Nozzle 2.0

HPA

Test object: HPA Test goal: Testing the new batch of accelerator diluted 1:1.

Test 1	1:1 Masterroc (167) 2 l/h + Duomix + HP 2.0 + Possolit retarder .1% (premix w.)
Test 2	1:1 Masterroc (167) 3 l/h + Duomix + HP 2.0 + Possolit retarder .1% (premix w.)
	ratio water 0,18 van 0,17 (water tot premix)
Test 3	1:1 Masterroc (167) 4.5 l/h + Duomix + HP 2.0 + Possolit retarder .1% (premix w.)

Remarks:

• DT 3 was disabled (had influence on the readings of DT 2 and DT 1) (unfortunate) • Lars: Typical example of whatever

Test results: 1. More accelerator results in more fluctuations of the pressure in dt-2 2. The print was unevenly hardened. (left side vs right side of layer nozzle) 3. accelerator buffer vessel, started leaking due to pressure buildup. 4. Water / accelerator switching might cause instability / squirting.

Potential next tests:

Option 1: (Lars) 1. Printing with more retarder/plasticizer 2. Dilute accelerator more

Option 2: (Kees) 3. Higher water content in initial mix 4. More plasticizer/retarder (to minimize the fluctuations in pressure) 5. Less diluted accelerator (as buckling is primary failure mode)

General comment: 1. Printing the cylinder vs HPA (more standardized testing) 2. Test less, know more.

Time	Remarks	Measurement
14:06	Start Water dry-run Lmec	
14:08	Connecting duo-mix to nozzle	
14:11	dt-2 shows a readout error, there is a relationship between dt-1, dt-2 dt-3	
14:20	Whatever, start the duomix	
14:21	Stop Stop (duomix), DT 1 > 20 bar	
14:22	DT 1 < 4 bar	
14:23	Duo-mix start DT-1 2 bar	
14:24	Duo-mix and water off (start accelerator)	
14:27	Start nozzle, concrete is running	22.1˚C temp. amb.
14:31	Accelerator valve open Dt1- 3 bar	
14:32	Nozzle speed 40% to 50%	
14:32	Pressure dt-2 9 bar	
14:34	Lmec on water	
14:34	Duo-mix off	

Conclusion setup:

- Pressure sensors work incorrectly, decided to do the test anyway.

Test 1: 2l/h Masterroc 1:1 - water temp: (?) | Air temp: 21˚C

Time	Remarks	Measurement
	Start test 1	
14:36	Ratio duo-mix water mixture 0.17 to 0.18	
14:37	Nozzle start	
14:38	Accelerator on	
14:39	Start print, nozzle speed to 55%	
14:40	Nozzle speed to 60%	
14:40	Temperature nozzle	Temp nozzle 38˚C
14:41	Dt-2 Stabilizes at 11 bar	
14:42	Nozzle speed to 50%	
14:44	Volkert suspects not enough accelerator on a "finger-test" on the initial layer	Accelerator to 3l/h
14:45 Buckling failure layer 7. In the inside layer		
14:46 Cleaning for test 2		

Conclusion test 1:

Strength development of the concrete is slow with 2l/h Masterroc 1:1, buckling failure after layer 7.

Annotation Volker during printing: Change accelerator:water ratio, suggestion (Accelerator : water from 1:1 to 1:75)

Test 2: 3l/h Masterroc 1:1 (60% motor) - water temp: (?) | Air temp: 22˚C

Time	Remarks	Measurement
14:46	Start test 2	
14:46	First layer 45% robot speed	
14:47	Dt_2 steady at 10 bar	
14:48	"Ripple formation" (print surface is ugly?)	
14:49	Lars is going steady and the print too	
14:52	Dt-2 steady 9.5 bar	L0 31 ˚C
		L5 38 ˚C
14:53	Pressure drops a little. (dt-2)	
14:54	Bottom layer too soft, (assumption, the print object will fail)	
14:55	Layer prints next to previous layer, buckling occurs. Layer 12	22.1˚C
14:56	Lmec accelerator to water	

Conclusion test 2:

Stable results, increase in strength development with 3l/h Masterroc 1:1, printed layers from 7 to 12.

Annotation Kees: Interesting decrease in temperature, what could be the reason?

Test 3: 4l/h Masterroc 1:1 (Error: robot-speed 45% whole print) - water temp: (?) | Air temp: 22˚C

Time	Remarks	
14:58	Start test 3	
14:59	Nozzle 30,3 ˚C, pressure dt-2 11.5	
15:02	Start print, D-t 2 aggressive	
15:02	visual squirting (probable due to air-bubbles)	
15:03	55 seconds per layer (Robotspeed 45%)	
15:04	Leaking pressure valve Lmec dt-2 10.5	
15:06	Temperature Mortar 36.5 ˚C, 32 ˚C nozzle	Mortar 36.5 ˚C
15:06	Squirting	L0: 33 ˚C
15:07	D-t 2 unstable 11.5 bar	
15:08	Noticeable difference in strength printed structure between test 3 and test 2 and 1.	
15:08	Visual squirting.	
15:06	Temperature Mortar 36.5 ˚C, 32 ˚C	
15:08	Squirting	
15:09	Pressure buildup Emec, leakage buffer vessel , stop test 3.	

Conclusion test 3:

Pressure in DT_2 is fluctuating more in test 3. (15:04) Leaking of the pressure valve resulted in a slight drop in DT_2. Additionally the printed layers showed an uneven distribution of accelerator.

Pressure increased to 11.5 bar with an increase to 4.5 l/h.