



Focus On...

Recycling


www.crclarke.com

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INTRODUCTION

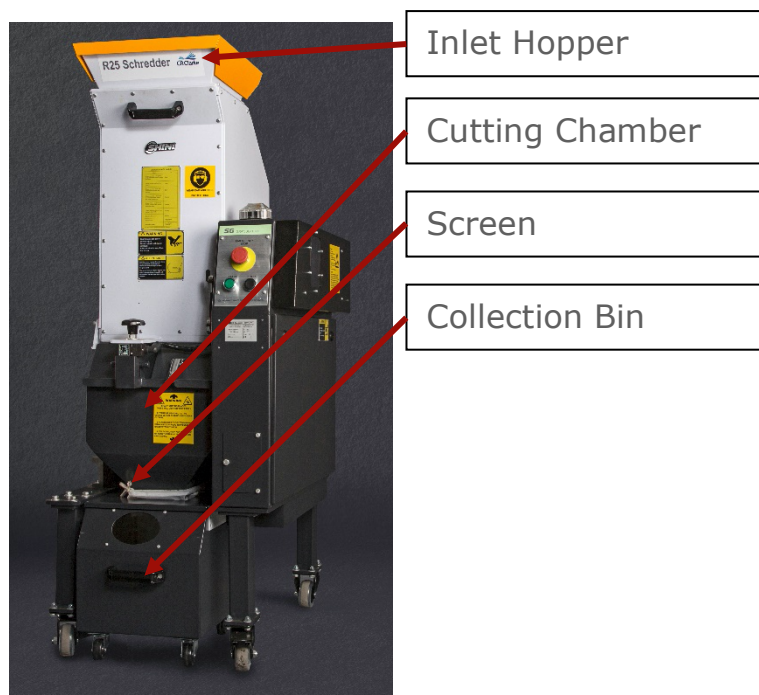
The issues surrounding plastics are well publicised. While most would agree that the creation of single-use or short-life plastic items should be reduced as much as possible, this is actually quite difficult to balance with the needs and expectations of modern living. Let's start with the basics, and look at the main types of thermoplastic materials in use today. These have been split into their recycling codes (a system implemented by the Society of the Plastics Industry in 1988 to help recyclers to identify the type of plastic an item is made from).

Identification Number	Material Type	Common Uses
	PET/PETE - Polyethylene terephthalate	Drink Bottles, Food Packaging
	HDPE – High Density Polyethylene	Bottles and other coloured or translucent liquid containers
	PVC – Poly Vinyl Chloride	Some cling films, a diminishing amount of packaging
	LDPE – Low Density Polyethylene	Carrier Bags
	Polypropylene	Ropes, chemical tanks, chair bases
	Polystyrene	In solid form : Packaging inserts, coloured displays In foamed form : protective packaging, insulation
	Others	Plastics not covered by other Groups
	ABS	Drainage pipes and fittings, automotive parts, toy building blocks

GRANULATING PLASTICS

Most plastics can be granulated, converting them from their original form into relatively uniform flakes. To make the most of a granulator, the materials should be sorted prior to granulating to ensure that the resultant material is as useful as possible. Materials should be sorted by recycling number, which may also involve removing caps from drink bottles, as these will invariably be made from a different type of plastic to the body of the bottle. Any labels should also be removed. If the material is wet or dirty it should be washed and dried.

For any reasonably sized granulator, items such as drink bottles can be loaded as a single piece. Larger items such as chair backs will normally need to be cut into sections to allow them to fit into the granulator inlet hopper, this can be done using a bandsaw or hand saw. Most granulators have a cutting chamber with a combination of static and rotating blades that crunch up the material. A perforated screen under the blades prevents the granulated material from falling out of the cutting chamber until it is smaller than the size of the holes in the screen. If the granules are too big to fall through the holes, the blades will pick them up and cut them again. Using this system the maximum size of granule can be set, however there is no minimum size, so depending upon the action of the granulator and the material characteristics the granulate could end up being somewhat finer than the screen.



C R Clarke R25 Granulator

CONSIDERATION OF COLOUR

Mixed colours can be processed together, this leads to a mottled effect in any processed parts. Should the finished colour be important, materials should be separated accordingly prior to granulating.

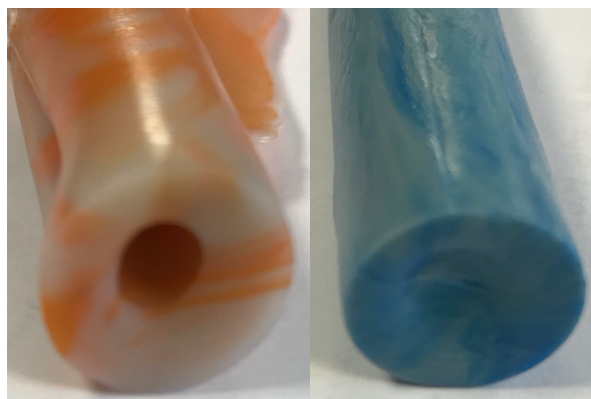
Please be aware that any granulator will have odd bits of material left in the cutting chamber. Therefore, if colour is crucial it should be cleaned before use.

STORAGE OF GRANULATED PLASTICS

It is quite common for material to be granulated in batches, and then used later on. Granulated materials should be stored in clearly labelled containers, both to keep them clean and for ease of identification.

MOISTURE IN MATERIALS

The majority of plastic materials will absorb atmospheric moisture. As processing temperatures are invariably above 100°C, this moisture will boil during moulding or forming. This can lead to blisters and imperfections in moulded parts. The two moulded cylinders in the pictures below are made from the same material in the same injection mould. The orange one was not dried. The moisture in the material boiled and then, as it condensed, pulled the weakest part of the moulding inwards, looking like a moulded hole. Once the blue material was dried, the same moulding was produced with just a little shrinkage as the material cooled down.











RE-CONSTITUTING GRANULATED PLASTICS

There are a number of solutions for re-constituting granulated materials into new, usable items. We will focus on:

- *Injection Moulding*
- *Compression Moulding of Flat Sheets*
- *Compression Moulding of Finished Items*

The following table describes how suitable each materials for these processes:

	Number	Injection Moulding	Compression Moulding
 PETE	1 - PET	X	X
 HDPE	2 – HPDE	<i>Easy</i>	<i>Easy</i>
 V	3 – PVC	X	X
 LDPE	4 – LDPE	<i>Easy</i>	<i>Easy</i>
 PP	PP	<i>Moderate</i>	<i>Easy</i>
 PS	PS	<i>Easy</i>	<i>Easy</i>
 OTHER	Others	<i>Maybe Possible</i>	<i>Maybe Possible</i>
 ABS	ABS	<i>Moderate</i>	<i>Easy</i>

WORKING WITH TYPE 7 MATERIALS

Type 7 materials cover a wide range. To aid identification, the manufacturer may add a description to the type 7 recycling logo. This could include acrylic (PMMA), PC, and sometimes also ABS (Type 9 plastic is not recognised in all countries).

Please note that there is not a global agreement on the use of recycling codes, for example China has a more comprehensive system to aid identification of materials. However the above list of codes should be a good starting point for most recycling projects.

Type 7 materials, including PC and acrylic (PMMA) can be successfully granulated. PC should not be processed using any heating devices that take it above its fabrication temperatures (160 – 180°C), as this could lead to the release of toxic fumes. Acrylic (PMMA) can be successfully pressed into new sheets of material. However this does require a high-pressure recycling press, such as our R60.

MARKING OF RECYCLED ITEMS

While there are no regulations stating that recycled plastics need to be marked, to create a truly circular manufacturing system it makes good sense to mark any items that are manufactured. There are a couple of options for marking:

Moulds can be etched, so that the material type is embossed in each moulding. The downside of this is that each mould can only be used for the marked material.

A set of aluminium recycling pennies can be purchased. These can either just be added to the mould before it is filled, or placed in a recess to leave a flatter finish. This allows moulds to be used for various materials.

Materials can be cold-stamped, embossing a mark into the surface.

INJECTION MOULDING

Industrial Injection Moulding machines tend to be large and complex, but allow high-volume production of identical parts. However, they would normally be run with tightly prescribed material types, to ensure that they maintain tolerance and product characteristics.

Moulds for this type of machine can be very expensive to produce, but can create very intricate objects.

For simpler items and lower volume production, a manual desktop injection moulding machine can prove the ideal solution. Some of the benefits include:

- *Low Initial Cost*
- *Tooling can be easily and cost-effectively made from aluminium*
- *A 3D printed insert can be made which, in conjunction with a standard aluminium backshell, can allow intricate parts to be easily produced*
- *Very easy to set up and operate, enabling low volumes to be produced cost-effectively*
- *Can be used with granulated, recycled materials*



C R Clarke 25 & 35 Injection Moulding Machines

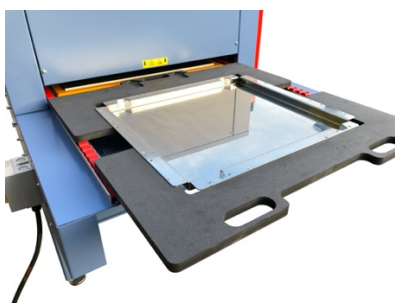
COMPRESSION MOULDING OF FLAT SHEETS

Flat sheets can be produced using a combination of heat and pressure. This normally takes the form of a pair of contact heating plates with a mechanical closing device (often a hydraulic cylinder or a screw-jack). Once the material has softened and flowed, it is cooled within the mould, making a rigid piece of material.

Once a piece of material has been produced, it can be fabricated in the same way as a virgin piece. This could include laser cutting, routing, bending and forming.



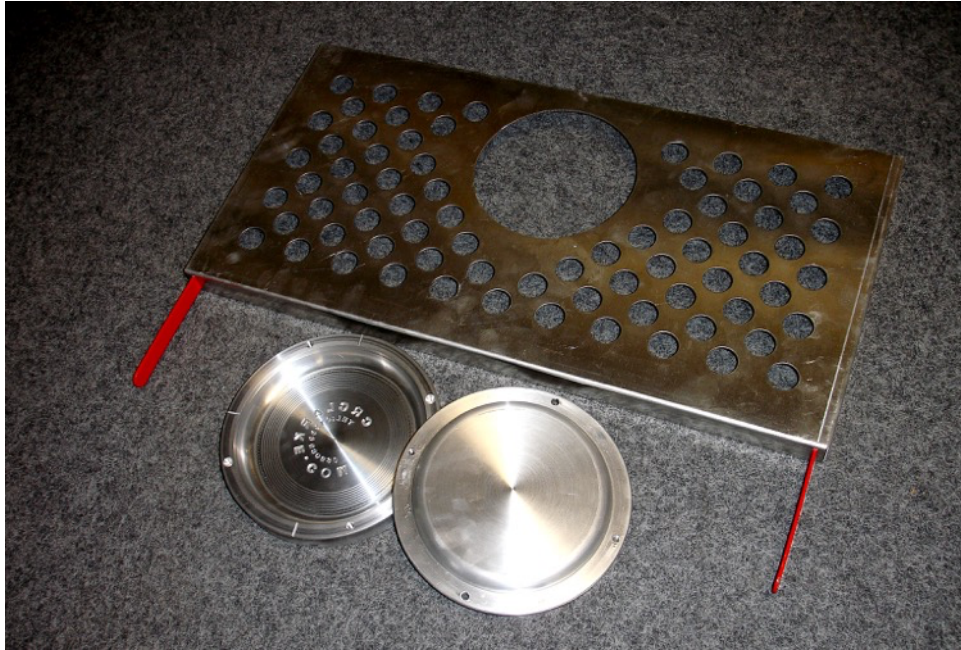
C R Clarke R30 Sheet Press



10mm Sheets produced on the C R Clarke R60 Sheet Press

COMPRESSION MOULDING OF FORMED PRODUCTS

The use of a suitably machined aluminium mould allows the creation of a finished item from the Sheet Press.



Mould for the manufacture of Frisbees, with optional engraved name & logo

OUTPUT CAPACITY

Parts/Hour	Parts per Hour	Parts per 8 Hour Day
Injection Moulding	60	480
Sheet Press, allowing the material to cool in the Press before releasing	0.25	2
Sheet Press, with Air Cooling System	1	8
Sheet Press, with additional Liquid Cooling Press	4	32

DESIGNER APPLICATIONS

Type 7 plastics can be recycled with a bit of thought, care and experimentation.

These materials can open up a number of possibilities for designer products, such as this stool that was designed and made by @HGowlett_DT using acrylic that was granulated in the C R Clarke R25 and pressed in the C R Clarke R30.



BENEFITS OF THE SCHRED RECYCLING SYSTEM

There are a number of benefits to the system, as follows:

- *It can create a circular material supply, especially for semi-consumable items such as Supermarket display. When a display is damaged or redesigned, it is returned, granulated and the material is used to make the replacements.*
- *It adds to the green credentials of both the producer and the customer*
- *It reduces material purchase costs*
- *Reused material can be supplemented by other sources, as an example your local garage probably throws away a huge number of screenwash containers each year, a strategically placed receptacle to collect these could provide a steady stream of usable material*
- *It is actually a genuine benefit to the environment*

C R CLARKE RECYCLING PRODUCT RANGE

R25 Granulator

The R25 is compact and very easy to use and produces high quality granulated material. The precision cutting blades ensure efficient production and one unit can produce enough granulated material to use with either of our Sheet Presses



R30 Sheet Press

Maximum Panel Size of 458 x 310mm x 25mm.
Maximum pressure 3 Tonnes
Not suitable for PMMA



R30W Cooling Press

Ideal for use with the R30, to cool materials more efficiently.

R60 Sheet Press

Maximum Panel Size of 600 x 600 x 40mm.
Maximum pressure 100 Tonnes
Roller Track system for ease of loading
Suitable for PMMA



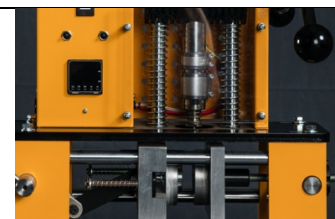
R60W Cooling Press

For use with the R60 Sheet Press
Maximum Pressure 100 Tonnes
Roller track system for ease of loading and unloading
Suitable for PMMA – reduces cooling time to less than 10 minutes for most parts



25 Injection Moulder

Simple to use, benchtop mounted injection moulder
Will operate with steel, aluminium or high-temperature 3D printed moulds
Temperature control and Ejector system



Should you wish to discuss how in-house recycling and remanufacturing could benefit you, please don't hesitate to contact us:

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