

NIST Additive Construction Laboratory

Scott Z. Jones, Ph.D.

Infrastructure Materials Group

Ph: +1 301 975 4948

Email: scott.jones@nist.gov

Overview

The Additive Construction Laboratory features a six axis, six degree of freedom articulated robot arm mounted to a 10 m 7th axis track. The arm has a 3 m reach with 150 kg payload for an approximate build volume of 3 m x 3 m x 10 m. Material is supplied to the robot by a dry mix grout pump. Two nozzles are available: a single component and two-component nozzle

- *Robot Model:* IRB 6700-150/3.20
- *Degrees of freedom:* 6 DOF + 7th linear axis
- *Operating speed:* maximum robot speed is 1.6 m/s. Print speed is limited by the flow rate of the grout pump which ranges from 0.08 L/s to 1 L/s
- *Resolution:* The single component nozzle has a diameter of 23 mm and controls the resolution of the printed objects. The robot has a positional repeatability of 0.10 mm and a path repeatability of 0.15 mm

The dry mix grout pump is the m-tec Duo Mix 2000, a positive displacement pump capable of pumping grout with a maximum aggregate size of 4 mm. It is integrated into the robot controller and can be operated from the robot teach pendant. The pump flow rates are calculated from the robot speed and user-supplied filament geometry.

The two-component mixing nozzle adds a second component to the grout material at the nozzle. Pumping hardware for the second component must be designed to fit user applications.

Robot and Grout Pump



Left: ABB IRB 6700-150/3.20 mounted on the 7th axis linear track. The single component nozzle is fitted to the end of the of the 6th axis. A 6.35 cm ID flexible hose supplies grout to the nozzle

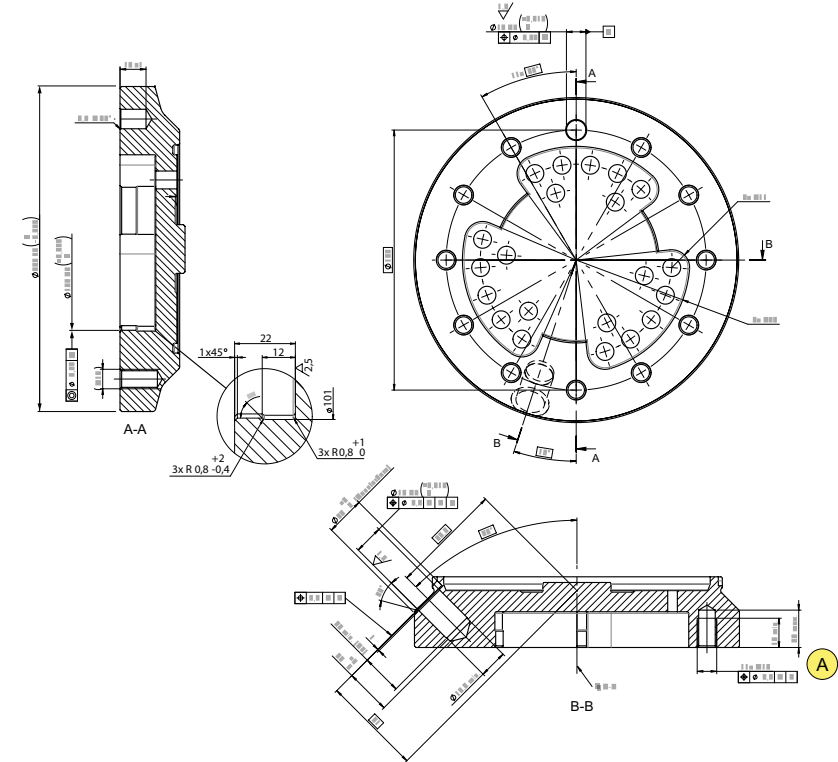


Above: M-tec Duo Mix 2000 grout pump located behind splash shield. The pump is integrated into the the robot controller and can be controlled by the robot or by an operated using the robot teach pendant. The maximum aggregate size is 4 mm.

Available Tools and Mounting Flange



Left: The single component nozzle with 23 mm ID.
Right: Two-component mixing nozzle. Component 1 is supplied by the grout pump and component 2 is supplied by user-supplied hardware.



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A	Thread length: 18 mm.
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Above: Tool mounting flange dimensions. Full CAD files for the IRB 6700-150/3.20 are available here:
<https://new.abb.com/products/robotics/industrial-robots/irb-6700/cad-models>

Layout of Additive Construction Cell

