Laboratory Essentials

- Tools
- Laboratory Safety
- Personal Protection
- Oxygen Depletion Monitors
- Specialty Materials
- Vacuum and Cryogenics Supplies

We provide our customers with the same specialty materials and tools we use in the construction and maintenance of our cryogenic systems. Materials include tubing, solders, fluxes and adhesives suitable for cryogenic service. A selection of non-magnetic tools permits working in proximity to high-field magnets. Hazards of cryogenic service are minimized with the safety equipment we provide and procedures we recommend. For example, our Oxygen depletion monitors minimize the risks of working in constrained areas in the presence of cryogens, while our face masks and gloves minimize hazards of cryogenic spills.

OXFORD INSTRUMENTS

Tool Box

- A convenient set of accessories for storing and moving tools and equipment around the laboratory

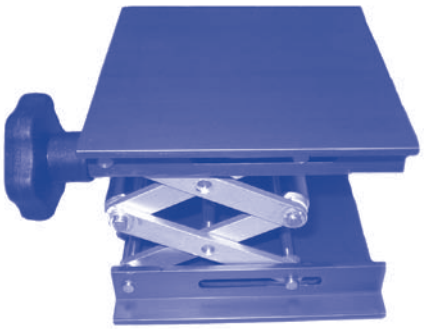
This 4-drawer polypropylene tool chest is moulded in black and yellow. The chest provides safe storage for non-magnetic tools, small parts and components. Drawers are easily removed. External dimensions are 380 x 270 and 310 mm high.

Catalogue Number
S7-330

Small Lab Jack

- Support and easily align optical or other experimental equipment with these stable platforms

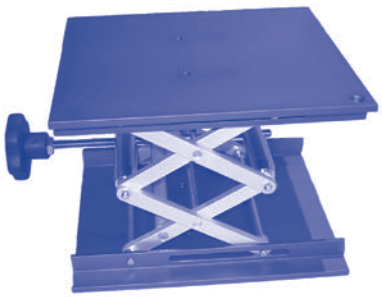
Fine mechanism permits precise adjustment of 100 x 100 mm platform. Height is adjustable from 43 to 140 mm. Capacity is 30 Kg.



Catalogue Number
S7-310

Medium Lab Jack

Fine mechanism permits precise adjustment of 200 x 200 mm platform. Height is adjustable from 57 to 290 mm. Capacity is 80 Kg.



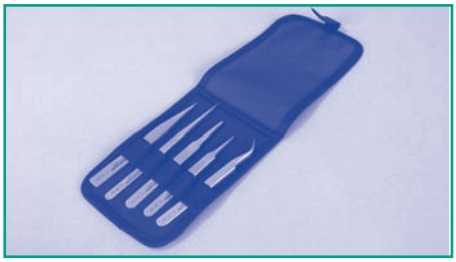
Catalogue Number
S7-311

Precision Tweezers Kit

- Position or retrieve small objects with ease

Lindstrom general purpose non-magnetic tweezers, in ESD-safe padded wallet. Set contains 5 popular tip styles.

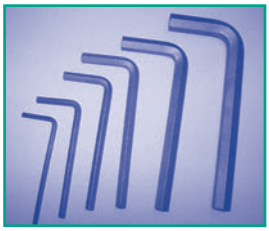
Catalogue Number
S7-312



Non Magnetic Hand Tools

- A requirement near any high field magnet

Non magnetic hand tools, manufactured from high strength copper beryllium alloy; included are spanners, screwdrivers, pliers, allen keys.



Tool type	Size (where applicable)	Catalogue Number
Allen key set (mm)	3, 4, 5, 6, 8 10	S7-104
Combination pliers (mm)	200	S7-117
Diagonal side cutting pliers		S7-103
Knife		S7-120
Long nose pliers		S7-102
Scissors (mm)	200	S7-118
Adjustable wrench (mm)	200	S7-101
Screwdriver	Flat no. 4	S7-119
Screwdriver	Phillips no. 1	S7-115
Screwdriver	Phillips no. 2	S7-116

Non Magnetic Combination Spanners

Non magnetic combination spanners, manufactured from high strength copper beryllium alloy.

Size	Catalogue Number
8 mm	S7-105
9 mm	S7-106
10 mm	S7-107
11 mm	S7-108
12 mm	S7-109
13 mm	S7-110
14 mm	S7-111
15 mm	S7-112
16 mm	S7-113
17 mm	S7-114

Utility Tools (Magnetic)

A set of Allen keys are available comprising of the following sizes: 1.27 mm, 1.5 mm, 2 mm and 2.5 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm, and 10 mm.

A range of scalpels, knives and blades are available.

The artist brush is a hand tool for applying varnishes etc. The 1/2" brush is handy for brush cleaning equipment.

Description	Catalogue Number
Set of Allen Keys	A5-401
Disposable knives (pack of 5)	A5-411
Spare blades for disposable knives (10)	A5-412
Scalpel handle - size 3	A5-413
Scalpel blades (pack of 10)	A5-414
Artist brush (pack of 10)	A5-431
1/2" Paint Brush (pack of 5)	A5-432

Heat Gun

Portable heat gun delivers 50°C to 650°C temperatures for shrink tubing, general heating, and de-icing operations. Output is 1600W (230/240V), 1400W (110V), with airflow of 250-500 l/min. Easily cleaned air filter prevents debris from entering the unit.

Description	Catalogue Number
120V (US plug)	S7-351
240V (UK plug)	S7-352

Cotton Gloves

Lightweight cotton gloves for the protection of delicate or sensitive items where hand contact could be detrimental to the performance of the product, e.g. superinsulation.

Description	Catalogue Number
Small	C8-117
Medium	C8-107
Large	C8-110

Disposable Gloves

Latex rubber gloves prevent contamination of clean surfaces (high vacuum, optics).

Description	Catalogue Number
Small	C8-118
Medium	C8-108
Large	C8-128
Extra Large	C8-138

Cryogenic Gloves and Aprons

These products have been developed to give protection down to minus 125°C against Freezer Burn and Frostbite. For high temperature use, protection is given to handling objects up to 150°C.

The products are manufactured from a highly efficient Polyolefin insulation with an outer Nylon skin, which is laminated to a micro porous film. This makes the products very flexible in use and water resistant. Aprons are 61 mm (24 inches) wide and have adjustable straps.

- Never immerse gloves in any liquid
- Keep gloves and aprons readily accessible
- Do not use product close to naked flame or surfaces in excess of 150°C

Size	Catalogue Number	
	Aprons	Gloves
		Wrist (285-310 mm long)
Small	S2-101	S1-111
Medium	S2-102	S1-112
Large	S2-103	S1-113
Extra Large	S2-104	S1-114

- Eye Injury prevention is particularly important when handling liquid cryogens

Safety Glasses/Goggles

Ultra comfortable, soft body goggle conforms comfortably to your face.

Description	Catalogue Number
Safety Glasses	S3-202
Safety Goggles	S3-203

Full Face Visor

This lightweight visor protects the entire face from chemical splashes or molten metal. The visor harness is fully flexible to prevent cracking if dropped. An adjustable nylon and polycarbonate head harness gives a comfortable and secure fit for the user.

Catalogue Number
S3-201

Respirators

Three mask types are offered to provide protection from common airborne contaminants. The user must carefully consider the proper level of protection based upon the application.

Description	Application	Catalogue Number
Welding Respirator	Welding Fumes	S3-101
Dust Respirator/ Nuisance Odour	Dust and Odour	S3-102
Dust Respirator, General Purpose	Dust	S3-103

GasAlertExtreme™ Oxygen Monitor

GasAlertExtreme™ provides extraordinary cost of ownership advantages. These include simple automated calibration, 2 year lithium battery and simple one-button control. All of these features lower your training and maintenance costs. Operated by an advanced microcontroller and a plug-in electrochemical sensor, the GasAlertExtreme™ is equipped with high output audible/visual alarms and built-in concussion-proof boot.

The bright, large LCD shows real-time oxygen concentrations and the instrument's status at all times. The full function self-test verifies sensor, circuitry and battery integrity and activates the audible/visual alarms each time you turn the instrument on. The detector clearly advises the oxygen level and alarm status.

The compact, rugged GasAlertExtreme™ is designed with the most advanced RFI protection available today. Delivered ready for use, simple clip the instrument to you lapel, pocket, belt or hard hat for unequalled protection.

- Continuous LCD shows real-time gas concentration with backlight – low light (auto); in alarm (auto) and on demand
- Small size (1.1 x 2.0 x 3.75 in / 28 x 50 x 95 mm) and lightweight (2.9 oz / 83 g)
- Provides 90 db tone and bright LED indication on alarm
- 3 year battery life (9,000 hours)
- Low and high alarms with adjustable set points
- Classified intrinsically safe by UL to U.S and Canadian standards, Canelec certified, CE marked
- Full function self-test of: sensor, battery and circuit integrity; and audible/visual alarms
- Pocket/belt clip, test cap and hose, battery, and instructions in local languages included

Protect against Oxygen depletion in liquid cryogen environments using GasAlert™ monitors. This common but frequently overlooked hazard is easily avoided.

Catalogue Number
S5-101

Measuring Range
Alarm Setpoints (Factory defaults are
Low Alarm
High Alarm
Operating Temperature

Description	Catalogue Number
Replacement 2 year Oxygen Sensor	S5-102
Battery, 3 year Lithium, 3 volt, Disposable	S5-103
Stainless Steel Alligator Clip	S5-104

GasAlert™ Fixed Oxygen Monitor

- Individual continuous status LCD for each channel
- 85 dB alarm
- Up to 4 detectors may be connected
- Easy installation; slim profile

Entirely self-contained, the CR-4000 monitor provides uninterrupted monitoring of oxygen levels in laboratory spaces. Operated by an advanced microcontroller, the controller supervises up to 4 remote electrochemical sensors. Alarm conditions cause a visual display and activate optional remote signalling devices.

Remote Oxygen Detectors must be ordered separately (see S5-210).

Classified intrinsically safe by UL to U.S and Canadian standards, Canelec certified, CE marked.

Model	Description	Catalogue Number
CR-4000	Fixed Gas Monitor	S5-201
CD-420	Oxygen Detector	S5-210
SS-RX01	Replacement Oxygen Sensor	S5-211

Specification	
	Oxygen (% by Volume)
Measuring Range (%)	0-30
Alarm Set points (%) (Factory defaults are shown. Alarm levels are field adjustable)	Low -19.5 and High -23.5
Operating Temperature (°C)	-20 to +50
Electrical Supply (VAC)	115 or 230
Enclosure	NEMA 12
Dimensions (inches)	2.4 x 13 x 9.5
Weight (pounds)	5
Mounting	Equipped with hanging slots and hinged door
Alarm relays	1) Low Alarm
	2) High Alarm
	3) Fault Alarm
Relay Outputs	SPDT contacts, rated at 10 amps @ 120 VAC
Local audible alarm	85 db buzzer within enclosure

GasAlert™ Fixed Detector

This 4 - 20 mA transmitter provides continuous monitoring for Oxygen deficiency hazards. Engineering with proven sensing and instrument technology to eliminate false alarms and direct linear output for compatibility with the S5-201 Fixed Gas Monitor.

- Direct linear 4 - 20 mA outpout with 12 - 35 DC supply voltage
- Diagnostic signal transmission during system faults
- Field selectable gases and measuring ranges
- Failure/ brownout protection

Catalogue Number
S5-210

GasAlertClip™ Extreme

This economical, maintenance-free oxygen monitor provides two years of protection. The water-resistant GasAlertClip Extreme has a built-in concussion-proof boot and is ideal for amphibious operations and high-moisture environments.

Equipped with two alarm levels and an internal vibrator, the GasAlertClip Extreme includes high-output visible and audible alarms. An easy reading display indicates detector life remaining, alarm set points and peak alarm exposures.

The GasAlertClip Extreme`s advanced microprocessor performs a full function self-test automatically on startup and on demand to verify sensor, circuit and battery integrity, as well as audible/ visual alarm operation.

Note: once activated this unit operates continuously for 2 years under normal conditions. Life expectancy will be reduced when alarms exceed 3-5 minutes per day.

Clip it to your lapel, pocket, belt or hardhat for personal O_2 protection. Once activated, this unit monitors continuously for 2 years.

Catalogue Number
S5-110

Safety Helmet

Protector style HC600 is the latest in comfort, style and durability.

- Unique ventilation option
- Protection against lateral deformation
- Protection against molten metal splash
- Meets standards for electrical insulation
- Visor protection interface
- Hearing protection

Description	Catalogue Number
Yellow	S3-301
Orange	S3-302
Hi visibility yellow	S3-303

Hearing Protector

Continuous exposure to high noise levels can lead to hearing problems.

Lightweight comfortable alternative to ear plugs. Hearing Protector headset is comfortable yet effective at reducing high ambient noise to safe levels. Complies with European Standard EN 352-2.

Catalogue Number
S3-404

Warning Sign

"CAUTION - MEN WORKING" and "HAZARDOUS AREA". Stands 18" tall.

Catalogue Number
S6-414

Lockout Kits

Our selection of useful lockout devices, enabling compliance with safe industrial practices.

Lockout type	Description	Catalogue Number
Starter Kit	Assortment includes lockouts for gate valves (4), ball valves (4), safety hasps (5), padlock assortment (4), labels (10), carrying bag	S6-101
Ball Valve	For ball valves 6 - 25 mm	S6-131
Ball Valve	For ball valves 32 to 76 mm	S6-132
Butterfly Valve	For butterfly valves	S6-121
Lockout Hasp	25 mm hasp, 11 holdes for up to six padlocks	S6-161
Gate valve	165 to 254 mm dia.	S6-111
Gate valve	64 to 127 mm dia.	S6-112
Non-conductive Lockout Hasp		S6-152
Padlock	Red body	S6-141
Power protection seal	For UK style plugs, prevents accidental removal of plug from socket	S6-301
Power protection seal labels	Pack of 10 labels	S6-311
Lockout Scissors	Scissors style lock with 0.9 m cable for multiple power sources	S6-151
Tag holder and slide	Pack of 10 holders	S6-201
Tag holder pull-tite seals - red	Pack of 1000 seals	S6-211
Safe to use/ do not use tag	Pack of 10 tags	S6-221
Safe to operate/ do not operate tag	Pack of 10 tags	S6-222
Valve open/ closed tag	Pack of 10 tags	S6-223
Do not switch power tag	Pack of 20 tags	S6-224

Safety Signs

Informative safety signs help alert staff and visitors of potential dangers. Vinyl signs adhere to any clean, smooth surface and are ideal for indoor use. Durable plastic signs are semi-rigid with an adhesive backing. They are suited for use on interior or exterior flat surfaces.

Message	Material	Dimensions	Catalogue Number
Strong Magnetic Field	Plastic	275 x 200 mm	S4-101
Strong Magnetic Field	Vinyl	275 x 200 mm	S4-111
Strong Magnetic Field and Pace Maker	Vinyl	275 x 200 mm	S4-301
Strong Magnetic Field, Pacemaker and Asphyxiation	Plastic	275 x 200 mm	S4-201
Strong Magnetic Field, Pacemaker and Asphyxiation	Vinyl	275 x 200 mm	S4-211
Head Protection Must Be Worn	Plastic	300 x 250 mm	S4-514
Head Protection Must Be Worn	Vinyl	300 x 250 mm	S4-504
Hearing Protection Must Be Worn	Plastic	150 x 125 mm	S4-513
Hearing Protection Must Be Worn	Vinyl	150 x 125 mm	S4-503
Do Not Use Mobile Phones	Plastic	250 x 200 mm	S4-511
Do Not Use Mobile Phones	Vinyl	250 x 200 mm	S4-501
No Access For Unauthorised Persons	Plastic	250 x 200 mm	S4-512
No Access For Unauthorised Persons	Vinyl	250 x 200 mm	S4-502

Area Marking Tape

Premium yellow tape for the line marker (S6-420) of thickness 0.225 mm, width 50 mm and length 33 m.

Catalogue Number
S6-421

Area Marking Line Applicator

The Line Marker allows you to apply tape without having to kneel or position tape by hand. This versatile unit comes with a convenient built in accessory kit, which includes a guideline, yellow crayon, tape-cutting knife, radius profile, straight edge and measuring tape. The exclusive design is light weight and will stand up to years of constant use. For use with 1-1/2 inch core tapes only. Ideal for applying tape alongside walls, obstacles, in straight lines or in curves.

Catalogue Number
S6-420

Area Marking: Chain

Warning chain made of strong yellow polyethylene (25 m length, 2.7 Kg) used with warning posts (S6-401).

Catalogue Number
S6-402

Area Marking: Post

Barricade potentially hazardous areas indoors with portable plastic posts. Their lightweight yet tough construction stands up to years of use in applications (6 per pack).

Catalogue Number
S6-420

Vacuum Grease

This general purpose vacuum grease may be used for lubricating and sealing 'O' rings, cone seals, etc. It has a good stability over the temperature range -40 °C to 200 °C. It is inert to oxidation and is highly resistant to a wide range of corrosive chemicals and aqueous analytical reagents.

Supplied in 50 gram tubes.

Catalogue Number
A4-903

Tip

Use thermal grease for good thermal contact to temperature sensors and easy removal.

Apiezon N Grease

Apiezon N Grease High vacuum grease, also usable for making thermal contact between sensors and cold surfaces.

Vapour pressure: $<10^{-9}$ mbar at 20°C Melting point: 43°C

Supplied in 25 gram tubes

Catalogue Number
A4-902

GE Low Temperature Varnish

Please note that shipping restrictions may apply, consistent with local hazardous chemical requirements.

This insulating varnish is used, for example, when securing or thermally anchoring electrical wires to solid surfaces. It has excellent bonding properties and good electrical and chemical resistance, combined with good resistance to thermal cycling

Catalogue Number
C5-101

Data
Viscosity at 21 °C: 10 to 16 poises
Thermal conductivity between 4 K and 10 K: 3.2 x 10^{-5} Watts/cm K
Volume resistivity: 1013 to 1015 Ω/cm
Air drying time: 15 minutes
Solvent: 1:1 mixture of toluene and ethanol
Available in 30 ml jar

Sensor and Heater Cement

This air-curing cement is ideally suited to potting temperature sensors and heaters. Can be softened for removal by soaking in warm soapy water.

Available in 50 gram pots.

Data
Temperature range: -180°C to 1500°C
Adheres to keyless surface
Variable viscosity
Electrically insulating
Proof against oil, acid, etc
Odourless

Catalogue Number
C5-105

Cartridge heaters are mounted with this cement to promote heat transfer

IS 496 Cyanoacrylate Adhesive

A fast-curing solvent-free cyanoacrylate adhesive which rapidly bonds rubber and is particularly suitable for making up non-standard 'O' rings.

Available in a plastic container with applicator.

Contents 20 gram.

Catalogue Number
C5-103

Caution should be exercised as this product bonds human skin rapidly

Epoxy Resin Adhesive

Epoxy resin adhesive consists of adhesive and hardener which are mixed at 2:1 ratio by volume. This bonding adhesive remains flexible enough at helium temperatures to make mechanical joints that remain strong after repeated thermal cycling. It is suitable for bonding materials with dissimilar coefficients of expansion. Other applications include bonding KRS5, Mylar and aluminised Mylar windows.

Furnished in 30 + 15 gram set.

Data
Initial viscosity of resin-hardener mixture at 21°C: 60 to 80 poises
Coefficient of expansion: 125 to 135 x 10^{-6} linear/K
Volume resistivity: 1013 to 1015 Ω/cm
Thermal conductivity: 1.7 to 1.9 x 10^{-3} Watts/cm K
Available as a set of 30 grams of adhesive and 15 grams of hardener

Catalogue Number
C5-102

Please note that shipping restrictions may apply, consistent with local hazardous chemical requirements.

Silicone Rubber

A cold-curing silicone rubber used for sealing, potting and insulating purposes. Available in a handy 78 gram dispenser.

Catalogue Number
C9-101

General Purpose Epoxy Resin Adhesive

Thoroughly clean mating surfaces prior to applying adhesives

General purpose epoxy resin adhesive used for bonding plastics glass-metals, ceramics and sealing porous surfaces. Used for mounting all types of windows except for KRS5 and Mylar.

Available as a 150 gram set.

Catalogue Number
C5-104

Araldite Adhesives & Dispensers

Please note that shipping restrictions may apply, consistent with local hazardous chemical requirements.

Dispensers are recommended to facilitate use of the Araldite adhesives. Select the dispenser that corresponds with the desired adhesive package size.

Adhesive Dispensers	
Description	Catalogue Number
Size 50 ml - integral cutter 1:1, 2:1, 10:1 plunger	C5-320
Size 200 ml - lightweight & well balanced, delivers even product flow	C5-321
Size 400 ml - lightweight & well balanced, delivers even product flow	C5-322

Araldite Adhesive

The data below indicates the detailed product properties and performance of each product.
Adhesive performance was obtained following recommended pre-treatment of substrates.

Product Code	Description	Ferrous Metals & Aluminium	Copper	Zinc and Galvanised Metal	GRP/SMC/GRE/ Thermoset Composites	ABS/PVC	Acrylics/Polycarbonate	Polyamides/Polystyrene Foams/Polyurathane Foams	Rubbers	Glass/Quartz/Precious Stones	Ceramics	Wood	Time required to reach 50% of final sheer strength (at 23C)	Cartridge/ Pack Sizes	Catalogue Number
2010	A toughened, fast cure epoxy ideal for metal bonding	●	●	◒	◒				◒	◒	●	◒	3 hrs	200 ml	C5-301
2011	A multi-purpose epoxy with long working life	●	●	●	◒		◒	●	◒	◒	●	●	10 hrs	50/200 ml	C5-302 / C5-352
2012	A fast cure, multi-purpose epoxy	●	●	●					◒	◒	◒	●	1¾ hrs	50/200 ml	C5-303 / C5-353
2013	A metal coloured epoxy paste, suitable for use on vertical applications	●	●	●	◒			◒	◒			◒	10 hrs	50/200 ml	C5-304 / C5-354
2014	A grey epoxy paste offering high chemical and temperature resistance	●	●	●	●						◒	◒	5 hrs	50/200 ml	C5-305 / C5-355
2015	A toughened epoxy paste ideal for GRP, SMC and dissimilar substrates	●	●	◒	●				◒		◒		10 hrs	50/200 ml	C5-306 / C5-356
2017	A flexible epoxy with rapid cure	◒	◒	◒	◒	●			◒			◒	4 hrs	200 ml	C5-307
2018	A flexible polyurethane ideal for bonding thermoplastics	◒			●	●	●	●	●				16 hrs	200 ml	C5-308
2020	A transparent epoxy ideal for glass or ceramics bonding	●	●							●	●		24 hrs	500 g pack	C5-309
2021	A rapid curing, toughened multi-purpose methacrylate	●	◒			●	●	●	◒	◒	◒		20 mins	50/400 ml	C5-310 / C5-360
2022	A toughened, resilient methacrylate for bonding thermoplastics	◒	◒		●	●	●	◒	◒	◒	◒		30 mins	50/400 ml	C5-311 / C5-361
2024	A rapid curing, toughened methacrylate for bonding thermoplastics and composites	◒	◒		●	●	◒	◒	◒				15 mins	37.5/ 380 ml	C5-312 / C5-362
2026	A transparent flexible polyurethane for bonding plastics and glass	◒	◒			●	●	◒	◒	●			4 hrs	50/200 ml	C5-313 / C5-363
2027	A Polyurethane paste ideal for SMC and GRP	◒			●		◒	◒	◒				10 hrs	500 ml	C5-314

● = excellent

◒ = adequate

Blank = n.a.

Cryogenic Books

Description	Catalogue Number
Practical Cryogenics	L1-101
Safety Matters	L1-102
Introduction to Thermometry Below 1 K	L1-103

Electronics Manuals

Description	Catalogue Number
IPS120-10 Manual	L2-101
ISS 10 Manual	L2-102
ITC 501 Manual	L2-201
ITC 502 Manual	L2-202
ITC 503 Manual	L2-203
ITC 601 Technical Manual	L2-301
ITC 601 User Manual	L2-302
ILM 200 Series Manual	L2-401
Cryojet Controller	L2-501

Transfer Tube Manuals

Description	Catalogue Number
LLT Manual	L3-101
TTL Manual	L3-102
Needle Valve Manual	L3-103

System Manuals

Description	Catalogue Number
Cryojet	L4-101
Optistat DN Static	L4-201
Optistat DN-V	L4-202
Optistat CF Dynamic	L4-203
Optistat CF Static	L4-204
Optistat SXM	L4-205
Microstat He & CF-V	L4-301
ESR 900	L4-401
ESR 910	L4-402
Heliox VL Insert Manual & Data	L4-501

Indium Wire

Indium wire for demountable liquid helium seals, 1 and 1.5 mm diameter. Available by the metre up to 10m lengths

Description	Catalogue Number
1.5 mm dia.	C4-101
1.0 mm dia.	C4-102

Data
Melting point: 155°C
Purity: 99.99%
Impurities: 500 ppm, mainly Cd, Sn, Tb, Tl

Most applications use 1 mm indium. Damaged seals may benefit from 1.5 mm indium. Clean indium wire and seal surfaces with solvent prior to installation

Non-superconducting Solder (at 4.2 K)

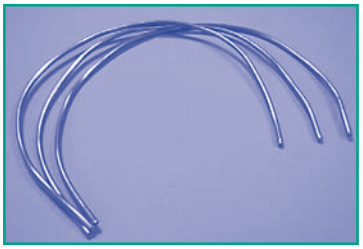
For use where non-superconducting solder at low temperature is required e.g. attaching electrical leads to metal specimens. Superconducting transition temperature in zero field Tc=1 to 1.6 K.

Data
Melting point: 265°C
Composition: Eutectic alloy 82.5% Cd, 17.5% Zn
Available in 250 gram bars

Catalogue Number
C4-201

Woods Metal

Care should be taken with this product when in use as fumes may be hazardous



For use where low temperature joints need to be readily demountable and vacuum tight at low temperature after repeated thermal cycles. Also used to make joints which avoid re-melting any neighbouring soft-soldered joints.

Data
Melting point: 65 to 70°C
Composition: 50% Bi, 25% Pd, 12.5% Sn, 12.5% Cd
Tensile strength: Approximately half of that of lead-tin solder
Stronger than lead-tin soft solder at 4.2 K
Available per 200 gram lots

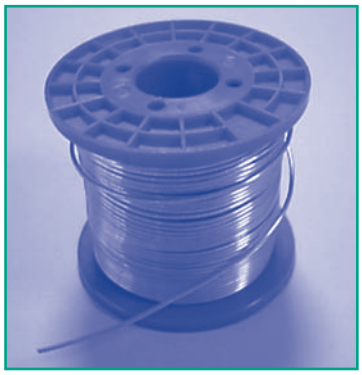
Catalogue Number
C4-203

Multicore Solder

Personnel should wash hands following handling of solder or soldered products

A general-purpose, flux-cored solder which is non-corrosive for use on electrical and electronics applications.

Available in 500 gram reels



Data
Tensile strength:* Up to 6 tons/in^2 (9.6 Kg/mm^2 92N/mm^2) *Copper-to-copper joint.
Bonding temperature: 225°C
Electrical conductivity: 16% IACS
Hardness: 15 BHN

Catalogue Number
C4-205

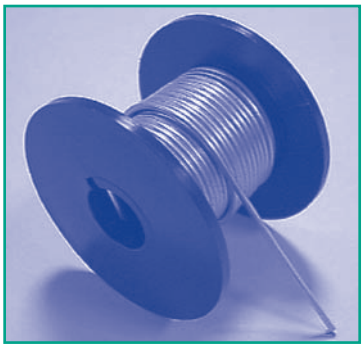
Soft Solder

A silver-bearing alloy providing good strength and ductility for use on stainless steel, mild and low alloy steels and copper and its alloys.

Solder is 1.5 mm diameter. Reel contains 6 m length.

This silver-tin eutectic alloy is free from cadmium, zinc and lead and is suitable for use with flame, induction and resistance soldering.

For best results use with C4-402 flux.



Catalogue Number
C4-204

Silver Solder

Data
Tensile strength: 300 to 400 N/mm^2
Electrical resistivity: 1.6 x 10-7 Ω/m at 20°C
Bonding temperature: 590°C
Melting temperature: 660°C
Length: 450 mm
For best results use with F236/2 flux

A silver solder suitable for stainless steel and electrical wiring. Furnished in 450 mm rod form. Use of C4-401 flux is recommended.

Diameter	Catalogue Number
1.0 mm	C4-301
1.5 mm	C4-302
2.4 mm	C4-303
Sold per length	

Provide adequate ventilation when soldering. Wash hands after handling any solder or soldered items

F236/1 Flux

A high fluidity flux with good penetration, for use with silver solder. Available in 1 Kg plastic pots.

Data
Working temperature range: 450 to 900°C

Catalogue Number
C4-401

Use warm water to remove all traces of soldering flux to avoid corrosion

157 Flux

Recommended for use with soft solder. Available in 1 Kg plastic pots.

Data
Working temperature range: 150 to 375°C

Catalogue Number
C4-402

Please note that shipping restrictions may apply, consistent with local hazardous chemical requirements.

Superior Fluxes

Supersafe #30 is ideal for electrical and electronic applications. Flux residue should be removed with water

Superior's range of fluxes aid soldering to copper, constantan, manganin, and stainless steel, with incremental degrees of activity.

Flux	Properties	Catalogue Number
Supersafe #30	Excellent general purpose flux for materials other than stainless; non corrosive, excellent in vacuum systems and cryostats	C4-403
Superior #67	Zinc-free, with greater activity, for mild stainless steel, copper and non-ferrous alloys	C4-404
Superior #71	High activity flux for stainless-steel, ferrous metals, nickel, Inconel and other alloys. Contains zinc chloride. Flux resides must be cleaned with water containing 2% HCl, followed by hot water rinses as necessary	C4-405

Lens Cleaner

When lens tissue is rolled-up then pulled apart, the resulting soft fibres are suitable for fine surface cleaning

A general industrial optical cleaner for removing dust and dirt from windows. Suitable for all windows except KRS5 and Zinc Selenide.

Available in 52 ml plastic bottles.

Catalogue Number
C9-103

Electronics Cleaner

An anti-static foam cleaner effective on plastics, vinyl, and cabinets containing electronic and electrical products.

Available in 400 ml spray can.

Catalogue Number
C9-104

Vacuum Compound

This substance has excellent workability for use as a temporary sealing compound in laboratory vacuum work. Although it has good adhesion in service, it can easily be removed from working surfaces and is therefore reusable.

Available in 1 Kg tins

Catalogue Number
A4-901

PTFE Tape

An elastic tape that is suitable for sealing applications or securing wiring and thermometry in low-temperature apparatus.

Size: 12 mm wide by 12 m reel.

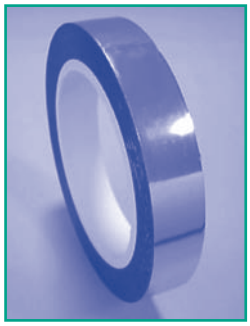
Catalogue Number
C8-101

Aluminised Mylar Tape

Self-adhesive tape for bonding and holding down aluminized Mylar and superinsulation.

Size: 19 mm wide by 55 m reel.

Catalogue Number
C8-102



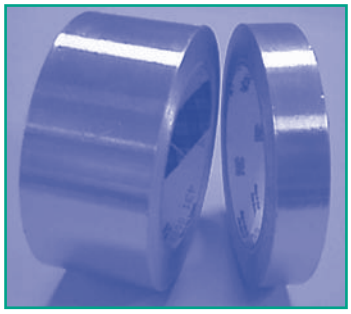
Acetate Tape

Semi-self-adhesive black cloth tape suitable for outer wrapping and wire protection. Withstands low temperatures - adhesive thermosets. Reel length is 55 m.

Width	Catalogue Number
19 mm	C8-103
25 mm	C8-104

Aluminium Tape

Self-adhesive aluminium tape for bonding and holding down aluminized Mylar and superinsulation. Also useful for blocking unwanted radiation paths in low temperature equipment.



Description	Catalogue Number
Size: 19 mm wide by 50 m reel	C8-105
Size: 50 mm wide by 50 m reel	C8-106

Kapton Tape

Self-adhesive insulating tape for high temperature applications with excellent electrical and physical properties - useful for securing film heaters.

Description	Catalogue Number
Size: 25 mm by 50 m reel	C8-210
Size: 12.5 mm by 50 m reel	C8-211

Nylon Line

A nylon monofilament line used for securing cryogenic wiring etc. Furnished on 100 m reel and suitable for use in liquid helium environments.

Diameter	Catalogue Number
0.22 mm	C9-105
0.27 mm	C9-106
0.35 mm	C9-107

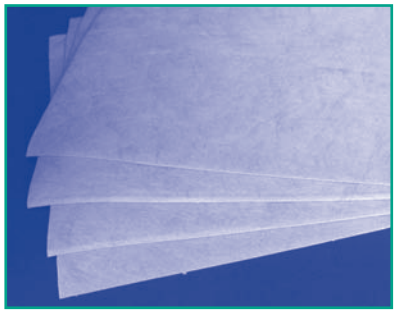
Lens Cloth

Soft fibre, non-scratch tissue for use with lens cleaner C9-103

Available in packs of 5. Sheet size 200 x 300 mm.

Catalogue Number
C9-102

Spill Mat



Absorbent material designed for general liquid spills.
Box of 50 pads, each 480 x 480 mm.

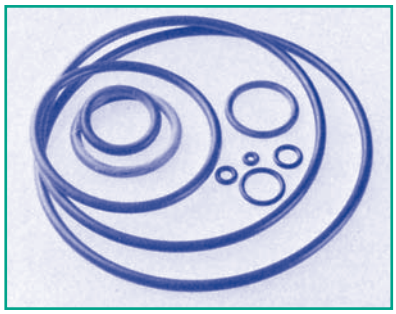
Catalogue Number
S6-605

Place one of these mats under a leaking pump to minimise slip/fall risk

'O' Rings

Oxford Instruments Direct stocks a comprehensive range of sizes of Nitrile and Viton 'O' rings.

For assistance in selecting replacement parts for an Oxford Instruments product, please contact us.



Section diameter	Size ranges I/D
0.070"	0.078" - 1.375"
0.103"	0.375" - 2.812"
0.139"	0.750" - 10.00"
0.210"	1.500" - 4.500"
0.275"	4.500" - 15.50"

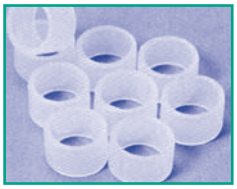
Order 'O' rings by ID, cord diameter and material, or identify the 'O' ring location on a specific product

Measure tubing OD to insure compatibility with coupling to avoid leaks

Polythene Olives

Polythene olives seal tubing in compression fittings.

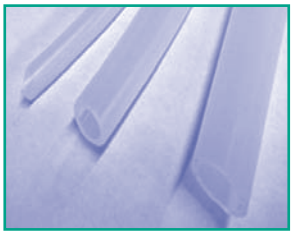
Furnished in packs of 10.



O/D (mm)	I/D (mm)	O/D (in)	I/D (in)	Catalogue Number
12.7	9.5	0.500	0.375	H1-401
15.9	12.7	0.625	0.500	H1-402
19.1	15.9	0.750	0.625	H1-403

Polythene Tubing

Flexible tubing is rigid enough to handle pressure or vacuum applications.

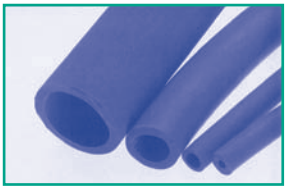


O/D (mm)	I/D (mm)	O/D (in)	I/D (in)	Catalogue Number
9.5	6.3	0.375	0.250	H1-301
12.7	9.5	0.500	0.375	H1-302
15.9	12.7	0.625	0.500	H1-303
10.0	7.0	0.394	0.276	H1-304

Rubber Tubing

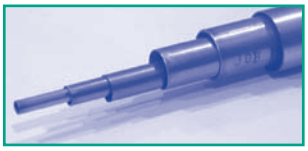
Latex tubing adapts to a wide range of diameters

High quality, durable, natural rubber and latex tubing for general laboratory use.



Material	I/D (mm)	Wall Thickness (mm)	I/D (in)	Wall Thickness (in)	Catalogue Number
Rubber	6.4	3.2	0.250	0.125	H1-501
Rubber	6.4	1.6	0.250	0.062	H1-502
Rubber	3.2	3.2	0.125	0.125	H1-503
Rubber	12.7	3.2	0.500	0.125	H1-504
Rubber	25.4	3.2	1.000	0.125	H1-505
Latex	8.0	2.4	0.313	0.094	H1-506

Stainless Steel Tubing



A range of seamless stainless steel tubing is available in sizes from 0.56 mm to 25.40 mm outside diameter, wall thicknesses 0.13 mm to 0.56 mm. All tubes are to AISI 321 specification. Tolerances: Outer diameter (O/D) ±0.07 mm, wall thickness ±10%.

Tubing can be ordered in either 1, 2 or 3 meter lengths. Contact your local representative for tubing availability in your area

O/D (mm)	Wall (mm)	O/D (in)	Wall (in)	Catalogue Number
0.56	0.13	0.022	0.005	C1-001
0.71	0.15	0.028	0.006	C1-002
1.22	0.20	0.048	0.008	C1-003
1.52	0.25	0.060	0.010	C1-004
2.03	0.25	0.080	0.010	C1-005
3.18	0.15	0.125	0.006	C1-006
3.18	0.30	0.125	0.012	C1-007
4.75	0.15	0.187	0.006	C1-008
4.75	0.56	0.187	0.022	C1-009
6.35	0.15	0.250	0.006	C1-010
6.35	0.56	0.250	0.022	C1-011
7.95	0.15	0.313	0.006	C1-012
7.95	0.56	0.313	0.020	C1-013
9.53	0.20	0.375	0.008	C1-014
9.53	0.56	0.375	0.022	C1-015
11.13	0.20	0.438	0.008	C1-016
12.70	0.25	0.500	0.010	C1-017
12.70	0.56	0.500	0.022	C1-018
15.88	0.25	0.625	0.010	C1-019
19.05	0.25	0.750	0.010	C1-020
22.23	0.30	0.875	0.012	C1-021
25.40	0.30	1.000	0.012	C1-022

A range of welded and bead reduced stainless steel tubing is available in sizes from 28.60 mm to 101.60 mm outside diameter, wall thicknesses 0.38 mm to 0.50 mm. All tubes are to AISI 321 specification. Tolerances: 28.60 mm to 63.50 mm; ±0.13 mm, 69.85 mm to 101.60 mm; ±0.18 mm.

O/D (mm)	Wall (mm)	O/D (in)	Wall (in)	Catalogue Number
28.60	0.38	1.125	0.015	C1-023
31.75	0.38	1.250	0.015	C1-024
38.10	0.38	1.500	0.015	C1-025
44.45	0.38	1.750	0.015	C1-026
50.80	0.38	2.000	0.015	C1-027
57.15	0.38	2.250	0.015	C1-028
63.50	0.50	2.500	0.020	C1-029
69.85	0.25	2.750	0.010	C1-030
88.90	0.25	3.500	0.010	C1-031
101.60	0.38	4.000	0.015	C1-032

Stainless Steel Tubing

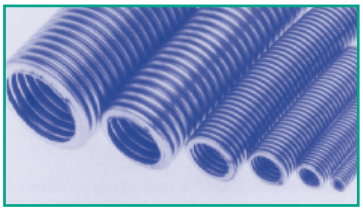
A range of rolled and welded stainless steel tubing is available. The sheet is to AISI 321 specification. Tolerance on the outer diameter (O/D) is ±0.02".

O/D (mm)	Wall (mm)	O/D (in)	Wall (in)	Catalogue Number
76.20	0.25	3.000	0.015	C1-033
114.30	0.38	4.500	0.015	C1-034
127.00	0.38	5.000	0.015	C1-035
127.00	1.63	5.000	0.064	C1-036
139.70	0.38	5.500	0.015	C1-037
139.70	1.63	5.500	0.064	C1-038
152.40	0.38	6.000	0.015	C1-039
152.40	1.63	6.000	0.064	C1-040
165.10	0.38	6.500	0.015	C1-041
165.10	1.63	6.500	0.064	C1-042
177.80	0.38	7.000	0.015	C1-043
177.80	1.63	7.000	0.064	C1-044
190.50	0.38	7.500	0.015	C1-045
190.50	1.63	7.500	0.064	C1-046
203.20	0.56	8.000	0.022	C1-047
203.20	1.63	8.000	0.064	C1-048
215.90	0.56	8.500	0.022	C1-049
215.90	1.63	8.500	0.064	C1-050
228.60	0.56	9.000	0.022	C1-051
228.60	1.63	9.000	0.064	C1-052
241.30	0.56	9.500	0.022	C1-053
241.30	1.63	9.500	0.064	C1-054
254.00	0.56	10.000	0.022	C1-055
254.00	1.63	10.000	0.064	C1-056

Flexible Stainless Steel Tubing

General purpose corrugated stainless steel tube is available for conveying liquids and gases where pressures, high or low temperatures, or corrosion are important factors.

Sold by the metre. When ordering, please state the minimum length required.



Use stainless steel welding flanges to adapt this tubing to desired fittings.

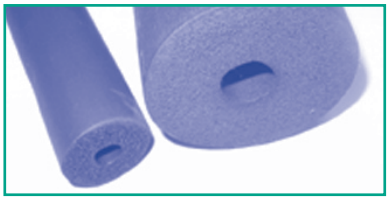
Metal thickness (in)	Grade	Construction
0.25 to 0.375 O/D x 0.008	321	Butt welded
0.50 to 0.750 O/D x 0.010	321	Butt welded
1.00 to 4.000 O/D x 0.012	321	Butt welded

Nominal I/D (in)	Max. O/D (in)	Constant flexure (in)	Permanent bend (in)	Catalogue Number
0.25	0.46	4	1.0	C2-001
0.38	0.65	6	1.1	C2-002
0.38	0.79	8	1.5	C2-003
0.75	1.08	8	1.3	C2-004
1.00	1.39	9	2.0	C2-005
1.25	1.74	9	3.0	C2-006
1.50	2.01	10	3.5	C2-007
2.00	2.70	11	5.0	C2-008
2.50	3.26	13	5.5	C2-009
3.00	3.88	15	6.0	C2-010
4.00	5.15	23	11.0	C2-011

Flexible Insulating Tube

I/D	O/D	Catalogue Number
10 mm	25 mm	H1-101
15 mm	38 mm	H1-102

This foam neoprene tube is ideal for insulating liquid nitrogen transfer tubes.
Stock length is 6.5 ft (2 m).

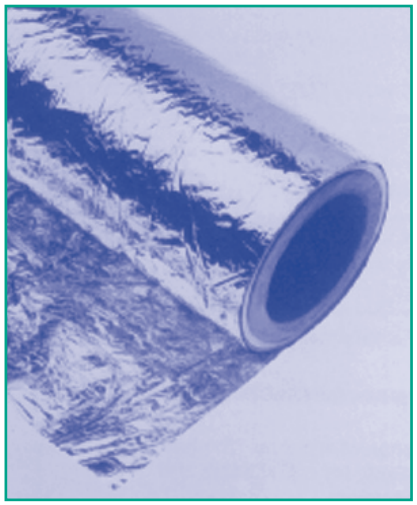


Insulated liquid cryogen lines deliver greater quantities of liquid , resulting in improved system operation.

This low thermal emissivity material is ideal for application to cryogenics vessels to reduce the radiative heat load

Avoid contamination of your vacuum space - use gloves when handling superinsulation

Superinsulation NRC-2®



Catalogue Number
C7-101

This aluminized plastic film which is uniquely crinkled, providing built-in stand-offs to minimise heat transfer by conduction in multilayer applications. The stand-offs eliminate the need for additional spacers to separate the reflecting radiation barriers. Due to point contact only within the layers, large areas of planar contact are eliminated and each layer is permitted to reach its own separate equilibrium temperature.

The above feature, together with the material's high mechanical strength and tear resistance, makes it ideal for cryogenic insulation applications such as in the fabrication of cryostats.

Material is 1.4 metres wide and is sold in 10 metre or 370 metre lengths.

Note: Coated one side only.

NRC-2 / Two®

Superinsulation film with a vacuum deposited aluminium layer applied to both sides of the film to provide an extra effective radiation barrier. The film is intentionally crinkled to provide built-in stand-offs to minimise heat transfer by conduction.

Material is 1.4 metres wide, and is sold in 10 metre or 370 metre lengths.

Catalogue Number
C7-102

NRC-2 500®

Similar in construction and application to NRC-2 but with an additional 250 angstrom deposition layer providing a more effective radiation barrier for radiation emitted by lower temperature surfaces. As with NRC-2, the film is intentionally crinkled to provide built-in stand-offs to minimise heat transfer by conduction.

Material is 1.4 metres wide, and is sold in 10 metre or 370 metre lengths.

Note: Coated one side only.

Catalogue Number
C7-103

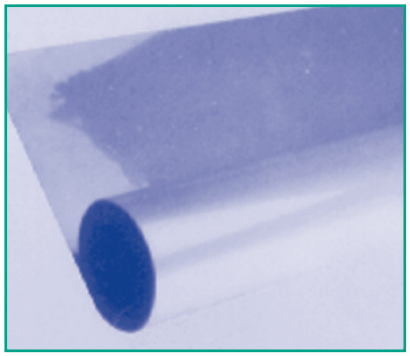
Cryolam®

NRC-2 superinsulation metallised on each side to approximately 400 angstroms, laminated with Reemay®, spunbounded pet style.

Available in 1.5 m widths. Sold in metre lengths. Please state length required when ordering.

Catalogue Number
C7-104

Clear Mylar Sheet

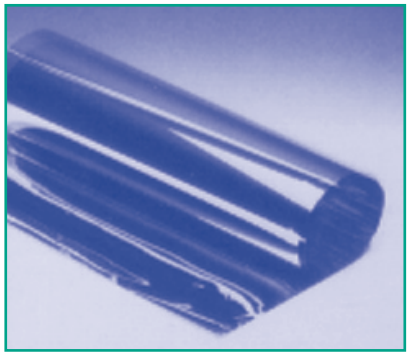


Clear Mylar film is 900 mm wide, available in various thicknesses. Mylar is suitable for coil winding interleaving and insulation, and cryogenic window applications.

Sold in metre lengths. Please state length required when ordering.

Thickness	Catalogue Number
0.025 mm	C7-105
0.076 mm	C7-106
0.127 mm	C7-107

Aluminium Foil

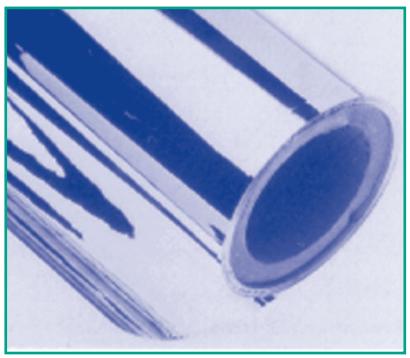


Highest purity aluminium foil, 0.127 mm thick. Its thickness and low emissivity qualities make it particularly suitable as a superinsulation material at temperatures below 77 K.

Available by the metre on rolls 500 mm wide. Please state length required when ordering.

Catalogue Number
C7-108

Aluminized Mylar Film



Suitable for cryogenic window applications, this is available in a single size, 0.127 mm thick x 1 metre wide.

Sold by the metre. Please specify length required when ordering.

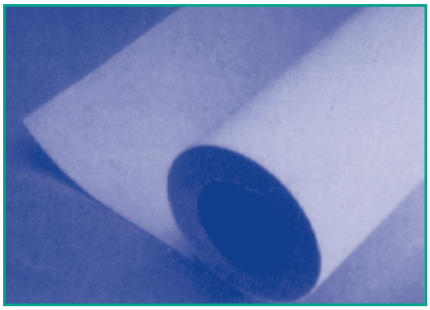
Catalogue Number
C7-109

Myoflex Sheet

This material is a combination of clear Mylar (0.127 mm thick) and Terylene. The Terylene is bonded to both sides of the Mylar film.

Catalogue Number
C7-110

Width of the roll is 900 mm. Please state length required when ordering.



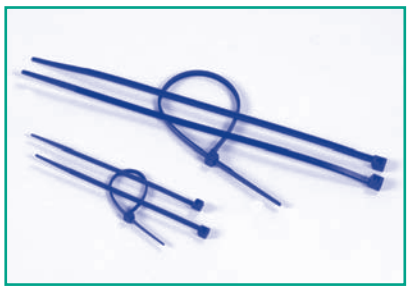
Polyester Netting

This 30-denier knitted polyester netting used for insulating cryostats is available in 2.3 metre widths.

Please state length required when ordering.

Catalogue Number
C7-111

Tie Wraps



Plastic tie wraps useful for grouping cables and holding cables to frameworks.

Available in packs of 20.

Size	Catalogue Number
Small (max. dia. 22 mm)	C9-109
Large (max. dia. 52 mm)	C9-110

Heat Shrink Tubing Kit

Catalogue Number
S6-265

This 100+ piece kit offers an assortment of four different versions of clear heatshrink tubing having expanded diameters from 3.2 to 9.0 mm.

- Polyolefin - operating temperature 135°C, shrink temperature 110°C. Standards: SAE-AMS-DTL 23053/5
- Dual Wall Polyolefin (adhesive lined) - operating temperature 105°C, shrink temperature 115°C
- Semi-rigid, highly flame retardant PVDF heatshrink tubing - operating temperature 175°C, shrink temperature 175°C
- Very flexible, flame retardant, Fluoropolymer heatshrink tubing - operating temperature 200°C, shrink temperature 130°C

All supplied in 100 mm lengths

1/8" Spiral Wrap Tubing

Nylon tubing with spiral cut to protect delicate wires from sharp edges.

Catalogue Number
S6-266

All fuses are direct replacements for Oxford Instruments products

Replacement Fuses

Popular fuses and hard-to-find values are available for prompt shipment.

Description		Catalogue Number
Fuse, Instrument, 500 ma	Pack of 5	**F1-101**
Fuse, Instrument, 0.8 AT	Pack of 5	F1-102
Fuse, Instrument, 1 AT	Pack of 5	F1-103
Fuse, Instrument, 1.6 AT	Pack of 5	F1-104
Fuse, Instrument, 2.5 AT	Pack of 5	F1-105
Fuse, Instrument, 3.15 AT	Pack of 5	F1-106
Fuse, Instrument, 5 AT	Pack of 5	F1-107
Fuse, Instrument, 6.3 AT	Pack of 5	F1-108
Fuse, Thermal ESR 900	Each	F1-109
Fuse, Kelvinox, 6 A	Each	F1-110
Fuse, Kelvinox, 10 A	Each	F1-111
Fuse, Kelvinox, 16 A	Each	F1-112
Fuse, Kelvinox, 20 A	Each	F1-113
Fuse, Kelvinox, 32 A	Each	F1-114

Cryomagnetic Lab Setup

1 Installation and maintenance

A laboratory scale cryomagnetic system is likely to require most of the following equipment, some of it only occasionally.

1.1 Personal safety equipment

- You must wear a full face shield for cryogenic work, otherwise suitable safety goggles
- You must wear loose fitting, insulating gloves suitable for protection against splashes of liquid helium and nitrogen
- You must erect hazard warning signs to make sure that anyone approaching the system is aware of potential hazards
- Oxygen depletion monitoring is recommended

1.2 Mechanical equipment

- Crane capable of lifting the system
- Pumping set assembly as in Figure 1 consisting of a fore pump for rough vacuum; ultimate vacuum 10^{-3} mbar, turbo-molecular pump; ultimate vacuum 4×10^{-9} mbar, gauge for measuring low vacuum; $10^{-1} – 10^{-3}$ mbar, gauge for measuring high vacuum; $10^{-3} – 10^{-6}$ mbar, valves as shown to permit changeover from fore pump alone to a combination of fore and turbo pump. For applications sensitive to oil contamination such as pumping out the vacuum space in spectroscopy instruments or spaces containing high surface area superinsulation, a dry pump is recommended for the fore vacuum. Diaphragm pumps are used in this case by Oxford Instruments. Otherwise, a two-stage rotary vane pump may be used.

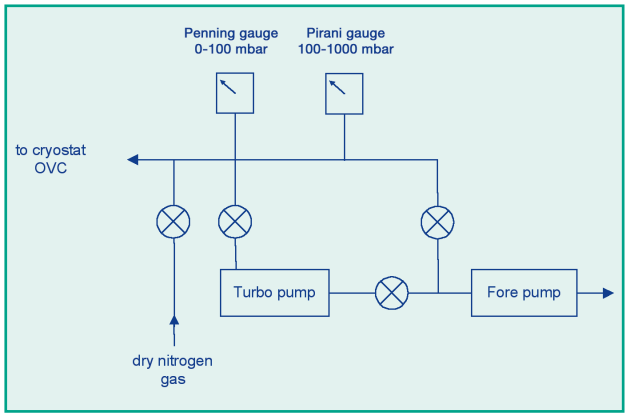


Figure 1 Typical pumping system

- Uncontaminated flexible stainless steel pumping line of diameter at least 25 mm
- Liquid nitrogen transfer lines and fittings

1.3 Electrical equipment

- Portable helium leak detector
- Hot air blower of at least 1.5 kW capacity
- Digital multimeter

1.4 Tools (ideally non-magnetic)

- Small pliers
- Open ended spanners (wrenches) 7 mm – 23 mm
- Hexagonal Allen keys 3 mm – 14 mm
- Flat blade screwdrivers
- Hand torch
- Claw hammer
- Selection of rubber stoppers (3 – 25 mm, depending on system)
- 13 mm Hexagonal Socket Adaptor

1.5 Consumables

- Sufficient liquid helium for initial filling and one quench
- Sufficient liquid nitrogen for initial pre-cool, refill and partial top-up
- Vacuum grease (eg general purpose grease and high vacuum grease, eg N grease)
- Cleaning agent (eg Inhibisol)
- Solvent to remove cleaning agent residue (alcohol based)
- Paper tissues
- Cotton or disposable vinyl gloves
- Cylinder of high purity helium gas (99.999%, UK size L) fitted with a 0 – 2 bar pressure regulator together with a suitable flexible hose
- Aluminised Mylar tape
- Rubber bladder for pressurising Helium liquid in dewar
- Indium wire 1 mm diameter plus abrasive pad for cleaning old Indium wire from joints
- Assorted natural rubber and polythene tubing

Natural rubber and polythene tubing should NEVER be used for the transfer of cryogenic fluids.

reference

1.6 Making Indium seals

Oxford Instruments Superconductivity uses two main types of indium seal as illustrated in Figure 2. They use 1 mm diameter indium wire retained either in a groove (by a flat surface) or in a corner (between 2 flanges).

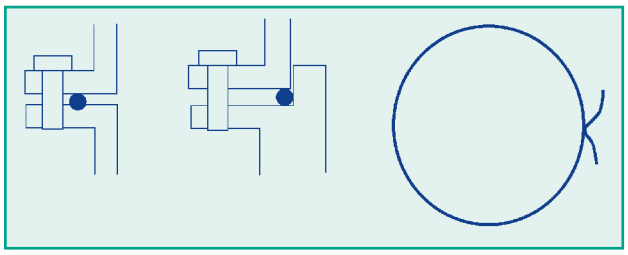


Figure 2 Indium seals; face seal, corner seal and loop showing ends of wire crossed

- Before making the seal ensure that the groove and the mating surface are clean. Thoroughly remove old indium wire. If necessary a solvent can be used for cleaning. It is possible to grease the surfaces to make it easier to remove the wire later but this is not necessary.
- Lay the new piece of indium wire in the groove or around the male part (corner seal) and overlap the ends of the wire as shown in Figure 2.
- Bring the two flanges together and hold them loosely in place with 2 bolts. Ensure any alignment marks on the flanges indicate the correct relative orientation.
- Fit the other bolts and tighten them with the fingers only.
- Slowly and evenly tighten all of the bolts with a small spanner (wrench) or Allen key. Do not overtighten.
- On large seals (>50 mm diameter) leave the joint for an hour for the indium to flow slightly then re-tighten.

It is often difficult to separate indium seals because the indium metal seems to glue the flanges together. For this reason most large indium seals have two or more threaded holes in one of the flanges for "jacking screws".

Remove the bolts that hold the indium seal together but leave 2 bolts loosely in place so that the flanges do not fall apart when they separate. Use another 2 of these bolts to push the flanges apart by screwing them evenly into the jacking bolt holes. This will push the flanges apart.

Recommended Safety Practices

Safe use of liquefied gases

Liquid nitrogen and helium are inert gases which do not support life. Small volumes of liquid can evaporate into large volumes of gas (approximately 700:1 ratio) and consequently can easily deplete the oxygen content of the air in enclosed spaces, thus causing asphyxiation.

Use only containers specifically designed for cryogenic service. Use proper transfer equipment such as stainless steel flexible hoses, phase separators or special filling adaptors or funnels to prevent splashing or spillage.

Ensure the vessel is operated in an area with adequate ventilation.

Cryogenic liquefied gases can cause severe burns if the liquid is allowed to come into contact with bare skin or delicate tissues such as the eyes.

Wear protective clothing. Wear warm, dry, non-absorbent gloves (such as leather). Wear eye protection (such as glasses, goggles or face screen). Handle cryogens with care and pour or transfer slowly to avoid spilling.

Liquid oxygen constitutes a further major hazard in that it supports combustion and this can be explosive in its intensity.

Avoid all possible sources of fire.

No smoking. No naked flames or sparks. No electric meters or welding equipment. No combustible materials in the equipment or nearby. Do not use oil or grease on any screw threads or fittings. Equipment for oxygen service must be thoroughly de-greased.

1.7 First aid treatment for cold burns

Flush the affected areas of skin with copious quantities of tepid water but do not use any form of direct heat such as hot water or a room heater. Move the casualty to a warm place (about 22 °C). If medical attention is not immediately available arrange for the casualty to be transferred to hospital without delay. While waiting for transport:

- Loosen any restrictive clothing
- Continue to flush the affected areas of skin with copious quantities of tepid water

- Protect frozen parts with bulky, dry, sterile dressings. Do not apply so tightly as to cause restriction of blood circulation.
- Keep the patient warm and at rest.
- Ensure ambulance crew or hospital is advised of details of the accident and first aid treatment already administered.
- Smoking and alcoholic beverages reduce the blood supply to the affected part and should be avoided.

1.8 Asphyxiation

Atmospheres containing less than 18% oxygen are potentially dangerous and entry into atmospheres containing less than 20% is not recommended.

Asphyxia due to oxygen deficiency is often rapid with no prior warning to the victim. A general indication of what is liable to happen in oxygen deficient atmospheres is given in the next table although the reactions of some individuals can be very different.

Oxygen content (vol %)	Effects and symptoms (at atmospheric pressure)
11 –14	Diminution of physical and intellectual performance without the person's knowledge
8 – 11	Possibility of fainting after a short period without warning
6 – 8	Fainting within a few minutes; resuscitation possible if carried out immediately.
0 – 6	Fainting almost immediate; death ensues; brain damage even if rescued.

The victim may well not be aware of the asphyxia. If any of the following symptoms appear in situations where asphyxia is possible and breathing apparatus is not in use, immediately move the affected person to the open air, following up with artificial respiration if necessary:

- Rapid and gasping breathing
- Rapid fatigue
- Nausea
- Vomiting
- Collapse or incapacity to move
- Unusual behaviour

Attempts to rescue affected persons from confined spaces or where oxygen deficient atmospheres may be present should only be made by persons trained in the use of breathing apparatus and confined entry space procedures.

1.9 Oxygen depletion

This considers the worst case scenario when the entire contents of the cryogenic vessel are lost to the room immediately after it has been filled. Air is displaced from the room by the volume of liquid in the dewar plus the filling losses, which are assumed to add another 10%.

The total volume of gas evaporated V_G is $1.1 \times V_D \times f/1000$ m^3

where V_D is the volume of the dewar (litres)
f is the gas factor (gas:liquid ratio)

If the volume of the room is V_R then the oxygen percentage will have been reduced from 21% to $21 \times (V_R - V_G) / V_R$ %

Example: The room is 6 x 8 x 2.5 metres (120 m^3). A 25 litre dewar of liquid nitrogen has just been filled. If the entire dewar is spilled the oxygen concentration is reduced to

$$21 \times \left(120 - \frac{1.1 \times 25 \times 694}{1000}\right)/120 = 17.6\%$$

The atmosphere is potentially dangerous.

1.10 Ventilation

The type of ventilation depends on a multitude of factors such as type of location, gas type, possible leaks etc.

Ventilation can be natural or forced. The design criterion is the number of air changes per hour.

In locations above ground level with no special ventilation openings natural ventilation will provide typically 1 change per hour. This is not the case in buildings with windows that are tightly sealed. For underground rooms with small windows 0.4 changes per hour can be considered as an average value.

Natural ventilation is generally sufficient for handling (storing, filling, transfer etc) transportable cryogenic vessels above ground level, provided that the room is large enough or that any outdoor area is not enclosed by walls.

An indoor area should have ventilation openings with a total area of 1% of the ground area. The openings should be positioned diagonally across the room. The density of the gas should also be taken into consideration; the main opening at the highest point for gases lighter than air (eg helium) and at ground level for gases heavier than air (eg cold nitrogen).

To achieve more than 2 air changes per hour a forced ventilation system is necessary. Different regulations may recommend or require for different situations a specific number of air changes per hour.

In typical situations the gas concentration in a room can be calculated using

$$C_t = \frac{L \cdot f}{V \cdot N}(1 - e^{-Nt})$$

where C_t is the fractional gas concentration after t hours

L is the liquid boiloff rate l/hr

f is the gas factor (gas:liquid ratio)

V is the room volume m^3

N is the number of air changes per hour

t is the time in hours

After long periods (large t) the expression simplifies to

$$C_t = \frac{L \cdot f}{V \cdot N}$$

Example: the boiloff rate from the dewar in 1•9 is 0.25 litres/hour and the number of gas changes per hour is taken as 0.4.

$$C_t = \frac{2 \times 694 \times 0.25 / 1000}{140 \times 0.4} = 0.006$$

This calculation includes a safety factor 2 and shows that the average oxygen concentration could be reduced by 0.6%. As the local reduction may be much higher then forced ventilation is recommended.

2 Magnetic fields

The influence of a magnet extends in all directions and is invisible. The influence may be summarised with a stray field map showing appropriate field contours. The low field contours (eg 1 and 5 gauss) for a large magnet may be several metres from the field centre.

2.1 Static steel

The presence of steel within the 30 gauss contour can cause

- Excessive force on the cryostat components, leading to poor cryogenic performance
- Perturbations to the magnetic field leading to poor homogeneity

Typical items that cause problems are steel beams and pillars and reinforcing for concrete, particularly when these are distributed non-symmetrically. It is also possible that steel in the building will become magnetised and cause areas of increased field at some distance from the system. This may affect items such as VDUs in adjacent rooms.

2.2 Moving steel

As well as the problems described above, moving steel can affect experimental results. For this reason vehicles and elevators should be outside the 1 gauss contour and large steel equipment such as gas bottles or pallet trucks kept outside the 10 gauss contour. Movement should be controlled even at this distance.

2.3 AC Mains fields

Large electric motors and transformers can corrupt experimental data and it is advised to keep them outside the 5 gauss contour.

2.4 Other magnets

Other magnets can give the same problems as static steel. It is advisable that the 5 gauss contour of one magnet does not cross the centre of another. Even at this distance energising or de-energising either system can affect the other. Therefore magnets that are frequently swept from one field to another are best kept outside the 1 gauss contour.

2.5 Sensitive equipment

The following Table gives guidelines for safe location of some sensitive equipment.

Safe working field	
1 gauss	Image intensifiers Electron microscopes Accurate measuring scales X-ray machines Graphics terminals Nuclear cameras
5 gauss	Pacemakers Public access without warning signs Cathode ray tubes
10 gauss	Computers Watches and clocks Credit cards
20 gauss	Magnetic storage media
50 gauss	Magnet power supply Shim coil power supply