SEP

Specialised Engineering Products

MANUFACTURING IN RUBBER

INTRODUCTION

Specialised Engineering Products Limited was established in 1976 and is a quality assured company to industry approved standards.

The company is recognised throughout most industries as being a supplier of high quality sealing devices for the majority of fluid sealing applications. As such, our development in rubber technology has remained progressive, with rubber lending itself so readily to so many sealing duties.

Our foundations are firmly established as a service company, where our ability to respond quickly, through close technical co-operation, to quotation and despatch, has built SEP an enviable reputation. Our vision and ongoing philosophy is to maintain these high levels of service as a significant manufacturing company and develop these far beyond those of just the fluid sealing sector. It is our ultimate intention to offer the widest range of quality, competitively priced products manufactured in rubber.

Our commitment to continuous improvement has taught us, if there is one outstanding lesson, it is that the earlier a designer involves the rubber engineer, the greater the benefits in terms of cost, design effectiveness and ease of production.

This brochure has been designed to give designers and end users of rubber products easy-to-use technical information, the result of which will assist successful working partnerships in producing high quality, cost effective, trouble free components.

SEP continues to meet the growing demands of modern industry, setting our standards for the future even higher than those of today. As such, the products we manufacture and supply offer only the very best quality and reliability, minimising equipment down time and increasing safety.

ANDREW SMITH
Managing Director

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BENEFITS OF RUBBER

Rubber has found itself used in many industrial applications because it provides and maintains elastic properties across a wide range of temperatures. Engineers and designers choose rubber because of its wide range of properties, available in such a varied source of manufacturing processes, including sheeting, die or machine cut shapes/gaskets, moulded components, and extruded lengths – which can be joined to form endless rings or shapes.

Some of the properties include:

- Temperatures ranging from -60°C to +300°C
- Wide range of colours
- Wide range of hardness
- Resistance to extremes of weather and outdoor environments indefinitely
- Electrically insulating, conductive or anti-static
- Resistance to fuels, oils and chemicals while retaining its properties
- Flame retardent and self extinguishing types
- Maintain tension and compression forces as in seals – even in hostile environments
- Accommodates movement, shock, thermal changes, tolerance and rough surfaces
- Absorbs vibration, noise and can insulate
- Gas and fluid seal capability
- With a low thermal conductivity it can reduce heat transfer
- With conductive fillers it can aid heat transfer
- It has friction properties and is comfortable to grip

- The surface can be smooth and clean to assist hygienic applications
- It can be used in direct contact with foodstuffs when processed appropriately
- It can be bonded effectively to metals, plastics, engineering materials and other substrates
- It can be inflated and pressurised

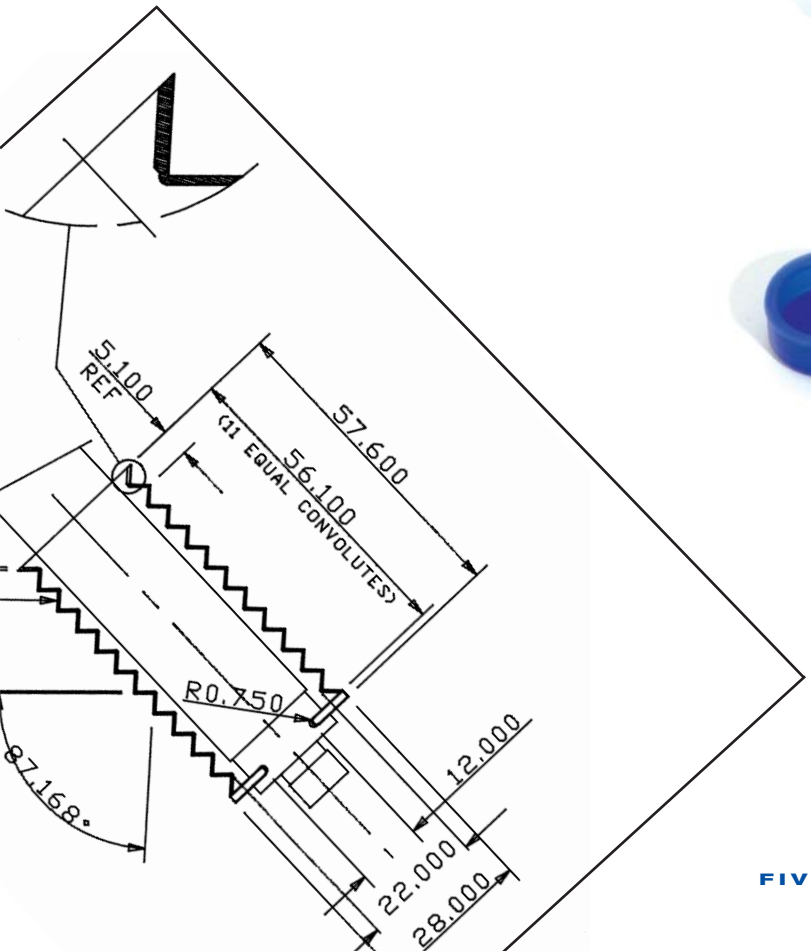
Whilst no single material has all the desired properties, indeed some properties may only exist in one type of rubber, by understanding the application involved, the desired properties can often be achieved with careful selection and suitable compounding.

SELECTION AND COSTING OF RUBBER

Whether the requirement is for a new part, or replacements for existing parts that do not meet your expectation in quality, cost, performance or availability, the same set of general rules apply. Good communication is vital if parts are to be supplied to customer satisfaction at the right price. An existing sample or basic drawing is a good start, but questions answered now will prevent surprises and difficulties later.

We strongly recommend that a specification is produced to consider and record the following points:

- Is it a new part or potential replacement of existing part?
- What is the expected usage – either batch or annually?
- Are there price constraints on parts or tooling?
- How is the component to be used?
- Will there be movement, vibration or compression?
- What is the highest service temperature?
- What is the continuous service temperature?
- What is the lowest temperature the part must remain operable?
- What products (including cleaning agents) will be encountered?
- Is product contact continuous or intermittent?
- Is long term weather or ozone resistance important?
- Is there a specific surface finish required?
- What colour?
- What are the tolerances?
- If the component is moulded, what amount and position of flash is allowable?



As mentioned earlier, no one rubber type may have all the required properties. However by understanding the requirements through efficient communication, a cost effective material and manufacturing process will evolve.

RUBBER DIRECTORY

Natural Rubber

Isoprene

The original natural material which has been in commercial use since the turn of the last century. A widely developed rubber with a large range of low cost compounds.

PROPERTIES:

- High resilience
- Wide range of hardnesses
- Good compression set
- Very strong - tear & abrasion resistant

LIMITATIONS:

- Lack of resistance to oil and organic fluids
- Poor resistance to ozone, weather & oxidation – tendency to perish in open air
- Low working maximum temperature

TYPICAL APPLICATIONS:

- Duties requiring good tensile strength & wear resistance
- Shock absorption
- Dynamic components working inside equipment that are protected from constant air changes

SBR

Styrene Butadiene Rubber

One of the cheaper synthetic rubbers which is easy to process in large quantities.

PROPERTIES:

- Good physical strength
- Good tear & abrasion resistance

LIMITATIONS:

- Poor resistance to oils or fuels

TYPICAL APPLICATIONS:

- Widely used in the Footwear (shoe sales) and Tyre industries

EPDM

Ethylene Propylene Diene Monomer

Another low cost synthetic rubber, originally developed in the 1950s for use within the tyre manufacturing industry. It became more widely used because of its outstanding resistance to ozone, weathering and water.

PROPERTIES:

- Excellent water resistance, even at elevated temperatures
- Good stability over long periods of time
- Resistant to many water based chemicals
- Excellent weathering resistance

LIMITATIONS:

- Will not resist oil or oil based products

TYPICAL APPLICATIONS:

- Potable water duties (WRC approved)
- 'O' Rings, Seals & Gaskets
- General engineering not exposed to oil

Neoprene

Chloroprene

One of the first synthetic rubbers developed in the search for oil resistant compounds. Extensively used due to its wide range of useful properties and comparatively low price.

PROPERTIES:

- Resistant to oils & chemicals
- Flame retardant (self extinguishing)
- Water & weather resistant

LIMITATIONS:

- Not suitable for contact with fuels
- Tendency to tear once initially damaged

TYPICAL APPLICATIONS:

- Most general engineering & mechanical applications, other than those in contact with fuel

Hypalon

Chlorosulphonated Polyethylene

Another rubber developed around the 1950s. A combination of similarities between both EPDM & Neoprene, with some improved characteristics.

PROPERTIES:

- Resistant to oils and chemicals, especially at elevated temperatures
- Outstanding ozone & weathering resistance - stable over long periods of time
- Water resistant

LIMITATIONS:

- Not suitable for contact with fuels
- Not particularly resilient

TYPICAL APPLICATIONS:

- Heavy weather conditions
- Where there is exposure to hot liquids

RUBBER DIRECTORY

Nitrile

Acrylonitrilebutadiene

A good quality oil resistant rubber with reasonable performance in contact with fuels. There are rubbers with higher degrees of resistance, but these are much more expensive.

PROPERTIES:

- Good resistance to Petroleum based fluids - even at elevated temperatures
- Very low level of permeability to gases

LIMITATIONS:

- Flammable and burns with toxic fumes
- Comparatively low resistance to ozone and weathering
- Poor electrical strength

TYPICAL APPLICATIONS:

- Seals, Gaskets, 'O' Rings etc., in contact with petroleum based fluids
- Sealing against gases

Therban

HNBR

Hydrogenated Nitrile generally bridges the gap in relation to performance and cost between Nitrile and Viton.

PROPERTIES:

- Good physical strength with very good tear and abrasion resistance
- Good dynamic behaviour with flex cracking resistance
- Outstanding resistance to steam and hot water
- Resists ozone and weathering
- Maintains many of its properties at elevated temperatures

LIMITATIONS:

- Like Nitrile it has poor electrical and flame resistance

TYPICAL APPLICATIONS:

- Seals in vehicle engines
- Diaphragms requiring good heat ageing properties and resistance to oils and chemicals

Silicone

Polysiloxane

This rubber is generally characterised by its clean, smooth appearance with good flexibility. It has an excellent range of working temperatures and outstanding resistance to weathering.

PROPERTIES:

- Wide temperature range
- Outstanding resistance to ozone & weathering
- Good resistance to oils
- Excellent electrical strength
- Low level of toxicity

LIMITATIONS:

- Not particularly strong, however careful compounding can improve this
- Not suitable for contact with fuels
- Expensive compared to most other rubbers

TYPICAL APPLICATIONS:

- Situations involving extremes of high & low temperatures - Aerospace
- Electrical applications
- Contact with food stuffs (FDA)

Viton

Fluorocarbon

Suited to the petrochemical industry, this synthetic rubber offers the best all round resistance to hostile chemicals and oils particularly at elevated temperatures.

PROPERTIES:

- Good resistance to petroleum based fluids
- Excellent chemical resistance
- Strong with good tear and abrasion resistance
- Excellent upper temperature capabilities
- Good resistance to water
- Outstanding oxidation, ozone and weather resistance

LIMITATIONS:

- Limited use at lower temperatures
- Very expensive compared to nearly all other rubbers

TYPICAL APPLICATIONS:

- Fluid sealing duties at elevated temperatures in contact with aggresive chemicals and petroleum products

Fluorosilicone

Fluorinated Polysiloxane

Best suited where conditions of low temperature are present especially in contact with hostile chemicals, oil and fuel.

PROPERTIES:

- Outstanding ozone and weather resistance
- Resistant to fuels at lower temperatures
- Excellent electrical strength
- Very wide temperature range from -60 to 200 centigrade

LIMITATIONS:

- Not particularly strong with relatively poor tear and abrasion resistance
- Extremely expensive

TYPICAL APPLICATIONS:

- Normally special applications where performance in extremes of temperature are required – Aerospace, petrochemical

DATA CHART

COMMON NAME	NATURAL	SBR	EPDM	BUTYL	NEOPRENE
CHEMICAL NAME	Isoprene	Styrene Butadiene Copolymer	Terpolymer of Ethelene Propylene & a Diene	Isobutene -Isoprene	Chloroprene
ABBREVIATION	NR	SBR	EPDM	IIR	CR
COST FACTOR	1	1	1	2	2
HARDNESS RANGE	30-95°	40-95°	20-85°	30-85°	30-90°
COLOURS	Full Range	Full Range	Full Range	Limited Range	Limited Range
HEAT RESISTANCE					
maximum continuous	75°C	85°C	130°C	130°C	95°C
maximum intermittent	105°C	115°C	150°C	150°C	125°C
LOW TEMPERATURE RESISTANCE	-40°C	-40°C	-40°C	-40°C	-40°C
RESISTANCE					
oxidation	Fair	Fair	Excellent	Excellent	Very Good
ozone & weather	Poor	Poor	Outstanding	Outstanding	Very Good
PHYSICAL STRENGTH	Excellent	Good	Good	Good	Good
COMPRESSION SET	Good	Good	Good	Good	Fair to Good
TEAR RESISTANCE	Very Good	Fair	Good	Good	Good
ABRASION RESISTANCE	Excellent	V. Good/Excellent	Good	Good	Good
ADHESIVE PROPERTIES	Good	Good	Fair	Fair	Good
RESILIENCE					
hot	Excellent	Good	Very Good	Fair	Very Good
cold	Excellent	Good	Very Good	Good	Very Good
PERMEABILITY TO GASES	Fair	Fairly Low	Fairly Low	Excellent	Low
DIELECTRIC STRENGTH	Excellent	Excellent	Excellent	Excellent	Good
FLAME RESISTANCE	Poor	Poor	Poor	Poor	Self-extinguishing
WATER RESISTANCE (ABSORBTION)	Very Good	Good	Excellent	Excellent	Fair
CHEMICAL RESISTANCE					
acids	Fair	Fair	Good	Good	Good
bases	Good	Good	Good	Good	Fair
SOLVENT RESISTANCE (20°C)					
alcohol	Good	Good	Good	Good	Good
acetone	Fair	Fair	Good	Good	Fair
benzene	Unsatisfactory	Unsatisfactory	Unsatisfactory	Unsatisfactory	Unsatisfactory
FUEL RESISTANCE					
*ASTM FUEL B @ 40°C	Unsatisfactory	Unsatisfactory	Unsatisfactory	Unsatisfactory	Poor
OIL RESISTANCE					
*ASTM OIL NO.1 @ 20°C	Poor	Poor	Poor	Poor	Excellent
@ 100°C	Unsatisfactory	Unsatisfactory	Unsatisfactory	Unsatisfactory	Good
*ASTM OIL NO.3 @ 20°C	Unsatisfactory	Unsatisfactory	Unsatisfactory	Unsatisfactory	Good
@ 100°C	Unsatisfactory	Unsatisfactory	Unsatisfactory	Unsatisfactory	Fair

The data provided within this literature is intended as a general guide to a material's general properties and behaviour. They should be read in conjunction with the appropriate standards and legislation relating to the properties and safe application of rubber. Customers must assure themselves that the parts supplied are safe in use and have been tested under actual service conditions.

DATA CHART

HYPALON*	NITRILE	SILICONE	THERBAN†	VITON*	FLUOROSILICONE
Chlorosulphonated Polyethylene	Acrylonitrile Butadiene Copolymer	Polysiloxane	Hydrogenated Acrylonitrile-Butadiene Rubber	Fluorinated Hydrocarbon	Fluorinated Polysiloxane
CSM	NBR	Si	HNBR	FPM	FSi
3	2	6	8	15	40
45-85°	40-100°	20-80°	50-95°	50-95°	40-80°
Limited Range	Limited Range	Full Range	Full Range	Limited Range	Limited Range
130°C 160°C	100°C 130°C	205°C 300°C	140°C 165°C	205°C 260°C	180°C 200°C
-25°C	-20°C	-60°C (special grades -80°C)	-20°C	-20°C	-60°C
Excellent Outstanding	Good Fair	Excellent Outstanding	Excellent Very Good	Outstanding Outstanding	Excellent Outstanding
Good	Good	Poor	Good	Good	Poor
Fair	Good	Good	Good	Good	Good
Good	Good	Poor	Very Good	Good	Poor
Fair	Good	Poor	Very Good	Good	Poor
Fair	Good	Fair to Good	Good	Good	Poor
Fair Fair	Good Good	Good Good	Fair Fair	Fair Fair	Fair Fair
Low	Low	Fairly Low	Good	Very Low	Fairly Low
Good	Poor	Good	Poor	Good	Excellent
Self-extinguishing	Poor	Good	Poor	Self-extinguishing	Self-extinguishing
Very Good	Good	Good	Very Good	Good	Good
Very Good Good	Good Fair	Fair Fair	Good Good	Excellent Fair	Good Fair
Good Fair Unsatisfactory	Good Unsatisfactory Unsatisfactory	Good Fair Unsatisfactory	Excellent Good Fair	Good Unsuitable Good	Good Unsuitable Good
Poor	Fair	Unsuitable	Good	Excellent	Fair (good at low temperatures)
Excellent Good Excellent Fair	Excellent Good Excellent Good	Excellent Good Good Fair	Excellent Excellent Excellent Excellent	Excellent 150°C Excellent Excellent 150°C Excellent	Excellent 150°C Excellent Excellent 150°C Excellent

*Du Pont Registered Trade Mark †Bayer Registered Trade Mark

PRECISION RUBBER MOULDING

As detailed earlier in the brochure an enquiry for rubber mouldings can be raised for many reasons. Our wealth of experience, manufacturing for all industries, will assist in either new design or replacement of existing parts that do not meet your expectation in quality, cost or performance.

The scope of mouldings we are able to offer has developed largely on our customers requirements. The products we supply vary in size, material, quantity and tolerance, resulting in the development of our considerable flexibility.

Our comprehensive range of moulding presses are built to our own modular specification, offering full interchangeable tool loading to any press, thus giving SEP unparalleled ability in responding to urgent requirements. Suited to small batch work as well as high volume production, the same presses give our customers the impression they expect – cleanliness, innovation and quality.

Typical products

- Specification moulded sheets
- All types of seals
- Special application gaskets
- Diaphragms (plain, fabric reinforced, PTFE backed)
- Bellows
- Bottle fillers
- Bushes/Coupling Rubbers
- Rubber vulcanise bonding to PTFE/PFA
- Rubber vulcanise bonding to metal
- Covering and Recovering of Rollers

Industries

- Commercial engineering
- Marine
- Food processing and pharmaceutical (FDA compliant work)
- Petrochemical
- Aerospace

References and approved status available on request

PRECISION RUBBER MOULDING

Enquiries can be raised from the customers specification, drawings, samples (new or old), or merely a bright idea in the back of a designer's mind. Once a mutual understanding of the part exists (reference to our Selection and Costing of Rubber will be useful – see page 5), development prototypes through to full production manufacturing can proceed.

Our in-house design office and toolroom is capable of creating precision mould tools as well as quick turnaround temporary tools for one off small quantity batches. Full 2D and 3D capability being available to produce single cavity compression tools, through to multi-cavity injection moulds.

TOLERANCES

Hardness is measured in degrees, Shore A or IRHD (International Rubber Hardness Degrees) and is based on a defined indentation into the rubber under a set load. User variation can be as great as +/-2.5° and +/-1.5° respectively, and differences between the two types of readings can be significant. The general acceptable tolerance of rubber hardness is +/-5°, with improved capability of +/-2° on harder rubbers if requested.

Dimensional tolerances in rubber are generally less critical as the material deforms readily and accommodates variations. Tighter limits can be achieved with careful tool design and rigorous procedural control, but restricted production rates often have a commercial cost.

Unless specified ISO 3302 generally applies.

Tolerances for moulded products
to ISO 3302 1995 (BS 3734)
Table classes M1 (Precision) and M2 (Commercial)
Values in mm
F = Fixed dimensions C = Closure dimensions

Nominal Dimension		Class M1		Class M2	
Above	Up to	+/- F	+/- C	+/- F	+/- C
0.00	2.50	0.08	0.08	0.10	0.15
2.50	4.00	0.08	0.10	0.10	0.15
4.00	6.30	0.10	0.10	0.15	0.20
6.30	10.00	0.10	0.15	0.20	0.25
10.00	16.00	0.15	0.20	0.25	0.30
16.00	25.00	0.20	0.25	0.25	0.35
25.00	40.00	0.20	0.25	0.35	0.45
40.00	63.00	0.25	0.35	0.40	0.50
63.00	100.00	0.35	0.40	0.50	0.65
100.00	160.00	0.40	0.50	0.70	0.90

EXTRUSION, HOT VULCANISING AND FABRICATION

Particular attention to detail plays a vital role in the manufacture of extruded sections and profiles, with various applications demanding different tolerance control. SEP takes a keen interest in the intended use of products to ensure that they are always suitable in terms of dimensional stability, hardness, colour matching where required, and that the most reliable rubber is used.

An almost infinite range of sections can be produced in most grades of rubber i.e. food grades (FDA), high and low temperature capabilities and compounds resistant to known medium.

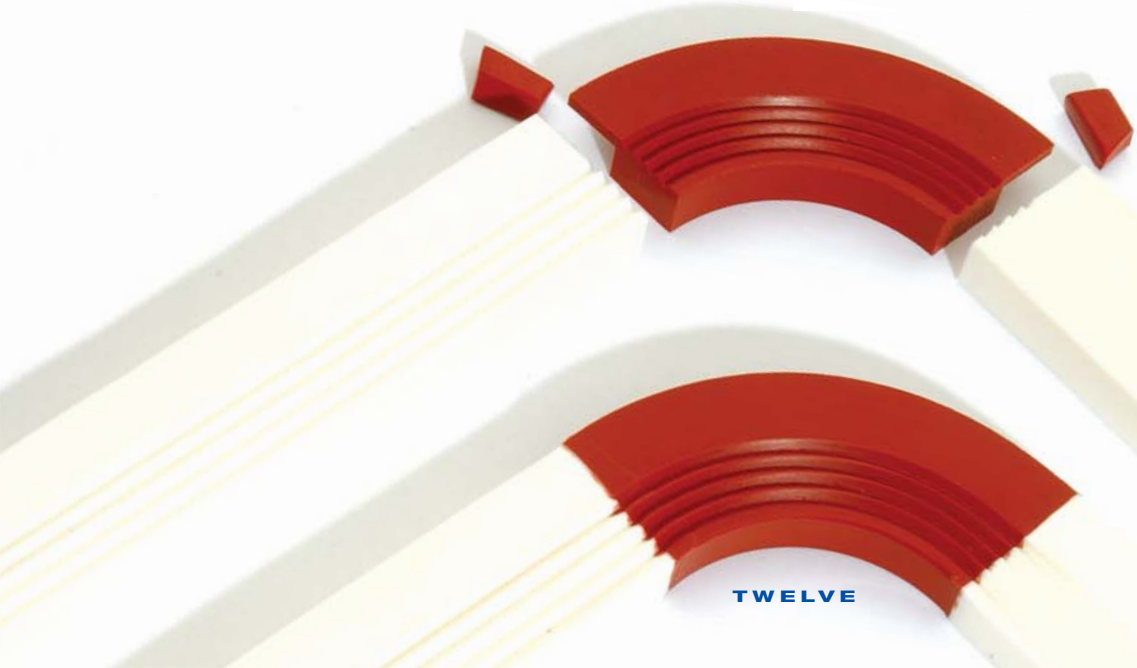
Whilst most rubbers can be joined using a comprehensive range of modern adhesives, the most successful method of joining two pieces of cured rubber together permanently is by hot vulcanising. This process can offer virtual equivalence in strength, flexibility and resistance to product or atmospheric attack and maintain the clean lines of an endless moulded product.

This process is normally utilised for manufacturing products that are impractical to mould in one piece, offering significant savings in tool charges with quicker deliveries.

Virtually any shape, hardness or rubber type can be joined.

Typical products

- Large section or diameter 'O' Rings
- Hollow section seals (tube, etc.)
- Large segmented gaskets (exceeding available sheet sizes)
- Large segmented gaskets with profiled section
- Sleeves and ducting
- All profiled extrusion
- Inflatable seals (up to 12 bar rated) *see pages 14/15*



Hot Vulcanised 'Extrusion' to 'Corner Mouldings', producing 1867mm x 1257mm steriliser door seals

RUBBER GASKETS AND SHEETING

SEP process and/or supply full or part rolls of sheeting, from a comprehensive stock in both commercial and specification grade elastomers.

The list below being the most frequently requested.

Natural

White food quality Natural

Natural insertion

Neoprene

EPDM (WRC approved)

Nitrile

White food quality Nitrile

Silicone (FDA)

Fluoroelastomer (Viton®)

Gaskets, strip or virtually any die-cut shape can be produced utilising the same stock from a variety of cutting and fabrication processes.

Cream DTD 5531 grade Silicone 0.5mm thick. Ultrasonically cleaned for oxygen service within the Aerospace Industry

Special application requests show our ultimate flexibility. Where a requirement exists for a specification grade of rubber, thickness, hardness and colour, we have the ability to mould the material in an economic sheet size and cut the gasket within the same factory – sometimes on the same day.

Similar operations exist where gaskets are cut from moulded rings to reduce waste and cost associated with the more expensive sheet materials.

Viton Gaskets 596mm od x 572mm id x 4mm thick

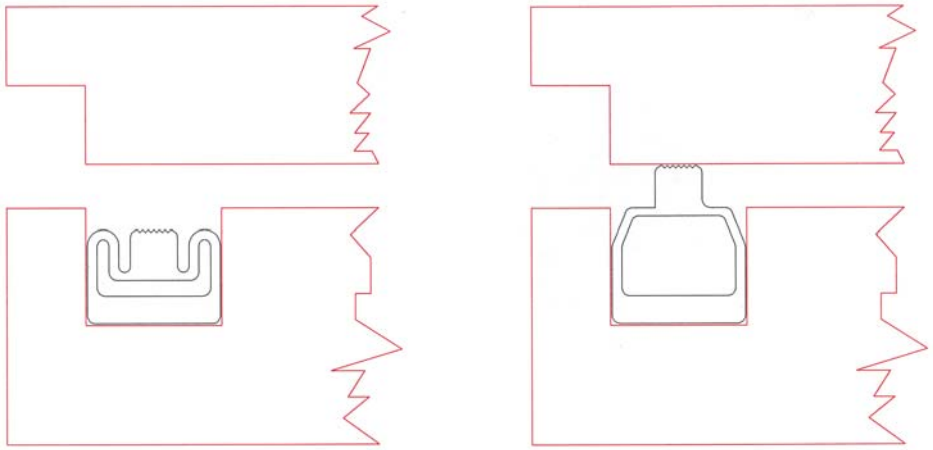
INFLATABLE RUBBER SEALS

The inflatable seals manufactured by SEP are designed to provide a clean, time saving solution to hermetic sealing against, powders, granules, gases, liquids and dust.

These seals are most useful to seal fabricated pieces of equipment where:

- the sealing gap may vary
- fast efficient assembly and disassembly is required
- hygienic procedures exist (FDA applications)

Generally working from within a given groove size the seals can operate axially, radially inward or radially outward.



All seals are supplied with a suitable inflation connector, selected to accommodate any restrictions associated with the equipment or customer preference.

Most requirements are for the FDA approved Silicone Rubber in either white or red iron oxide colours. Other rubbers and colours are available. Using pre-extruded profiles held in stock, SEP utilise a high pressure 'Shot Moulding technique, which injects an identical compound at the join forming a high strength bond, with a clean smooth line finish. No additives or adhesives form part of the bond. This process provides the seal with an ability to work under higher pressures than most if not all other similar type seals in the market.

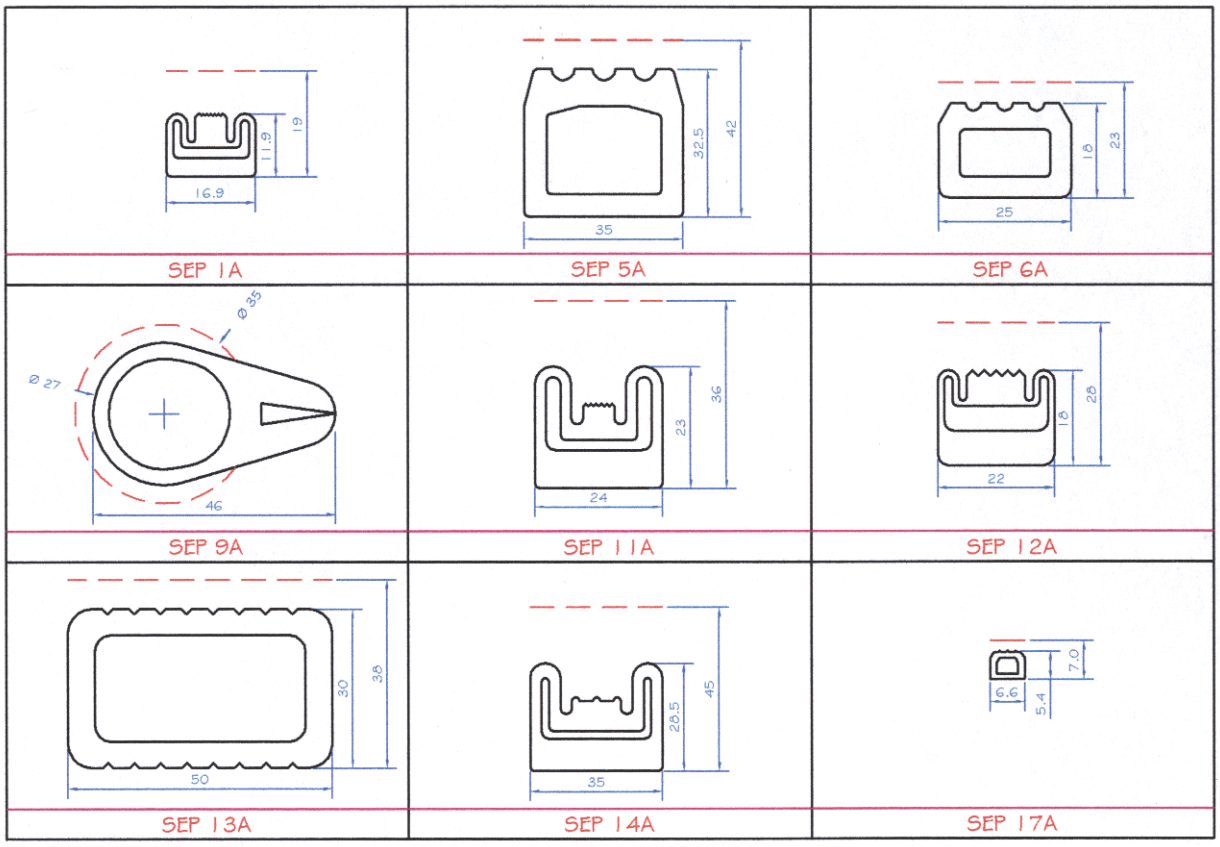
The same 'Shot Moulding' technique is used to bond most types of inflation connectors to the seals. This procedure bonds the connector to the parent seal during the vulcanisation of the injected compound, the strength of which far exceeds any mechanical fixing or adhesive bond, associated with this type of seal.

INFLATABLE RUBBER SEALS

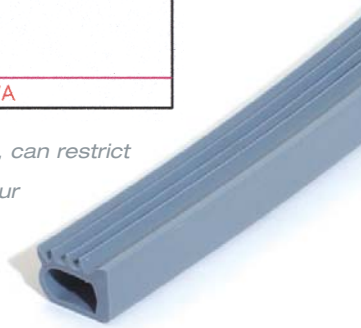
All seals manufactured by SEP are independently pressure tested and supplied with a supporting 'Test Certificate'. These tests on free standing, unsupported seals vary from 1 bar to 4 bar pressure, dependent on the profile type and/or customer specification.

With the aid of purpose designed test rigs, which enclose the seal, our production techniques are tested (and supported with proven case history) on some profiles to perform at up to 12 bar pressure.

The profiles shown are the most frequent extrusions utilised by SEP in the manufacture of FDA approved silicone rubber inflatable seals. Other profiles are available and others can be manufactured to virtually any customer design or requirement.



The inflated dimensions shown are guides only, as unsupported surface area (closure dimension), can restrict working pressures on some seal profiles. Customers should verify specific profile suitability with our technical sales department.



Seal Description

Example: 1150 / SEP1A / 3 / a / 1234 / R

Developed length (mm); Type of extrusion profile;

Seal face orientation (1 = radially outwards, 2 = radially inwards, 3 = axially up or down);

Inflation connector orientation (a = opposite seal face, b = side wall adjacent to seal face);

Valve connector type and parts; Colour (R = red, W = white).

COMPANY INFORMATION

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