN 209000	
300 x 300 mm	YEN 165000	YEN 318000		

C 413040 Thickness 4mm

Size

Web Code
 995-655-108
 244-909-865
 334-292-362

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
50 x 50 mm	YEN 26400	YEN 33000	YEN 47400	YEN 81500
150 x 150 mm	YEN 64000	YEN 115000	YEN 269000	
305 x 305 mm	YEN 221000	YEN 429000		

C 413050 Thickness 5mm

Size

Web Code
 848-360-764
 637-421-584

Size	Quantity	
	1pc	2pcs
50 x 50 mm	YEN 29400	YEN 37200
150 x 150 mm	YEN 107000	

Made from high-performance thick cloth and densified by liquid impregnation, carbonization and graphitization.

C 413100 Thickness 10.0mm

Size

Web Code
 677-691-400
 929-657-420
 659-646-733

Size	Quantity		
	1pc	2pcs	5pcs
50 x 50 mm	YEN 31600	YEN 38800	YEN 56000
150 x 150 mm	YEN 80500	YEN 145000	
300 x 300 mm	YEN 270000		

Made from high-performance thick cloth and densified by liquid impregnation, carbonization and graphitization.

Carbon/Epoxy Composite

Carbon fibre - Epoxy Resin Matrix

Carbon/Epoxy Composite
Carbon fibre - Epoxy Resin Matrix



Sheet

Coefficient of thermal expansion - Longitudinal	x10 ⁻⁶ K ⁻¹	2.1
Coefficient of thermal expansion - Transverse	x10 ⁻⁶ K ⁻¹	2.1
Compressive Strength - Longitudinal	MPa	570
Compressive Strength - Transverse	MPa	570
Density	g cm ⁻³	1.6
Shear modulus - in-plane	GPa	5
Shear strength - in-plane	MPa	90
Ultimate Compressive Strain - Longitudinal	%	0.8
Ultimate Compressive Strain - Transverse	%	0.8
Ultimate Shear Strain - in-plane	%	1.8
Ultimate Tensile Strain - Longitudinal	%	0.85
Ultimate Tensile Strain - Transverse	%	0.85
Volume fraction of fibres	%	50
Young's Modulus - Longitudinal	GPa	70
Young's Modulus - Transverse	GPa	70

C 423025 Thickness **0.25mm** Tolerance **± 20 %**

Size	Quantity				
	1pc	2pcs	5pcs	10pcs	20pcs
100 x 100 mm	YEN 15700	YEN 19000	YEN 26800	YEN 37400	YEN 37800
150 x 150 mm	YEN 18200	YEN 22400	YEN 32200	YEN 45200	
300 x 300 mm	YEN 25600	YEN 33000	YEN 57500		
500 x 500 mm	YEN 35400	YEN 59000	YEN 133000		

C 423050 Thickness **0.5mm** Tolerance **± 20%**

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
100 x 100 mm	YEN 15700	YEN 19000	YEN 26600	YEN 37400
150 x 150 mm	YEN 18200	YEN 22400	YEN 32200	YEN 45000
300 x 300 mm	YEN 25600	YEN 32800	YEN 52500	
500 x 600 mm	YEN 37800	YEN 61500		
1000 x 1250 mm	YEN 113000	YEN 217000		

C 423065 Thickness **0.65mm**

Size	Quantity		
	1pc	2pcs	5pcs
100 x 100 mm	YEN 19900	YEN 24800	YEN 33200
150 x 150 mm	YEN 24400	YEN 31200	
300 x 300 mm	YEN 38000		

Tolerance on thickness : +/-20%.

C 423085 Thickness **0.85mm** Tolerance **± 20%**

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
50 x 50 mm	YEN 15800	YEN 19200	YEN 24200	YEN 30200
100 x 100 mm	YEN 21000	YEN 26400	YEN 35400	
150 x 150 mm	YEN 26000	YEN 33400		
300 x 300 mm	YEN 42000			

C 423100 Thickness **1.0mm** Tolerance **± 20%**

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
50 x 50 mm	YEN 16400	YEN 20200	YEN 27600	YEN 37600
100 x 100 mm	YEN 21600	YEN 27600	YEN 39200	
150 x 150 mm	YEN 26800	YEN 35000		
300 x 300 mm	YEN 43800			

C 423130 Thickness **1.3mm** Tolerance **± 20%**

Size	Quantity		
	1pc	2pcs	5pcs
100 x 100 mm	YEN 21600	YEN 27200	YEN 37000
150 x 150 mm	YEN 27000	YEN 35000	
300 x 300 mm	YEN 46400		

C 423200 Thickness **2.0mm** Tolerance **± 20%**

Size	Quantity		
	1pc	2pcs	5pcs
100 x 100 mm	YEN 23400	YEN 29800	YEN 40800
150 x 150 mm	YEN 29600	YEN 38600	
300 x 300 mm	YEN 58500		

Composite – Carbon/Epoxy Composite

Carbon/Epoxy Composite

Carbon fibre - Epoxy Resin Matrix



Sheet

C 423250

Thickness 3.5mm

Tolerance ±20%

Size

Web Code
 444-584-108
 558-295-371
 784-147-908

Size	Quantity		
	1pc	2pcs	5pcs
100 x 100 mm	YEN 24800	YEN 31800	YEN 51000
150 x 150 mm	YEN 31800	YEN 46400	
300 x 300 mm	YEN 79500		

C 423400

Thickness 4mm

Size

Web Code
 408-313-544
 914-576-801
 404-756-952
 147-458-980

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
100 x 100 mm	YEN 26600	YEN 32800	YEN 56500	YEN 99500
150 x 150 mm	YEN 32600	YEN 49000	YEN 102000	
300 x 300 mm	YEN 81000	YEN 149000		
500 x 500 mm	YEN 199000			



Rod

Compressive Strength - Longitudinal	MPa	800-1300
Compressive Strength - Transverse	MPa	50-250
Density	g cm ⁻³	1.6
Flexural modulus - Longitudinal	GPa	125
Flexural strength - Longitudinal	MPa	1200
Tensile strength - Longitudinal	MPa	1100-1900
Tensile strength - Transverse	MPa	50
Thermal Expansion Coefficient - Longitudinal	x10 ⁻⁶ K ⁻¹	-0.3 to -0.7
Thermal Expansion Coefficient - Transverse	x10 ⁻⁶ K ⁻¹	28
Ultimate Compressive Strain - Longitudinal	%	0.8
Ultimate Compressive Strain - Transverse	%	2.5
Ultimate Tensile Strain - Longitudinal	%	1.1
Ultimate Tensile Strain - Transverse	%	0.5
Volume fraction of fibres	%	55-60
Young's Modulus - Longitudinal	GPa	120-140
Young's Modulus - Transverse	GPa	10

C 427905

Diameter 2mm

Size

Web Code
 794-181-991
 272-745-965

Length	Quantity			
	1pc	2pcs	5pcs	10pcs
500 mm	YEN 13400	YEN 16000	YEN 22000	YEN 26800
1000 mm	YEN 15200	YEN 18600	YEN 26200	YEN 38200

C 427910

Diameter 3mm

Size

Web Code
 793-449-178
 181-148-584

Length	Quantity			
	1pc	2pcs	5pcs	10pcs
500 mm	YEN 14700	YEN 18000	YEN 25400	YEN 32000
1000 mm	YEN 16900	YEN 21000	YEN 31400	YEN 49600

C 427925

Diameter 25mm

Colour Black

Size

Web Code
 403-978-451
 340-923-560

Length	Quantity		
	1pc	2pcs	5pcs
500 mm	YEN 23400	YEN 35400	YEN 75500
1000 mm	YEN 34400	YEN 60000	

Typical Analysis : Not applicable

Composite – Carbon/Epoxy Composite

Carbon/Epoxy Composite

Carbon fibre - Epoxy Resin Matrix



Tube

Material		High Precision Tubes
Thermal Expansion Coefficient - Longitudinal	$\times 10^{-6} \text{ K}^{-1}$	0.1
Volume fraction of fibres	%	55-60
Young's Modulus - Longitudinal	GPa	110-120

C 427477 Outside Diameter..... **47.6mm** Wall Thickness..... **1.9mm**
 Inside Diameter..... **43.8mm** Condition..... **Ultra-straight tube**
 Straightness..... **+/- 0.25mm over 1500mm**

Size	Web Code	Length	Quantity			
			1pc	2pcs	5pcs	10pcs
100 mm	562-073-692	100 mm	YEN 31000	YEN 41400	YEN 66000	YEN 117000
200 mm	259-205-039	200 mm	YEN 38000	YEN 54000	YEN 112000	
500 mm	400-634-078	500 mm	YEN 59500	YEN 109000		
1500 mm	183-348-745	1500 mm	YEN 151000			

This tube has a straightness tolerance of +/-0.25mm over 1500mm and a coefficient of expansion of 1.10^{-7} K^{-1} .

Carbon/Polyaramid

Carbon fibre - Polyaramid fibre



Fabric

Other weaves and thicknesses are available on request.

C 403525 Weight.m⁻²..... **174g** Thickness..... **0.26mm**
 Warp Yarn..... **198T(C) 127Tex** Weft Yarn..... **198T(C) 127Tex**
 Ends x Picks/10cm..... **47** Weave..... **Plain**

Size	Web Code	Size	Quantity	
			1pc	2pcs
125 x 180 mm	642-585-224	125 x 180 mm	YEN 14000	
150 x 150 mm	683-728-608	150 x 150 mm	YEN 14000	
170 x 180 mm	708-907-018	170 x 180 mm	YEN 14400	

Alternate picks are Kevlar 49[®] and Carbon fibres. Plain weave: Warp (longitudinal) yarns (ends) pass over and under alternate weft (transverse) yarns (picks) and vice-versa.

C 403528 Weight.m⁻²..... **188g** Thickness..... **0.3mm**
 Warp Yarn..... **200(C) - 158(K)Tex** Weft Yarn..... **200(C) - 158(K)Tex**
 Ends x Picks/10cm..... **50x50** Weave..... **Plain**

Size	Web Code	Size	Quantity			
			1pc	2pcs	5pcs	10pcs
150 x 150 mm	466-076-657	150 x 150 mm	YEN 17400	YEN 21800	YEN 33400	YEN 51000
300 x 300 mm	259-584-589	300 x 300 mm	YEN 21400	YEN 27600	YEN 42400	YEN 64000
500 x 500 mm	448-064-399	500 x 500 mm	YEN 26800	YEN 35200	YEN 57000	
1000 x 1000 mm	008-049-123	1000 x 1000 mm	YEN 40200	YEN 68000		

Warp yarn pattern is two Carbon fibres followed by one Kevlar 49[®] fibre, and the weft pattern is two Kevlar 49[®] followed by one Carbon fibres.

C 403520 Weight.m⁻²..... **210g** Thickness..... **0.25mm**
 Warp Yarn..... **198T(C) 127Tex** Weft Yarn..... **198T(C) 127Tex**
 Ends x Picks/10cm..... **63x63** Weave..... **3/1 Twill**

Size	Web Code	Size	Quantity			
			1pc	2pcs	5pcs	10pcs
100 x 100 mm	293-979-546	100 x 100 mm	YEN 13100	YEN 15000	YEN 20000	YEN 26000
150 x 150 mm	879-946-813	150 x 150 mm	YEN 13900	YEN 16100	YEN 21800	
300 x 300 mm	681-532-614	300 x 300 mm	YEN 16400	YEN 19700		

Alternate picks are Kevlar 49[®] and Carbon fibres. 3/1 Twill - warp yarns pass over three weft and under one weft yarns. Adjacent warp yarns are displaced by one weft yarn.

C 403521 Weight.m⁻²..... **210g** Thickness..... **0.3mm**
 Warp Yarn..... **200(C) - 158(K)Tex** Weft Yarn..... **200(C) - 158(K)Tex**
 Ends x Picks/10cm..... **67x67** Weave..... **3/1 Twill**

Size	Web Code	Size	Quantity			
			1pc	2pcs	5pcs	10pcs
150 x 150 mm	993-355-269	150 x 150 mm	YEN 17600	YEN 22000	YEN 33800	YEN 51500
300 x 300 mm	169-409-321	300 x 300 mm	YEN 21800	YEN 28000	YEN 43200	YEN 65000
500 x 500 mm	176-171-702	500 x 500 mm	YEN 27400	YEN 35800	YEN 59500	
1000 x 1000 mm	021-469-802	1000 x 1000 mm	YEN 41400	YEN 72000		

3/1 Twill - warp yarns pass over three weft and under one weft yarns. Adjacent warp yarns are displaced by one weft yarn.

Carbon/Polyetheretherketone Composite
Carbon fibre - PEEK Matrix



Sheet

Compressive Strength - Longitudinal	MPa	630
Density	g cm ⁻³	1.6
Tensile modulus - parallel to plane	GPa	50
Tensile strength - Longitudinal	MPa	750
Volume fraction of fibres	%	62

EK403010 Thickness 1.0mm Condition 8-ply Quasi-isotropic Grade APC 2

Size	Web Code	Size	Quantity		
			1pc	2pcs	5pcs
	949-190-685	50 x 50 mm	YEN 35200	YEN 45200	YEN 77000
	451-075-242	100 x 100 mm	YEN 58500	YEN 78000	
	384-407-734	150 x 150 mm	YEN 81500		

Carbon/Vinylester
Carbon fibre - Vinylester matrix



Rod

Compressive Strength - Longitudinal	MPa	900-1100
Density	g cm ⁻³	1.5-1.65
Flexural modulus - Longitudinal	GPa	65-85
Flexural strength - Longitudinal	MPa	800-1000
Tensile modulus - Longitudinal	GPa	136
Tensile strength - Longitudinal	MPa	900-1200
Ultimate Tensile Strain - Longitudinal	%	1.4
Volume fraction of fibres	%	55-60

VE407910 Diameter 1.0mm Condition Pultruded

Size	Web Code	Length	Quantity				
			1pc	5pcs	10pcs	20pcs	50pcs
	278-769-432	1000 mm	YEN 13100	YEN 16700	YEN 20000	YEN 24200	YEN 33800

Other sizes, reinforcing fibres and matrices available on request.

VE407930 Diameter 5.0mm Condition Pultruded

Size	Web Code	Length	Quantity			
			1pc	2pcs	5pcs	10pcs
	601-310-789	500 mm	YEN 17700	YEN 21000	YEN 28800	YEN 43200
	163-847-107	1000 mm	YEN 20200	YEN 24400	YEN 38400	YEN 65500

VE407940 Diameter 6.0mm Condition Pultruded

Size	Web Code	Length	Quantity				
			1pc	2pcs	5pcs	10pcs	20pcs
	501-562-653	300 mm	YEN 16000	YEN 18800	YEN 25400	YEN 34600	YEN 50500
	112-320-103	500 mm	YEN 17200	YEN 20400	YEN 28000	YEN 40600	YEN 66000
	040-021-411	1000 mm	YEN 19400	YEN 23600	YEN 35400	YEN 60000	YEN 104000

VE407950 Diameter 10.0mm Condition Pultruded

Size	Web Code	Length	Quantity			
			1pc	2pcs	5pcs	10pcs
	002-676-895	200 mm	YEN 21000	YEN 25800	YEN 38400	YEN 65000
	334-605-561	500 mm	YEN 25200	YEN 33000	YEN 64500	
	825-691-898	1000 mm	YEN 31000	YEN 50000		

Composite – Carbon/Polyetheretherketone Composite

Carbon/Vinylester
Carbon fibre - Vinylester matrix



Tube

Compressive Strength - Longitudinal	MPa	900-1100
Density	g cm ⁻³	1.5-1.65
Flexural modulus - Longitudinal	GPa	65-85
Flexural strength - Longitudinal	MPa	800-1000
Tensile modulus - Longitudinal	GPa	136
Tensile strength - Longitudinal	MPa	900-1200
Ultimate Tensile Strain - Longitudinal	%	1.4
Volume fraction of fibres	%	55-60

VE407211	Outside Diameter..... 6.0mm Inside Diameter..... 4mm	Wall Thickness..... 1.0mm Condition..... Pultruded
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs 10pcs
875-479-666	500 mm	YEN 16800 YEN 20200 YEN 26800 YEN 38400
341-896-905	1000 mm	YEN 19300 YEN 23800 YEN 35600

VE407320	Outside Diameter..... 8.0mm Inside Diameter..... 5mm	Wall Thickness..... 1.5mm Condition..... Pultruded
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs
439-516-311	200 mm	YEN 15900 YEN 18500 YEN 24600
939-546-511	500 mm	YEN 18300 YEN 22000
071-289-637	984 mm	YEN 21000

VE407321	Outside Diameter..... 8.0mm Inside Diameter..... 6mm	Wall Thickness..... 1.0mm Condition..... Pultruded
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs 10pcs
287-478-409	200 mm	YEN 15900 YEN 18500 YEN 24600 YEN 33000
693-912-991	500 mm	YEN 18300 YEN 22000 YEN 30000 YEN 49000
928-272-225	1000 mm	YEN 21000 YEN 25800 YEN 44600

VE407430	Outside Diameter..... 10.0mm Inside Diameter..... 7mm	Wall Thickness..... 1.5mm Condition..... Pultruded
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs 10pcs
415-504-543	200 mm	YEN 16900 YEN 20000 YEN 27000 YEN 38000
938-065-676	500 mm	YEN 19900 YEN 24200 YEN 38000 YEN 65000
258-206-920	1000 mm	YEN 23400 YEN 30800 YEN 60500

VE407435	Outside Diameter..... 12.0mm Inside Diameter..... 9mm	Wall Thickness..... 1.5mm Condition..... Pultruded
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs 10pcs
056-208-234	200 mm	YEN 17600 YEN 21000 YEN 28600 YEN 43600
237-142-325	500 mm	YEN 21000 YEN 25800 YEN 45000 YEN 79000
526-849-488	1000 mm	YEN 25000 YEN 36200 YEN 74500

VE407541	Outside Diameter..... 16.0mm Inside Diameter..... 12.5mm	Wall Thickness..... 1.75mm Condition..... Pultruded
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs 10pcs
434-903-362	500 mm	YEN 19600 YEN 24200 YEN 34600 YEN 57500
021-394-983	1000 mm	YEN 22800 YEN 28600 YEN 53500

VE407650	Outside Diameter..... 25.0mm Inside Diameter..... 22mm	Wall Thickness..... 1.5mm Condition..... Pultruded
Size	Quantity	
Web Code	Length	1pc 2pcs 5pcs 10pcs
942-983-052	100 mm	YEN 18300 YEN 22200 YEN 31000 YEN 50000
872-879-789	200 mm	YEN 21000 YEN 26000 YEN 43800 YEN 77000
109-969-828	500 mm	YEN 26200 YEN 40200 YEN 84500
746-230-136	1000 mm	YEN 39000 YEN 67500

Composite – Carbon/Vinylester

E-glass/Epoxy
Boro-silicate glass/Epoxy

Thermal Properties
 Upper working temperature

130-150 C

Mechanical Properties

Compressive strength - longitudinal
 Compressive strength - transverse
 Density 1.90 g cm⁻³
 Tensile strength - longitudinal
 Thermal expansion coefficient - long.

300 MPa
 415 MPa
 490 MPa
 11 x 10⁻⁶ strain K⁻¹



Sheet

SI403210 Thickness **0.3mm**

Size
Web Code
 893-463-033
 725-707-973

Size	Quantity		
	1pc	2pcs	5pcs
150 x 150 mm	YEN 13900	YEN 16400	YEN 22200
300 x 300 mm	YEN 18000	YEN 22200	

SI403220 Thickness **0.5mm**

Size
Web Code
 610-378-727
 740-885-575

Size	Quantity		
	1pc	2pcs	5pcs
150 x 150 mm	YEN 13900	YEN 16500	YEN 22200
300 x 300 mm	YEN 18100	YEN 22400	

SI403240 Thickness **1.0mm**

Size
Web Code
 453-168-857
 888-915-650
 078-665-570

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
150 x 150 mm	YEN 15400	YEN 18500	YEN 25400	YEN 35200
300 x 300 mm	YEN 21000	YEN 26400	YEN 49400	
600 x 600 mm	YEN 39000	YEN 69000		

SI403260 Thickness **1.6mm**

Size
Web Code
 932-190-260
 337-063-356
 416-566-975
 155-694-993
 770-834-549

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
100 x 100 mm	YEN 14200	YEN 16900	YEN 23000	YEN 31000
200 x 200 mm	YEN 18700	YEN 23200	YEN 36200	
300 x 300 mm	YEN 23200	YEN 31400	YEN 65000	
400 x 400 mm	YEN 28400	YEN 47800		
600 x 600 mm	YEN 51500	YEN 94000		

SI403280 Thickness **3.0mm**

Size
Web Code
 874-815-256
 594-744-032

Size	Quantity	
	1pc	2pcs
150 x 150 mm	YEN 18200	YEN 22600
300 x 300 mm	YEN 26600	

SI403300 Thickness **5.5mm**

Size
Web Code
 381-737-102
 347-258-431

Size	Quantity	
	1pc	2pcs
150 x 150 mm	YEN 21200	YEN 26800
300 x 300 mm	YEN 40200	



Rod

SI407930 Diameter **30mm**

Size
Web Code
 133-713-310
 209-847-771
 596-764-415

Condition **Machining feedstock**

Length	Quantity		
	1pc	2pcs	5pcs
100 mm	YEN 20800	YEN 30200	YEN 58500
200 mm	YEN 28400	YEN 45400	
500 mm	YEN 51000		

Fabric Reinforced Phenolic
Phenol

Thermal Properties
 Upper working temperature

130 C

Mechanical Properties

Compressive strength - longitudinal
 Compressive strength - transverse
 Density 1.36 g cm⁻³
 Shear strength - in-plane
 Tensile strength - longitudinal

310 MPa
 200 MPa
 90 MPa
 68 MPa

Composite - E-glass/Epoxy

Fabric Reinforced Phenolic
Phenol



Sheet

PL403020 Thickness 1.6mm

Size

Web Code
 321-956-625
 080-186-708

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
145 x 145 mm	YEN 7900	YEN 9900	YEN 14500	YEN 20600
295 x 295 mm	YEN 11300	YEN 14800	YEN 22200	

Polyaramid/Polyphenylenesulphide Composite
Polyaramid fibre - PPS Matrix

Mechanical Properties

Elongation at break 1.5 %
 Thermal expansion coefficient - long. 27×10^{-6} strain K⁻¹
 Young's modulus - transverse 9.6 GPa



Sheet

Compressive Strength - Longitudinal	MPa	76
Density	g cm ⁻³	1.25
Flexural modulus - Longitudinal	GPa	7.6
Flexural strength - Longitudinal	MPa	124
Volume fraction of fibres	%	~25

SU403100 Thickness 6.35mm

Reinforcement Randomly oriented chopped fibre



Xi

Size

Web Code
 529-186-907
 148-362-608
 545-327-391

Size	Quantity			
	1pc	2pcs	5pcs	10pcs
100 x 100 mm	YEN 39600	YEN 69500	YEN 160000	YEN 310000
150 x 150 mm	YEN 75500	YEN 142000		
300 x 300 mm	YEN 270000			



Rod

Compressive Strength - Longitudinal	MPa	76
Density	g cm ⁻³	1.25
Flexural modulus - Longitudinal	GPa	7.6
Flexural strength - Longitudinal	MPa	124
Tensile strength - Longitudinal	MPa	83
Volume fraction of fibres	%	25

SU407920 Diameter 6.35mm

Reinforcement Randomly oriented chopped fibre



Xi

Size

Web Code
 165-919-904
 739-999-957
 499-990-114
 498-770-615

Length	Quantity				
	1pc	2pcs	5pcs	10pcs	20pcs
100 mm	YEN 17500	YEN 20800	YEN 27600	YEN 36000	YEN 57500
200 mm	YEN 20400	YEN 24800	YEN 34000	YEN 54000	
500 mm	YEN 26200	YEN 33000	YEN 62000		
1000 mm	YEN 32600	YEN 51000			

SU407924 Diameter 8.0mm

Reinforcement Randomly oriented chopped fibre



Xi

Size

Web Code
 346-331-771
 291-474-182
 434-273-586
 284-193-630

Length	Quantity				
	1pc	2pcs	5pcs	10pcs	20pcs
100 mm	YEN 18400	YEN 22000	YEN 29400	YEN 38800	YEN 67500
200 mm	YEN 21600	YEN 26600	YEN 37000	YEN 64000	
500 mm	YEN 28000	YEN 36000	YEN 74500		
1000 mm	YEN 35600	YEN 61000			

SU407950 Diameter 25.0mm

Reinforcement Randomly oriented chopped fibre



Xi

Size

Web Code
 524-200-145
 525-017-333
 627-164-734
 395-595-733

Length	Quantity				
	1pc	2pcs	5pcs	10pcs	20pcs
100 mm	YEN 26800	YEN 34000	YEN 65000	YEN 118000	YEN 224000
200 mm	YEN 33200	YEN 52000	YEN 115000	YEN 218000	
500 mm	YEN 61000	YEN 112000	YEN 265000		
1000 mm	YEN 111000	YEN 212000			

Polyaramid/Vinylester Composite

Polyaramid fibre - Vinylester matrix

Thermal Properties

Lower working temperature -50 C
 Upper working temperature 80 C



Rod

Compressive Strength - Longitudinal	MPa	100-300
Density	g cm ⁻³	1.2-1.4
Flexural modulus - Longitudinal	GPa	17-22
Flexural strength - Longitudinal	MPa	150-250
Tensile strength - Longitudinal	MPa	800-1000
Ultimate Tensile Strain - Longitudinal	%	2.5
Volume fraction of fibres	%	50-60

VE417920	Diameter..... 2.0mm	Condition..... Pultruded					
	Size	Quantity					
	Web Code 820-636-721 579-596-347	Length	1pc	2pcs	5pcs	10pcs	20pcs
		500 mm	YEN 15700	YEN 18100	YEN 23400	YEN 30600	
		1000 mm	YEN 17500	YEN 20600	YEN 27400	YEN 36200	YEN 50000

Other sizes, reinforcing fibres and matrices available on request.

VE417940	Diameter..... 5.0mm	Condition..... Pultruded					
	Size	Quantity					
	Web Code 449-541-307 192-674-438	Length	1pc	2pcs	5pcs	10pcs	20pcs
		500 mm	YEN 17500	YEN 20800	YEN 28400	YEN 42400	
		1000 mm	YEN 19900	YEN 24200	YEN 38000	YEN 65000	YEN 115000

VE417960	Diameter..... 6.0mm	Condition..... Pultruded					
	Size	Quantity					
	Web Code 084-311-853 538-979-122 372-388-563	Length	1pc	2pcs	5pcs	10pcs	20pcs
		200 mm	YEN 16200	YEN 19100	YEN 26000	YEN 35200	
		500 mm	YEN 18800	YEN 22800	YEN 32200	YEN 53500	
		1000 mm	YEN 21600	YEN 26800	YEN 48400	YEN 86000	YEN 156000

VE417980	Diameter..... 10.0mm	Condition..... Pultruded					
	Size	Quantity					
	Web Code 548-569-631 571-201-736 400-216-696	Length	1pc	2pcs	5pcs	10pcs	20pcs
		200 mm	YEN 21000	YEN 25800	YEN 38400	YEN 65000	
		500 mm	YEN 25200	YEN 33000	YEN 64500	YEN 117000	
		1000 mm	YEN 31200	YEN 50000	YEN 108000	YEN 203000	YEN 385000



Tube

Compressive Strength - Longitudinal	MPa	100-300
Density	g cm ⁻³	1.2-1.4
Flexural modulus - Longitudinal	GPa	17-22
Flexural strength - Longitudinal	MPa	150-250
Tensile strength - Longitudinal	MPa	800-1000
Ultimate Tensile Strain - Longitudinal	%	2.5
Volume fraction of fibres	%	50-60

VE417210	Outside Diameter..... 6.0mm	Wall Thickness..... 1.5mm					
	Inside Diameter..... 3mm	Condition..... Pultruded					
	Size	Quantity					
Web Code 211-479-934 434-999-535	Length	1pc	2pcs	5pcs	10pcs	20pcs	
	500 mm	YEN 16900	YEN 19900	YEN 27000	YEN 38000		
	1000 mm	YEN 19000	YEN 23000	YEN 33400	YEN 56000	YEN 96500	

VE417320	Outside Diameter..... 8.0mm	Wall Thickness..... 1.5mm					
	Inside Diameter..... 5mm	Condition..... Pultruded					
	Size	Quantity					
Web Code 374-941-645 867-707-722 463-468-127	Length	1pc	2pcs	5pcs	10pcs	20pcs	
	200 mm	YEN 15600	YEN 18100	YEN 24000	YEN 32200		
	500 mm	YEN 17800	YEN 21200	YEN 29000	YEN 45000		
	1000 mm	YEN 20400	YEN 24800	YEN 40400	YEN 70000	YEN 125000	

Composite – Polyaramid/Vinylester Composite

Polyaramid/Vinylester Composite

Polyaramid fibre - Vinylester matrix



Tube

VE417430	Outside Diameter..... 10.0mm	Wall Thickness..... 1.5mm				
	Inside Diameter..... 7mm	Condition..... Pultruded				
Size		Quantity				
Web Code			1pc	2pcs	5pcs	10pcs
933-517-316	Length	200 mm	YEN 16700	YEN 19700	YEN 26600	YEN 36600
689-668-034		500 mm	YEN 19600	YEN 23800	YEN 36200	YEN 61500
208-512-086		1000 mm	YEN 22800	YEN 29400	YEN 57000	YEN 192000

VE417540	Outside Diameter..... 15.0mm	Wall Thickness..... 1.5mm				
	Inside Diameter..... 12mm	Condition..... Pultruded				
Size		Quantity				
Web Code			1pc	2pcs	5pcs	10pcs
064-005-385	Length	100 mm	YEN 15800	YEN 18400	YEN 24400	YEN 32800
000-670-928		200 mm	YEN 17500	YEN 20800	YEN 28200	YEN 42200
083-863-754		500 mm	YEN 20800	YEN 25600	YEN 43400	YEN 76000
482-965-601		1000 mm	YEN 24600	YEN 35000	YEN 71500	YEN 132000

VE417650	Outside Diameter..... 25.0mm	Wall Thickness..... 1.5mm				
	Inside Diameter..... 22mm	Condition..... Pultruded				
Size		Quantity				
Web Code			1pc	2pcs	5pcs	10pcs
370-706-253	Length	100 mm	YEN 19700	YEN 24200	YEN 36800	YEN 63000
338-284-427		200 mm	YEN 23000	YEN 29200	YEN 56500	YEN 103000
285-556-562		500 mm	YEN 32000	YEN 53000	YEN 117000	YEN 222000
694-565-058		1000 mm	YEN 52000	YEN 93000	YEN 216000	YEN 422000

Polyethylene/Polyethylene Composite

PE fibre - PE matrix



Sheet

Density	g cm ⁻³	0.96
Flexural modulus - Longitudinal	GPa	9.1
Flexural strength - Longitudinal	MPa	90
Tensile modulus - Longitudinal	GPa	9.1
Volume fraction of fibres	%	> 80

These sheets comprise UHM polyethylene fabric (Tenfor fibre) embedded in a UHMW polyethylene matrix. The re-inforcement is balanced to give simialar properties in the two major directions.

ET403020	Thickness..... 2mm				
	Size	Quantity			
Web Code			1pc	2pcs	
756-449-053	85 x 85 mm	YEN 20200	YEN 26400		
704-929-230	85 x 175 mm	YEN 24400			

Re-inforcing fabric : 2/2 twill weave of 300g.m⁻².

ET403060	Thickness..... 6mm				
	Size	Quantity			
Web Code			1pc	2pcs	
858-315-006	60 x 60 mm	YEN 22200	YEN 29000		
289-375-935	125 x 125 mm	YEN 41800			

Re-inforcing fabric : 2/2 twill weave of 300g.m⁻².

Polypropylene-Polypropylene composite

PP fibre - PP matrix

Common Brand Names : Curv

Composite – Polyaramid/Vinylester Composite

Polypropylene-Polypropylene composite

PP fibre - PP matrix



Sheet

Density	g cm ⁻³	0.92
Tensile modulus - Longitudinal	GPa	5.0
Tensile modulus - Transverse	GPa	5.0
Tensile strength - Longitudinal	MPa	180
Tensile strength - Transverse	MPa	180

PP403030	Thickness	0.3mm	Colour	Black
Size	Quantity			
Web Code	Size	1pc	2pcs	5pcs
005-047-396	150 x 150 mm	YEN 7600	YEN 10300	YEN 18200
971-821-315	300 x 300 mm	YEN 8500	YEN 11700	YEN 20400
329-527-317	600 x 600 mm	YEN 10400	YEN 15100	

PP403090	Thickness	0.9mm	Colour	Black
Size	Quantity			
Web Code	Size	1pc	2pcs	5pcs
072-588-668	150 x 150 mm	YEN 7900	YEN 10800	YEN 19000
865-812-008	300 x 300 mm	YEN 9200	YEN 12600	YEN 23200
764-100-198	600 x 600 mm	YEN 12200	YEN 20200	

PP403200	Thickness	2.0mm	Colour	Black
Size	Quantity			
Web Code	Size	1pc	2pcs	5pcs
917-022-789	150 x 150 mm	YEN 8400	YEN 11500	YEN 20200
615-633-935	270 x 380 mm	YEN 10400	YEN 14400	YEN 29200
338-699-863	600 x 600 mm	YEN 15800	YEN 27200	

PP403300	Thickness	3.0mm	Colour	Black
Size	Quantity			
Web Code	Size	1pc	2pcs	5pcs
897-105-227	150 x 150 mm	YEN 8700	YEN 12000	YEN 20800
044-783-517	300 x 300 mm	YEN 10800	YEN 14900	YEN 29200
329-612-703	600 x 600 mm	YEN 17100	YEN 30000	

Composite – Polypropylene-Polypropylene composite

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