

Bill of material (Smart Injector)

Component	Name	Quantity	Unit	Blueprint	Information
01_frame	Aluminium profile Rexroth 45x45 mm	12	meters	frame	Every frame part and support for mounting is made out of these profiles.
	Mounting angles aluminum	70	pieces	-	-
	M8 screw+nut for mounting	100	pairs	-	M8 x 20 Screw, M8 T-Slot Nut.
02_extruder	NEMA34 and gearbox	1	piece	extruder 1-NEMA34_and_gearbox	8.6 Nm motor torque, 48 V, rotates at 800 rpm when fully running (6:1 ratio of the planetary gear). Keeps the gearbox shaft aligned with the extrusion screw. Prevents high radial forces on the extrusion screw.
	Motor positioner	1	piece	extruder 2-motor_positioner	Two sheet metals welded together.
	Mounting NEMA34	1	piece	extruder 3-mounting_NEMA34	The hopper version in the CAD has not been tested yet.
	Hopper	1	piece	extruder 4-hopper	Should be bigger than the most outer diameter of the heating sleeves and made for the desired temp. range (which is between 240 and 300 degrees).
	Isolation	1	piece	extruder 5-isolation	Made out of a turned part welded to a thread (thread in the ebay link).
	Nozzle	1	piece	extruder 6-nozzle	Steel pipe (4 mm wall thickness) with a 1" thread at the end. It is screwed to the nozzle. The hopper is mounted on the heating pipe.
	Heating pipe	1	piece	extruder 7-heating_pipe	Transmits the axial force from the extrusion screw to the M12 threads. Without it the frame could not withstand the force.
	Assembly pressurepart	1	piece	extruder 8-assembly_pressurepart	To monitor the rpm of the extrusion screw, we use a hall sensor in combination with a magnet fixed to the shaft of the gearbox. This part also prevents the machine user from grabbing the rotating shaft.
	Mounting hall sensor extruder	1	piece	extruder 9-mounting_hall_sensor_extruder	300 W each and suitable for the 34 mm outer diameter of the heating pipe. One of them is directly on the nozzle.
	Heating sleeves	6	pieces	-	M12x1.75 mm thread. 650 mm long. Screwed into the fixed platen to transmit the axial force.
	M12 thread	2	pieces	-	Aluminium profile Rexroth 45x45 mm to mount the motor on.
	Connector	1	piece	extruder - overview	13 mm inner diameter. Made out of two aluminum parts with a polymer part in between. One inner diameter has to be drilled up to 16 mm in order to fit the gearbox shaft.
	Claw clutch	1	piece	-	Bought the screw from the PreciousPlastic bazar. It is approx 590 mm long and has a 13 mm shaft.
	03_clamp_mechanism	Extrusion screw	1	piece	-
Stationary platen		1	piece	clamp mechanism 1 - stationary_platen	-
Movable platen		1	piece	clamp mechanism 2 - movable_platen	The material we used is aluminum.
Bearing block		2	pieces	clamp mechanism 3 - bearing_block	SBR 12 linear guide.
Linear guide		2	pieces	clamp mechanism 4 - linear_guide	40 mm x 30 mm profiles, 3 mm thick.
Aluminum frame		2	pieces	clamp mechanism 5 - aluminum_frame	In use is a fine thread because it gives the system a higher clamping force.
M12 x 1.5 thread		2	pieces	clamp mechanism 6 - M12x1.5_thread	The material we used is PETG.
Tooth belt pulley big		2	pieces	clamp mechanism 7 - tooth_belt_pulley_big	The mounting in the CAD is the newer version, we did not test this one yet.
NEMA17 and mounting		2	pieces	clamp mechanism 8 - NEMA17_and_mounting	HTD 5M - 600. (in the link is a HTD 5M - 500 but it should work aswell)
Tooth belt		2	pieces	clamp mechanism 9 - tooth_belt	M12 x 1.5 thread. The material we used is steel.
Thread block	2	pieces	clamp mechanism 10 - thread_block	Aluminium profile Rexroth 45x45 mm as shown in the clamp_mechanism - overview blueprint.	
04_ventilation_system	Aluminum profiles for mounting motors on	8	pieces	-	Used for the structure to hold the 3d printed parts.
	Small steel pipes 10mm outer diameter	4	pieces	-	The material we used is PLA.
	Ventilation mould	1	piece	ventilation - 1	The material we used is PLA.
	Ventilation extruder	1	piece	ventilation - 2	The material we used is PLA.
	Aluminum fan	1	piece	-	-
05_mounting_limitswitch	Connector ventilation	1	piece	ventilation - 3	The material we used is PLA.
	Mounting limitswitch	3	pieces	mounting_limitswitch	Consists out of three separate bodies. They fix the limitswitch in position. Normally closed. They have to be used as normally closed switches, otherwise there is no way to detected a broken circuit from the limitswitch.
06_user_panel	Limitswitch	2	pieces	-	to detected a broken circuit from the limitswitch.
	LCD	1	piece	-	Arduino 20x4 LCD-Modul + I2C Interface.
	Buttons	4	pieces	-	-
	3d printed parts	10	pieces	user_panel	The material we used is orange PETG.
07_electronics	Emergency stop	1	piece	-	1 phase emergency stop.
	Stepper driver	1	pieces	-	Stepper driver 2.4-7.2A for NEMA34 48V VCC.
	Stepper driver	2	pieces	-	For NEMA17 12V VCC.
	Arduino MEGA	1	piece	-	For an easy wiring we added a shield on the Arduino (it is visible on the pictures in Additional_pictures).
	12 V powersupply	1	piece	-	12V 10A 120W.
	48 V powersupply	1	piece	-	48V 8.3A 400W.
	5 V relais	1	piece	-	Arduino relais 4 channels 5V to 230V modul.
	Hall sensor	3	pieces	-	Arduino hall sensor digital active-low 5V VCC.
	Emergency stop	1	piece	-	Front instalation, 2 poles.
	Main switch	1	piece	-	Front instalation, 4 poles, 16A.
	PID controllers	3	pieces	-	Digital PID temperature controller + thermoelement type K.
	Circuit breaker	1	piece	-	One phase type: 10B.
	Control cable	8	meters	-	Control cable shielded LIYCY 4x1,5 mm ² for stepper motors (4m for NEMA 34 and 2x2m for both NEMA 17).
	Control cable	12	meters	-	Control cable shielded LIYCY 10x0,5 mm ² for user panel & Sensorinformations (4m for NEMA 34 Hall Sensor and thermoelements at heating sleeves and 4m for the limitswitches and thermoelement type K).
Power cable	3	meters	-	LIYCY 4x1,5 mm ² for heating coil form and fixed plates.	
Power cable	4	meters	-	LIYCY 5x1,5 mm ² for heating sleeves.	

Component	Name	Comments on the component	found on/how is it built	Link
01_frame	Aluminium profile Rexroth 45x45 mm	It is important that the nuts and/or screws fit the profile groove. We had problems when we ordered the wrong nuts.	Ebay	http://ebay.us/GAfcCT
	Mounting angles aluminum M8 screw+nut for mounting	There are none of these angles added to the CAD yet. just install them in the angles of the profile according to the pictures. Except some spots you should be free in choice where to install them. -	Ebay Ebay	http://ebay.us/Cw5RHO http://ebay.us/Cw5RHO
02_extruder	NEMA34 and gearbox	One of the more expensive components. A solution without stepper motor would be an idea, since the extruder doesn't have to be in a very exact position. The planetary gear has to fit your motor! We made the mistake to buy a motor without groove for a feather key, but bought a gearbox that needs one. We had to improvise and grind it down. Not a pretty solution at all.	Ebay	http://ebay.us/L4QzIk
	Motor positioner	-	3d printed and two M8 threads	-
	Mounting NEMA34	-	manufactured ourselves	-
	Hopper	We have only used a printed one so far. As you might guess it melted pretty quick.. So we also need to built this one.	manufactured ourselves	-
	Isolation	The brand from ours is Rockwool.	3d printed and manufactured ourselves	http://ebay.us/1vsvUy
	Nozzle	Pictures in folder Additional_pictures.	manufactured ourselves	http://ebay.us/IGnMs7
	Heating pipe	Pictures in folder Additional_pictures.	Ebay and manufactured ourselves	-
	Assembly pressurepart	Link to the needed roller bearings (Model 30206)	manufactured ourselves	http://ebay.us/6F7dut
	Mounting hall sensor extruder	Pictures in folder Additional_pictures.	3d printed	-
	Heating sleeves	Two heating sleeves are controlled by one PID controller.	Ebay	-
	M12 thread	Pictures in folder Additional_pictures.	Ebay	http://ebay.us/Jx8iu0
	Connector	Pictures in folder Additional_pictures.	Ebay	http://ebay.us/GAfcCT
	Claw clutch	Pictures in folder Additional_pictures.	Ebay	http://ebay.us/vhWutx
03_clamp_mechanism	Extrusion screw	The price we payed with 300 Euros is high. We have already seen some for 140 Euros or less. If you decide to use a stronger motor, make sure that your screw is always stronger and can handle the torque. You don't want this expensive part to break.	PreciousPlastic Bazar	https://bazar.preciousplastic.com/machines/extruder/extruder-kits/extrusion-screw-and-barrel/
	Stationary platen	It also has two holes for inserting heating sticks. Sometimes the plate gets too cold and the plastic in the nozzle does not heat up enough. For fixing this problem the plate should not have contact to the nozzle at all. Drill a hole which is big enough to place the nozzle directly to the mould.	manufactured ourselves	http://ebay.us/U4Pela
	Movable platen	No heating sticks are needed in this plate.	manufactured ourselves	http://ebay.us/U4Pela
	Bearing block	Consists of two axial bearings, two dustcovers for the bearings and a solid aluminum part to insert the bearings. This aluminum part is connected with the fixed platen through M8 screws.	manufactured ourselves	http://ebay.us/A7QObh
	Linear guide	We did not figure out a good way to fix the linear guid to the frame yet. If you come up with a good solution, it would be nice to see it :). 3 mm is the minimum thickness for these profiles. Otherwise they are not rigid enough to hold the heavy movable platen plus the mould.	Ebay	http://ebay.us/81dB6D
	Aluminum frame	The thread needs to be very straight. Otherwise you get high radial forces in the system, which can even block the motors.	Ebay and manufactured ourselves	http://ebay.us/mu0CLI
	M12 x 1.5 thread	Do not tighten the screws too much because it can break your printed part.	Ebay	http://ebay.us/WKyHYX
	Tooth belt pulley big	It is very crucial to align the two pulleys. Otherwise your belt will try to slip of them.	3d printed	-
	NEMA17 and mounting	A weaker/smaller belt would also work but in this way you can always switch to a stronger motor.	Ebay and 3d printed	-
	Tooth belt	Lubrication at the thread is important. Otherwise the Steppers have a hard time opening the mould when it is closed.	Ebay	http://ebay.us/YkpwZa
	Thread block	When a part is injected, the torque needed to open the mould is significantly higher.	manufactured ourselves	http://ebay.us/4ZUbqt
	Aluminum profiles for mounting motors on	Pictures in folder Additional_pictures.	Ebay	http://ebay.us/GAfcCT
	04_ventilation_system	Small steel pipes 10mm outer diameter	Pictures in folder Additional_pictures.	Ebay
Ventilation mould		Pictures in folder Additional_pictures.	3d printed	-
Ventilation extruder		Pictures in folder Additional_pictures.	3d printed	-
Aluminum fan				http://ebay.us/7ygYPr
05_mounting_limitswitch	Connector ventilation	Pictures in folder Additional_pictures.	3d printed	-
	Mounting limitswitch	The threads in this printed part were cut after printing. Therefore the holes in the parts are printed with the core diameter for cutting a thread.	3d printed	-
06_user_panel	Limitswitch	-	Ebay	http://ebay.us/4ZSswm
	LCD	Pictures in folder Additional_pictures.	Ebay	http://ebay.us/vdHxR2
	Buttons	Pictures in folder Additional_pictures. A smaller user panel with just the 4 buttons and the emergency stop would also work well. The LCD is not in use yet.	Ebay	-
07_electronics	3d printed parts	Pictures in folder Additional_pictures.	Ebay	-
	Emergency stop	It is very important to have the emergency stop always ready close to your hands. Thats why there has to be one on the user panel.	Ebay	http://ebay.us/AHqMF1
	Stepper driver	-	Ebay	http://ebay.us/L4QzIk
	Stepper driver	Not all of the drivers we ordered for the NEMA17 were good. A lot of them come from China and are super crappy. Don't go with the cheap ones.	Ebay	http://ebay.us/WxHVHR
	Arduino MEGA	-	Ebay	https://store.arduino.cc/arduino-mega-2560-rev3
	12 V powersupply	The one on the picture is not built for a switch cabinet. So we had to fix them in some way. Next time we would buy some for the switch cabinet.	Ebay	http://ebay.us/U11Y17
	48 V powersupply	Same here with the 48 V powersupply. It's not for a switch cabinet.	Ebay	http://ebay.us/HKaUWL
	5 V relays	They are switched on to heat up the fixed platen and the mould with the heating sticks.	Ebay	http://ebay.us/s8gPx4
	Hall sensor	They observe the synchronous movement of the two threads while opening/closing the mould.	Ebay	http://ebay.us/GvAVpb
	Emergency stop	Cuts off the power to the motors when pushed.	Ebay	http://ebay.us/AHqMF1
	Main switch	As the name already says, it's the main switch to turn the machine on/off.	Ebay	-
	PID controllers	-	Ebay	http://ebay.us/kiNHSn
	Circuit breaker	If the Amp goes to high, the circuit breaker melts and there is no power in the system anymore.	Ebay	-
	Control cable	-	Ebay	http://ebay.us/WszqxP
	Control cable	shielded cables because otherwise the sensor signals are strongly disturbed.	Ebay	http://ebay.us/aqFS2K
Power cable	-	Ebay	http://ebay.us/3hvWHK	
Power cable	-	Ebay	http://ebay.us/4B4vNo	