



## *Tips & Tricks*

Here at Precious Plastic Monash, we love to experiment!

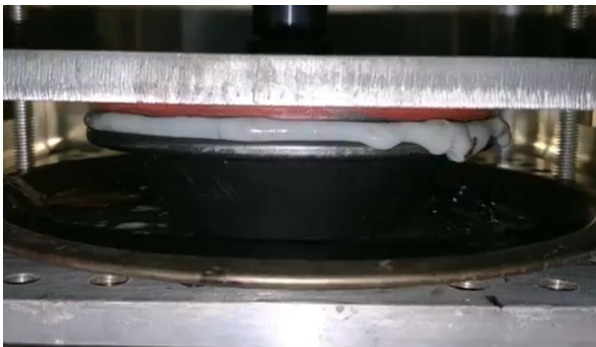
Whilst we have had a lot of success with our machines and products, we have also made our fair share of mistakes along the way. Here are some tips and tricks about using the machines in the integration unit and making plastic products.

But first... make sure you have read the Safe Work Instructions and Risk Assessments for each machine before operation.


We also recommend the User Safety Guide & Checklist becomes a part of the routine operation of the Integration Unit - it can be a handy checklist for inexperienced users.

# Machines & the Integration Unit

Tip/Trick	Description
Cleaning the shredder	It is essential to clean the shredder after each use. Especially if you are <u>changing plastic type</u> . Otherwise you'll have pellets of mixed plastic type, which are not recyclable. :(
Electrical Wiring	Ensure that where you source your power from is on 3 separate circuits, otherwise you could trip the mains power due to the unit using up to 40 amps at full power. If you are unsure how to do this, find someone qualified in the field.
Shredder input volume	The shredder can consistently shred for hours on end, however, if you load it too much at once, plastic can get stuck between the blades and the sieve, causing it to stall. Instead, keep adding plastic bit by bit.
Injector shot size	If you are injecting into a large mould and want the maximum shot size of the injector, fill the barrel, let it melt, then fill again as more room has been made in the barrel from the pellets melting into a solid shot.
Injector melt time	10-12 minutes has been found to be an ideal melt time for our barrel. This will change depending on your barrel material/thickness/band heater power/plastic type etc. Create your own spreadsheet and inject at various melt times to get your own settings for your machine :)
Solid plastic in Extruder barrel	Make sure that the band heaters are turned on and have completely melting the plastic in the barrel before turning the motor on. If turned on before the plastic is melted the motor will still try to turn and could possibly shear the compression screw.
Injector purging	It is hard to completely clean the injectors barrel after use unless you take the entire machine apart and clean the inside with a wire brush. Instead, before use, heat up the


	<p>injector and add some plastic to 'purge' what is left in the barrel. The plastic you add to purge should be the same material as the product you wish to make so that the entire product is homogenous. Additionally, before attaching the moulds, we found purging a small volume helped indicate that the shot is ready to inject. If the lever won't go down or nothing comes out, it may not have melted completely or could have a potential blockage.</p>
Plastic overflow in Compressor	<p>Our compression oven has a collection of jig holes to bolt your moulds into. These holes will be really tough to clean if any plastic falls into them. Either design your moulds or have a drop sheet so that any plastic overflow from creating a product will not turn into seep into the holes.</p> 
Integration Unit Stability	<p>Operation of the machines causes considerable vibrations. If setting up on uneven ground, chock the corners to keep the unit stable.</p>

# Plastic

Tip/Trick	Description
Working with HDPE/LDPE	LDPE and HDPE swells during cooling (the faster it cools, the more it swells) so be careful about melting it in moulds that can't be disassembled easily. As a result, the team hasn't found a good way to create products using this material as of yet.
Shredding soft LDPE	Wraps around shredder blades and stalls motor. Opt for melting soft LDPE into a dough in oven then cold forming into moulds.
Plastic toxicity	<p>The good! (Non-toxic)</p> <ul style="list-style-type: none"> <li>- PET (1) - Although non-toxic, PET is very hard to process due to its narrow melting window. PPM team has avoided PET for this reason.</li> <li>- HDPE(2)</li> <li>- LDPE(4)</li> <li>- PP (5)</li> <li>- PLA (7)</li> </ul>  <p>The bad!</p> <ul style="list-style-type: none"> <li>- PS (6) &amp; ABS (7) <ul style="list-style-type: none"> <li>- Releases styrene gases. Mildly toxic, if processing, ensure all safety precautions in place. Masks, ventilated area etc. Required PPE can be found online.</li> </ul> </li> </ul> <p>The ugly!</p> <ul style="list-style-type: none"> <li>- PVC (3) <ul style="list-style-type: none"> <li>- Releases chlorine gas! Very toxic! Stay away from this unless all necessary safety procedures in place.</li> </ul> </li> </ul> <p>NOTE: More detailed material information can be found in the original PP Download Kit. These comments supplement that information.</p>

Plastic melting temperatures	DO NOT exceed the quoted melting temperature for the given plastic type. Like cooking with food, you need to stick to the correct temperatures for the correct amount of time. Straying from these values will cause the material to degrade and become discoloured and brittle.
Material labelling	Labelling your shredded plastic is as crucial as sorting and cleaning it. A simple colour coded system is recommended.

# Moulds & Products

Tip/Trick	Description
Mould preheating	The temperature difference between the injectors barrel tip and the mould caused issues as the plastic would cool too quickly and solidify before injection. Preheating the moulds in the oven solved this issue and produced high quality products with minimal warping
Compressor moulds	Make sure you heat both the top and bottom part of your compressor mould. Especially if you are cold forming. The reason for this is that if the moulds are at different temperatures, it will cause a ribbed cooling effect instead of a smooth surface.
Making moulds	<p>When creating moulds, a few things need to be considered:</p> <p>The plastic takes on whatever surface you melt it in.</p> <ul style="list-style-type: none"> <li>- Ceramic/glass will give you a gloss finish.</li> <li>- Clean steel / teflon coatings will give you a matte finish</li> </ul> <p>If your surface is dirty or porous, you will have a very hard time removing the product. Additionally, if making a product such as a bowl or vase, make sure the design has a draft angle as shown in this image.</p> <div style="text-align: center;"> <p>Parts with no draft      Parts with draft</p>  </div> <p>If you wish to use a mould but don't want to add a non-stick coating, consider a high temp industrial mould release. This creates a film between the product and the</p>

	<p>surface, allowing it to be removed easily. An example of what we used is linked here:</p> <p><a href="https://downloads.chemtrend.com/sites/default/files/pds/chemtrend_zyvax_enviroshie_ld_pds_2016_01_11_en.pdf">https://downloads.chemtrend.com/sites/default/files/pds/chemtrend_zyvax_enviroshie_ld_pds_2016_01_11_en.pdf</a></p>
Cooling plastic products	<p>Different cooling techniques create products of various quality and structure.</p> <ul style="list-style-type: none"> <li>- Quenching <ul style="list-style-type: none"> <li>- Rapid cooling</li> <li>- Causes warping</li> <li>- High internal stresses formed making the product harder but potentially more brittle</li> </ul> </li> <li>- Annealing <ul style="list-style-type: none"> <li>- Slow cooling</li> <li>- Large reduction in warping, especially in large products</li> <li>- Increases ductility with some sacrifice in strength</li> </ul> </li> </ul>
Plastic sheets	<p>Flat recycled plastic sheets can be very versatile in their application. They can be cut using a scroll or bandsaw into a variety of shapes. Not only this, if a sheet of consistent thickness is made, it can be used with a laser cutter to create a bunch of complex shapes with minimal effort.</p> <p>Things to note about sheets of plastic:</p> <ul style="list-style-type: none"> <li>- Use the recommended settings for your laser cutter depending on the thickness and plastic type. Saying this, we have noticed different sheets acting differently with the same settings, mainly with multi-coloured sheets. Same as the injector, create your own sheet of recommended settings.</li> <li>- After forming the sheet, either let it cool slowly or place it under a flat weight to make sure it doesn't warp.</li> </ul>