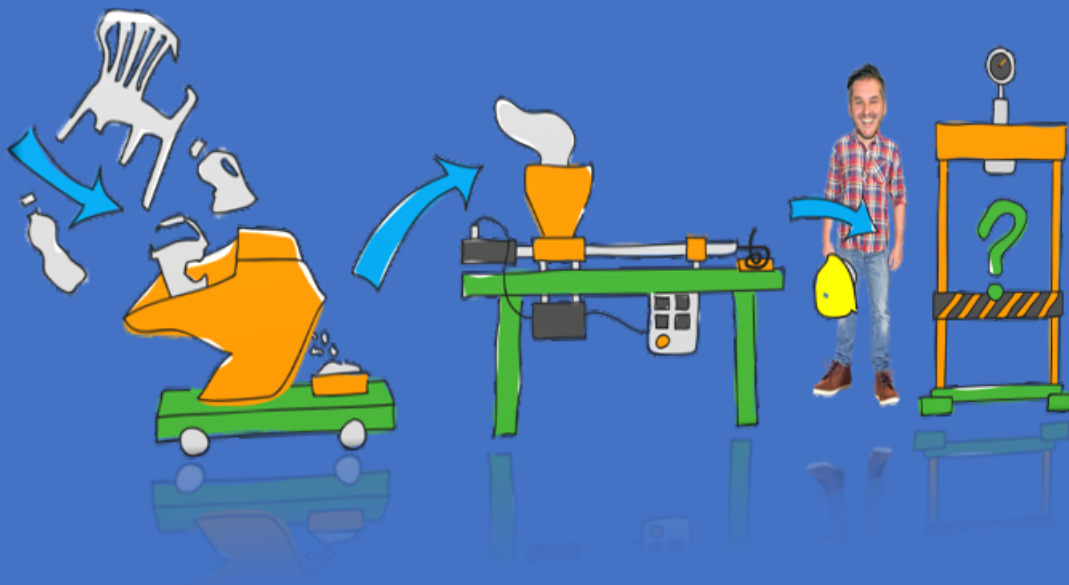


# INSTRUCTION MANUAL MACHINES



S6 Circulair wall

Inhoudsopgave

- 1. Sheet press ..... 2
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- 3. Bending machine ..... 8

## 1. Sheet press



### Roadmap

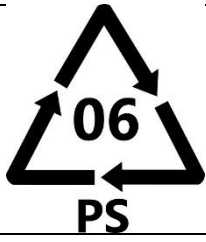
1. Switch on the machine.
2. Set the time and temperature to desired settings and wait for it to warm up.
3. Put the granules in the mould. (Pay attention to which mould you take).
4. Secure the latches at the front of the mould and place it into the machine.
5. Turn the release knob fully clockwise to lock the pump.
6. Pump the lever to raise the lower hotplate. Stop pumping when firm resistance felt.
7. When you pump the lever the time on the timer will automatically start.
8. Every few minutes give the clamp an additional pump to ensure that the granules are still under pressure as they soften.
9. When the time ends a short buzzer will indicate that the mould can be released.
10. Turn the release knob anti-clockwise to lower the hotplate.
11. Slide the mould out of the machine and put it in the cooler.
12. Wait for the mould to cool to room temperature.
13. Release the latches and look for the result!


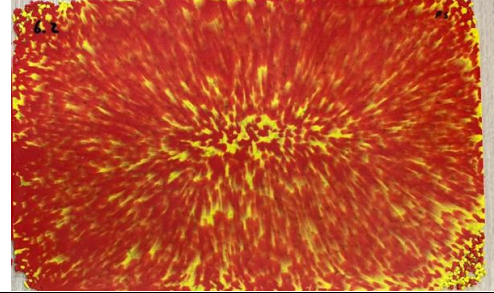
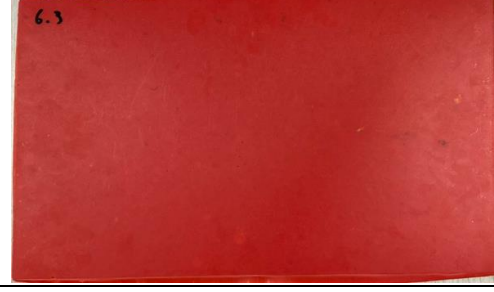
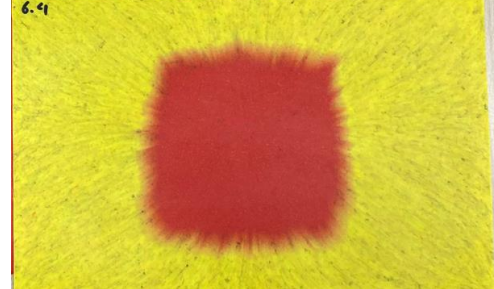
Plastic	Density ( $\rho$ )	Small mould (487x284x2 mm)	Big mould (487x309x2mm)	Temperature sheet press	Time in sheet press
PET	$1,34 \frac{g}{cm^3}$				
HDPE	$0,95 \frac{g}{cm^3}$	290g	315g	200°C	15 min
PP	$0,90 \frac{g}{cm^3}$				
PS	$1,05 \frac{g}{cm^3}$	320 g	350 g	200°C	15 min



Material PS

### General information

	Small mould	Big mould
Mould sizes	Small 487 x 284 x 2 mm	Big 487 x 309 x 2 mm
Volume	$V = 276616 \text{ mm}^3$	$V = 300966 \text{ mm}^3$
Quantity plastic [g] $m = V \cdot \rho \cdot 1,1$	$m = 276,62 \cdot 1,05 \cdot 1,1 = 319,49 \text{ g}$	$m = 300,97 \cdot 1,05 \cdot 1,1 = 347,62 \text{ g}$



Test	Type mould thicknes	Time (min) Temp. oven	Gram (g) Grain size	Time (min) Temp. release	Notes
1.6.1 	Small mould 2mm	200 C 10 min	280 g 2x	38 C 14 min	Corners are not full  Solution: Put more material in the mould
1.6.2 	Big mould 2mm	200 C 15 min	280 g 2x	64 C 10 min	Corners not full, curvature after release  Solution: Put more material in the mould. Use a lower release temperature.
1.6.3 	Small mould 2mm	200 C 10 min	320 g 1x	27 C 15 min	Perfect corner, material quantity seems perfect, 2 cavities in the corners.  Solution: Put the material in the middle of the mould, but make sure the corners are a little bit covered with material.
1.6.4 	Big mould 2mm	200 C 15 min	350 g 1x/2x	21 C 30 min	Corners full, everything good except for a few small air cavities  Solution: Put the material in the middle of the mould, but make sure the corners are a little bit covered with material.




<p>1.6.5</p> 	<p>Small mould 2mm</p>	<p>200 C 15 min</p>	<p>360 g 1x/2x</p>	<p>15 C 30 min</p>	<p>Slowly increased the pressure to reduce cavities, still small cavities</p> <p><i>Solution:</i> Put the material in the middle of the mould, but make sure the corners are a little bit covered with material. (This not possible if you want a pattern in the sheetpres)</p>
<p>1.6.6</p> 	<p>Small mould 4mm</p>	<p>200 C 20 min</p>	<p>640 g 1x</p>	<p>21 C 30 min</p>	<p>frame has shifted a little bit, otherwise the plate looks good. Also the plate isn't equal in thickness, it is 4 to 6 mm.</p> <p><i>Solution:</i> Make a frame outside the frame, so frame can't move. Let the mould cool down faster and do this under pressure.</p>

Material HDPE

General information

	Small mould	Big mould
Mould sizes	Small 487 x 284 x 2 mm	Big 487 x 309 x 2 mm
Volume	$V = 276616 \text{ mm}^3$	$V = 300966 \text{ mm}^3$
Quantity plastic [g] $m = V \cdot \rho \cdot 1,1$	$m = 276,62 \cdot 0,95 \cdot 1,1 = 289,06g$	$m = 300,97 \cdot 0,95 \cdot 1,1 = 314,51 g$

$$\rho = 0,95 \text{ g/cm}^3$$



Test	Type mould thickness	Time (min) Temp. oven	Gram (g) Grain size	Time (min) Temp. Release	Notes
					
1.2.1 	Big mould 2mm	200 C 15 min	348 g 1x	35 C 20 min	1x sheared, corners not full, the plate is warping  Solutions: Shred the HDPE one more time for smaller granules. Let the mould cool down faster and do this under pressure.
1.2.2 	Small mould 2mm	200 C 15 min	310 g 2x	21 C 60 min	2x sheared, plate is warped  Solutions: Let the mould cool down faster and do this under pressure.



## 2. Injection mould



### Roadmap

1. Switch on the machine with the mould attached
2. Set the temperature to 350
3. Wait for 20 minutes for the machine to heat up
4. Meanwhile measure the needed amount of granulate
5. Fill the machine with the granulate
6. Wait 15 minutes for the granulate to melt
7. Press the molten granulate in the mould
8. Remove the mould from the injection mould and cool it down
9. Remove the part from the mould

Test Type mould	Set temp (°C)	Heat up time (min)	Gram (g) Grain size	Time (min) Temp. Release	Notes
					Simple mould for testing the machine.
2.6.1 ps 	220	25	150	10	<p><i>Was not hot enough, so the grains didn't meld at the bottom.</i></p> <p><i>Solution:</i> <i>Use a higher temperature</i></p>

<p>2.6.2 ps</p> 	350	15	150	5	<p><i>the middle grains didn't melt because the material didn't get enough time to melt.</i></p> <p><i>Solution:</i> <i>Let the material heat up for longer to the inner grains can melt as well.</i></p>
<p>2.6.3 ps</p> 	350	15	150	20	<p><i>Everything melted but at the top the mould didn't fill completely.</i></p> <p><i>Solution:</i> <i>Make a few airways to make a path for the air to get out.</i></p>

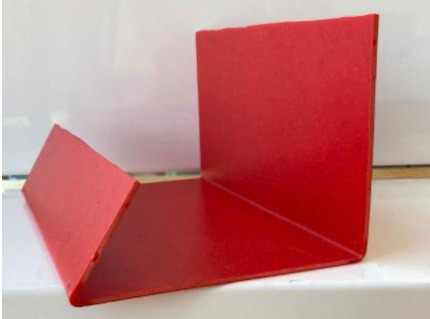
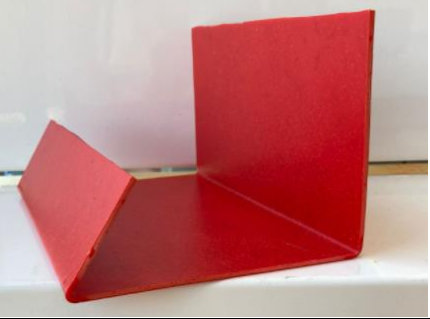


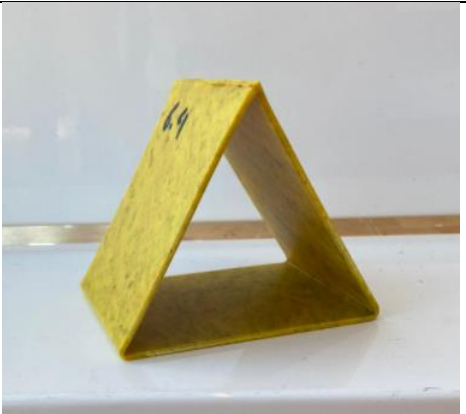
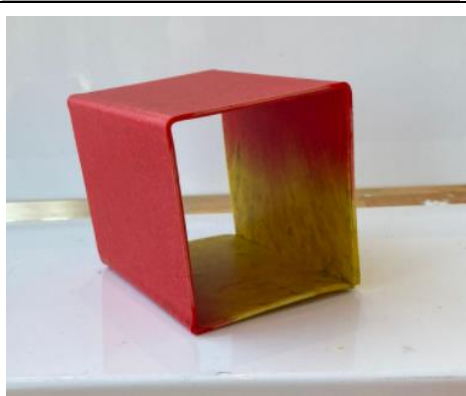
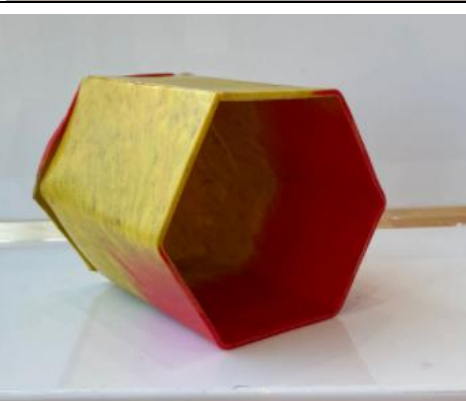
### 3. Bending machine



#### Roadmap

1. Switch on the machine
2. Set the temperature to max (to 6)
3. Wait for 15 minutes for the machine to heat up
4. Meanwhile set the mould to the correct angle
5. Place the sheet at the line on which you need to bend on the heating element
6. Wait 50 seconds until the material can be bent by hand
7. Place the sheet in the mould with the heated line in the middle
8. Keep the sheet there until the heated line is cooled down

Test	Temp. (C)	Time (s)	Corner (...°)	Notes
3.6.1 	Max	50 s	90°	Tight corner
3.6.2 	Max	50 s	60°	Tight corner




3.6.3			Max	50 s	3x 60°	Tight corners
3.6.4			Max	50 s	4 x 90°	<p>Less tight corners, small bend in a corner</p> <p>Solution: Work more accurately and calculate better where the bend line comes</p>
3.6.5			Max	50 s	6 x 120°	Tight corners



## 4. Mould + hydraulic press






### Roadmap

1. Switch on the oven and pre heat it till 220 °C
2. Weight you're material and put it in the oven for 30 min
3. Take the material out and twist it to release the air bubbles
4. Put the material back in the oven for 30 min
5. Pre heat the mould for 30 min with the material
6. Put the mould under the hydraulic press and give pressure on the mould with the material inside
7. Leave the mould for 2 hours under pressure
8. Take the mould out of the press and get the material out

Test Type mould wood	Set temp (°C)	Heat up time (min)	Gram (g) Grain size	Time (min) Temp. Release	Notes
					Simple mould made out of multiplex wood. After 4 tries the mould deformed to much so we couldn't use it anymore.
<p>4.6.1 PS</p> 	200 °C	60 min	480 g	30 min	<i>To much material, we couldn't close the mould. The material also cool down to fast so we need to pre heat the mould. But that's quite hard with a wooden mould.</i>
<p>4.6.2 PS</p> 	220 °C	60 min	350 g	30 min	<i>Here we have less material, but you see that the mould didn't fill all the corners. The material also didn't spread that well, this meant that we have a lot spare material that went out of the mould.</i>
<p>4.2.1 HDPE</p>	220 °C	60 min	400 g	60 min	<i>This one worked quite well. But the mould was deforming so the final form is not what had hoped for.</i>

					
4.2.2 HDPE	220 °C	60 min	350 g	5 days	<i>Here used less material. HDPE shrunk more than PS so the thickness of the wall was not right. Also the form was not that good because the mould was getting worse.</i>
					

Test Type mould steel	Set temp (°C)	Heat up time (min)	Gram (g) Grain size	Time (min) Temp. Release	Notes
					A simple mould out of layers of steel. The layers were welded together with a few point welds. Some of these welds have broken on the first test leaving a few some slits for material to come out of.
4.6.3 PS 	220°C	60 min	400 g	1 night	<i>To much material, we couldn't close the mould. But the needed forms are visible.</i>
4.6.4 PS 	220°C	60 min	220 g	1 night	<i>Definitely not enough material. This was due to a mess up.</i>

<p>4.6.5 PS</p> 	<p>220°C</p>	<p>60 min</p>	<p>350 g</p>	<p>120 min</p>	<p><i>Still not enough material and the material came through the slits in in mould pushing the layers open. But the forms are visible.</i></p>
<p>4.6.6 PS</p>	<p>220°C</p>	<p>120 min</p>	<p>400 g</p>		