

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

GEOMETRICAL AND MECHANICAL DRAWING

9351/02

Paper 2

May/June 2005

3 hours 10 minutes

Additional Materials: A2 Drawing Paper
Standard Drawing Equipment

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name at the bottom right-hand corner of every sheet of paper you use.

You should spend the first ten minutes in reading the whole of the question paper before attempting the questions.

Short concise notes and small, auxiliary sketches may be presented to clarify any design features.

If you use more than one sheet of paper, fasten the sheets together.

Do not use staples, paper clips, highlighters, glue or correction fluid.

The number of marks is given in brackets [] at the end of each question or part question.

Dimensions are given in millimetres.

This document consists of **3** printed pages and **1** blank page and an insert.



SHAFT GOVERNOR

The given drawings show some of the components of a Shaft Governor for a Turbo-alternator.

Oil is supplied under pressure at **B**. When the speed of the shaft falls, the governor causes the sleeve to move from left to right allowing oil to pass from **B** to **A**, where it passes to a cylinder and piston (not shown) which, in turn, operates the steam supply valve.

When the speed of the shaft is too high, the governor causes the sleeve to move back in the reverse direction, preventing the oil reaching valve A and allowing oil to drain from valve **A** to valve **C**, where it passes to a sump.

Method of Assembly

Main Shaft Sub-Assembly

The two GOVERNOR BALLS are firmly attached to the GOVERNOR ARMS (see Design Feature 1).

Note: The governor balls are connected by helical springs. These are not shown and are not required in your answer.

The GOVERNOR ARMS are fitted in the position indicated on the MAIN SHAFT (see Design Feature 2) and held in position by an M26 hexagonal nut, 40 mm across the flats and 12 mm thick.

The Main Shaft Sub-assembly is inserted in the GOVERNOR SLEEVE, with the end **D** of the GOVERNOR BALLS located in the slot **E** of the GOVERNOR SLEEVE and with the line **LL** vertical.

The GOVERNOR SLEEVE, with the Main Shaft Sub-assembly in it, is inserted in the BODY.

The FLANGE PLATE is attached to the BODY at **F** with the recess on the outside (see Design Feature 3). There is a gasket (not shown) between the FLANGE PLATE and the BODY.

To complete the required views, a number of Design Features need to be considered. Modifications and additions will need to be made to the given components and it is essential that the designed items are drawn clearly on the required views. These Design Features **must** be supported by annotated sketches, drawn separately and suitably positioned on your answer sheet.

The Design Features are:

- 1 a method of attaching the GOVERNOR BALLS to the GOVERNOR ARMS through the 8 mm holes at **H**, so that the GOVERNOR BALLS can oscillate freely about the GOVERNOR ARMS; [2]
- 2 a method of ensuring that the GOVERNOR ARMS rotate with the MAIN SHAFT; [2]
- 3 a method of attaching the FLANGE PLATE to the BODY; [2]
- 4 a method of connecting the 10 mm inside diameter pipe to the bosses of the BODY. [3]

It should be noted that credit will be given for the size and accurate location of the engineering fixings used.

Answer the following questions using either first or third angle orthographic projection.

- 1 Draw full size, the following views of the assembled Shaft Governor:
 - (a) a front view with the BODY as shown in the question paper and with the line **MM** on the MAIN SHAFT 50 mm to the left of the line **NN** on the BODY.
The upper half of this view is to be a section, the plane of the section and the direction of the view being indicated at **XX**, and the lower half an outside view. Your solution to Design Feature 4 is to be shown as a section, with a short length of 10 mm inside diameter pipe in boss **A** only; [50]
 - (b) an end view as seen in the direction of the arrow **EV**. The right hand side is to be a section, the plane of the section and the direction of the view being indicated at **YY**, and the left hand side an outside view; [26]
 - (c) a plan, in projection with (a), of the **Main Shaft Sub-assembly ONLY**. Do not draw the Body and the Flange Plate in this view. [8]
- 2 Draw the symbol of projection used for your answer, in accordance with BS 308 or PP7308, in the bottom right hand corner of your answer sheet. [2]
- 3 Complete a parts list tabulating all parts, together with suitable materials from which they might be made. [5]

NOTE

- 1 Where a number of similar fixing devices are used to join together two components, it is necessary to draw one only, but the positions of the others must be indicated clearly.
- 2 Hidden detail is not required in any view unless it is necessary to amplify a Design Feature.
- 3 Sizes not shown are left to your discretion.
- 4 Fillet radii should be of appropriate size throughout.

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