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ADDITIVE MANUFACTURING THROUGH 3D PRINTING FDM-FUSED DEPOSIT MODELING OF TOP COVER

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ABSTRACT

In this work, it is proposed to make by additive manufacturing through 3D printing with FDM technology FDM (Fused Deposition Modeling - Modeling by Depositing Fusible Filament) some landmarks of the washing head which is common to the light water well drilling rigs FA100, FA125, FH150 and FG40.

A washing head like the FA100 washing head, which has the casing and the drilling fluid supply fittings, 3D printed from PETG and ABS+ filament, has never been made in Romania.

The main advantages of using this manufacturing technology are that by purchasing such equipment, a large number of different landmarks can be made and the final price of the landmark.

KEYWORDS: washing head housing, 3D printing, Fused Deposition Modeling, water drilling installation

1. Introduction

Due to the common use of this flush head on light water well drilling rigs FA100, FA125, FH150 and FG40, its generic name will be "FA100 Flush Head".

The washing head is the most important sub-assembly in a water well drilling installation, and ensures the operation of the installation on the principle of "hydraulic rotary drilling with direct circulation of drilling fluid", whereby, inside the rotating drill rod assembly is injected, through the washhead, drilling fluid from the discharge of the drilling mud pump, which is fed from a pit (pit) dug below ground level.

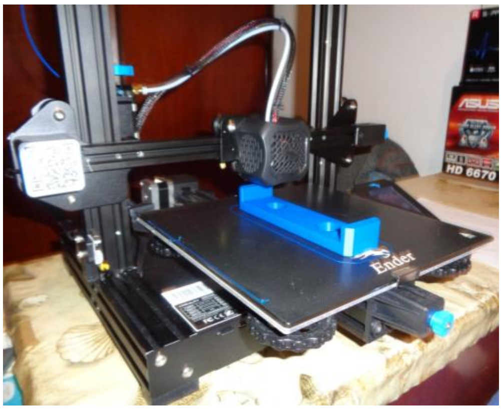

Fig. 1. *Creality Ender 3 V2 3D printer, Shenzhen*

The 3D printed FA100 washing head housing prototype will be additively manufactured through 3D interfacing with PETG filament on the Creality Ender 3 V2 3D printer, Shenzen China. The housing from the FH150 washing head, cost a lot, 1600 lei, before, manufactured by the communist workers from massive welded steel semi-finished products, with very low labour productivity, and with primitive

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manufacturing technologies, now in the 3D printed version of PETG and ABS+, it costs only 120 lei, the labour is almost Zero, it is a spectacular leap in work efficiency and productivity.

The FA100 washing head top cap landmark prototype will be manufactured by 3D printing from ABS+ filament on Creality Ender 3 V2 3D printer, Shenzen China [2, 3]. This new variant of realization of the various landmarks offers many advantages compared to the classic realization processes.

The technical characteristics of the printer used are presented in Table 1.

The material used to manufacture the top cover marker is ABS+ with characteristics described in Table 2.

Table 1. *Technical specifications*

Specific technology	FDM (Fused Deposit Modeling - Modeling by Depositing heated fusible filament, layer by layer
Print volume (liters)	12.1
Print dimensions (mm)	220x220x250
Filament diameter (mm)	1.75
Extruders	1, MK10
Print nozzle	Brass, 0.4 mm
Layer thickness (mm)	0.1-0.4
Printing temperature	max. 260
Printing table	Heated, max. 110 °C
Compatible materials	PLA, TPU, ABS, PETG
Display	Color LCD
Command	Rotary knob
Connectivity	USB
External media support	Card SD
Software	Cura (compatible Simplify3D, Repetier Host)
OS compatibility	Windows, Mac, Linux
File format	STL, OBJ, G-code
Feeding	100-265 V 50-60 HZ 270 W
Size (mm)	475x470x620
Net weight (kg)	6.8
Package dimensions (mm)	595x495x165
Package table (kg)	9.6

Table 2. *Characteristics of ABS+*

No. crt.	**Type of filament material for FDM 3D printing**	**Temp. Nozzle 3D Print Head °C**	**Temperature bed printer °C**	**Tensile Strength [MPa]**	**Elongation at Break [%]**	**Flexural Strength [MPa]**	**Flexural Modulus [MPa]**	**Impact Strength [MPa]**
1	ABS+	260	110	40	30	68	2443	42

2. Fabrication

Superior cover landmark, no. drawing FG40-04.05.09.0 was additively manufactured by FDM 3D printing with ABS+ filament according to the drawing in Figure 2.

Figure 3 shows the 3D modeling in the Autodesk Fusion 360 program of the upper cover landmark, which results in the STL format file for "slicing" before its 3D printing.

Figure 4 shows the 3D slicing modeling of the top cover landmark, using the slicing program, Ultimaker Cura 4.13.1

Figures 5 and 6 show the slicing settings of the top cap landmark.

Figure 7 shows the top cap landmark, 3D printed, using ABS+ filament, on the Creality 3D printer, Ender 3 V2.

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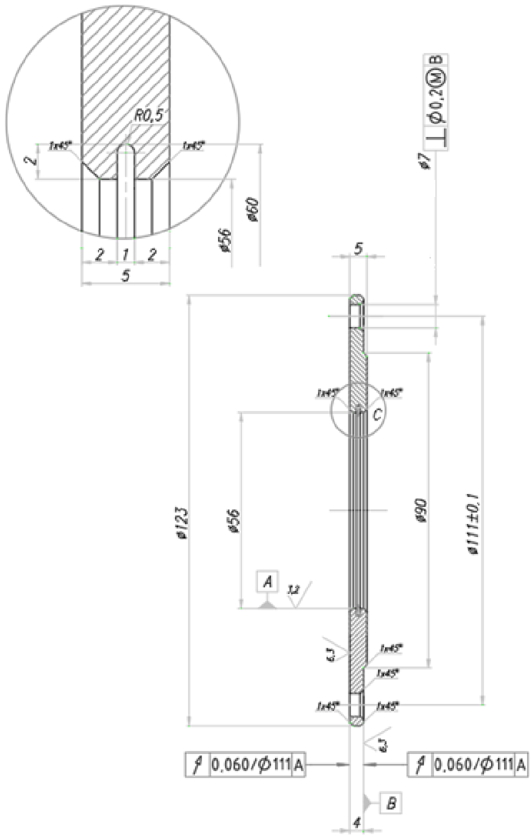

Fig. 2. *Execution drawing - top cover*

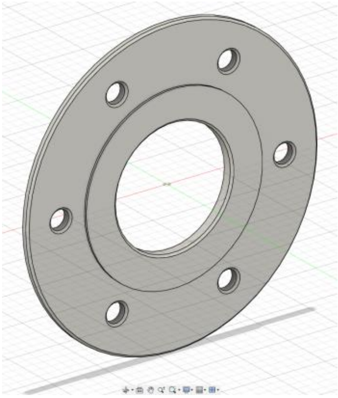

Fig. 3. *3D modeling in Autodesk Fusion 360 of the top cap landmark, resulting in the STL format file for "slicing" before its 3D printing*

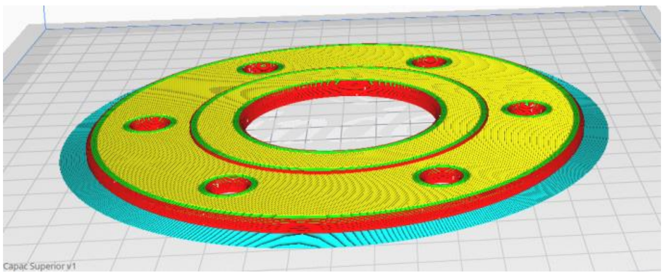

Fig. 4. *3D slicing modeling of the top cap landmark, using the slicing program, Ultimaker Cura 4.11*

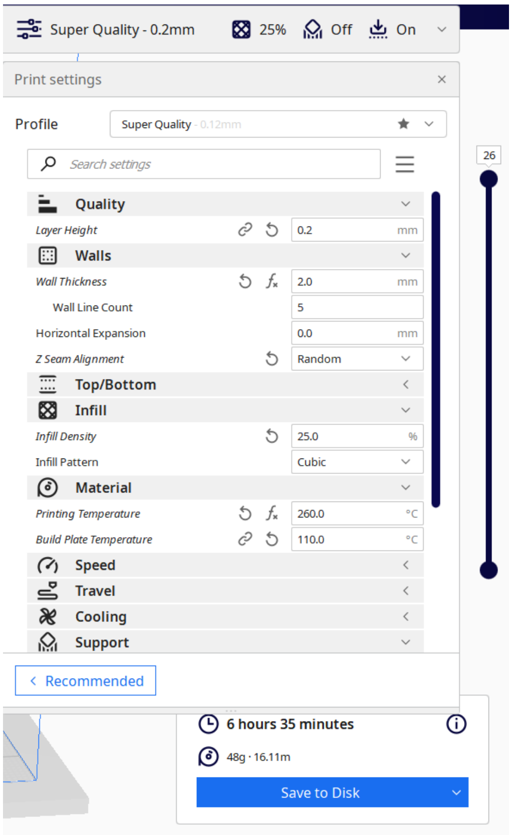

Fig. 5. *Top cap landmark slicing settings*

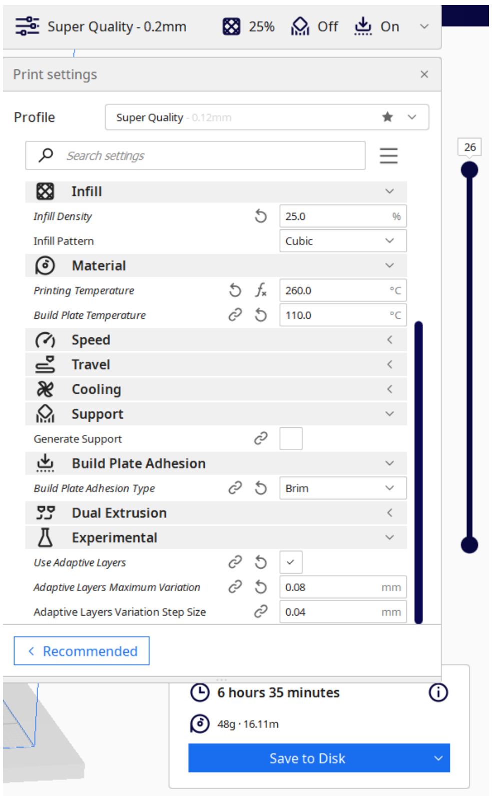

Fig. 6. *Top cap landmark slicing settings*

Fig. 7. *Top cap landmark 3D printed using ABS+ filament on Creality Ender 3 V2 3D printer*

Conclusions

The realization of landmarks using 3D printing technologies are increasingly widespread in the industry due to the advantages they offer: low energy consumption, very high material utilization efficiency, very high productivity because each printer can be considered a semi-robotic cell and not least the final price that the constructed landmark has.

Also, the built landmark behaved in operation in the same way as the one built from metallic materials using classic technologies.

In the present work, the method of making the "Top cover" landmark using 3D printing technology was experimentally highlighted. Analysing the data, it can be seen that it takes 6 hours and 35 minutes to achieve a higher quality. This time compared to a classic process of obtaining the "Top Cover" landmark, for example by stamping, perforating and embossing, may seem significantly longer, but it must also be taken into account the manufacturing preparation times, which are long in compared to 3D printing technology.

Another factor to consider is the cost of equipment versus machine tools. From this point of view, 3D printing technology is much more advantageous, and the amortization of the investment is done faster than by purchasing machine tools.

We can conclude that the use of 3D printing technologies in the industry is a variant that over time can replace the use of classic technologies.

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