Test Project

Module 3 Mechanical assemblies and detail drawing for manufacture

Mechanical Engineering CAD

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Introduction

The project contains the following documents/files:

- Printed task
- Printed drawings of parts or assemblies for modeling
- Supplied files (folder… /M3_GIVEN FILES).

Description of project and tasks

You are required to model and assemble an automatic pipe bending machine, improve the design of specified mechanisms according to the requirements, and generate detailed drawings and a Motion Animation.

You have 6 hours to complete the project.

Instructions to the Competitor

Review the printed drawings, Test Project description and 3D data files, then model the components as requested, and generate detailed drawings and an animation.

Modeling and Assembling of Parts

1. Using Fusion , convert the 5 stl files into solid bodies, and save as IPT files: PBM-001-002-006, PBM-001-003-006, PBM-001-003-016, PBM-001-005-003, PBM-002-014.
2. Refer to the supplied drawings, model 9 parts as required: PBM-001-004-005, PBM-001-011, PBM-001-028, PBM-001-006-006, PBM-002-004-014, PBM-002-001-008, PBM-002-004-011, PBM-002-004-012, PBM-001-015.
3. Refer to the BOM information, complete the assembling of subassembly PBM-002. Subcomponent PBM-002-004 is only provided with BOM information.
4. Refer to given drawings, complete the assembling of subcomponent PBM-001-003 as follows:
   (a) Insert the modelled parts PBM-001-003-006 and PBM-001-003-016 into the assembly.
   (b) Based on the given information, determine the center distance A of the mounting holes on part PBM-001-003-002 and modify the model accordingly.
5. Refer to given drawings, complete the assembling of subcomponent PBM-001-004 as follows:
   (a) Insert the modelled part PBM-001-004-005 into the assembly;
   (b) Based on the given information, determine the center distance B of the mounting holes on part PBM-001-004-002 and modify the model accordingly.
6. Refer to given drawings, complete the assembling of subassembly PBM-001 as follows:
   (a) In component PBM-001-001, use Design Accelerator to generate the sprocket PBM-001-001-001 and chain PBM-001-001-004. The transmission ratio between sprocket PBM-001-001-001 and sprocket PBM-001-001-002 is 0.56, and the thickness of sprocket PBM-001-001-001 is 5.32 mm. The sprockets and chain shall comply with the standard ISO 606 The distance between the centers of adjacent pins must not exceed 10 mm
   (b) In component PBM-001-043, use Design Accelerator to generate the pulley PBM-001-043-002 and timing belt PBM-001-043-003. The transmission ratio between pulley PBM-001-043-001 and pulley PBM-001-043-002 is 1.23, the thickness of pulley PBM-001-043-002 is 16.2 mm, and the thickness of belt PBM-001-043-003 is 12.7 mm. For the belt, use the L profile.

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(c) Based on the assembly information and the features of the mating parts, determine the number of teeth of the gear and use Design Accelerator to generate the spur gear feature for part PBM-001-015. Fit the part into the assembly
(d) Refer to the assembly drawing provided to complete the assembly of the missing parts: PBM-001-011, PBM-001-0028. Do not add any screws.

(i) In subassembly PBM-001-006, fit the missing part PBM-001-006-006.
(ii) In subassembly PBM-001-002, fit the missing part PBM-001-002-006.
(iii) In subassembly PBM-001-005, fit the missing part PBM-001-005-003.

7. Refer to given drawings, complete the assembling of main assembly PBM-00 as follows:
(a) Based on the positions and features of the provided components, determine the stroke of piston PBM-009-001-006 so that the maximum rotation angle of subcomponent PBM-001-003 reaches 180°, and modify the length of part PBM-009-001-002 accordingly.
(b) In subcomponent PBM-009-031, use Design Accelerator to generate sprocket PBM-009-031-001, sprocket PBM-009-031-002, and chain PBM-009-031-003. The sprockets and chain shall comply with the standard ISO 606, the transverse pitch must not exceed 45.5 mm. Make the necessary adjustments to the chain to ensure it fits correctly.
(c) Add the missing components and complete the main assembly.

8. Save the model parts according to the competition naming convention.

Create Detailed Drawings and MBD Annotations

1. On a sheet (size A2), create an assembly drawing of subassembly PBM-001 as follows:
(a) Add proper views.
(b) Based on the dimensional tolerance on the given drawings and IPT files, add necessary and accurate fit dimensions to the assembly drawing.
(c) Add balloons and a structured part list with three (3) columns—NO., QTY., and PART NUMBER.
(d) Add position views of the motion mechanisms in subcomponents PBM-001-003 and PBM-001-004, and indicate the stroke dimensions.
(e) Add a position view of the motion mechanism in subassembly PBM-001.
(f) Include one (1) shaded isometric view.

2. On a sheet (size A2), create an assembly drawing of subassembly PBM-002 as follows:
(a) Add proper views to fully express the assembling relations of all levels of components.
(b) Based on the dimensional tolerance on the given drawings and IPT files, add necessary and accurate fit dimensions to the assembly drawing.
(c) Add a structured part list with three (3) columns—NO., QTY., and PART NUMBER.

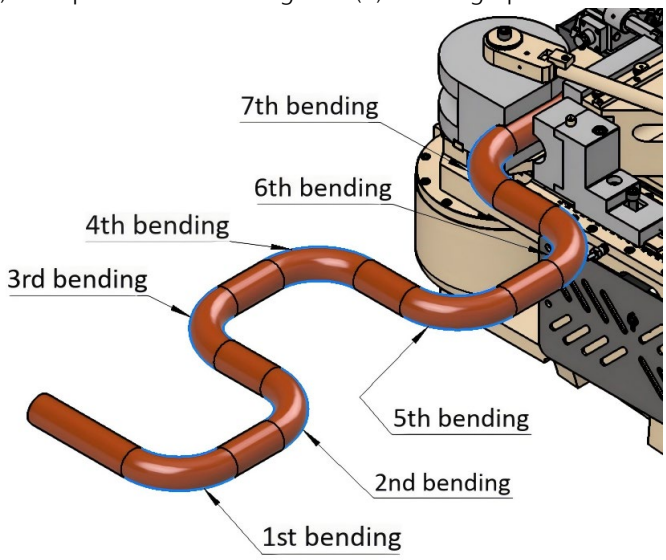
3. On a sheet (size A2), create an exploded drawing of PBM-002:
(a) Add a shaded exploding isometric view, with all levels of components exploded.
(b) Add balloons and a structured part list with three (3) columns—NO., QTY. and PART NUMBER.

4. Insert MBD annotations in PBM-001-003-016, and export the 3D PDF file:
(a) Add all necessary dimensions and surface roughness.
(b) Based on your professional engineering knowledge, add dimension tolerances and GD&T.

5. On a sheet (size A2), create a detailed drawing of PBM-002-004-014 as follows:
(a) Use an appropriate way of presentation to fully express the component structure.
(b) Add necessary dimensions and surface roughness.
(c) Based on the information provided in the drawing, add accurate GD&T.

Create an Animation

1. Create a motion animation for "PBM-00" as follows:
   (a) Duration not longer than 70s, format as avi, and frame rate as 20 frames per second.
   (b) 1-6s, the straight pipe is pushed into PBM-001 by PBM-002, then clamped. The pipe is subsequently bent by PBM-001 to complete the first 90° bending operation.
   (c) 6-10s, PBM-001 releases the pipe and returns to its initial position. The pipe is then pushed forward again.
   (d) 10-14s, the pipe is clamped again and PBM-001 performs the second bending operation.
   (e) 14-18s, PBM-001 releases the pipe and returns to its initial position. The pipe is then pushed forward again.
   (f) 18-24s, the pipe rotates 180° around its center axis to adjust the bending position. It is then clamped, and PBM-001 performs the third bending operation.
   (g) 24-28s, PBM-001 releases the pipe and returns to its initial position. The pipe is then pushed forward again.
   (h) 28-32s, the pipe is clamped again and PBM-001 performs the fourth bending operation.
   (i) 32-36s, PBM-001 releases the pipe and returns to its initial position. The pipe is then pushed forward again.
   (j) 36-42s, the pipe rotates 180° around its center axis to adjust the bending position. It is then clamped, and PBM-001 performs the fifth bending operation.
   (k) Complete the remaining two (2) bending operations according to the above sequence.



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Marking Scheme

CRITERION	SUBCRITERION	MARKS		
		Judgement	Measurement	Summary
C1	Part modeling	-	9	9
C2	Component assembling	-	4	4
C3	Detailed drawings	-	7.5	7.5
C4	Motion Animation	1	3.5	4.5
		1	23	**25**

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