Robot System Design (RME40003)

Project – Robotic Assembly

Design a single robot based manufacturing cell for the assembly of one of the products described in the attached documents.

Assumptions may be made regarding dimensions and material properties of individual components if required.

A report describing the design of the robot based manufacturing cell should be submitted.

Refer to attached document '**Design of a Robotic Assembly Cell** (Explanatory Notes)' for further information and guidance on the project

The report should address the following issues:

(a) Component rationalisation/re-design for robot assembly
(b) Design of jigs/fixtures for location and support of components during the assembly process
(c) Design of grippers for manipulation and assembly of components
(d) Design/selection of storage systems, feeders and orientation devices for components
(e) Selection of industrial robot for carrying out assembly operations including detailed technical justification
(f) Flowchart of robot program for assembly cycle
(g) Dimensioned layout of manufacturing cell
(h) Cycle time analysis for robotic assembly
(i) Design of safety system for robot based assembly cell

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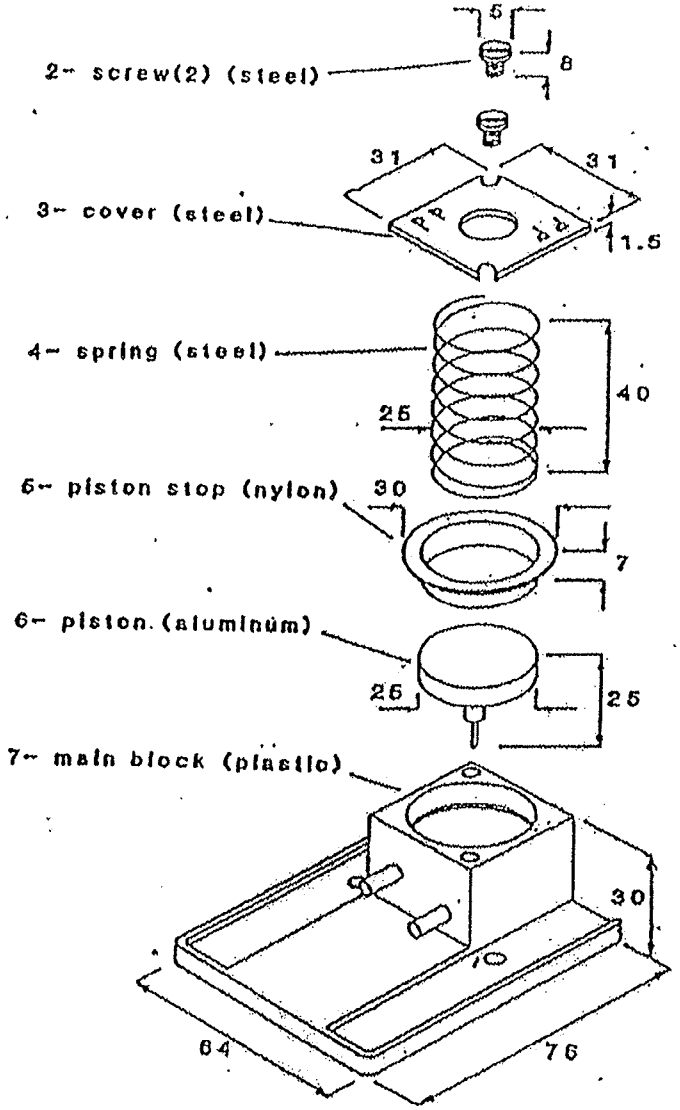
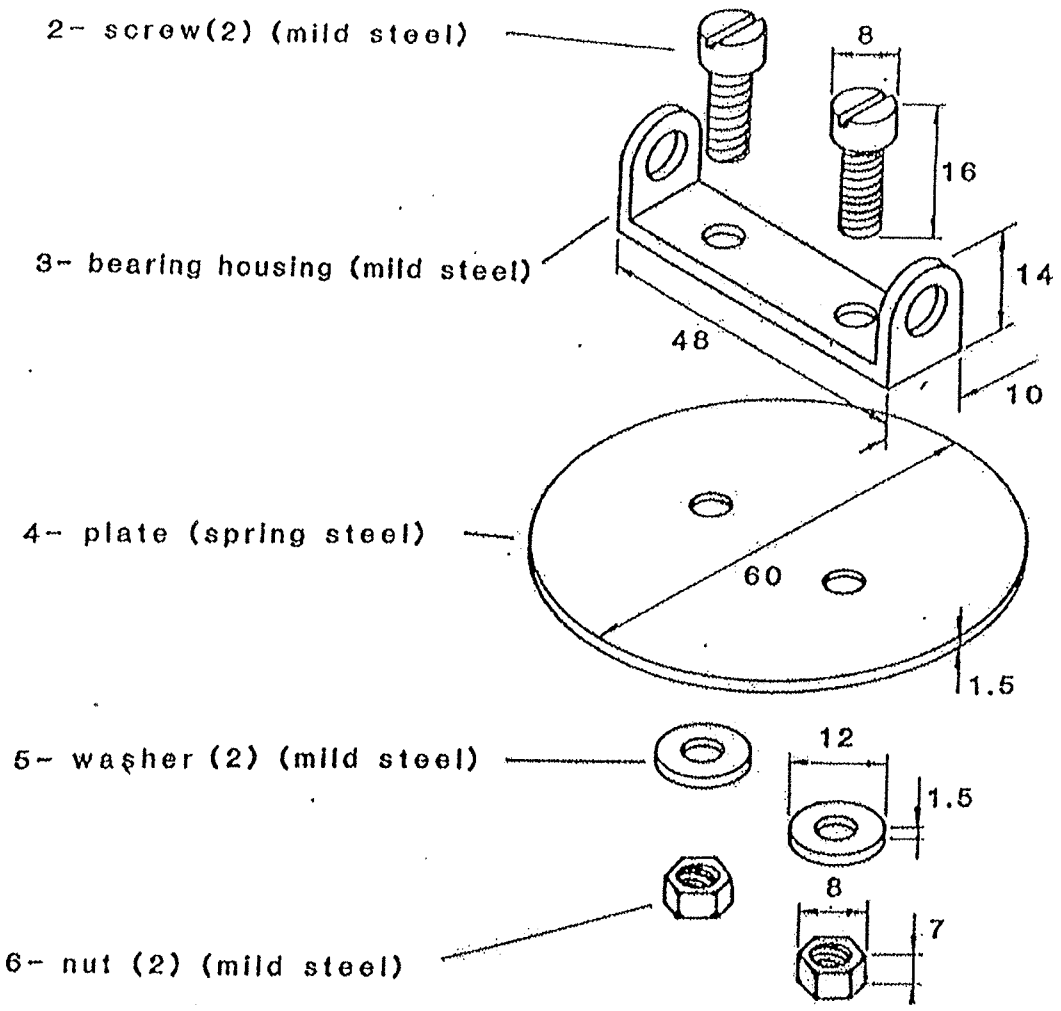


Pneumatic Piston Sub-Assembly

1- complete assembly



Diaphragm Assembly

(dimensions in mm)

Marking Scheme

1. Component rationalisation / re-design (3 marks)
2. Fixture design/selection or design of orientation and feeding devices (4 marks)
3. Gripper design (3 marks)
4. Robot selection (3 marks)
5. Workcell layout (2 marks)
6. Flowchart of robot program (2 marks)
7. Cycle time analysis (2 marks)
8. Design of safety system (4 marks)
9. Report (2 marks)

Design of a Robotic Assembly Cell (Explanatory Notes)

1. Select either the Pneumatic Piston Subassembly or Diaphragm Assembly for your project
2. If you selected the Pneumatic Piston Subassembly you can reduce the number of components as part of component rationalisation and redesign. The number of components cannot be reduced for the Diaphragm Assembly
3. Note that the circular shape of the plate should remain unchanged in the Diaphragm Assembly
4. Read sections 5.1 – 5.9 of notes (RME40003 Robot System Design.pdf) on Blackboard prior to carrying out component re-design / rationalisation. Design changes may be carried out to components to aid automated feeding, orientation, gripping by robot, insertion, assembly or to reduce cycle time. All design changes have to be approved prior to implementation.
5. A fixture is required to securely hold the components during the assembly process. The fixture could contain pneumatically operated components
6. Read section 5.10 of notes (RME40003 Robot System Design.pdf) on Blackboard prior to designing / selecting feeding and orientation devices for components in assembly. Detailed drawings / sketches have to be provided on the track design if incorporated in the feeders
7. Read sections 1.1 to 1.6 of notes (RME40003 Robot System Design.pdf) on Blackboard prior to carrying out the Robot Selection exercise. At least three types of robots have to be compared in terms of payload, work envelope, repeatability, speed, acceleration and degrees of freedom prior to selecting the preferred option
8. Read section 6 of notes (RME40003 Robot System Design.pdf) on Blackboard prior to carrying out End effector design for the robotic assembly operations. Grippers have to be pneumatically operated. Vacuum grippers and screw driver mechanisms can also be used if required. Detailed drawings / sketches have to be provided to describe the operation of the gripper mechanism(s).
9. The flowchart for the robot program for product assembly should contain information on all events relating to robot motion, component manipulation, assembly and sensing operations
10. The assembly cell design should incorporate a structured environment. Hence only simple on / off sensors (ie : microswitches, inductive sensors, capacitive sensors, light sensors are permitted)
11. A dimensioned drawing / sketch should be provided of the Workcell layout. It should contain information relating to the location of the robot, fixture and component feeders
12. Read section 4.2.2 of notes (RME40003 Robot System Design.pdf) on Blackboard prior to carrying out cycle time analysis. In carrying out cycle time analysis, ensure that all robot motions are split into three elements; fast, medium and slow speed as appropriate to ensure reliable assembly of the product. It is recommended that these speeds are fixed at 90%, 50% and 10% of the maximum speed listed for the selected

robot. Ensure that sufficient delay elements (1 sec) are included at appropriate points in the assembly cycle to ensure consistent and reliable assembly operations.

13. Read section 3 of notes (RME40003 Robot System Design.pdf) on Blackboard prior to designing the safety system for the robot assembly cell. Only the hardware and procedural elements of the safety system need to be described.

Please note that all design changes to components have to be approved prior to proceeding with the rest of the assembly cell design

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