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IE 241: Manufacturing Processes

Case Study #3: Machining

Introduction

Your team has been given the task by your supervisor to review an issue that has occurred with a part manufactured at your company. You are being asked to analyze the issue and report back to your supervisor on why the problems have occurred and suggest ways to prevent this issue from occurring in the future.

Present your recommendations in the form of a typed professional memo. Your report should be self-contained. In other words, no additional documentation should be needed to understand what you submit to the supervisor. The main memo should be limited to no more than 2 pages using normal text font and format. Graphs, data, sample calculations, and any other supporting documents may be attached. For example, the memo may refer to a figure showing a schematic diagram. The figure, however, should not be on the memo page itself. Also, you must refer to each figure, schematic, table, etc. you have attached in the memo.

You may discuss the assignments with the other groups. However, each group should come up with their own ideas and turn in one report. Save all of your attachments to one PDF document and submit on KHAS Learn as GroupNCS3, N being your group number.

Case Study Detail

The item illustrated in the figure is a steel part produced for the aerospace industry. Currently, a bar stock of 4" diameter and 24" length is used as the blank for the part. The following sequence of machining processes are then performed on the part to create final shape:

- 1) The part is turned on the outside to reduce diameter to 3.5". The tool is capable of cutting 0.1" depth of cut at a time, so 5 roughing passes are taken to reduce diameter and 1 finishing pass is taken to bring the diameter to 3.5".
- 2) The part is face-turned so that the face looking outside is smooth and flat.
- 3) A cut-off tool is used to cut a 2"-thick disc from the end of the bar stock. It is cut at a small tolerance higher than 2" for post-processing. Then, the bar stock is removed from the lathe and the cut-off disc is fixed in its stead. Since one side is flattened already, that side is fixed toward the chuck and the cut-off side faces outside.
- 4) The part face (that is just cut-off) is face-turned as well to create a part that is smooth on all faces. Also at this stage, the part thickness is brought to precisely 2".
- 5) A center drill is used on the lathe to create the initial hole in the middle at 1/4" diameter and 1/2" depth.
- 6) A 1/2" diameter drill bit is used on the lathe to enlarge the center hole and make it a through hole.
- 7) A special chamfer turning tool is used to enlarge the center hole and keep it a through hole at the enlarged diameter simultaneously. After this process, the inside diameter is created at 1".
- 8) Part is removed from the lathe and brought to a drill press to create the 4 holes as well as initial holes to create the curved slots (with a slot width of 1/4") - so a total of 6 holes at 1/4" diameter are created.
- 9) Part is removed from the drill press and brought to a vertical milling machine. The initial holes for the slots are used to create the two slots using a 1/4" diameter end mill. The end mill cannot take 2" depth of cut at a time, so 4 passes are taken at 1/2" depth each.
- 10) Sides of the part are rough-milled using a 1" diameter end mill. Due to the thickness of the side portions to be machined, four passes are used for each side.
- 11) Sides of the part are finished using a 1/4" diameter end mill.

The process takes many steps and includes three separate machines. Due to many reasons manufacturing-related, including but not limited to the amount of time the process takes, the complexity of the tools required, and the shop space required for the whole process, the process is too costly for the company. Also, the manufacturing team observes difficulties in fixturing the part in some portions of the process. As the project team, you are asked to come up with a solution to better manufacture the part in question, without sacrificing from the precision that is required by the industry.

Deliverables: Short memo (2 pages max.) and any attachments needed in the form of one PDF document named GroupNCS3.pdf. The file should have a title page as well. Submit one file as a group.

Due: May 15, 2020, 1 PM on Canvas

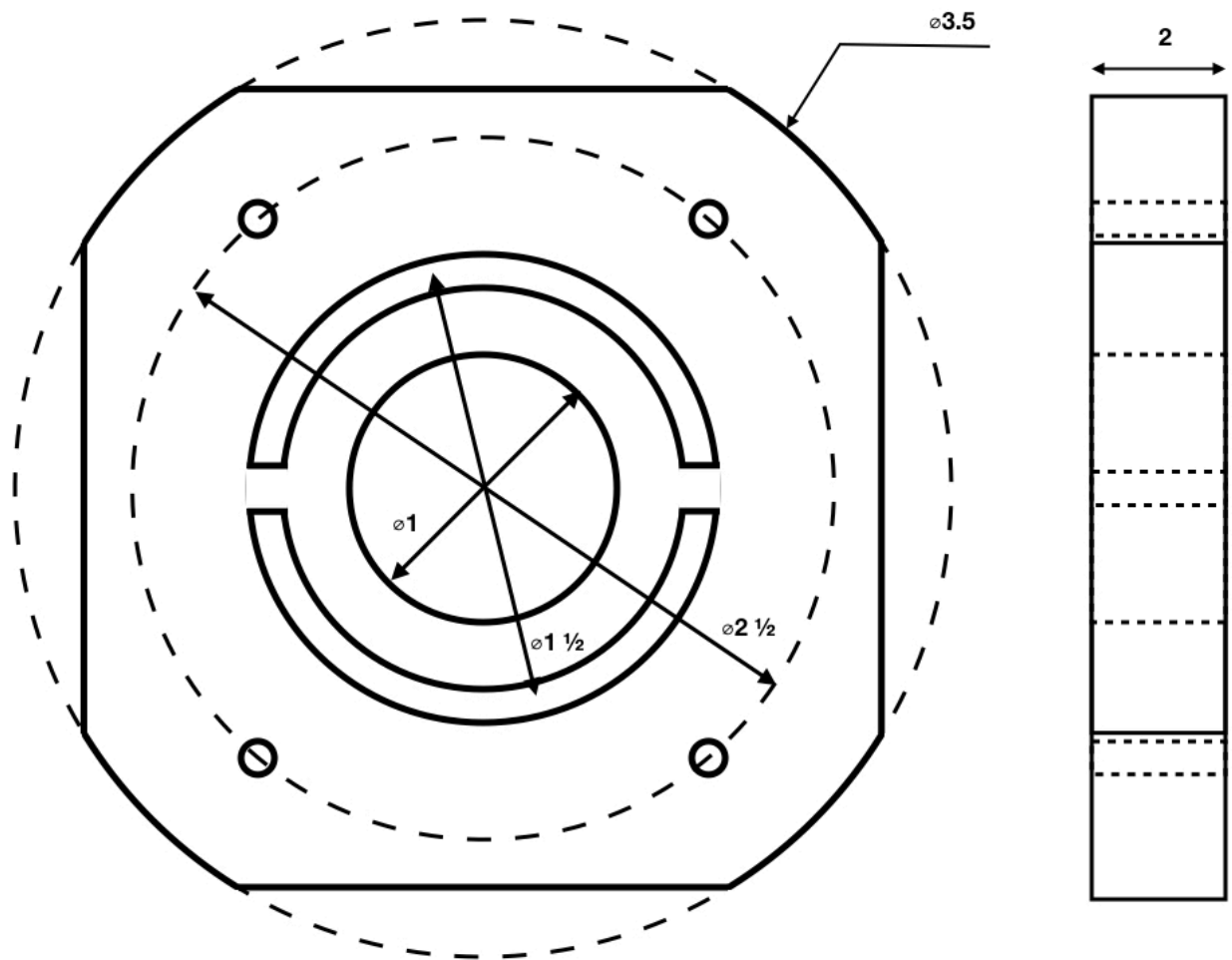


Figure: Rough drawing of part (not completely dimensioned - only for visualization purposes)



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