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Module 2 – Geometry and Pattern Development

Unit 4 – Cones and Pyramids

Duration – 12 Hours

Learning Outcome:

- Develop right conic frustums and pyramids
- Define terms used in radial line development
- Determine true shapes of obliquely cut planes and inclined faces and Project auxiliary views

Key Learning Points:

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Training Resources:

- Drawing instruments, equipment and materials
- Textbook: The Geometry of Sheet Metalwork
- Instructor handouts, drawings

Exercise

Sample exercise - Figure 1.

Key Learning Points Code:

\[ \begin{align*}
\text{M} &= \text{Maths} & \text{D} &= \text{Drawing} & \text{RK} &= \text{Related Knowledge} \\
\text{P} &= \text{Personal Skills} & \text{Sk} &= \text{Skill} & \text{H} &= \text{Hazards}
\end{align*} \]
Figure 1 - Radial Line Method

Exercise/Procedure Instructions
Sample exercises 2.2.4 A Figures 1-20
1. Develop the full template for the frustum of the right cone shown in Fig. 1. Scale: full size.
2. Fig. 2 shows the frustum of a right cone. Draw the elevation given, project an end view to the right and develop the full template with the seam at SS. Scale: full size.
3. Develop the full template, with the seam at YY, for the right conical frustum shown in Fig. 3. Scale: full size.
4. Develop the full template for the frustum of the right cone shown in Fig. 4; place the seam at SS. Scale: full size.
5. Develop the full template for the conical frustum shown in Fig. 5 and project a plan from the elevation. The seam should be placed on the short side. Scale: full size.

Exercise/Procedure Instructions
Sample exercises 2.2.4 B Figures 1-20
6. Fig. 6 shows the body of a ventilator for the apex of a roof. Develop the full template, placing the seam at SS. Scale: 1 : 10.
7. Develop the full template with the seam at SS for the right conical frustum shown in Fig. 7. Scale: 1 : 10.
8. Fig. 8 shows a hood in the shape of a right conical frustum with a vertical cutting plane. Develop the full template with the seam on the short side. Draw also the shape of the plate required, in the direction of arrow A, to blank off the vertical cut. Scale: 1 : 5.
9. Fig. 9 shows a jug top as part of a right cone. Develop the full template with the seam short side. Scale: full size.
10. Fig. 10 shows a food hopper in the shape of a right conical frustum. Develop the full template with the seam on SS. Scale: 1 : 10.
Cones and Pyramids

Cones and Pyramids can be developed by radial line or triangulation to use the radial method it is necessary to use the apex. For a right cone or pyramid the apex is directly above the centre of the cone/pyramid. The construction lines in a cone are usually numbered 0-6 and are called generators. The numbers 1-5 are false lengths, while 0 and 6 are true lengths. So when developing cones/pyramids we must be careful to project the lines 1-5 where they cut the joint lines out onto the outside of the cone. We refer to this as using the slant height.

Figure 1, which is your first drawing exercise, is referred to as a frustrum, which is what we call the part of the cone we will use. Normally we never use a full cone, only a part of it and this is sometimes called the frustrum.

A blowcap is one of the few times when we may use the full cone.

The position of the joint is normally on the short side unless otherwise stated. It is possible to conceal the joint for the sake of appearance that consideration takes precedence over the joint being put on the short side.
1. Establish ‘apex’ and swing arc OX.
2. Mark off usual 12 equal spaces.
3. Swing arc O¹X through to 6¹.
   Completed pattern should look like the following image:

   ![Figure 2 - Apex and Arc](image)

4. The spigot A goes inside pipe (cone) B. B goes inside spigot C. This is to ensure maximum air flow in the direction of arrow → and also to reduce any possible leaks.
5. The cone should be made so the large end fits neatly over spigot A and neatly into C.
6. The only true length lines on the elevation of the cone are OX and 6X. X3 is a false length as would the other lines from the base of the cone at 1, 2, 4, and 5.

   ![Figure 3 - Completed Pattern](image)

   Note carefully how the true length is gotten for a pyramid.
Calculations

True Length of a Line

1

![Figure 4 - True Length of a Line 1](image)

It is required to determine the true length of the edge AB. The construction in Figure 4 shows how AB is swung round so as to give a true elevation Ab. The elevation is a view on arrow X.

2

![Figure 5 - True Length of a Line 2](image)

To obtain the true shape of the side CDEF, an elevation on X and a plan are drawn, as shown in Figure 5. The side CDEF is swung down on to the horizontal. The true lengths of CD and EF are shown as cD and Ef.
1. Determine the true length of GH. A hint is given at G on the elevation.
2. Find the length of JK, i.e. the length of the joint between the vertical vee-piece and the sloping plane. A hint is given on the plane.
Self Assessment
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