CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Advanced Level

GEOMETRICAL AND MECHANICAL DRAWING 9351/2

PAPER 2

MAY/JUNE SESSION 2002

3 hours 10 minutes

Additional materials:
A2 Drawing paper

TIME 3 hours 10 minutes

INSTRUCTIONS TO CANDIDATES

Print your name, Centre number and candidate number 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.

INFORMATION FOR CANDIDATES

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

Dimensions are given in millimetres; if not given, a reasonable dimension may be assumed.

This question paper consists of 3 printed pages, 1 blank page and an insert.

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Flow Control Valve

The given drawings, in third angle projection, show the components of a Flow Control Valve. This reduces the flow through the inlet pipe when pressure rises on the delivery side of the valve.

Method of assembly

The PLAIN BEARING is pushed into its seating in the bottom of the square section of the BODY. The BAFFLE is secured to the flat on the PINION SHAFT by two M5 cheese head machine screws 8 mm long (not detailed). The PINION SHAFT is then lowered vertically into the BODY through the 52 mm diameter hole until the 8 mm diameter plain end locates in the PLAIN BEARING. The COVER PLATE is passed over the threaded end of the PINION SHAFT, and secured to the BODY by four bolts (not detailed) M6 x 15 mm long (see design feature **i**). The PINION is placed over the threaded end of the PINION SHAFT (see design feature **ii**) and secured with an M8 hexagon head nut (not detailed). The PINION is rotated until the BAFFLE is in the fully open position.

The M12 thread of the QUADRANT SHAFT is next screwed into its hole at the rear of the BODY. The QUADRANT with its 16 mm diameter boss facing downwards is then passed over the M8 threaded end of the QUADRANT SHAFT, and its centre line aligned to the centre of the PINION, with which it meshes. The QUADRANT is then secured by a washer 1 mm thick, and an M8 hexagon head nut (not detailed).

A sub-assembly for the valve is then made by:

- screwing the GLAND NUT through the central hole of the VALVE COVER,
- passing the 8 mm diameter end of the VALVE SHAFT down through the GLAND NUT,
- securing the VALVE to the VALVE SHAFT by a 3 mm diameter split pin (not detailed).

This sub-assembly is then located in the BODY, with the slot in the VALVE COVER in line with the slot in the top flange of the BODY. It is secured with four M8 bolts, 26 mm long, nuts and washers (not detailed). The ARM is then placed onto the 16 mm diameter section of the VALVE SHAFT and secured (see design feature **iii**).

The BUSH is inserted into the 16 mm diameter hole in the boss in the vertical web of the BODY, and the shaft of the CRANK is inserted through the BUSH, with the M8 thread protruding from the longer rear boss. The STRAIGHT LINK is then positioned between the ARM and the CRANK and PINS are inserted through the knuckle joints and secured with a 1 mm thick washer and a 2 mm diameter split pin (not detailed). The CRANK ARM, pointing vertically down, is then secured to the M8 threaded end of the CRANK shaft by means of an M8 nut (not detailed). The knuckle joint between the CRANK ARM and the OFFSET LINK is completed as previously described, and the larger end of the OFFSET LINK is located over the M6 spigot on the QUADRANT. A soft rubber washer 2 mm thick is placed over the spigot and is retained by a thin metal washer and M6 nut.

The position of the ARM is then adjusted on the VALVE SHAFT to eliminate any free movement between the CRANK and the LINKS.

To complete the required views, a number of design features need to be considered. Minor modifications may be made to the given components. It is essential that the designed items are drawn in clearly on the required views. These should be supported by annotated sketches suitably positioned on your answer sheet.

The design features are:

(i) a means of sealing between the COVER PLATE and the BODY to prevent fluid leaking; [3]

(ii) a means of ensuring positive drive between the PINION and the PINION SHAFT; [4]

(iii) a secure means of fixing the ARM to the VALVE SHAFT. This must allow for adjustments to be made to their relative positions. [4]

Your solution must include details of sizes and materials.

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

1 Draw, FULL SIZE, the following views of the assembled Flow Control Valve.

(a) A view looking in the direction of arrow **R** shown on the drawing of the BODY.

This view should be shown sectioned on the cutting plane X-X. [45]

(b) An end view projected from **(a)**, looking in the direction of arrow **S** shown on the drawing of the BODY.

This view should be sectioned on the cutting plane Y-Y. [25]

(c) A half-plan view, projected from **(a)**.

This view should be in outline form and include the half above the horizontal centre line. [16]

2 Draw the symbol of projection used to answer question 1, in the BOTTOM RIGHT HAND CORNER of your drawing. [3]

Note

1 Hidden detail is not required on any view.

2 Sizes not shown are left to your own discretion.

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