A Guide to Rubber Extrusions

White Paper

May 2015

Content

Executive Summary

J-Flex has created a white paper “A Guide to Rubber Extrusions” to provide those within the engineering and manufacturing industries a clear insight into the extrusion process and applications.

Whatever your engineering needs, J-Flex can help you design it, specify it and manufacture it for you. We can help from the initial concept of an extruded profile through to the manufacture of that profile.

Rubber Extrusions Defined

What is a Rubber Extrusion?

Extrusions can be manufactured in various materials from rubber, thermoplastic rubber and thermoplastics.

Extrusions are parts forced through a die of the required cross section under pressure of an extrusion machine or extruder. Profiles are manufactured in straight lengths or coils depending on size of profile and can be cut to length to suit customer requirements.

J-Flex is focused on the manufacture and supply of rubber extrusions, thermoplastic rubber extrusions (TPR) and thermoplastic extrusions.

Extruded Profiles – Materials

Extrusions can be manufactured in a wide range of materials or polymers. At J-Flex we are concerned with Natural and Synthetic Rubbers, Thermoplastic Rubber (TPR) and Thermoplastics (TP). The polymer selection is large and we can offer profiles in Natural/SBR, EPDM, Neoprene (Polychloroprene), Nitrile, Hydrogenated Nitrile (HNBR), Butyl, Silicone and Viton.

Which material or polymer is best for your application depends on the environment that the material is going to be subjected to. For example, UV, weathering, temperature extremes, solvent resistance, abrasion and resilience will affect the type of material that would be best for a particular application.

Extruded Profiles – Shapes and Sizes

Extrusions are manufactured in a multitude of cross sections from:

- **simple solid profiles** such as squares, rectangles, triangular and cord shapes
- **hollow sections** of the same profiles to give added compression for sealing applications such as D-sections, P-sections, U- Channels, square base channels, L- sections, H sections.

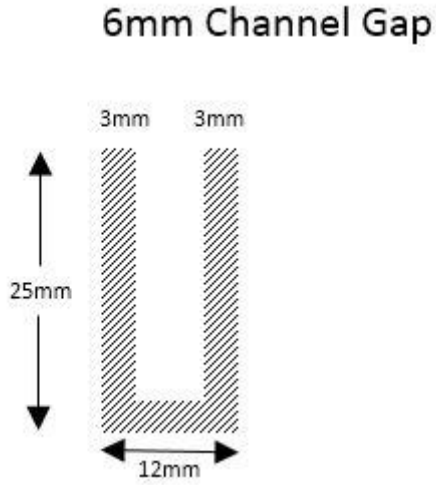
The size of profile is governed by the size of the extruder head and the size of the cross section of the profile.

Design Advice

When designing a profile look at the cross section and keep the wall thickness of the profile as equal as possible. For example a simple square base channel profile would break down into the following.

Leg 1 Height	Leg 1 Thickness	Leg 2 Height	Leg 2 Thickness	Base Width	Base Thickness
25mm	3mm	25mm	3mm	12mm	3mm

Polymers flow when heated and put under pressure and they behave with similar characteristics to a liquid such as water. The polymer will always flow to the largest cavity or cross section on the die thus starving thinner areas of the profile or cross section from material.

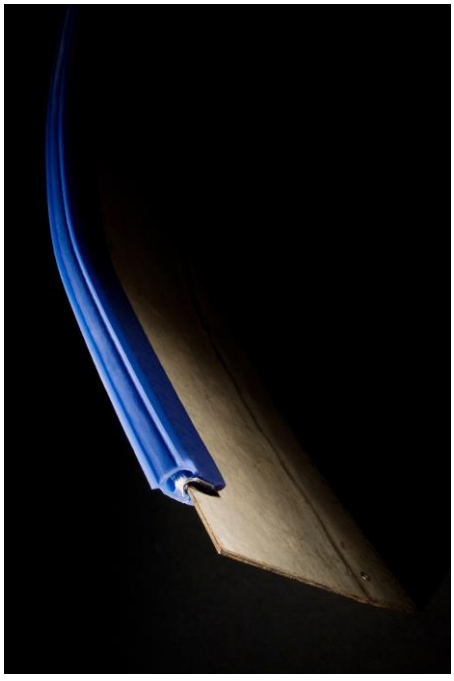


There are ways of getting around this. The toolmaker will apply bridge work to the back of the die to disrupt the flow of the polymer but in the first instance try and keep all areas of the profile with equal or as close to equal wall thickness.

Die plates for rubber extrusions are generally between 10 and 20mm thick mild steel and profiles are cut by CAD/CAM thus enabling tool modification to be recorded and accurate profile tolerances for initial sampling and then production following sample approval.

Thermoplastic extrusion dies can be far more intricate with breaker plates for supplying a steady source of plastic melt to the die. There are lead-in sections to direct flow of thermoplastic melt.

Extrusion Profiles – Applications and Industries



For over 30 years J-Flex has recognised that manufacturing and engineering industries will have requirements for extruded profiles to act as seals, edging trims, dunnage, bumpers or fenders.

As examples of industries where extrusions can be used:

- Food and Pharmaceutical Industries where components must comply with FDA, BfR, UK WRAS and EC Food Safety.

- Marine Industry applications include extrusions for use as watertight door and hatch seals, marina pontoon edge fenders, offshore wind turbine service vessels fenders, ship windscreen wiper blades.
- Mass Transit applications include for train door seals, train glazing seals, partition seals and gangway diaphragm seals. On ferries there is a need for the roll on roll off ferry door seals and hatch seals whilst aircraft applications include internal trim, pneumatic door seals and galley seals.

Extrusion Methods and Techniques

For extrusions manufactured from rubber compounds the process of extrusion is basically the same in that you have an extrusion machine or extruder. The profile die is located the head of the machine by means of a threaded locking ring. Initially the die plate is warmed with an external heat source to aid polymer flow in the early stages of setting up to run.

The extruder is switched on and pressures and temperature are monitored down the extruder barrel. The extruder head can have cooling water circulating to stop the rubber compound from curing in the head. The uncured rubber compound is generally supplied in wigwag form in a continuous length. Alternatively it can be supplied as hide and manually cut into strips to feed the extruder.

Feed is closely watched and the compound is drawn through feed rollers into a helical screw which masticates the compound, also heating it by friction, and pushes it to the head of the extruder. When the extruder head is full and back pressure has been created the polymer is forced through the die plate and the extrudate appears.

Now this is where the process can vary in the curing or the profile. When a rubber extrusion is produced the extrudate is un-cured i.e. it has not been vulcanised by heat treatment to create the cross linking of the polymer chains and thus create dimensional stability of the profile.

In the early days, and still in some cases, the extrusion is cured in a **pressurised steam environment** an autoclave. This method is generally used for larger sections such as D- section fenders for the marine industry. Another application of this method is used when you have to support the profile in cure to avoid it collapsing. This is done with a former and is called former curing.

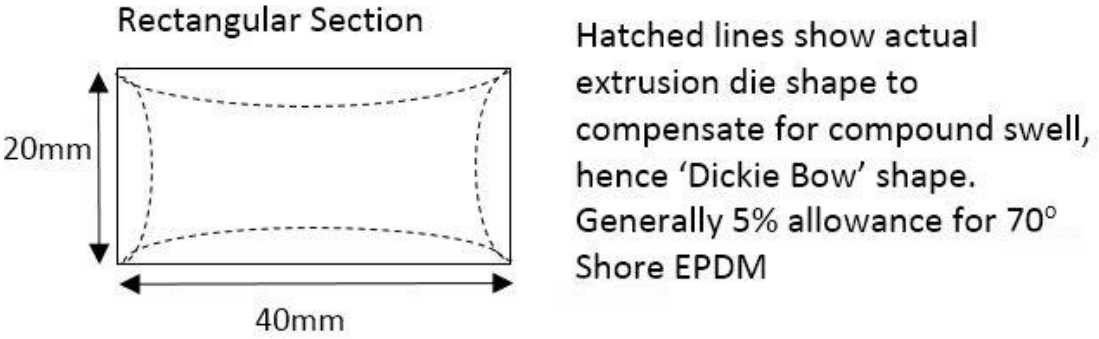
You are limited to the length of the profile by the length of the autoclave. Some profiles can be **coil cured** in an autoclave but this imparts a curved set to the profile.

Where smaller cross section profiles are required in quantity the **salt bath curing** system may be applicable. This method involves the extrusion passing through molten salt at 260°C – 550°C to cure the profile and then through a water tank to cool and remove any residual salt. Coil lengths of profile would be to customer requirements generally 25 – 50 metre coils.

Other methods of curing of profiles can be with microwave or hot air oven, especially for our silicone extrusions.

Die Manufacture

When a rubber compound is pushed through a die it swells and this has to be compensated for at the die manufacturing stage. Each rubber compound exhibits a different swell characteristic. Therefore if you were cutting a die to produce a solid rectangle you would take into account the percentage die swell characteristic of the compound to be run and build that into the die. The rectangle in effect on the die plate would look like a dickie-bow. The profile emerging from the die plate will swell and become a flat edged rectangular profile.



Dies for extruding thermoplastic profiles are generally cut oversize to that or the profile by around 10%. The profile is drawn down to size by the haul off.

This briefly describes the extrusion process and particularly with rubber compounds gets wrongly called a black art. It is all pretty straight forward and all we need from a customer is a sample of profile to reverse engineer, a fully dimensioned drawing or both.

So why not let the experts meet your next extrusion requirements?

About J-Flex

Established in 1984, and with over 30 years in the industry, J-Flex is an independent components manufacturer of rubber extrusions and mouldings, specialising in customer made items.

Nearly every extrusion or moulding project we look at for customers is a new project with new shapes, sizes and materials. However while each project is unique, the processes and expertise built up over 30 years means we can provide customers with the components they need for their individual requirements.

Our mission is to help our customers by providing the right extruded component, at the right time, in perfect condition.

We pride ourselves in good, old-fashioned customer service. Our customers are looking for product availability, reliability and a quick and efficient response to their requests. We deliver every time.

We are already helping over 1,500 customers and we export to over 40 countries.

We are accredited to BS: EN: ISO 9001: 2008 and are Registered Licensees under the DuPont Genuine Viton® Licensing Scheme. We also ensure where appropriate our products are tested and approved by the relevant authorities, and will provide relevant certifications on request.

J-Flex is also a member of the Gasket Cutter's Association (GCA), the European Seals & Gaskets Association (EUSGA) as well as a semi® Member.

If you are struggling to specify the right solution for your particular circumstances, please contact us and we'll do our very best to help you make the right decision.

Check out the download area of our website **www.j-flex.co.uk** for product information, data sheets and more.

J-Flex Extruded to Perfection

Why use J-Flex?

- 100 years Management experience in rubber production.
- ISO 9001 and Trade & Industry Approvals
- Wide range of well-maintained extrusion equipment
- Quick production & first off sampling
- Work from your CAD files
- Good material range – natural & synthetic polymers
- Acknowledged market leader in customer service
- Stringent inspection in accordance with industry A.Q.L. levels
- Full dimension & material conformity
- Delivery by agreement – never late
- Assembly/kitting to your specific requirements

Extruded Components From J-Flex

When it comes to extruded components preparation is important. As part of specifying the extrusion you require, it is important to think through the requirement you have and ideally to provide details as shown below:

- Drawings or full dimensions with tolerance.

- Environmental conditions.
  - Where is the extrusion going to be used?
  - Are there any temperature extremes both +°C and –°C?
  - Are there any chemicals or hydrocarbons which the extrusion comes into contact with?
  - Is the extrusion going to be in contact with any gases, is it a gas seal?
  - Weathering properties - Is it going to be exposed to UV, marine conditions or occasional outdoor conditions?
  - Is it in a food safe environment or potable water application?
  - Are there any stressing conditions that the extrusion will be exposed to, such as shear stress, compression or shock loading?

- Any special assembly conditions.

- Any other specialised requirements.

If you need help developing your specification, J-Flex is here to provide guidance. You can contact us directly on +44 1777 712 400 or email lance@j-flex.co.uk or michelle@j-flex.co.uk and we will be in touch.

About The Author

Richard Lewthwaite joined J-Flex in July 2014 as Regional Sales Manager for England and Wales.

With over 25 years' experience in the rubber manufacturing industry serving OEM and end users in the United Kingdom, Richard has a wealth of experience.

Richard certainly knows plenty about extrusions, which is why he was invited to write this white paper specifically.

J-FLEX RUBBER PRODUCTS
Engineering Rubber Components & Specialised Sheeting Products
Unit 1, London Road Business Park, Retford Notts, England DN22 6HG
tel: +44 (0) 1777 712400 fax: +44 (0) 1777 712409 www.j-flex.co.uk
email: lance@j-flex.co.uk or michelle@j-flex.co.uk

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