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ADDITIVE MANUFACTURING THROUGH 3D PRINTING OF THE MARK HOS PIPE DN 50, USING ABS+ FILAMENT

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ABSTRACT

This paper deals with the additive manufacturing by 3D printing of the Hose Pipe DN 50 landmark which is part of the Gas Reduction R2-Hose DN 2 in subassembly. This sub-assembly is a component part of the washing head of the light water well drilling installations FA 100, FA 125, FH 150 and FG 40. The generic name of the washing head will be FA 100. We use 3D printing technology because, on the one hand, it is technically possible to make the part and on the other hand, for economic reasons. It is approximately ten times cheaper to make the part through 3D printing than through conventional technologies

KEYWORDS: Hose pipe, 3D printing, Fused Deposition Modeling, water drilling installation

1. Introduction

Due to the common use of the washhead on light water well drilling rigs FA100, FA125, FH150 and FG40, its generic name will be "FA100 Washhead" [1-3].

The aim is to obtain the components of the washing head at water well drilling installations, through 3D printing additive manufacturing, both for technical and economic reasons [4-6]. From an economic point of view, it is approximately ten times cheaper to manufacture the parts of the washing head through 3D printing additive manufacturing than to manufacture them using conventional technologies. This issue represents a spectacular leap in work efficiency and productivity.

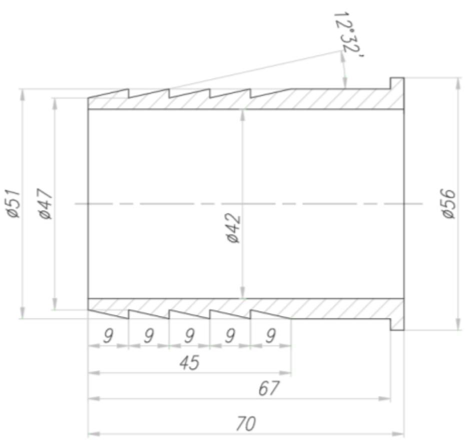

***Fig. 1.** Execution drawing for Hose Pipe DN 50*

This paper deals with the additive manufacturing by 3D printing of the Hode Pipe DN 50 landmark, component part of the washing head of water well drilling installations, generically called FA 100.

The landmark Hose Pipe DN 50, whose additive manufacturing through 3D printing is to be described, is part of the Gas Reducer R2-Hose DN 2 subassembly.

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The landmark Hose Pipe DN 50 was manufactured by 3D FDM printing with ABS+ filament according to the drawing in Figure 1.

2. Fabrication

Figure 2 shows the 3D modeling in the Autodesk Fusion 360 program of the Hose Pipe DN 50 landmark, which results in the STL format file for slicing before its 3D printing.

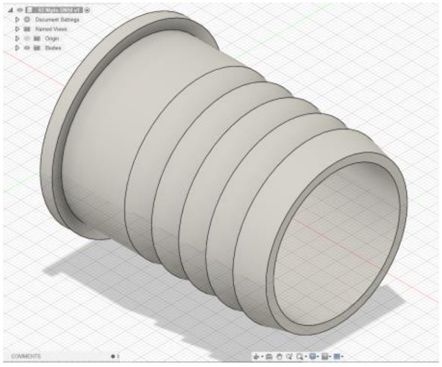

Fig. 2. *3D Modeling in the Autodesk Fusion 360 program of the Hose Pipe DN 50 landmark, which results in the STL format file for slicing" before its 3D printing*

Figure 3 shows the 3D slicing modeling of the Hose Pipe DN50 mm landmark, using the Ultimaker Cura 4.11 slicing program.

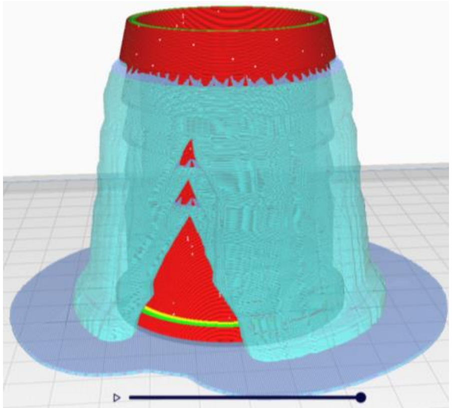

Fig. 3. *3D Slicing modeling of the Hose Pipe DN50 mm landmark, using the slicing program, Ultimaker Cura 4.11*

Figure 4 shows some of the settings for slicing the Hose Pipe landmark DN50 mm.

Other settings made for slicing the Hose Pipe DN50 mm are shown in Figure 5.

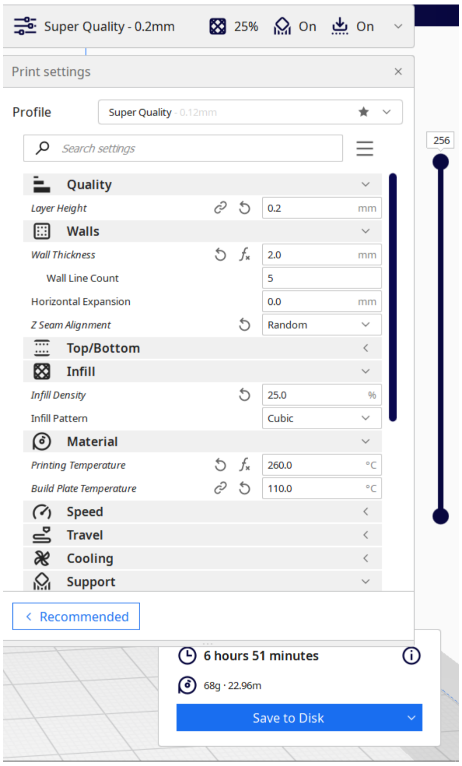

Fig. 4. *The first part of the settings for slicing the Hose Pipe landmark DN50 mm*

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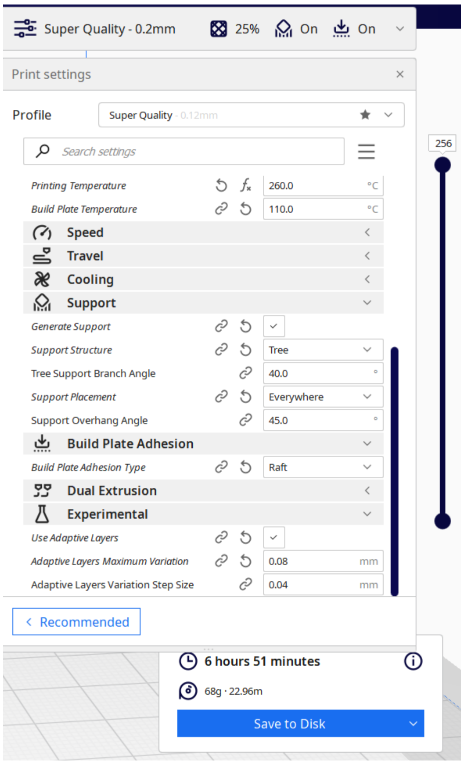

Fig. 5. *The second part of the settings for slicing the landmark HosePipe DN50 mm*

The main slicing settings for the Hose Pipe landmark DN50 mm in the Cura 4.13.1 program were as follows: Layer height = 0.2 mm; Wall thickness = 2 mm; Z-Seam Alignment = Random; Infill density = 25; Infill Pattern = Cubic; Material = ABS+ Printing Temperature = 260 ºC; Build Plate Temperature = 110 ºC; Generate Support = Yes; Support Structure = Tree; Tree Support Branch Angle = 40º; Support Placement = Everywhere; Support Overhang Angle = 39º; Build Plate Adhesion Type = Raft; Use Adaptive Layers = Yes; Adaptive Layers Maximum Variation = 0.08 mm; Adaptive Layers Variation Step Size = 0.04 mm.

It took 6 hours and 51 min to print the Hose Pipe DN50 mm and consumed 68 g of ABS+ filament. The Slice command is given.

Hose Pipe DN50 benchmark took 11 hours and 45 minutes to print. and consumed 67 g of ABS+ filament. The Slice command is given.

Figure 6 shows the landmark Hose Pipe DN50 mm, 3D printed, using ABS+ filament, on the Creality 3D printer, Ender 3 V2.

Fig. 6. *Landmark Hose Pipe DN50 mm fabricated by additive 3D printing on the Creality Ender 3 V2 3D printer*

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Conclusions

The manufacture of the landmark Hose Pipe DN50 mm through 3D printing, represented the optimal solution from a technical and economic point of view. In the conventional manufacturing version, a high manufacturing cost results and the labour productivity was low. In the 3D printed version made of ABS+ filament, the part costs approximately 10 times less, the labour being almost zero. This issue represents a spectacular leap in work efficiency and productivity.

This landmark is an integral part of the washing head from light water well drilling installations, type FA 100, FA 125, FH 150 and FG 40. The additive manufacturing by 3D printing of this landmark aims to reduce the manufacturing cost of light drilling installations water wells thus falling into the category of green projects and projects for the realization of industrial parts through additive methods.

The partial realization through additive manufacturing through 3D printing of some land-marks of light water well drilling installations has several advantages. On the one hand, from an economic point of view, the reduction of the manufacturing cost is obtained, and on the other hand, a modern, fast and relatively easy to implement technical solution is used.

Another objective pursued by the manufacture of light installations for drilling water wells at low costs and using modern technical solutions such as additive manufacturing through 3D printing, is the relaunch of irrigation in Romania. This is a requirement of the European commissioners in the National Recovery and Resilience Plan of Romania PNRR. The proposed solution is to make water wells with drilling installations, or a water well with a depth of 80 meters, on two hectares of land agricultural.

In the context of the war in Ukraine which led to the collapse of imports of raw materials and equipment in Europe and in the context of the container crisis in China, with delays of 2-3 years, for the import of equipment from China, it is possible to lay the foundations for an industrial relaunch and in Romania. Thus, it is proposed to align with the new reindustrialization of the EU by demonstrating the capability of manufacturing the prototype of the FH100 water well drilling installation, at the best price / quality ratio, by 3D printing and by manufacturing on CNC numerical control milling processing centers, with zero labour, this type of means of pro-duction having the status of Industrial Robots.

The objective pursued is the realization and testing of FH 100 type water well drilling installations, with hydraulic drive, on a monoaxle trailer, in a modern, flexible modular design, for the efficiency, flexibility and reduction of the energy costs of drilling, with 3 innovative modules being developed, namely: The module mechanically driven drilling head, Hydraulically driven Drilling Head Module and Hydraulic Drive Installation Module, integrated into the chassis of the monoaxle trailer These modules will contain innovative products of scientific and technological revolution consisting of resistance machine parts and other milestones made by manufacturing digitized additive, namely by 3D FDM printing, Fused Deposition Modeling, by hot extrusion layer by layer and by digitized subtractive manufacturing, by CNC processing.

At this moment, a true industrial, scientific and technological revolution is being dis-cussed worldwide, consisting in the development of Additive Manufacturing technologies through the use of 3D printing.

In this sense, the approach of manufacturing the components of light water well drilling installations, at the level of Romania, through additive methods such as 3D printing, is a perfectly justified technical-economic solution.

Acknowledgement

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