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MISSION POSSIBLE: BUILD A HOUSE IN 24 HOURS

Construction can be fast, environmentally friendly and affordable if we entrust all the complex work to smart machines.

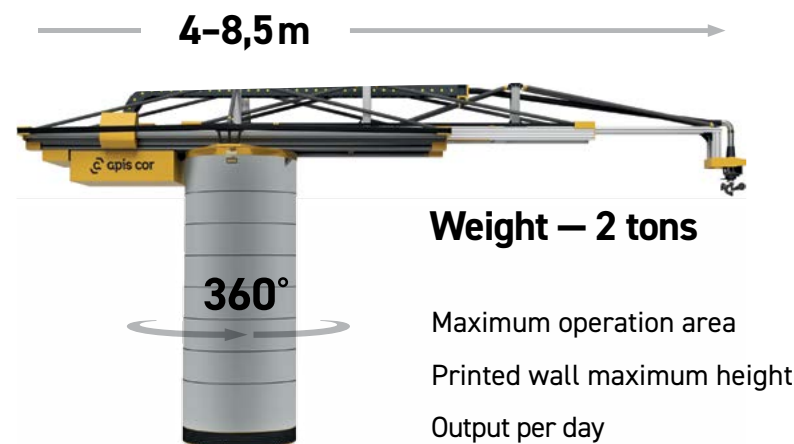
Apis Cor mobile 3D printer is capable of erecting a building in 24 hours, a 100 square meters house compliant with general construction standards and with a lifetime of 175 years.

FOR CONSTRUCTION WE USE

- Mobile 3D printer APIS COR with a unique program control;
- Concrete pump with automated mix and supply system for construction material;
- Silo for storage and transportation of dry construction mixtures.

ADVANTAGES OF A PRINTED HOUSE

- High-quality building structure with no errors or flaws caused by human factor.
- The resulting house has smooth wall surfaces which can be finished and painted right away.
- No construction waste at the construction site.
- Free choice of configuration and walls thickness.
- House total cost is significantly lower than that of its regular concrete counterpart.
- Walls can be insulated with any suitable insulative material.



We are the first company to invent a mobile 3D printer capable of printing a house «from the inside»

Maximum operation area
Printed wall maximum height
Output per day

132 m²
3300 mm
100 m²

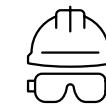
APIS COR 3D PRINTER ADVANTAGES

The main difference from other well-known construction 3D printing devices — APIS COR 3D printer constructs buildings while remaining inside the structure that is being erected.

The printer has a small footprint, and so it's easily transportable and does not require a long preparation procedure prior to the commencement of construction works. All preparation works occupy no more than 30 minutes.

Using a 3D printer you can implement any design or idea. Another advantage is the absence of construction waste.

By remaining in one place, APIS COR 3D printer can create walls layer by layer using concrete mix as a material.



2 operators for operation control



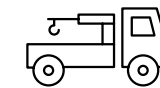
8 KW are consumed by the printer



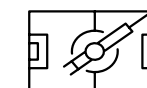
30 minutes to install and configure



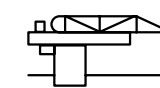
0 grams of construction waste



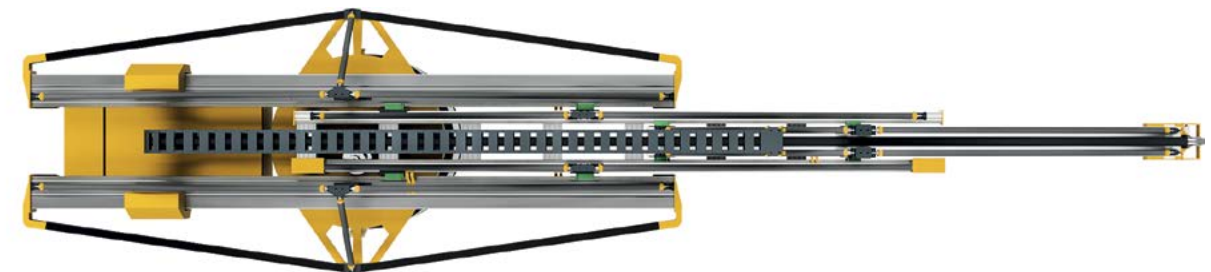
1 crane manipulator vehicle for transportation



132 m² — printing zone



Horizontal alignment



Effective mixing

Dry construction mix enters the mobile mix and supply unit and then is supplied to the printer.



Ease of use

AUTOMATED MIX AND SUPPLY SYSTEM

Thanks to the automatic mix and supply system construction process is executed with machine precision. Calculated and stable ratio of water and construction mix allows for guaranteed high-quality material.



Increased product life



Fast cleaning

1 EQUIPMENT KIT

1 Mobile construction 3D printer Apis Cor



2 Mobile automated concrete mix and supply unit (Mau)

3 Automatic auger

Warning! Construction mix silo is not included in the equipment delivery kit



2

DESCRIPTION OF THE TECHNOLOGY

Mobile construction 3D printer Apis Cor is an automated device for construction of buildings and structures with fine-grade fiber concrete and special additives using method of three dimensional printing.

3D printer is installed inside (fig. 1) or outside (fig. 2) of the object that it prints according to the prepared digital code that is loaded into 3D printer operating system.

3D printer carries out rotational and translatory movements in three planes, and the printing head moves along the preset trajectory path and sequentially layers down concrete, resulting in the building structure formation.

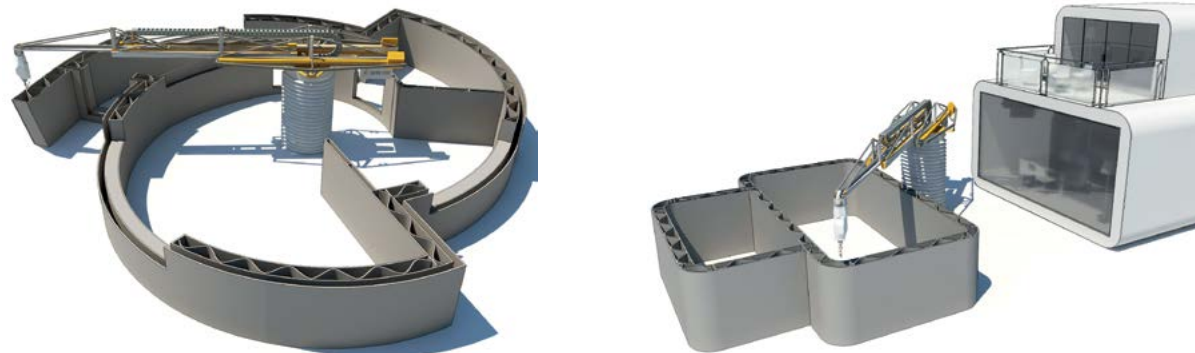


Fig. 1

Fig. 2

EQUIPMENT TECHNICAL SPECIFICATIONS

Mobile Construction 3D printer 7R

Dimensions in folded state (length, width, height)..... 4 000 x 1600 x 1500 mm
Weight..... 2000 kg

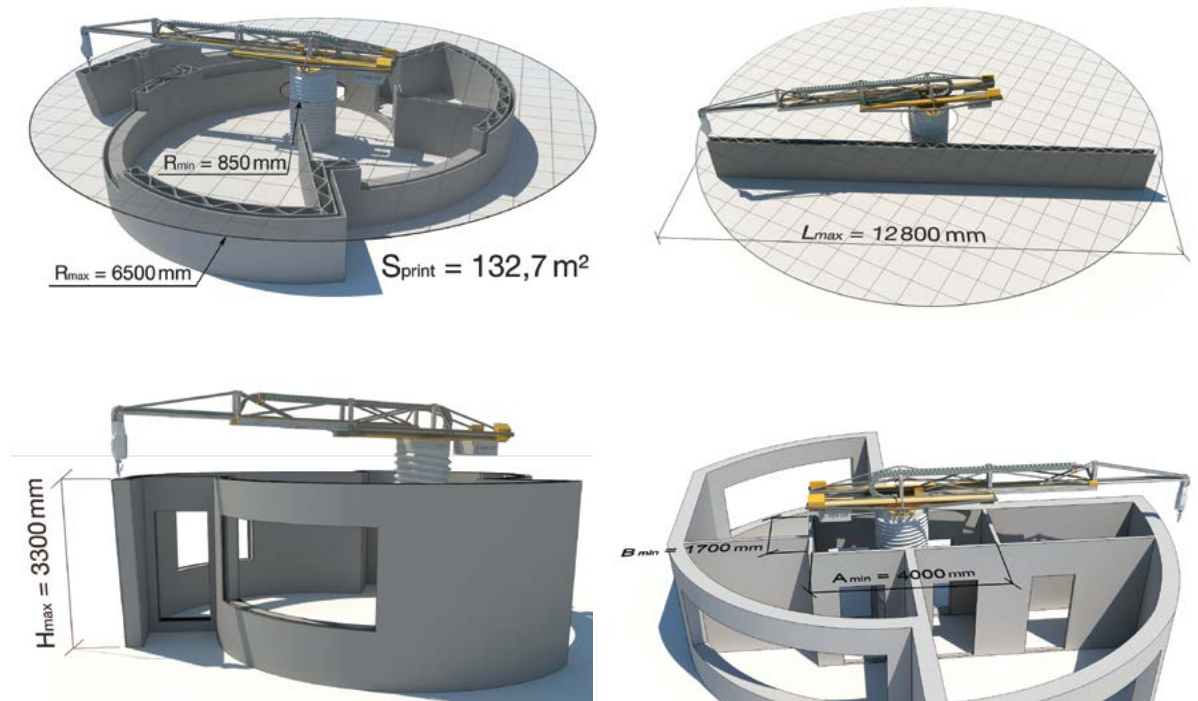
Power specifications

Total power output..... 18 KW
Power consumption..... 4 KW
Voltage 380 Volts, three-phase.
Frequency..... 50 Hz

Operation specifications

Maximum lifting height – base to extruder..... 3300 mm
Maximum arm extension length (relative to center) 6500 mm
Minimum extruder extension length (relative to center)..... 850 mm
Idling speed X/ Y max 20 m/min

Operation movement speed X/Y 1-10 m/min
Positioning precision X/Y 0,5 mm
Repeated positioning precision X/Y..... 0,2 mm
Positioning precision Z 0,1-0,2 mm
Max. operation area..... 132,7 sq.m.



Mobile Automated concrete mix and supply Unit MAC30h

Dimensions (length, width, height)..... 5600 x 2600 x 2600 mm
Weight..... 2000 kg

Power specifications

Total power output..... 15 KW
Power consumption..... 4 KW
Voltage 380 Volts, three-phase.
Frequency..... 50 Hz

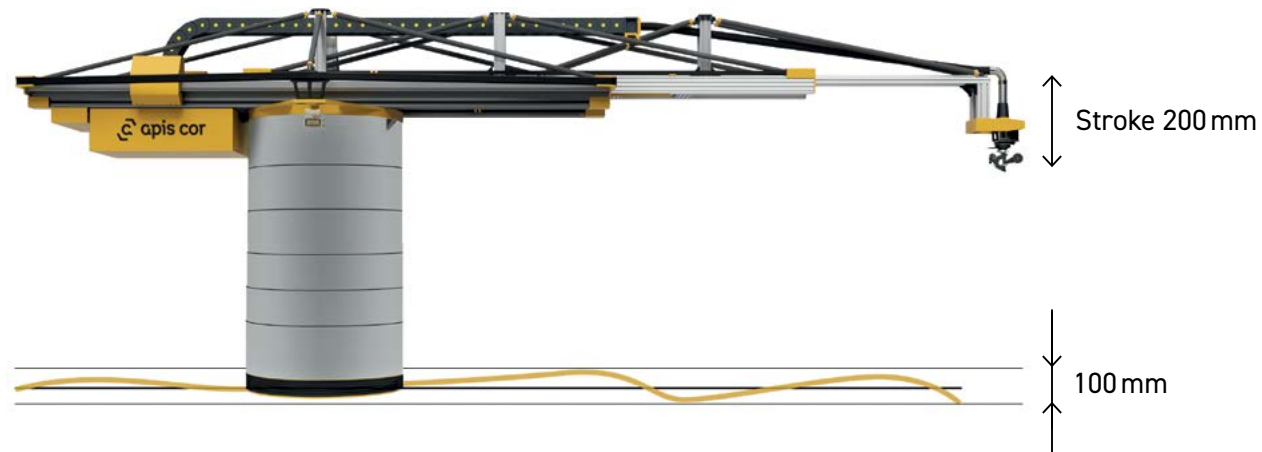
Output

Supply volume max 30 L/min.
Pressure..... max 30 Bar
Supply height max 30 meters
Supply length..... max 80 meters

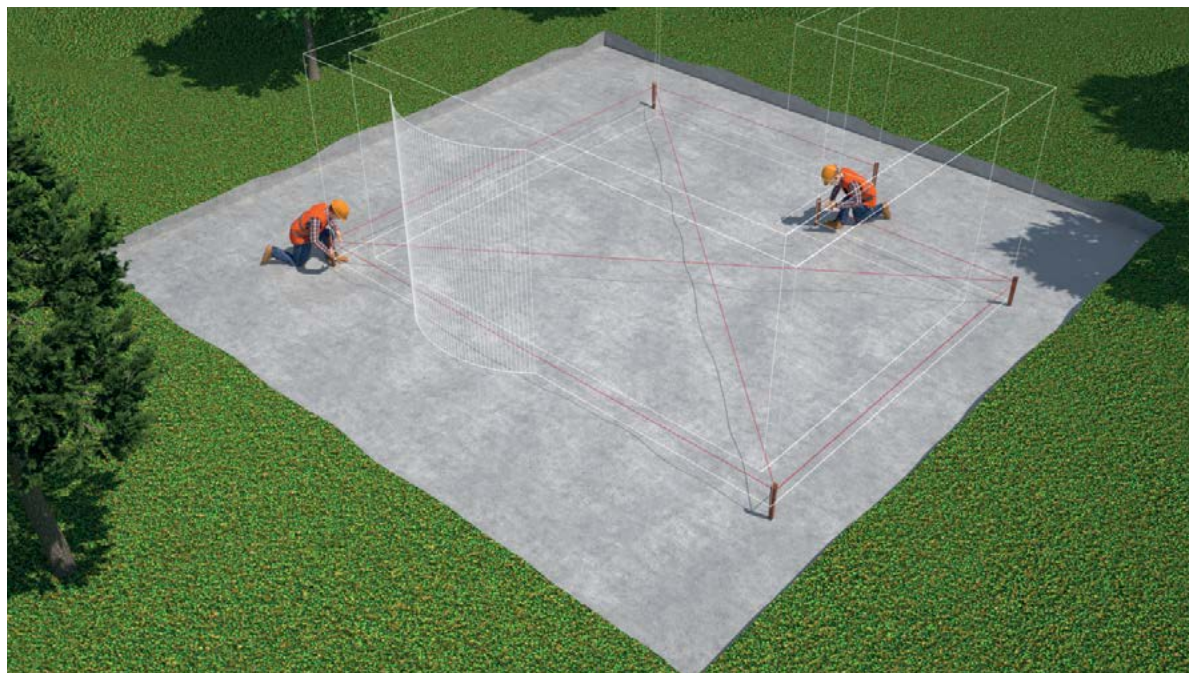
3

INSTALLATION OF EQUIPMENT

Construction begins with the preparation of the construction site with the standard machinery: front loader, bulldozer, grader. The maximum elevation differences of the prepared printer installation site must not exceed 10 cm.



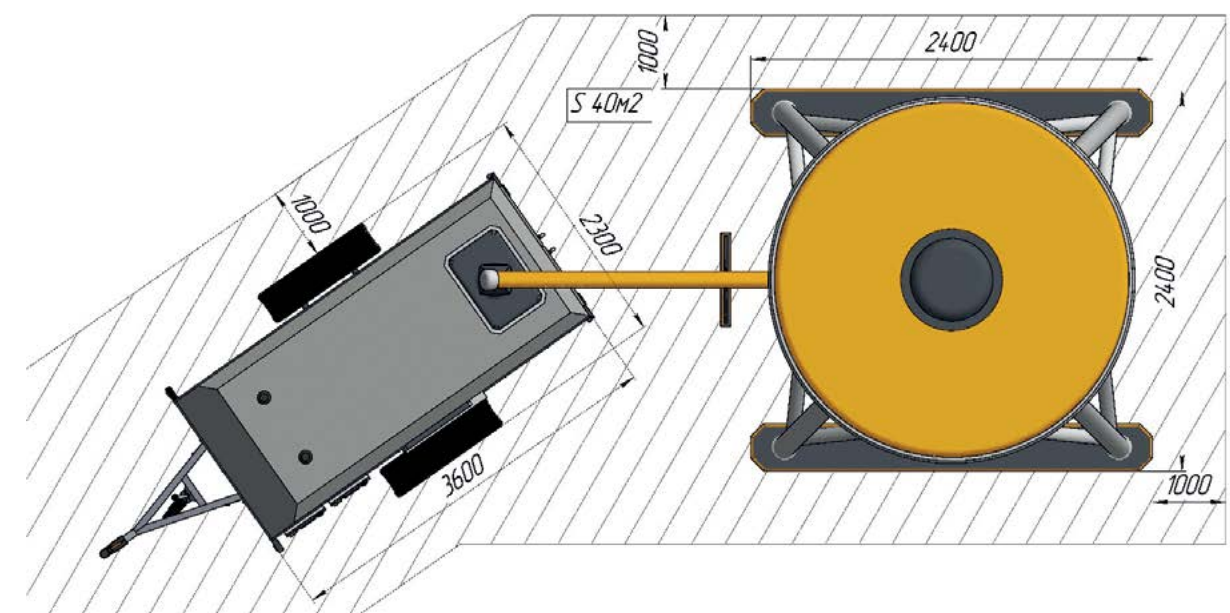
1 On the construction site a preliminary markup for the orientation of future building should be carried out. For this purpose it is necessary to mark the installation point of the 3D printer and one of the building corners.



2 Using a lorry (up to 5 tons) with a manipulator-crane (up to 3 tons) equipment for 3D printing is delivered (construction 3D printer and Mobile Automated Concrete Mix and Supply Unit (hereinafter MAU)) to the construction site. Dry construction mix supplied in bags and mobile silo are delivered to the construction site by the same vehicle with a crane-manipulator, which also puts the mixture into the silo.



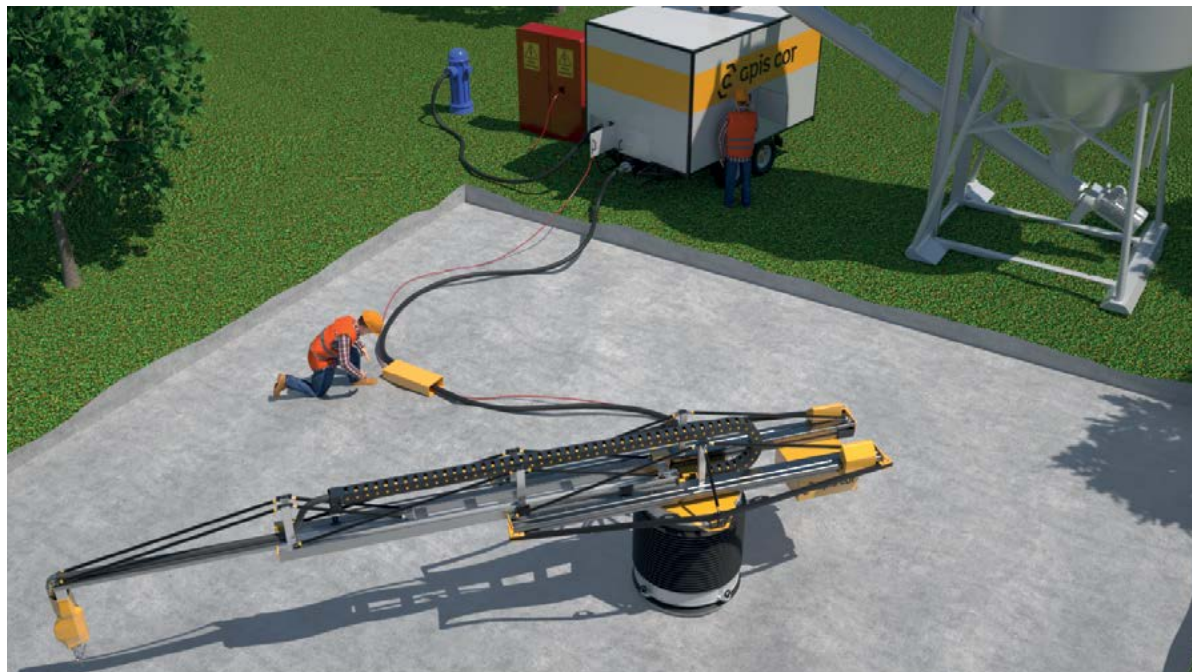
3D printer is installed on the marked point (see s. 2), MAU and silo are installed according to the following diagram





3 After installation of the 3D printer, MAU and mobile silo on the building site the connection of equipment to utility lines is carried out.

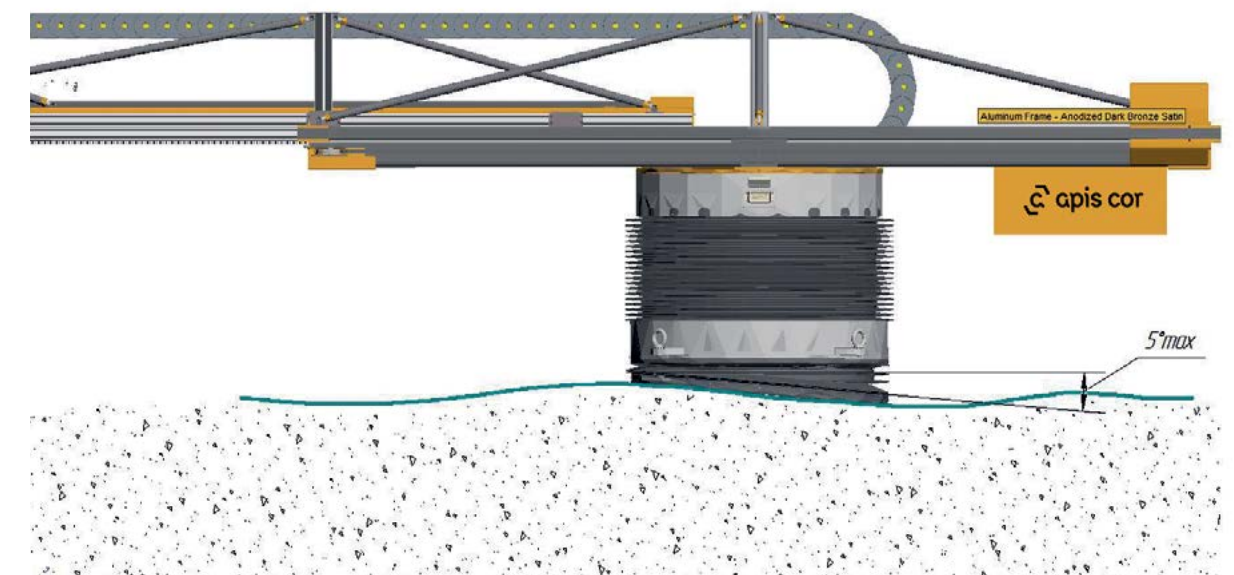
MAU connects to the silo using automated screw auger that goes in the equipment set. Using the crane manipulator auger is fixed in position. Auger silo connection flanges are standardized, and you will not have problems to connect our equipment with any silo.



4 Next MAU connects to power supply from central power line or mobile generator, as well

as water supply which is provided from the autonomous tank with the pump (connected to the mains via the pressure switch) or central water pipe. Then the 3D printer connects to the MAU feed line and special electro-cable included in the equipment kit.

5 After connecting the equipment, you must enable the 3D printer using the Control Panel, located on the MAU. The printer automatically aligns itself to the horizon, so there is no need to perfectly flatten the installation point surface, the soil slope in relation to horizon can be up to 5 degrees. 3D printer does not require hard fixing to the ground - it has an automatic stabilization system and regardless of arm extension distance the centre of gravity always remains on the axis of rotation, ensuring the equipment stability.



6 Next, you need to upload the 3D model of the future building to the printer's operating system using the USB port on the control panel. Then you must orient the building spatially according to the preset corner mark (see section 2). For this purpose it is necessary to orient the 3D printer extruder to the corner mark using the remote control or using the control panel and set this mark as primary (in control panel interface or on the remote control).

7 At this point everything is ready to start printing. Control and further support of the equipment works are handled by a team of 2 people - an operator and printing process assistant.

4 START OF CONSTRUCTION

1 The operator mounts an attachment with an ultrasonic sensor on the extruder. This will allow the printer to perform an analysis of the surface.



2 Using the control panel operator starts the process of print surface scanning. 3D printer makes idle passage and using ultrasonic sensor it makes a surface bump map, which takes into account all roughnesses on printing path.



3 Next the leveling of the printing surface takes place. Based on bump maps obtained after scanning, 3D printer automatically fills holes and roughnesses of printing surface, bringing it up to the horizon and preparing it for printing of foundation formwork (grillage) of the future building.



4 After that, the 3D printer starts printing foundation formwork, there is no need to make a provisional markup - strict adherence to project building model provides the ideal geometry.

Printer follows the specified trajectory and puts material layer by layer, and you can immediately see the contour of the future building. As the printing process goes the operators insert fiber-glass inserts and rebars according to the project. Automated system informs the operator about the need of insert installation and would not continue printing without installing them.



Warning! During printing the permissible technical breaks are no more than 30 minutes. If the operator does not resume the process — the system will automatically flush to avoid clogging the concrete line.

5 After printing the formwork operator needs to initiate the MAU and 3D printer automatic flushing on the Control Panel, located on the body of the MAU. Operator detaches the scanning extension and places the flush ball in the concrete line.



6 Next, the formwork is reinforced, connectors are installed in the clips and the formwork is filled in by heavy concrete.



7 The construction process can be resumed after 12 hours - at this point, concrete has had enough time to gain sufficient strength to continue printing.

8 Foundation is covered with waterproofing, and the operator installs the extruder to print walls with a smoothing device. It allows you to get the walls ready for painting outside and finishing works inside.

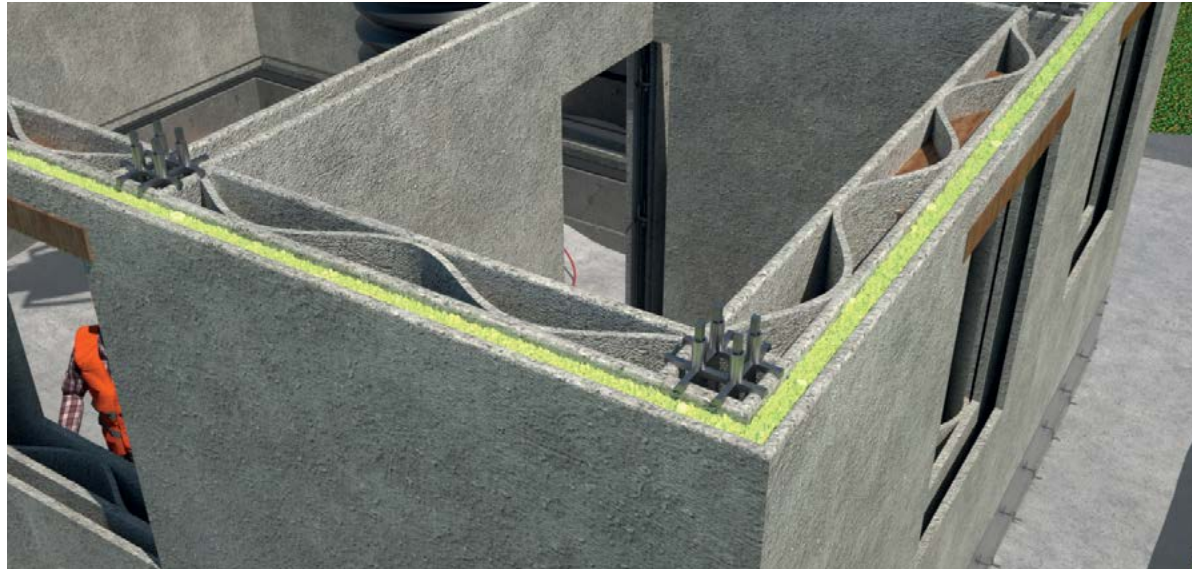
5 ERECTION OF WALLS AND PARTITIONS

1 The printing process of building walls is similar to formwork printing, the only difference is that walls have an internal connector shape. If it's necessary - simultaneously with walls printing a formwork print for reinforced concrete frame for subsequent reinforcement and heavy concrete filling is done - plastic templates are installed with intervals of 60 cm. for installation of rebars. Also, horizontal reinforcements are set for further linking with columns. During the printing horizontal inserts are also being installed, which reinforce the facade layer, forming a chamber for thermal insulation.



In places where there will be a window and door openings, inserts are set according to the project.

Vertical reinforcement scheme



2 Walls inner profile is selected during the building project design stage. It provides channels for laying engineering communications and chambers for thermal insulation material.

According to the project design bond beams can be constructed if necessary. Bond beams are reinforced and filled in by heavy concrete.



3 Inter-story floorings are done using hollow core concrete slabs with installation directly on the printed walls.



Strength class of concrete used for 3D printing by Apis Cor company, based on the test results, corresponds to the B20 grade.

4 Wall cavities are filled with insulator material which provides good heat and sound insulating characteristics of enclosing structures.



6 SECOND FLOOR PRINTING



If a project requires printing of a first floor then concrete or hollow floor decks should be used. When choosing a floor deck a printer load should be considered – approximately 1.2 tons per sq.m.

First floor walls printing is similar to the ground floor printing process.

7 CLEANING/DISMANTLING THE EQUIPMENT

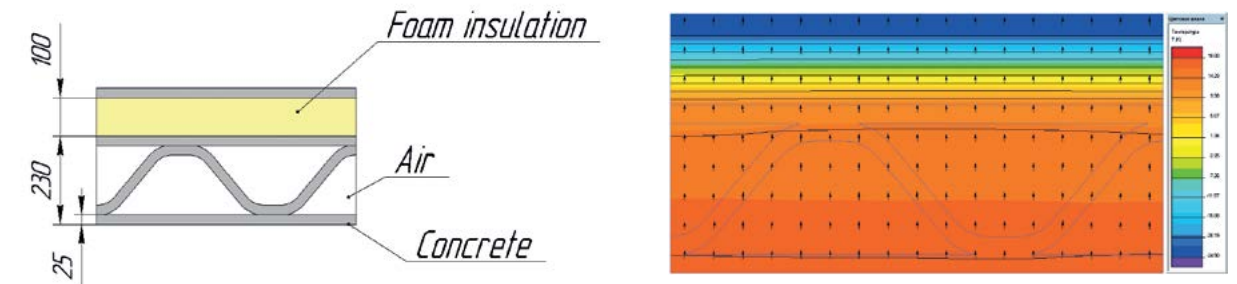
1 3D printer prints the walls up to the flooring (attic) installation mark and completes the printing cycle. At the end of the cycle 3D printer and MAU are flushed in automatic mode.

First, the MAU flushing procedure is initiated. Then the concrete line is detached and a flushing ball is inserted inside. After the MAU has completed its flushing procedure the concrete line flush is initiated and water pushes the ball through the line removing residual mixture.

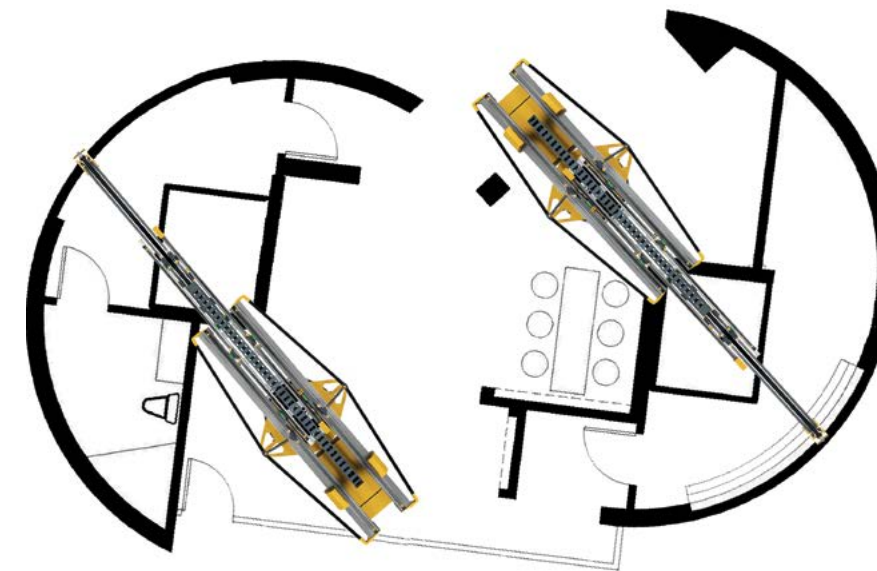
2 After flushing the 3D printer is disconnected from the power supply cable and concrete line and using the crane manipulator vehicle is retrieved from the printed building.



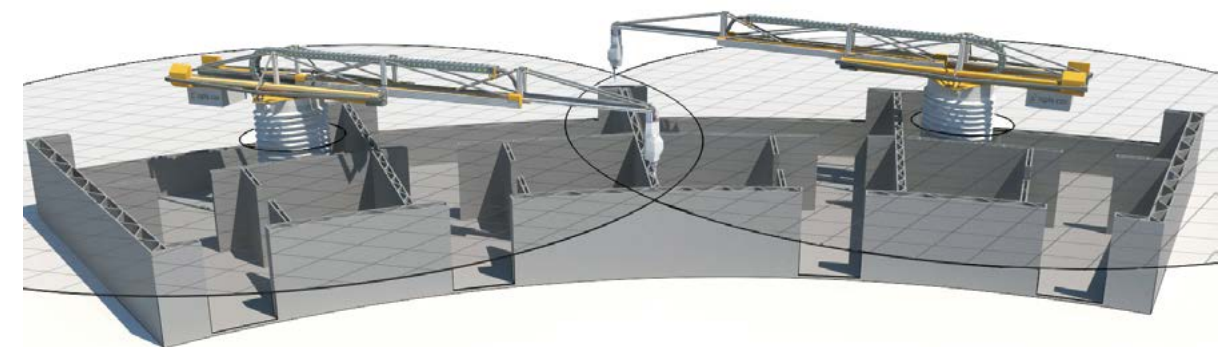
8 ADDITIONAL INFORMATION



Heat resistance for the following wall construction is 3.38 m²* c/W



When using two or more synchronized printers you can print 3D buildings and structures ranging from several hundred to tens of thousands of square meters.



To calculate the approximate cost and construction time we recommend to use the following benchmarks listed in tables №1 and № 2. The basis for calculation is taken for 1 square meter of a building structure, without reinforcement, configurations "A" (fig. 1) and "B" (fig. 2).

Cost of 1 cubic meter of construction mixtures used for three-dimensional printing of civil buildings and public facilities is ranging from 6000 to 9000 rubles, depending on the region. It's advisable to apply an arithmetic mean value which equals 7500 rubles/1 m³.

To calculate the cost and construction time, as well as the volume of concrete needed to print vertical building envelope of a specified area it is necessary to multiply the area of the exterior and interior walls, minus the area of window and door openings on the benchmarks listed in tables №1 and №2.

Vertical construction design configuration "A" used for internal load-bearing walls and non-bearing partitions.

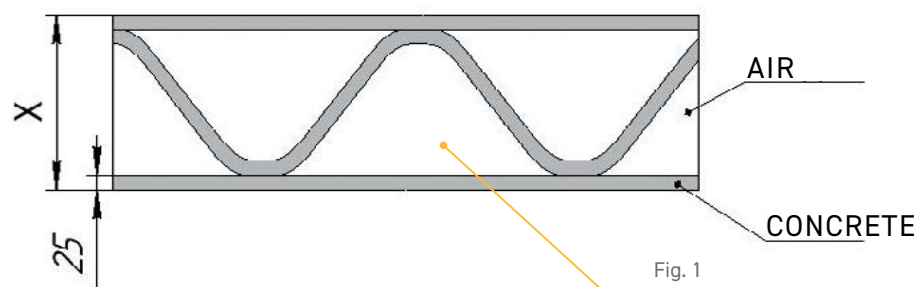


Table No. 1 of benchmarks for 1 sq.m. of building configuration design "A"

Structure with thickness x mm	Concrete volume m ³	Printing time h	Construction cost rub.
100-200	0,079	0,30	591,56
200-300	0,085	0,33	640,12

Vertical construction design configuration "B" used for exterior walls and self-supporting walls with insulation.

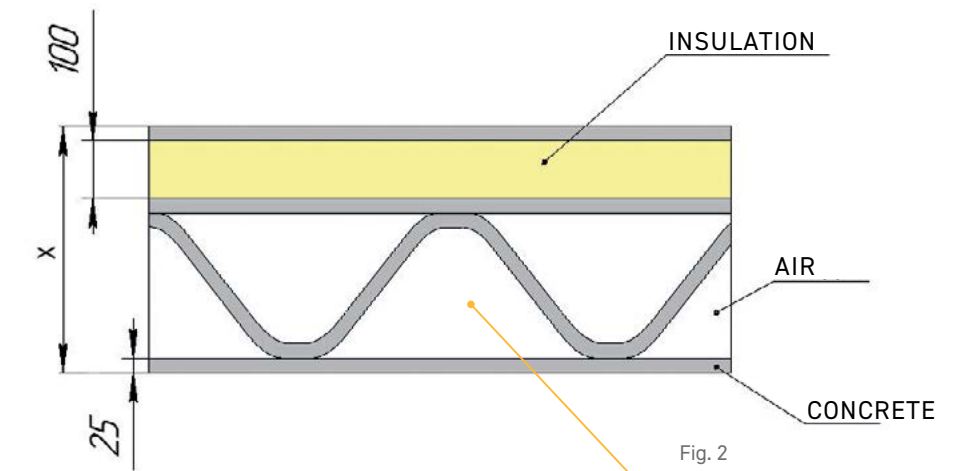


Table No. 2 of benchmarks for 1 sq.m. of building configuration design "B"

Structure with thickness x mm	Concrete volume m ³	Printing time h	Construction cost rub	The cost of the insulation (foam) rub	The total cost of structures rub
325-525	0,11	0,42	827,62	200	1027,62

1 Cost of foam insulator is calculated for 2,000 rub for 1 cubic meters of material including the blowing process on construction site.

11

EQUIPMENT KIT SPECIFICATIONS

SPECIFICATION

Delivery comprises:

Mobile construction 3D printer	1 pc.
Mobile Automated concrete mix and supply Unit	1 pc.
Product datasheet	1 pc.
Maintenance Kit	1 pc.
Licensed software	1 pc.
User manual	1 pc.



WE PRINT
BUILDINGS

3D PRINTING EQUIPMENT KIT SPECIFICATIONS

7R mobile construction 3D printer

Folded dimensions (length, width, height)	4000×1600×1500 mm
Weight	2000 kg

Power specifications

Total power output	18 kW
Power consumption	4 kW
Voltage	380 Volts, three-phase
Frequency	50 Hz

Operation specifications

Maximum lifting height – base to extruder	3300 mm
Maximum arm extension length (relative to center)	6500 mm
Idling speed X/Y	Max 20 m/min
Operation movement speed X/Y	1-10 m/min
Positioning precision X/Y	0,5 mm
Repeated positioning precision X/Y	0,2 mm
Positioning precision Z	0,1 - 0,2 mm
Printing zone radius	min 860 mm, max 6500 mm

Mobile Automated concrete mix and supply Unit MAC30h

Dimensions (length, width, height)	5600×2600×2600 mm
Weight	2000 kg

Power specifications

Total power output	15 kW
Power consumption	4 kW
Voltage	380 Volts, three-phase
Frequency	50 Hz

Output

Supply volume	Max 30 liters/min.
Pressure	Max 30 bar
Supply height	Max 30 meters
Supply length	Max 80 meters

Construction projects cooperation with «APIS-COR» company

TERMS OF COOPERATION

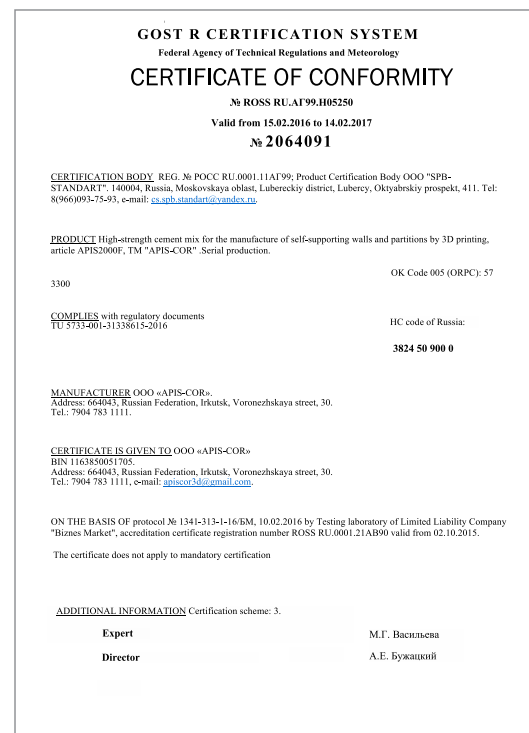
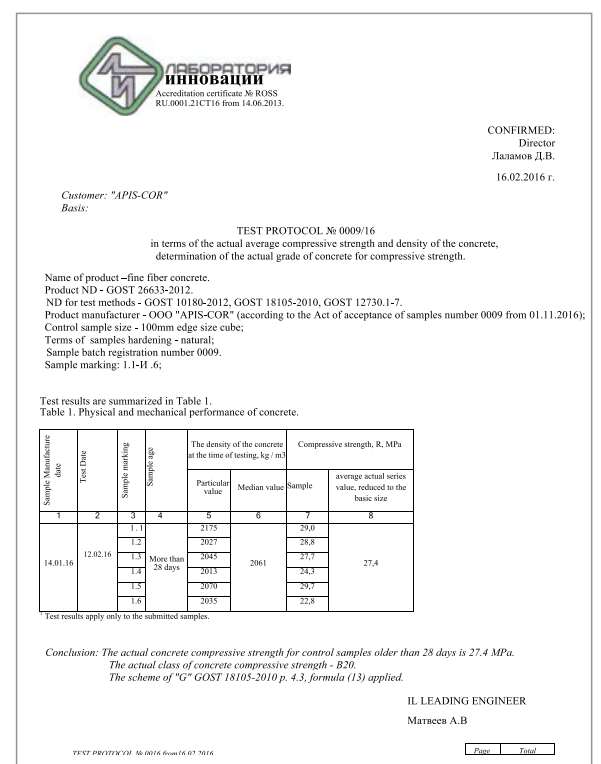
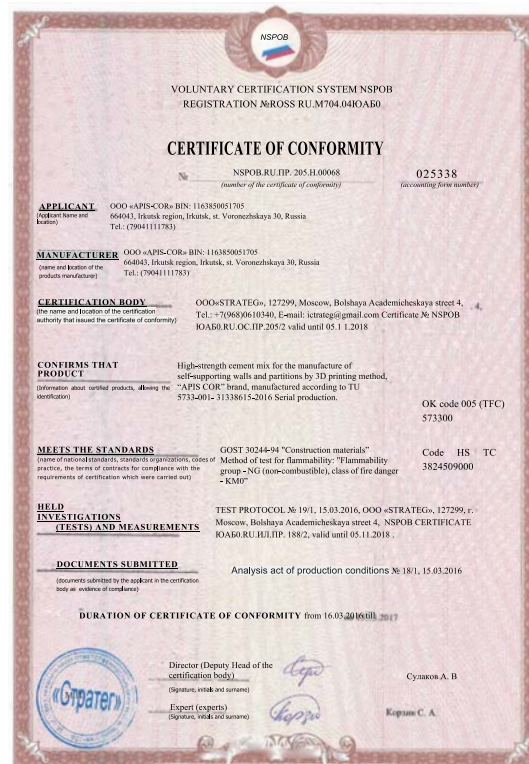
The «APIS-COR» company is always open to any suggestions.

We are interested in implementation of major construction projects starting with 100 houses where we can act as a contractor for the construction of building frames.

To make a decision to carry out a joint project, we ask that you provide the following information according to the questionnaire:

The initiator of the project	an individual/company Full name/company name
Project initiator information	Full legal data, mailing address, phone, website, email address, contact person information, company profile and activities
Initiator role in the project	General contractor, construction company, developer, etc.
Information about the site, on which construction is planned	Coordinates of the site, location and address, satellite images, documents for the property, property subject and his contacts.
Information about the current project status	building permit, project documentation, general plan, technical conditions, available engineering
What are the sources and modes of funding?	Personal funds/investment/loans/public funding/government contract/other

Your proposal will be considered as soon as possible, after which our manager will contact you according to the specified contact data and inform you about the decision of «APIS-COR» company. Thank you!





Limited liability company
«Apis-Cor»»
INN 3812118058
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