

CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

GEOMETRICAL AND MECHANICAL DRAWING

9351/02

Paper 2

May/June 2003

3 hours 10 minutes

Additional Materials: A2 Drawing paper

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; if not given, a reasonable dimension may be assumed.

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



POWER TAKE OFF DRIVE

The given drawings show some of the components of a Power Take Off Drive, which supports two shafts rotating at right angles to each other. Power is transferred from the vertical to the horizontal shaft by means of two bevel gears or mitre wheels, which ensure that the power transfer is constant.

Method of Assembly

The BUSH is pressed into the 48 mm diameter hole **A** in the MAIN CASTING with its flange against the 68 mm diameter boss.

A sub-assembly of the SPLINED VERTICAL SHAFT is made by:

placing a BEVEL GEAR on the splines with the gear teeth at the circlip end of the splines;

locating a 6 mm thick WASHER (not shown) between the BEVEL GEAR and the circlip groove;

fitting a circlip (not shown) in the groove.

This sub-assembly is then lowered into the BUSH until the BEVEL GEAR rests against the flange of the BUSH.

A sub-assembly of the HORIZONTAL DIRECT DRIVE SHAFT is made by:

placing the 10 mm thick THRUST WASHER on the splines of the shaft against the shoulder at **B**;

placing a BEVEL GEAR on the splines until it touches the THRUST WASHER;

retaining these components using a 6 mm thick washer (not shown) and a circlip.

The lower half of the SPLIT BEARING is fitted in the MAIN CASTING at **C**.

The sub-assembly of the HORIZONTAL DIRECT DRIVE SHAFT is then positioned by passing the 52 mm diameter shaft through the 88 mm diameter hole in the MAIN CASTING and loosely meshing the gear teeth of both BEVEL GEARS. The 36 mm diameter shaft of the sub-assembly will locate in the lower half of the SPLIT BEARING.

The BALL BEARING is placed over the 52 mm diameter shaft and pushed into recess **D** of the MAIN CASTING.

The BALL BEARING is held in position in the MAIN CASTING by the BEARING RETAINER which is secured by four M8 hexagonal head screws and washers (not shown).

To complete the whole assembly, the upper half of the SPLIT BEARING is placed over the 36 mm diameter shaft and secured in position by the BEARING CAP (see Design problem 1).

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 should be supported by annotated sketches, suitably positioned on your answer sheet.

The design features are:

- (i) a method of securing the BEARING CAP to the MAIN CASTING; [2]
- (ii) a method of securing the SPLIT BEARING in the BEARING CAP and the MAIN CASTING so that it does not rotate with the HORIZONTAL DIRECT DRIVE SHAFT; [3]
- (iii) a removable FLANGED PLATE, diameter 150 mm, to fit on the right-hand end of the HORIZONTAL DIRECT DRIVE SHAFT at **E**, which would enable power to be taken off in either direction of rotation. [4]

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

- 1 Draw, to a scale of 1:2, the following views of the assembled Power Take Off Drive:
 - (a) a sectional view, taken on the cutting plane **XX**, with the MAIN CASTING positioned as given in the question paper; [60]
 - (b) an end view taken in the direction of arrow **EV**; [8]
 - (c) a plan in projection with (a). Show the outline of the gears only in this view. [15]

- 2 Draw the symbol of the projection used for your answer in accordance with BS 308 or PP 7308, in the bottom right hand corner of your answer sheet. [2]

- 3 Complete a parts list tabulating all parts complete with suitable materials from which they might be made. [6]

NOTE

- 1 Hidden detail is not required on any view.
- 2 Sizes not shown are left to your own discretion.

