ABS Warp Reduction by added Pull-Down Clamps
Ufodoctor3, May 15th, 2019

1. Introduction

The main problem in ABS-printing is the shrinking of ABS by about 6 % during cooling.
We observe poor adhesion to the bed, warped edges and cracks
In addition to the many advice in the forum we show here a clamp-down method with results

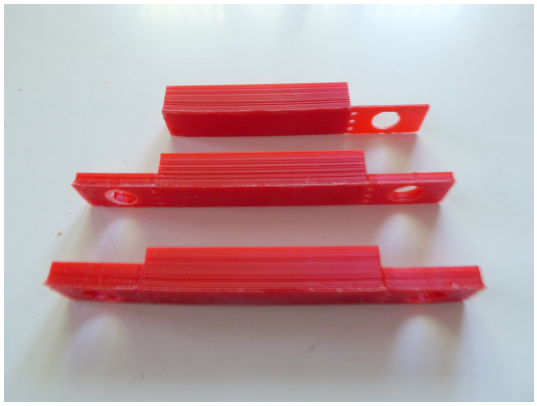


Fig. 1: Printed Objects

General ABS 3D-Print Advice:
1. Prepare ABS Juice (see google “ABS slurry”, 50 ml Acetone+ 4 gr ABS)
2. Apply this “ABS juice” directly on the glass bed or on Kapton or painter tape.
3. Protect your 3D-Printer against air flow from ALL SIDES, best with wood or acrylic glass plates.
4. After printing wait about 15 minutes for cooling down, but for removing the objects heat the bed to 80 Degree.

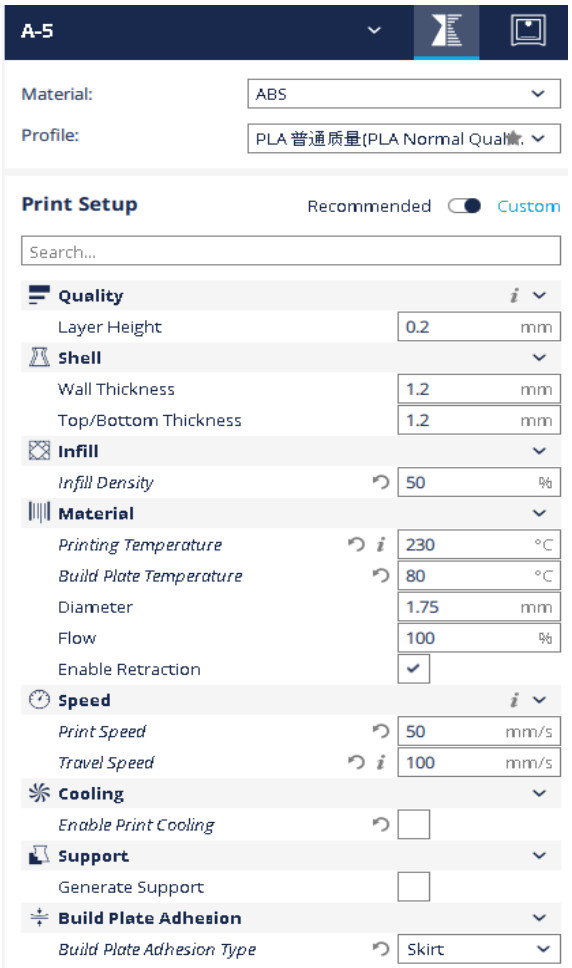
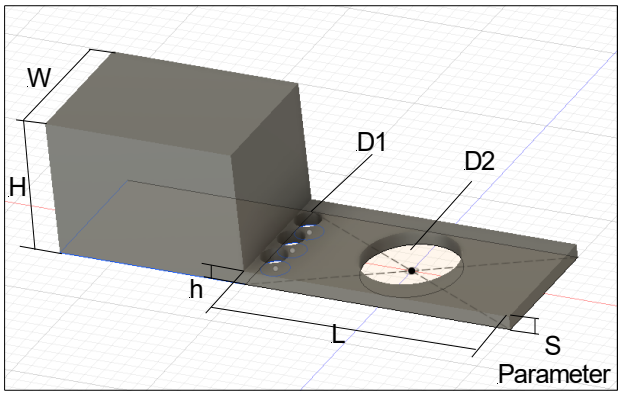


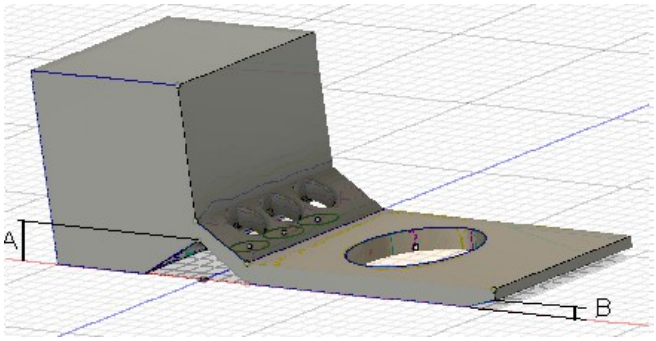
Fig. 2: Printer Settings

Fig. 4: Pull-Down Clamps dimensions



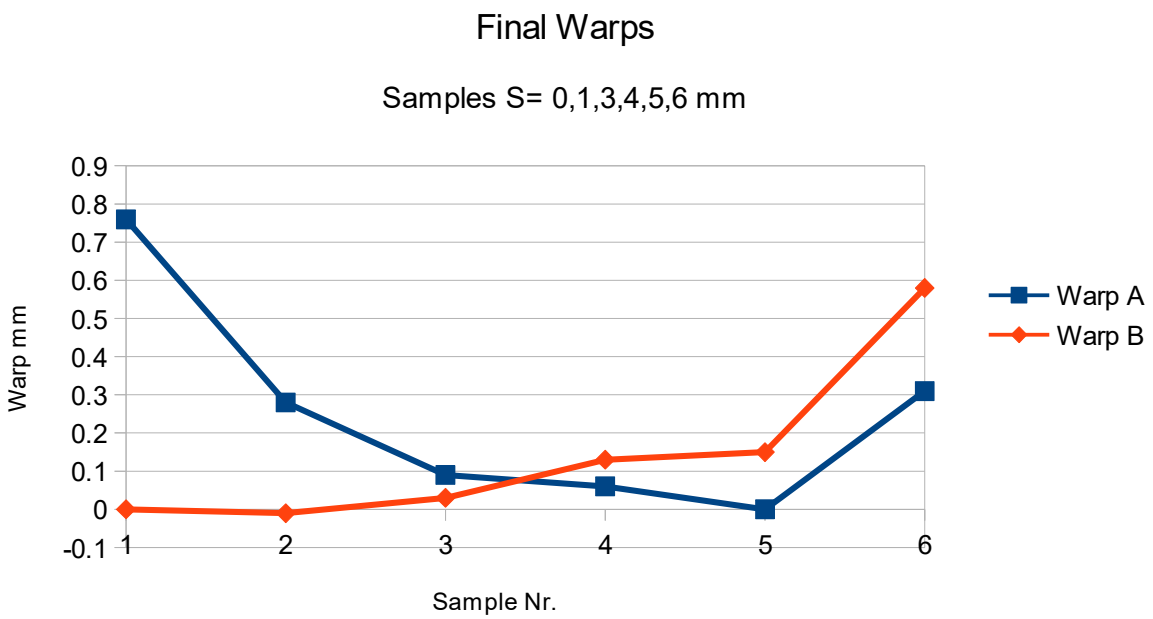
H, W=10mm, L=20mm, D1=2mm, D2=7mm
Parameter S: 0,1,3,4,5,6mm

Fig. 5: Sketch of exaggerated deformations



A: Warp Object, B: Warp Clamp

2. Experimental Results Fig. 6



3. Measured Data Table 1 (mm)

Parameter S	Warp A	Warp B	Height at A	Ref H	Height at B	Ref h
0	0.76	0	9.38	10.14	0	0
1	0.28	-0.01	9.86	10.14	1.13	1.12
3	0.09	0.03	10	10.09	3.02	3.05
4	0.06	0.13	10.03	10.09	3.9	4.03
5	0	0.15	10.08	10.08	4.87	5.02
6	0.31	0.58	9.75	10.06	5.42	6

3. Discussion

The warp A at the object can be reduced by clamps of matched dimensions.
In our example a clamp with a thickness S of about 1/3 to 1/2 of the object height H shows the best results.

Thicker clamps are not recommended because they tend to wrap, too, (see Fig. 6 to the right)
Heavy warped clamps will transmit the warp to the object.

See Fig. 4:
- The 3 holes D1= 2 mm serves as a weak suspension, but also for easy clamp removing
- The hole D2= 7 mm serves as a weak suspension of the right side of the clamp
- The clamp can be improved by a broader end plate with rounded edges.

With my best wishes for now happy ABS printing!