

G12 ECZ GMD PAPER 2 2014 SOLUTIONS

Grade 12 ECZ Geometrical and Mechanical Drawing Paper 2, 2014 (7040/2)

Construction/assembly methods -- this is a practical drafting exam, see note

A practical drafting exam: the true answer is a full-size drawing on A2 paper. This PDF gives the exact construction method and every dimension, not a

EXAMINATIONS COUNCIL OF ZAMBIA

Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level

**GEOMETRICAL AND MECHANICAL
DRAWING**

7040/2

PAPER 2

Wednesday

5 NOVEMBER 2014

Additional materials:

A2 Drawing paper (1 sheet)

Standard drawing equipment

TIME: 2 hours 40 minutes

MARKS: 100

INSTRUCTIONS TO CANDIDATES

Print your **name**, **centre number** and **candidate number** in the Title Block at the bottom right-hand side of your drawing paper.

There are **two (2)** questions in this paper. Answer **both** questions.

Use **both** sides of the drawing paper for your answers.

INFORMATION FOR CANDIDATES

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

The insert contains **Figure 2** for Section 2.

You have additional **10 minutes** to read carefully the text of Section 2 before answering the questions.

Arcs of circles less than **5mm radius** may be drawn freehand.

All dimensions are in millimetres unless otherwise stated.

Cell phones are not allowed in the examination room.

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Answer the question **from section 1 on one side** of the drawing paper and that **from section 2 on the other side**.

All dimensions are in **millimetres**.

Section 1 (16 marks)

Candidates are advised to spend not more than **20 minutes** on this section of the paper:

- 1** Three orthographic views of a bracket are shown in Figure 1.

Do not copy the views but sketch free hand and in good proportion, a pictorial view of the bracket with point 'N' in the foreground of the view.

The use of instruments, including any form of straight edge, when sketching the view or when lining in will be heavily penalised. Faint construction lines and points used when sketching the pictorial view should not be erased.

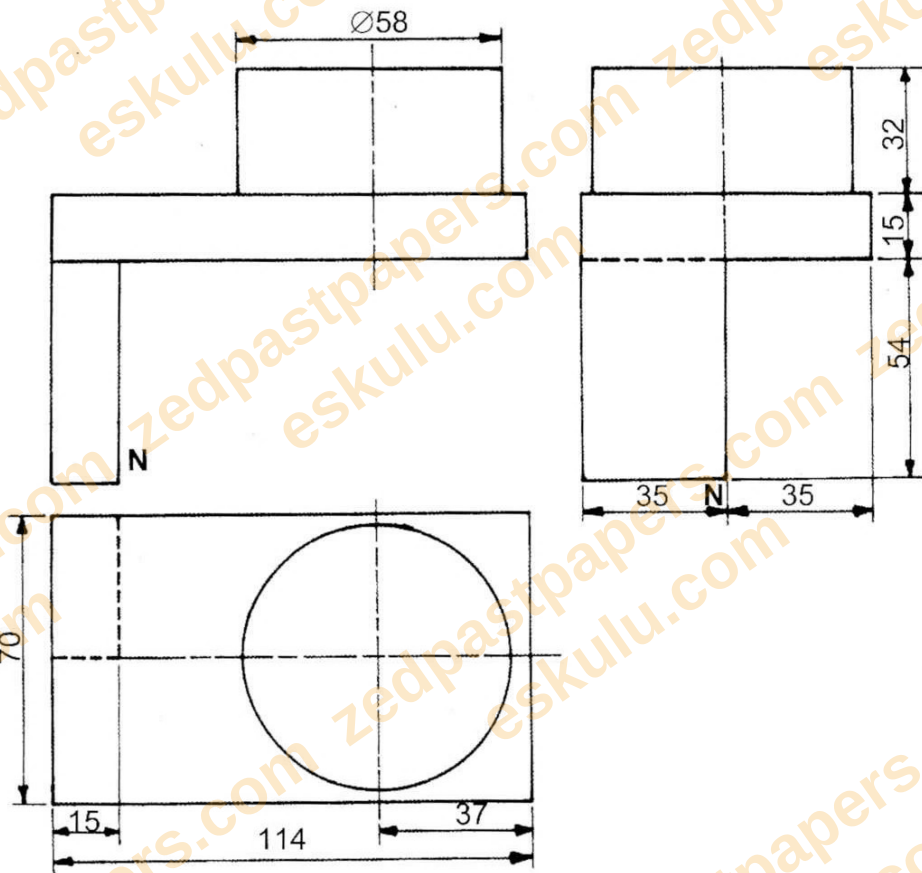


Figure 1
FIRST ANGLE PROJECTION

Section 2 (84 marks)

- 2 Figure 2 on the insert shows details of the main components of a **PRESSURE PUMP VALVE** in First Angle Projection.

The components are assembled as follows:

The SPINDLE (2) is inserted in the 40mm diameter hole of the BODY (1) and further lowered into the 20mm diameter hole of the body until it rests flush.

The FLANGE (3) is inserted through the threaded end of the spindle until it comes into contact with the body and then secured by the NUT (5) and WASHER (4).

The BOLTS (6) are fitted into the diameter 18mm holes in the flange through the threaded holes in the body.

With the components assembled as detailed above, draw full size the following views in either First Angle or Third Angle Projection showing only the left hand side bolt in place.

(a) A sectional elevation, the plane of the section being indicated by X – X in the plan.

(b) A plan viewed from arrow P.

NB

Suitable dimensions should be estimated where data is not provided. Hidden details or part lines are not required in any view.

Insert four important dimensions as recommended in BS 308. These should be of varied character and should include any of the following: length, diameter, radius and details of a bolt and nut.

In the lower right hand corner of the drawing paper and on the same side as that on which you have drawn the solution to question 2, draw the title block. Print in the title block the following details:

The title, your name, examination number and the scale used. Additionally, indicate by standard symbol the method of projection you have used.

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GEOMETRICAL AND MECHANICAL DRAWING

7040/2

PAPER 2

Thursday

30 OCTOBER 2014

Additional materials:

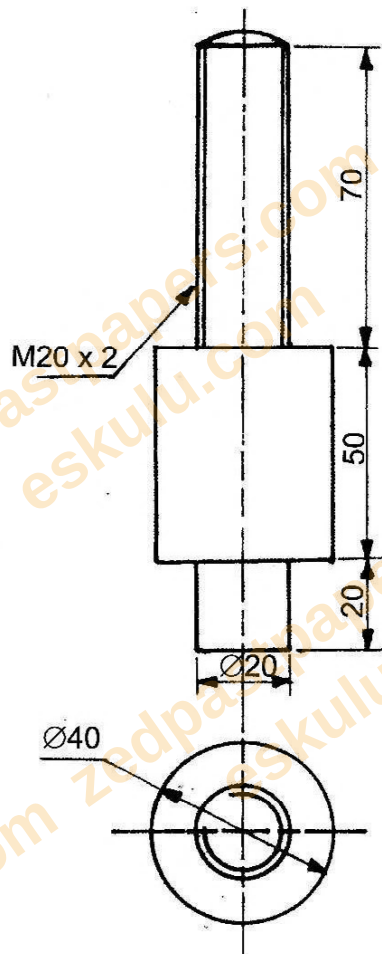
A2 Drawing paper (1 sheet)
Standard drawing equipment

Time: 2 hours 40 minutes

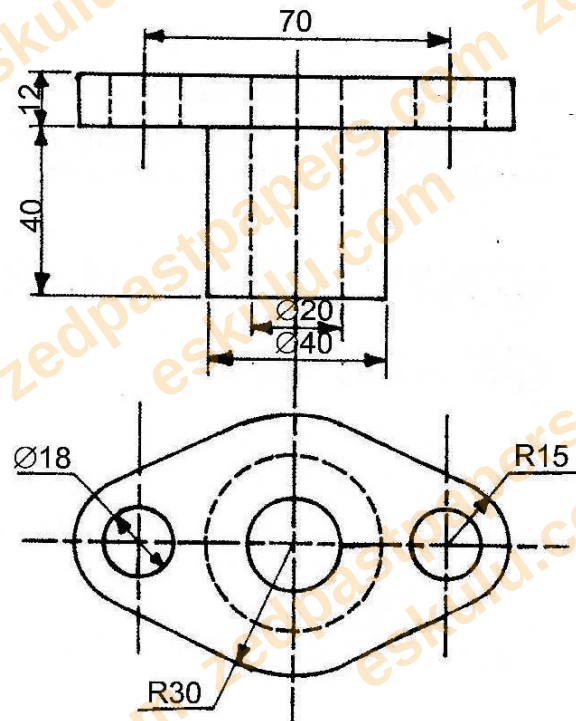
MARKS: 100

INSERT

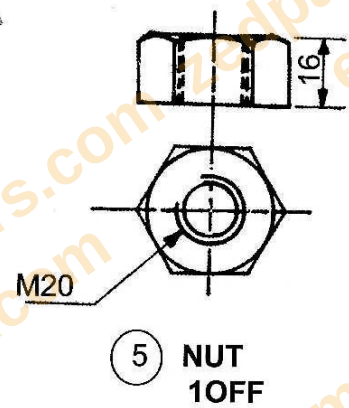
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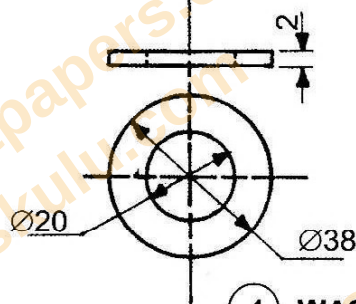
2 SPINDLE
1 OFF



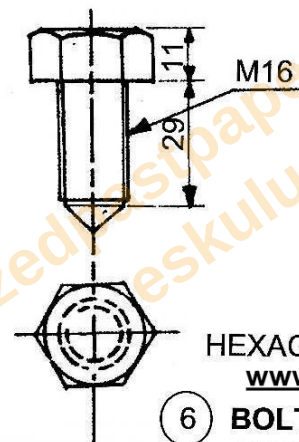
3 FLANGE
1 OFF



5 NUT
1 OFF



4 WASHER
1 OFF



HEXAGONAL
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6 BOLT
2 OFF

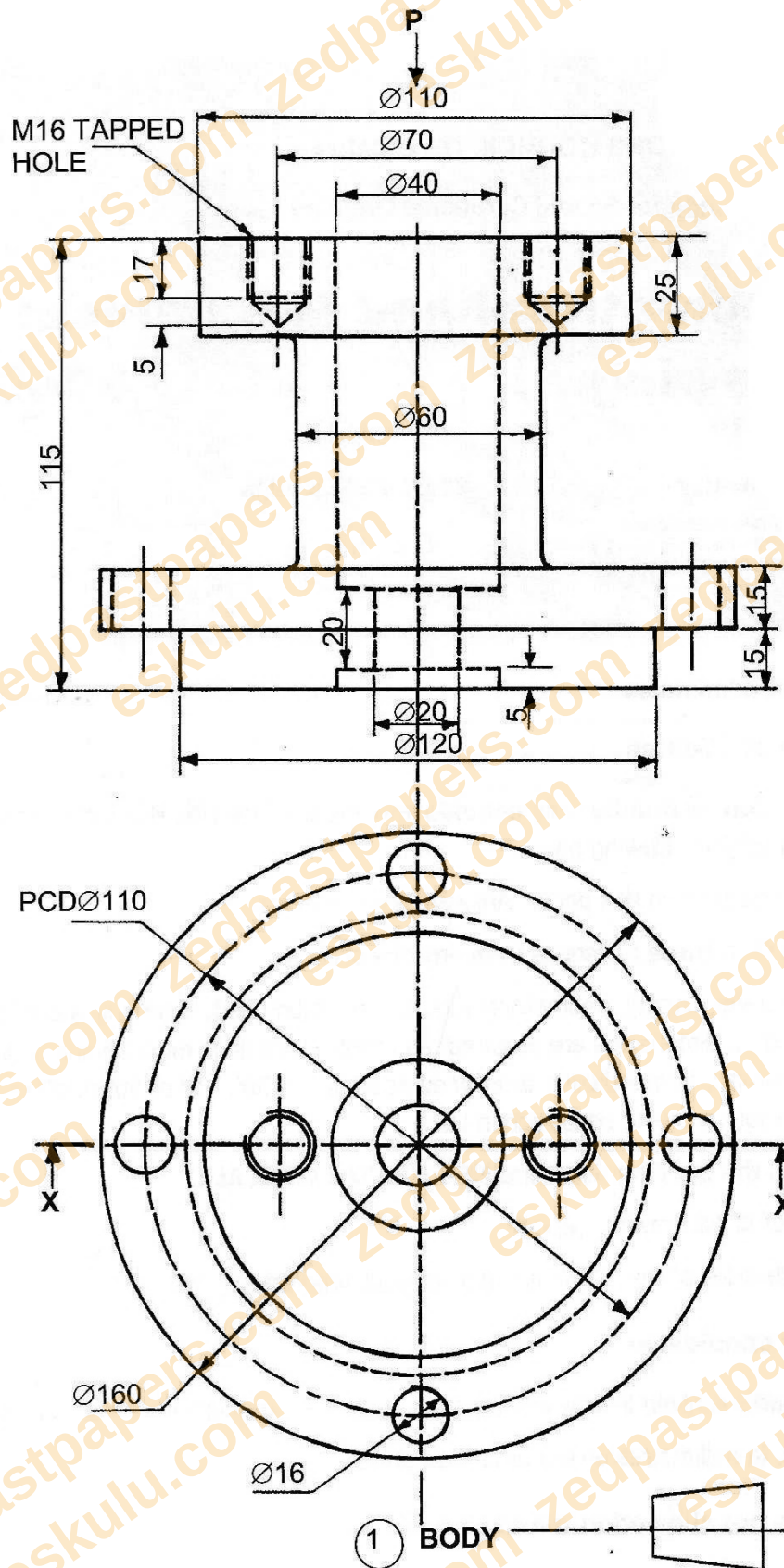


FIGURE 2

Geometrical and Mechanical Drawing/7040/2/Z2014 insert



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Question 1. SECTION 1 [16]. Three orthographic views of a bracket (Figure 1, first-angle, T-shaped bracket with a Ø58 boss, overall 70mm plan width, 114mm length, 15/37mm split, 32/15/54mm height divisions) are given. WITHOUT copying the views, freehand sketch a pictorial view with point N in the foreground, no instruments allowed.

Method: this tests freehand proportion/sketching skill, not instrument accuracy, so the 'answer' is a correct PROCEDURE rather than a to-scale drawing. First study the three given views to build a mental 3D model: the bracket is an L/T-shaped casting with a vertical web, a boss (Ø58 reducing to the through-hole) on top, and a base plate with a large through-hole, with point N marking the front-bottom corner of the vertical web.

Sketch freehand in an oblique or isometric-style pictorial (angles estimated by eye at roughly 30-45 degrees, NOT measured with a protractor or drawn with a straight-edge), starting with a light 'bounding box' construction (freehand, by eye) sized in proportion to the three views' relative measurements (70 wide x 114 long x roughly 70 tall including the boss), then blocking in the L-shaped profile, the cylindrical boss (sketched as a freehand ellipse, not a compass circle), and the base-plate hole -- all while keeping point N as the closest/frontmost visible corner of the sketch, as instructed.

Per the paper's explicit instruction, do NOT use any straight-edge or instrument at any stage (including for lining-in), and do NOT erase the faint construction lines/points used to build up the sketch -- both are specifically penalised.

Answer: Answer: correct procedure is freehand-only (no instruments at any stage, construction lines left visible), an oblique/isometric-style pictorial built from a light bounding box in the 70 x 114 x ~70 proportions read off Figure 1, with the boss/hole sketched as freehand ellipses, and point N positioned as the nearest corner to the viewer.

Question 2. SECTION 2 [84]. Figure 2 (insert) shows a Pressure Pump Valve assembly: BODY (1, Ø160 flange with 4x Ø16 holes on PCD110, central Ø120/Ø60/Ø70/Ø110/Ø40 bored boss with 2x M16 tapped holes at PCD... , overall height 115mm), SPINDLE (2, M20x2 threaded top, Ø40/Ø20 stepped shaft, 70/50/20mm heights), FLANGE (3, Ø18 bolt holes, R15/R30 profile, Ø20/Ø40 bore, 70mm wide, 12/40mm heights), WASHER (4, Ø20/Ø38, 2mm thick), NUT (5, M20, 16mm across), BOLT (6, M16 hexagonal, 11/29mm, 2 OFF). Assemble per the given instructions and draw, full size, in first- or third-angle projection: (a) a sectional elevation on X-X (plan), showing only the LEFT-HAND bolt in place; (b) a plan viewed from arrow P. No hidden details/part-lines. Insert 4 varied BS308 dimensions and a title block with projection symbol.

Assembly logic (from the given instructions): the SPINDLE's Ø40 shank sits in the BODY's Ø40 bore and its Ø20 lower shank is lowered further into the BODY's Ø20 bore until it rests flush (i.e. the spindle's step shoulder lands on the body's internal step between the Ø40 and Ø20 bores, at the 20mm-deep counterbore shown in the body). The FLANGE is threaded onto the SPINDLE's M20x2 top thread, passing down until the flange's underside contacts the top of the BODY's boss (bridging across the Ø60 boss top); it is secured there by the WASHER (Ø38 OD, Ø20 bore, 2mm thick) and the NUT (M20 hexagonal) threaded on top of the spindle above the flange. The two BOLTS pass through the FLANGE's two Ø18 holes and thread into the BODY's two M16 TAPPED HOLES shown in the body's top face -- only the LEFT-HAND one of these two bolts is to be shown, per the instruction.

(a) Sectional elevation on X-X: the plan's X-X line cuts horizontally through the body's flange at the level of the 4 mounting holes and the central bore -- so the section plane passes vertically through the full height of the assembly along this line, cutting through: the body's Ø160 outer flange (showing the 15mm flange thickness and the stepped Ø120/Ø110/Ø70/Ø110 bore profile up to the M16 tapped holes at the top, 115mm total body height), the spindle seated in the Ø40/Ø20 bores, the flange component bridging the top with its R30/R15 profile and Ø18 bolt hole (showing the LEFT bolt threaded down into the body's M16 tapped hole, hexagonal head visible above the flange), the washer and nut stacked above the flange on the spindle's M20x2 thread, all drawn as a true section (hatched at 45 degrees on all cut solid material, with the bolt/spindle/nut shown UN-hatched in the conventional way since fasteners are traditionally shown in true elevation, not sectioned, even when they lie on the cutting plane), full size, no hidden lines.

(b) Plan viewed from arrow P (looking down from above): shows the body's top face as a circle of Ø160 (outer flange) with the PCDØ110 bolt-hole circle (4x Ø16 holes, one aligned with each of the four compass points as shown), the central Ø110/Ø70/Ø40 concentric circles of the bore/boss, and the flange component's outline visible through/above (its R30/R15 rounded-oblong shape with the 2 Ø18 bolt positions), with only the left-hand bolt's hexagonal head shown (the right-hand bolt position left as a plain Ø18 hole, unfastened, per the instruction to show only the left bolt in place).

Suitable BS308 dimensions to insert (4 required, of varied character): (i) an overall LENGTH/height, e.g. 115 (body height); (ii) a DIAMETER, e.g. Ø160 (body flange OD) or Ø60 (boss bore); (iii) a RADIUS, e.g. R30 (flange corner radius); (iv) a bolt/nut/thread callout, e.g. 'M16 TAPPED HOLE' or 'M20 x 2' (spindle thread). Title block (bottom-right, same side as the Q2 solution): title 'PRESSURE PUMP VALVE -- SECTIONAL ASSEMBLY', candidate name, examination number, scale (1:1, since drawn full size), and the standard BS308 projection symbol (the frustum-of-cone/two-circles symbol) matching whichever of first- or third-angle projection was actually used.

Answer: Answer: assembly order is Body -> Spindle (seated flush in the $\varnothing 40/\varnothing 20$ bore) -> Flange (threaded onto the spindle's M20x2 top, resting on the $\varnothing 60$ boss) -> Washer + Nut (securing the flange on the spindle thread) -> left-hand Bolt only (through the flange's $\varnothing 18$ hole into the body's M16 tapped hole). Section X-X cuts vertically through this full stack for the sectional elevation; the plan from arrow P shows the $\varnothing 160/\text{PCD}\varnothing 110/4$ -hole body flange face with the flange component and single left-hand bolt head visible above it. See the detailed method above for what each view must show.

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