



Figure 8. Manufacturing of the *RBO Hand 3*. A complete hand can be built within five days, including curing time. Material cost is less than US\$ 250 with 3D printing as the highest cost factor. **Manufacturing of the Two-Compartment Finger:** **a)** Prior molding, a piece of inextensive PET-based fabric (black and white striped) is placed inside the 3D-printed mold (grey-brown) to reinforce the wall between the two compartments of the actuator. **b)** Top and bottom part of the mold are connected tightly. **c)** Silicone (blue) of type Dragon Skin™ 10 (Smooth-On) is poured into the mold. **d)** Connector plate is built from a laser-cut and -engraved piece of acrylic glass (violet). A hexagonal engraving holds a screw (grey) in place, which later connects the finger to the scaffold. The connector plate is finished by glueing a piece of woolly fabric (brown) to its backside. **e)** Connector plate is placed inside the mold with the woolly fabric facing downwards to soak in the wet silicone. **f)** After curing, the actuator is robustly connected to the acrylic connector plate. Both are removed from the mold. **g)** Cross-section of the actuator. Two silicone tubes (grey) are guided through designated holes in the connector plate and punctures in the silicone material towards the two compartments. The tube of the tip compartment passes through the base-compartment and the reinforced wall close to the palmer side of the finger. Holes and punctures are sealed with Sil-Poxy™ (Smooth-On) silicone adhesive. **h)** The bottom side of the actuator is sealed by attaching the *passive layer*, a sheet of inextensive PET-based fabric soaked with wet Dragon Skin™ 10 silicone (black and white striped). **i)** After the passive layer cured, a helix structure of nylon thread (white) is spun around the actuator. **j)** Soft finger pulp (grey) is cast in a separate mold, using Ecoflex™ 0030 (Smooth-On) silicone. **k)** Finally, the finger pulp is glued to the actuator with Sil-Poxy™. **Manufacturing of the Thumb Tip:** The tip of the thumb has only a single compartment and is manufactured by following steps **b)** to **k)**. However, the hexagonal laser-engraving of the connector plate houses a nut instead of a screw. The tube is inserted through a puncture on the dorsal side of the actuator instead of a hole in the connector plate. **Manufacturing of the Bellow Actuator:** (exemplary for proximal bellow) **l)** TPU-coated nylon fabric (green) and a baking paper (beige) are laser-cut into shape. Baking paper is placed between two precisely stacked sheets of nylon fabric whose coated sides face each other. A silicone tube (light grey) of 1.5 mm diameter is placed between baking paper and nylon fabric to ensure air flow between neighboring pouches. **m)** The fabric pieces are heat-sealed using a steam iron for approximately one minute with 220°C. The backing paper prevents the TPU coating from melting together which results in an air chamber. **n)** The actuator is folded at the connections of neighboring pouches to realize a stack. **o)** The actuator connects to a tube via a plastic hose fitting inserted into its outlet. A piece of silicone tube around the actuator-facing side of the fitting serves as rubber seal. Finally, air tightness is ensured by tightly spinning a nylon thread around the outlet at the location of the rubber seal. **p)** The soft silicone-based glove is molded separately. **Assembly of the Hand:** **q)** The thumb scaffold (anthracite) is 3D-printed using TPU plastic. It houses three bellow actuators with differently shaped pouches. **r)** The flaps of the thumb scaffold are bent open. The respective bellows are attached with screws and nuts to designated holes in each of the hinge joints. **s)** The median palm scaffold is also 3D printed using TPU plastic. **t)** A bellow consisting of a single pouch that has the same shape as the pouches of the proximal thumb bellow is connected with screws and nuts to the median palm scaffold. **u)** The fingers are connected to the 3D printed radial palm scaffold and ulnar palm scaffold using the screws inside the connector plates of the fingers and nuts. The tubes are guided by tunnels through the scaffolds. The thumb tip is connected to the thumb scaffold with a screw and the nut inside the connector plate of the thumb tip. The thumb scaffold and the median palm scaffold are placed in cut-outs of the ulnar and the radial scaffold. They are fixated by two plates which are connected with screws and sleeve nuts. The silicone glove is put on. Finally, the abduction bellows are placed inside pockets of the silicone glove between the fingers.