

Chapter 15

Hatching Drawings

CHAPTER OBJECTIVES

In this chapter, you will learn:

- *To hatch an area by using the Hatch tool.*
- *To use boundary hatch with Predefined, User defined, and Custom hatch patterns as options.*
- *To specify pattern properties.*
- *To preview and apply hatching.*
- *To create annotative hatching.*
- *To edit associative hatch and hatch boundary.*
- *To hatch inserted blocks.*
- *To align hatch lines in adjacent hatch areas.*

KEY TERMS

- | | | |
|-------------------|---------------------|---------------------|
| • <i>Hatching</i> | • <i>Gradient</i> | • <i>Islands</i> |
| • <i>Pattern</i> | • <i>Boundaries</i> | • <i>Edit Hatch</i> |

HATCHING

In many drawings, such as sections of solids, the sectioned area needs to be filled with some pattern. Different filling patterns make it possible to distinguish between different parts or components of an object. Also, the material of which an object is made can be indicated by the filling pattern. You can also use these filling patterns in graphics for rendering architectural elevations of buildings, or indicating the different levels in terrain and contour maps. Filling objects with a pattern is known as hatching (Figure 15-1). This hatching process can be accomplished by using the **Hatch** tool in the **Draw** panel or the **Tool Palettes**.

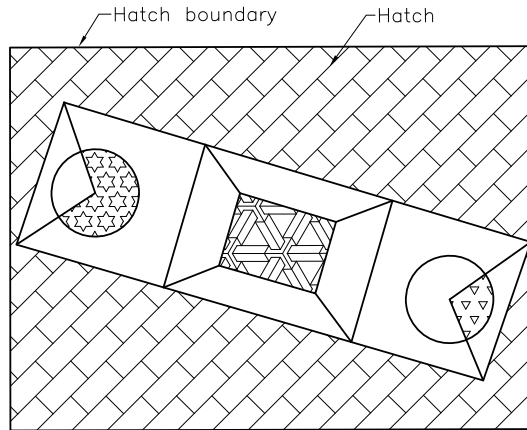


Figure 15-1 Illustration of hatching

Before using the **Hatch** tool, you need to understand some terms that are used while hatching. The following subsection describes some of the terms.

Hatch Patterns

AutoCAD supports a variety of hatch patterns (Figure 15-2). Every hatch pattern is composed of one or more hatch lines or a solid fill. The lines are placed at specified angles and spacing. You can change the angle and the spacing between the hatch lines. These lines may be broken into dots and dashes, or may be continuous, as required. The hatch pattern is trimmed or repeated, as required, to fill exactly the specified area. The lines comprising the hatch are drawn in the current drawing plane. The basic mechanism behind hatching is that the line objects of the pattern you have specified are generated and incorporated in the desired area in the drawing. Although a hatch can contain many lines, AutoCAD normally groups them together into an internally generated object and treats them as such for all practical purposes. For example, if

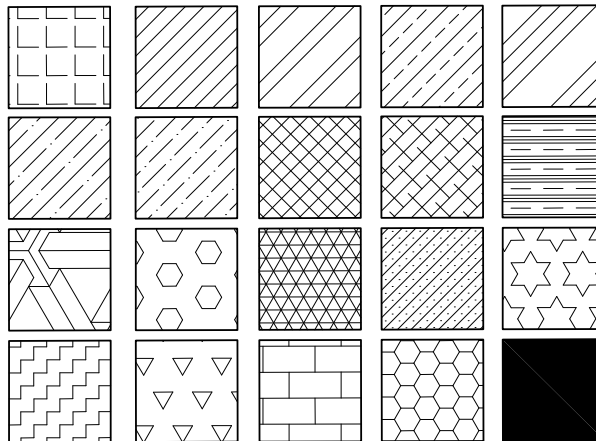


Figure 15-2 Some hatch patterns

you want to perform an editing operation, such as erasing the hatch, all you need to do is select any point on the hatch and press ENTER; the entire pattern gets deleted. If you want to break a pattern into individual lines to edit them, you can use the **EXPLODE** command.

Hatch Boundary

Hatching can be used on parts of a drawing enclosed by a boundary. This boundary may be lines, circles, arcs, polylines, 3D faces, or other objects, and at least part of each bounding object must be displayed within the active viewport.

HATCHING DRAWINGS USING THE Hatch TOOL *

Ribbon: Draw > Hatch
Command: HATCH or H

Toolbar: Draw > Hatch



The **Hatch** tool is used to hatch a region enclosed within a boundary (closed area) by selecting a point inside the boundary or by selecting the objects to be hatched. This tool automatically designates a boundary and ignores other objects (whole or partial) that may not be a part of this boundary. When you choose the **Hatch** tool, the **Hatch Creation** tab will be displayed, as shown in Figure 15-3. Also, you will be prompted to pick internal point. Select the type of hatch pattern in the **Pattern** panel, set the properties of the hatch pattern in the **Properties** panel, and move the cursor inside a closed profile; the preview of the hatch pattern will be displayed. Now, pick the internal point; the hatch will be applied. Alternatively, when you are prompted to pick an internal point, select the type of hatch pattern in the **Pattern** panel, set the properties of the hatch pattern in the **Properties** panel, and then pick an internal point; the hatch will be applied.

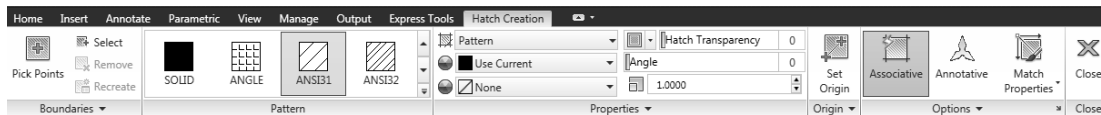


Figure 15-3 The Hatch Creation tab

EXAMPLE 1

Hatch

In this example, you will hatch a circle using the default hatch settings. Later, in the chapter you will learn how to change the settings to get the desired hatch pattern.

1. Choose the **Hatch** tool from the **Draw** panel; the **Hatch Creation** tab is displayed and you are prompted to pick internal point. Move the cursor over the circle; the preview of the hatch pattern is displayed.
2. Select a point inside the circle (P1) (Figure 15-4) and press ENTER; the hatch is applied, as shown in Figure 15-5.

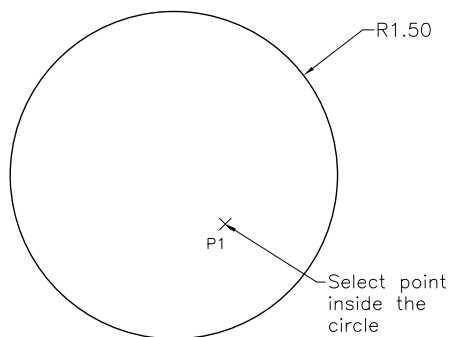


Figure 15-4 Specifying a point to hatch the circle

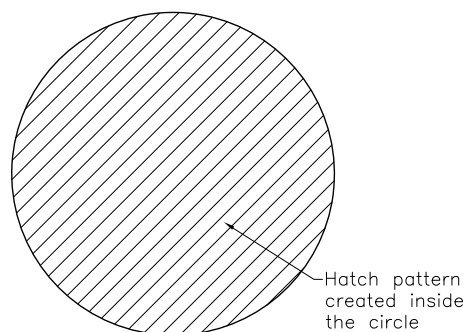


Figure 15-5 Drawing after hatching

**Tip**

The **FILLMODE** system variable is set to On by default (value of the variable is 1) and hence the hatch patterns are displayed. In case of large hatching areas, you can set the **FILLMODE** to Off (value of the variable is 0), so that the hatch pattern is not displayed and the regeneration time is saved.

You can also hatch a selected face of a solid model. However, to hatch a face of the solid model, you need to align the UCS at that face. You will learn more about this in later chapters.

PANELS IN THE Hatch Creation TAB

Before or after specifying the pick points, you can change the parameters of a hatch pattern using various options in the panels of the **Hatch Creation** tab. These panels and their options are discussed next.

Boundaries Panel

The options in the **Boundaries** panel are used to define the hatch boundary. This is done by selecting a point inside a closed area to be hatched or by selecting the objects. You can also remove islands, create hatch boundary, and define the boundary set by using the options in this panel, as discussed next.

Pick Points

This option is chosen by default and used to define a boundary from the objects that form a closed area. After invoking the **Hatch** tool, move the cursor over a closed region; the preview of the hatch will be displayed. Click inside the closed object; a boundary will be defined around the selected point and the hatch will be applied, as shown in Figure 15-6. The following prompts appear when you click inside the closed object.

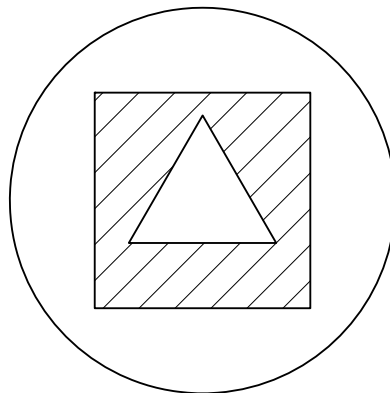
Pick internal point or [Select objects/remove Boundaries]: *Select a point inside the object to hatch.*

Selecting everything visible...

Analyzing the selected data...

Analyzing internal islands...

Pick internal point or [Select objects/remove Boundaries]: *Select another internal point or press ENTER to end selection.*



1. Invoke the Hatch command.
2. Select a point inside the square (between square and triangle)

Figure 15-6 Defining multiple hatch boundaries by selecting a point

**Tip**

Suppose, you have selected a point within an area for hatching and later you realize that you have selected the wrong area, in such a case, you can enter **U** or **Undo** at the Command prompt

to undo the last selection. You can also undo a hatch pattern that you have already applied to an area by entering **Undo** at the Command prompt.

Boundary Definition Error. Sometimes, while selecting the boundary to be hatched, AutoCAD displays an error. This error may occur due to various reasons. AutoCAD displays different types of Boundary Definition Error message boxes, depending on the kind of error occurred while selecting the boundary. For example, if you pick a point inside any boundary that is not closed, a message box will be displayed, as shown in Figure 15-7, informing that the hatch boundary is not valid. Choose the **Close** button and then create a closed area as boundary. You can also specify the gap tolerance value in the **Gap Tolerance** edit box in the **Options** panel so that hatch will be created if the gap is within the permissible limit. If you select the same boundary twice, the message that the boundary duplicates an existing boundary will be displayed.

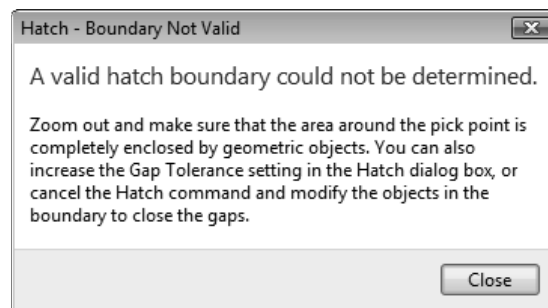
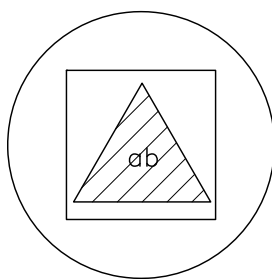


Figure 15-7 The **Boundary Not Valid** message box

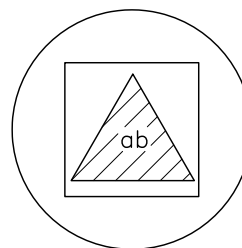
Select

This option lets you select objects that form the boundary for hatching. It is useful when you have to hatch an object and disregard objects that lie inside it or intersect with it. When you select this option, AutoCAD will prompt you to select objects. You can select the objects individually or use the other object selection methods. In Figure 15-8, the **Select** option is used to select the triangle. It uses the triangle as the hatch boundary, and everything inside it is hatched. The text inside the triangle, in this case, also gets hatched. To avoid hatching of such internal objects, select them at the next **Select objects** prompt. In Figure 15-9, the text is selected to exclude it from hatching. When using the **Pick points** option, the text automatically gets selected to be excluded from the hatching.



1. Choose the Select button.
2. Select the triangle for hatching and press ENTER.

Figure 15-8 Using the **Select Objects** button to specify the hatching boundary



1. Choose the Select button.
2. Select the triangle for hatching
3. Select the text.
4. Press ENTER

Figure 15-9 Using the **Select Objects** button to exclude the text from hatching



Tip

If you have an area to be hatched that has many objects intersecting with it, it is easier to select the entire object to be hatched rather than choosing the internal points within each of the smaller regions created by the intersection.

You can also turn off layers that contain text or lines that make it difficult for you to select hatch boundaries.

Remove

This option is used to remove boundaries and islands from the hatching area. Boundaries inside another boundary are known as islands. If you choose the **Pick Points** option to hatch an area, the inside boundaries, which are known as islands, will not be hatched by default. But, if you want to hatch the islands, you can choose the **Select** option and then the **Remove** option in the **Boundaries** panel. For example, if you have a rectangle and circles within, as shown in Figure 15-10, you can use the **Pick points** option to select a point inside the rectangle; AutoCAD will select both the circles and the rectangle. To remove the circles (islands), you can use the **Remove** option. When you select this option, AutoCAD will prompt you to select the islands to be removed. Select the islands to be removed and press ENTER to return to the dialog box. Choose **OK** to apply the hatch. Similarly, you can remove boundaries.

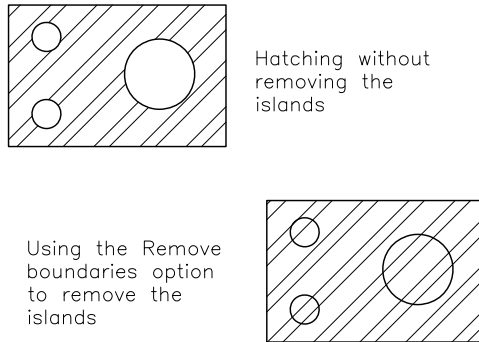


Figure 15-10 Using the **Remove Boundary** option to remove islands from the hatch area



Tip

*It may be a good idea to use the **Select Objects** option to select the object containing islands, if you want to remove the islands from the hatching area.*

Recreate

This option is available while editing a hatch and is used to recreate boundaries around the existing hatch pattern. On choosing this option, you will be prompted to specify whether you want to recreate boundaries as a region or as a polyline. You can also associate the hatch to the new boundary.

Retain Boundary Objects drop-down list

When you select an internal point in a region to be hatched, a boundary is created around it. By default, this boundary will be removed as soon as the hatch pattern is applied. The **Retain Boundary Objects** drop-down list (see Figure 15-11) provides options to specify whether the boundary is to be retained as object or not. You can also specify the type of object it can be saved as.

Select the **Don't Retain Boundaries** option, if you do not need the boundary to be saved. In case, if you need to retain the boundary, you can retain it as a polyline or region. If you select the **Retain Boundaries - Polyline** option the boundary created around the hatch area will be a polyline. Similarly, when you select **Retain Boundaries - Region**, the boundary of the hatch area will be a region. Regions are two-dimensional areas that can be created from closed shapes or loops.

Display Boundary Objects drop-down list

If you have chosen any one of the **Retain Boundaries** option then you can choose this option to display the resulting boundary, while editing. However, the boundary will merge with the profile of the drawing object. You can use the **Move** command to view the resulting hatch boundary.

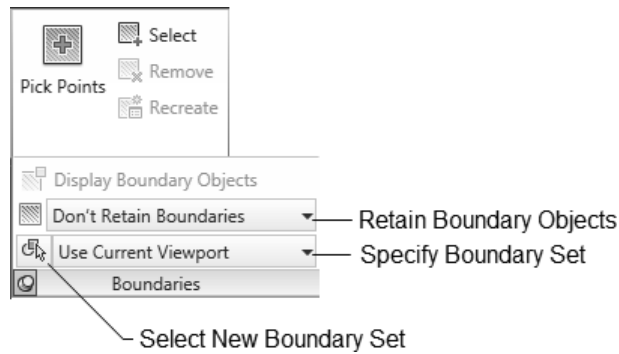


Figure 15-11 Options in the expanded **Boundaries** panel

Defining Boundary Set Area

When you invoke the **Hatch** tool and you have not formed a boundary set, there is only one option, **Use Current Viewport**, will be available in the **Specify Boundary Set** drop-down list (see Figure 15-11). The benefit of creating a selection set is that when you select a point or select the objects to define the hatch boundary, AutoCAD will search only for the objects that are in the selection set.

The default boundary set is **Use Current Viewport**, which comprises everything that is visible in the current viewport. Hatching is made faster by specifying a boundary set because, in this case, AutoCAD does not have to examine everything on screen. This option allows you to define a boundary area so that only a specific portion of the drawing is considered for hatching. You use this option to create a new boundary set.

When you choose the **Select New Boundary Set** button, you are prompted to select the objects to be included in the new boundary set. While constructing the boundary set, AutoCAD uses only those objects that you select and that are hatchable. If a boundary set already exists, it is replaced by the new one. If you do not select any hatchable objects, no new boundary set is created. AutoCAD retains the current set, if there is any. Once you have selected the objects to form the boundary set, press ENTER; you will notice that **Use Boundary Set** gets added to the drop-down list.

Remember that by confining the search to the objects in the selection set, the hatching process is faster. If you select an object that is not a part of the selection set, AutoCAD ignores it. When a boundary set is formed, it becomes the default for hatching until you exit the **Hatch** tool or select the **Use Current Viewport** option from the **Specify Boundary Set** drop-down list.



Tip

To improve the hatching speed in large drawings, you should zoom into the area to be hatched, so that defining the boundary to be hatched is easier. Also, since AutoCAD does not have to search the entire drawing to find hatch boundaries, the hatch process gets faster.

Pattern Panel

The **Pattern** panel displays all predefined patterns available in AutoCAD. However, the list depends upon the option selected in the **Hatch Type** drop-down list in the **Properties** panel. By default, the **Pattern** option is selected in this drop-down list and the predefined patterns are listed in the **Pattern** panel. A predefined pattern consists of ANSI, ISO, and other pattern types. The hatch pattern selected in this panel will be applied to the object. The selected pattern will be stored in the **HPNAME** system variable. ANSI31 is the default pattern in the **HPNAME** system variable. If you need to hatch a solid by using a solid color then choose the **Solid** option

and specify the color in the **Hatch Color** option in the **Properties** panel. Similarly, if you need to create a user-defined pattern, choose the **User** option from the **Pattern** panel and set the properties.

Properties Panel

The options in this panel (see Figure 15-12) are used to set the properties of the pattern selected in the **Pattern** panel. The different options are discussed next.

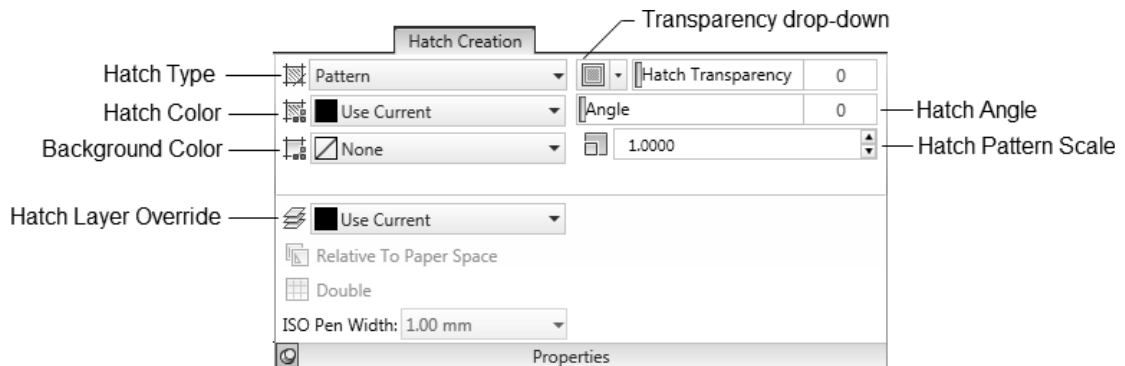


Figure 15-12 Options in the **Properties** panel

Hatch Type

The **Hatch Type** drop-down list displays the types of patterns that can be used for hatching drawing objects. The four types of hatch patterns available are **Solid**, **Gradient**, **Pattern**, and **User defined**. The predefined type of patterns come with AutoCAD and are stored in the *acad.pat* and *acadiso.pat* files. The **Pattern** type of hatch pattern is the default type. If you select the **Gradient** option from this drop-down list, the corresponding options will be listed in the **Hatch Creation** tab. These options are discussed later.

Hatch Color

Specify the color of the hatch in this drop-down list. On selecting the **Use Current** option, the color set in the **Properties** panel of the **Home** tab will be applied to the hatch.

Background Color

If you need to apply a background color to a hatch, then set a color in the **Background Color** drop-down list.

Hatch Transparency

If you need a hatch to be displayed in a transparent mode, set the transparency value in this edit box. You can also set the value by using the slider or by double-clicking in the edit box. By default it uses the transparency value set in the **Properties** panel of the **Home** tab. If you need to change the value, then select the required option in the **Transparency** drop-down. The other options available are **By Layer Transparency** and **By Block Transparency**.

Hatch Angle

The **Hatch Angle** slider is used to set the angle by which you can rotate the hatch pattern with respect to the *X* axis of the current UCS. The angle value is stored in the **HPANG** system variable. The angle of hatch lines of a particular hatch pattern is governed by the values specified in the hatch definition. For example, in the **ANSI31** hatch pattern definition, the specified angle of hatch lines is 45-degree. If you select an angle of 0, the angle of hatch lines will be 45-degree. If you enter an angle of 45-degree, the angle of the hatch lines will be 90-degree.

Hatch Pattern Scale

The **Hatch Pattern Scale** drop-down list is used to set the scale factors by which you can expand or contract the selected hatch pattern. You can enter the scale factor of your choice in the edit box by double-clicking in it. The scale value is stored in the **HPSCALE** system variable. The value 1 does not mean that the distance between the hatch lines is 1 unit. The distance between the hatch lines and other parameters of a hatch pattern is governed by the values specified in the hatch definition. For example, in the ANSI31 hatch pattern definition, the specified distance between the hatch lines is 0.125. If you select a scale factor of 1, the distance between the lines will be 0.125. If you enter a scale factor of 0.5, the distance between the hatch lines will be $0.5 \times 0.125 = 0.0625$.

Double

This option is available only for user-defined patterns. When you choose this option, AutoCAD doubles the original pattern by drawing a second set of lines at right angle to the original lines in the hatch pattern. For example, if you have a parallel set of lines as a user-defined pattern and if you select the **Double** option, the resulting pattern will have two sets of lines intersecting at 90-degree. You can notice the effect of selecting the **Double** option in Figure 15-13. If the **Double** option is selected, the **HPDOUBLE** system variable is set to 1.

Relative to Paper Space

This option is available only in a layout. If this option is selected, then AutoCAD will automatically scale the hatched pattern relative to the paper space units. This option can be used to display the hatch pattern at a scale that is appropriate for your layout.

ISO Pen Width

The **ISO Pen Width** drop-down list is available only for ISO hatch patterns. You can select the desired pen width value from the **ISO Pen Width** drop-down list. The value selected specifies the ISO-related pattern scaling.

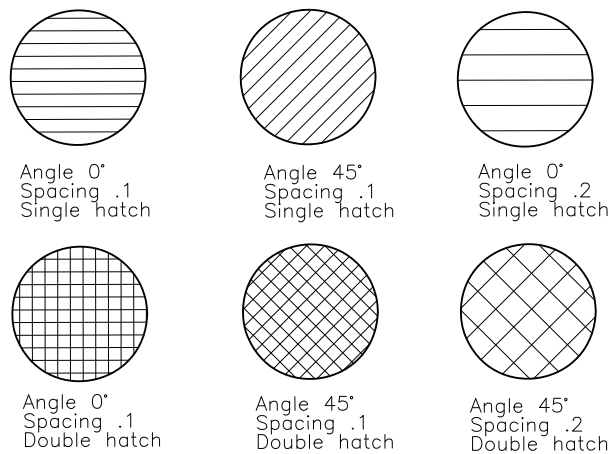


Figure 15-13 Specifying angle and spacing for user-defined hatch patterns

Origin Panel

Hatch pattern alignment is an important feature of hatching, as on many occasions, you need to hatch adjacent areas with similar or sometimes identical hatch patterns while keeping the adjacent hatch patterns properly aligned. Proper alignment of hatch patterns is taken care of automatically by generating all lines of every hatch pattern from the same reference point. The reference point is normally at the origin point (0,0). Figure 15-14 shows two adjacent hatch areas. The area on the right is hatched using the pattern ANSI32 at an angle of 0-degree



and the area on the left is hatched using the same pattern at an angle of 90-degree. When you hatch these areas, the hatch lines may not be aligned, as shown in Figure 15-14(a). The options in the **Origin** panel allow you to specify the origin of hatch so that they get properly aligned, as shown in Figure 15-17(b). The options in this panel are discussed next.

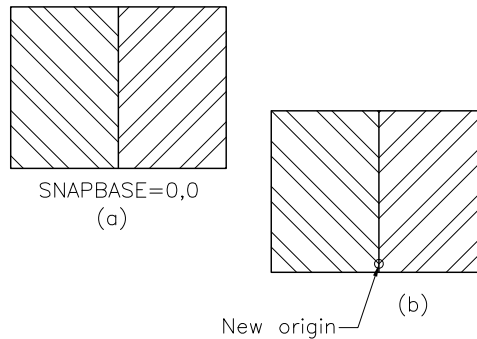


Figure 15-14 Aligning hatch patterns using the **SNAPBASE** variable

By default, the **Use Current Origin** button is chosen. This implies that the origin of the hatch pattern to be created is the origin of the current drawing. On choosing **Set Origin**, you need to specify the origin point for the hatch pattern in the drawing area.

You can also choose the other buttons to set the origin. For example, if you choose the **Bottom left** button from this panel, the origin of the hatch pattern will be at the bottom left corner of the boundary. Choose the **Store as Default Origin** button to store the origin just selected as the default origin for all the hatch patterns to be created now onwards.



Note

The reference point for hatching can also be changed using the **SNAPBASE** system variable.

Options Panel

The options in this area allow you to specify the draw order and some commonly used properties of the hatch pattern.

Associative

This button is chosen by default; therefore, when you modify the boundary of a hatch object, the hatch patterns will be automatically updated to fill up the new area. But, if the hatch boundary is a region, you cannot edit the shape of the hatch boundary. One of the major advantages with the associative hatch feature is that you can edit the hatch pattern or edit the geometry that is hatched without having to modify the associated pattern or boundary separately. After editing, AutoCAD automatically regenerates the hatch and the hatch geometry to reflect the changes. To edit the hatch boundary, select it and edit it by using grips.

Annotative

Choose this button to create an annotative hatch. An annotative hatch is defined relative to the paper space size. The scale of the annotative hatch objects changes in the viewport or layout according to the annotation scale assigned to the hatch objects and the annotation scale specified for that particular layout or viewport.

Gap tolerance

The **Gap tolerance** edit box is used to set the value up to which the open area will be considered closed when selected for hatching, using the **Pick Points** method. The default value of the gap

tolerance is 0. As a result, an open area will not be selected for hatching. You can set the value of the gap tolerance using the **Gap Tolerance** edit box. If the gap in the open area is less than the value specified in this edit box, the area will be considered closed and will be selected for hatching.

Create Separate Hatches

If you hatch multiple closed areas that are not nested together, then on selecting this option, a separate hatch will be created for each closed area. As a result, you can edit the hatches separately. If this option is not selected, the hatch created in all the selected closed areas will be treated as single entity and can be edited together.

Island Detection Style

The drop-down list below the **Create Separate Hatches** option is used to select the style of the island detection during hatching. There are four styles available in this drop-down list. The effect of using a particular style is displayed in the form of an illustration in the image tile placed before the name and is also shown in Figure 15-15. To set a particular style, select the corresponding option. The four styles available in this drop-down list are discussed next.



Note

The selection of an island detection style carries meaning only if the objects to be hatched are nested (that is, one or more selected boundaries are within another boundary).

Normal Island Detection. This style is selected by default. This style hatches inward starting at the outermost boundary. If it encounters an internal boundary, it turns off the hatching. An internal boundary causes the hatching to turn off until another boundary is encountered. In this manner, alternate areas of the selected object are hatched, starting with the outermost area. Thus, areas separated from the outside of the hatched area by an odd number of boundaries are hatched, while those separated by an even number of boundaries are not.

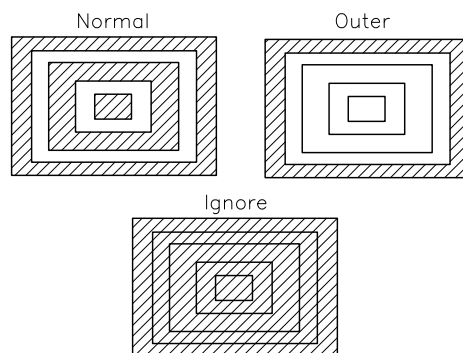


Figure 15-15 Using hatching styles

Outer Island Detection. This particular option also lets you hatch inward from an outermost boundary, but the hatching is turned off if an internal boundary is encountered. Unlike the previous case, it does not turn on the hatching again. The hatching process, in this case, starts from both ends of each hatch line; only the outermost level of the structure is hatched, hence, the name **Outer Island**.

Ignore Island Detection. In this option, all areas bounded by the outermost boundary are hatched. The option ignores any hatch boundaries that are within the outer boundary. All islands are completely ignored and everything within the selected boundary is hatched.

No Island Detection. In this option, even if the object is nested, the individual closed boundary is hatched separately.

**Tip**

It is also possible to set the pattern and the island detection style at the same time by using the **HPNAME** system variable. AutoCAD stores the Normal style code by adding **N** to the pattern name. Similarly, **O** is added for the Outer style, and **I** for the Ignore style to the value of the **HPNAME** system variable. For example, if you want to apply the **BOX** pattern using the outer style of island detection, you should enter the **HPNAME** value to the **BOX, O**. Now, when you apply the hatch pattern, the **BOX** pattern is applied using the outer style of hatching.

Match Properties

The **Match Properties** drop-down list is used to hatch the specified boundaries using the properties of an existing hatch. On selecting the down arrow, two options will be displayed. These two options are used to set the hatch origin with respect to an existing hatch. By default, the **Use current origin** option is selected; as a result, the current origin will be taken as the hatch origin. If you select the **Use source hatch origin** option, the hatch pattern will accept the origin of the source hatch as the origin of the current hatch pattern.

On selecting any one of the options, the following command sequence appears. Note that you must have applied hatch to an object before invoking this option.

Pick internal point or [Select objects/seTtings]: **_MA**

Select hatch object: *Select the object from which you have to inherit the hatch pattern*

Pick internal point or [Select objects/seTtings]: *Pick a point inside the object to hatch.*

Selecting everything...

Selecting everything visible...

Analyzing the selected data...

Pick internal point or [Select objects/seTtings]: **Enter** *(The selected pattern now becomes the current hatch pattern. If you then want to adjust the hatch properties, such as the angle or scale of the pattern, you can do so.)*

Specifying the Draw Order

The drop-down list below the Island detection is used to assign a draw order to the hatch. If you want to send the hatch behind all the entities, select the **Send to Back** option. Similarly, if you want to place the hatch in front of all the entities, select the **Bring to Front** option. If you want to place the hatch behind the hatch boundary, select **Send Behind Boundary**. Similarly, if you want to place the hatch in front of the boundary, select **Bring in Front of Boundary**. You can also select the **Do Not Assign** option, if you do not want to assign the draw order to the hatch.

Hatch Settings

You can also set the parameters discussed above using the **Hatch and Gradient** dialog box, as shown in Figure 15-6. To invoke this dialog box, choose the inclined arrow (**Hatch Settings**) in the **Options** panel of the **Hatch Creation** tab or after invoking the **HATCH** command type **T** and press ENTER when you are prompted to pick internal point. The default appearance of the **Hatch and Gradient** dialog box is slightly different from the one shown in Figure 15-16. This is because options like **Islands**, **Boundary retention** are not visible by default. To make these options visible choose the **More Options** button available at the lower right corner of the **Hatch and Gradient** dialog box.

Close

Choose the **Close** button to close the **Hatch Creation** tab. You can also click once in the drawing area after completing the hatching process to exit the **Hatch Creation** tab.

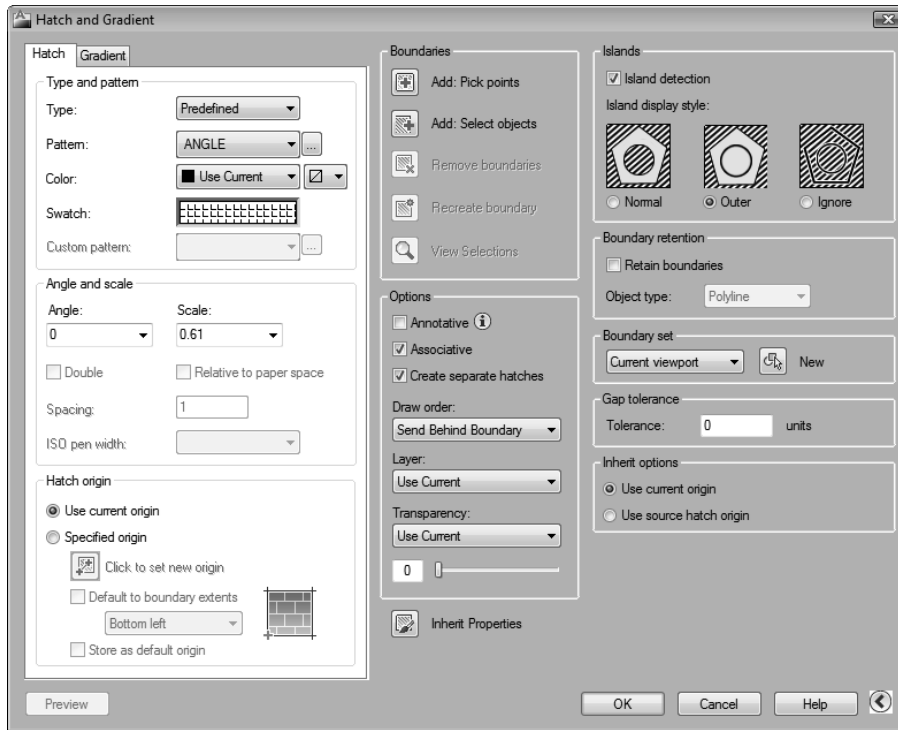


Figure 15-16 The *Hatch and Gradient* dialog box

EXERCISE 1

Hatch Scale & Hatch Angle

In this exercise, you will hatch the given drawing using the hatch pattern named **STEEL**. Set the scale and the angle to match the drawing shown in Figure 15-17.

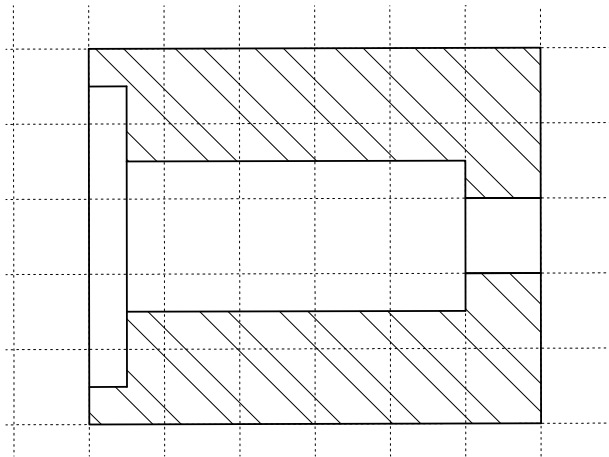


Figure 15-17 Drawing for Exercise 1

EXERCISE 2

Hatch Pattern

In this exercise, you will hatch the front section view of the drawing in Figure 15-18 using the hatch pattern for brass. Two views, top, and front are shown. In the top view, the cutting plane indicates how the section is cut and the front view shows the full section view of the object. The section lines must be drawn only where the material is actually cut.

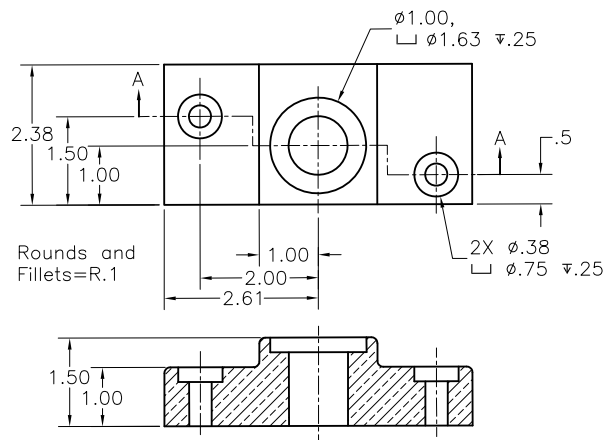


Figure 15-18 Drawing for Exercise 2

EXERCISE 3**Align Hatch**

In this exercise, you will hatch the given drawing using the hatch pattern ANSI31. Align the hatch lines as shown in the drawing (Figure 15-19).

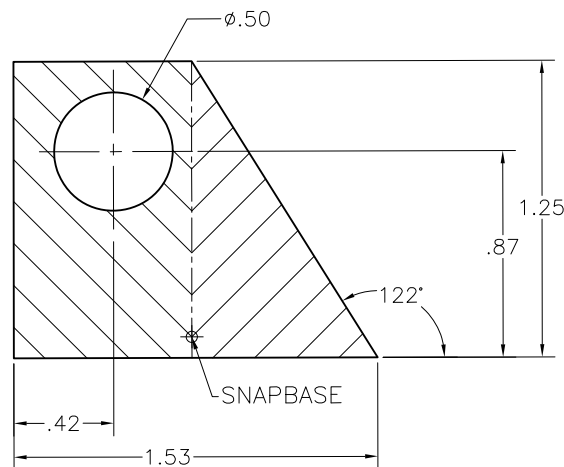


Figure 15-19 Drawing for Exercise 3

Setting the Parameters for Gradient Pattern

During hatching, you can select the **Gradient** option in the **Hatch Type** drop-down list to fill the boundary in a set pattern of colors. On selecting the **Gradient** option in the **Hatch Type** drop-down list, nine fixed patterns will be listed in the **Pattern** panel and their corresponding option will be displayed in the **Hatch Creation** tab, as shown in Figure 15-20. You can select the required gradient or specify the gradient pattern by entering its value in the **GFNAME** system variable. The default value of this variable is 1. As a result, the first gradient pattern is selected.

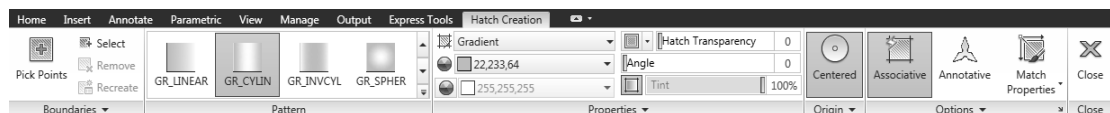


Figure 15-20 The Hatch Creation tab with the options for the Gradient pattern

You can set the colors for the Gradient in the **Gradient Color 1** drop-down list available in the

Properties panel. By default, you can set one color to the gradient. You can set the angle and the tint of the color by using the corresponding sliders. If you need to set two colors then choose the **Gradient Colors** button available on the left of the **Gradient Colors 2** drop-down list. On doing so, the **Gradient Colors 2** drop-down list will be enabled. Now, you can set the other color in this drop-down list. In this case, the **Tint** slider will not be available.

The **Gradient Angle** slider displays the angles that you can rotate the gradient fill with respect to the X axis of the current UCS. You can select any angle from this slider or you can also double-click and enter an angle of your choice in the edit box. The angle value is stored in the **GFANG** system variable.

The symmetricity of the gradient is set by choosing the **Centered** button in the **Origin** panel. If this button is not chosen, then the gradient fill is moved up and to the left.



Note

The other options are same as discussed earlier.



Tip

*To snap the hatch objects, set the **OSOPTIONS** system variable to **1**. You can also invoke the **Options** dialog box and choose the **Drafting** tab. Then, clear the **Ignore hatch objects** check box from the **Object Snap Options** area.*

CREATING ANNOTATIVE HATCH

You can create annotative hatch having similar annotative properties like text and dimensions. The annotative hatch are defined relative to the viewport scaling, you only have to specify the hatch scale according to its display on the sheet. The display size of the hatch in the model space will be controlled by the current annotation scale multiplied by the paper space height. You can also control the annotative properties of the hatch pattern as discussed in Chapter 7.

To create an annotative hatch, choose the **Hatch** tool from the **Draw** panel; the **Hatch Creation** tab will be displayed. Choose the **Select** option from the **Boundaries** panel, select the objects that you want to hatch, and press the ENTER key; the **Hatch and Gradient** dialog box will be displayed again. In the **Options** area of this dialog box, select the **Annotative** check box and choose the **OK** button. You can also convert the existing non-annotative hatch into the annotative hatch. To do so, select the non-annotative hatch in the drawing and select **Yes** from the **Annotative** drop-down list in the **Pattern** list of the **Properties** palette.



Note

*The annotative hatch pattern will only be displayed in the drawing area for the annotative scale that is set current while creating the hatch. To display that hatch pattern at any other annotative scale, you have to add that scale to the selected hatch using the **OBJECTSCALE** command.*

HATCHING THE DRAWING USING THE TOOL PALETTES

Ribbon: View > Palette > Tool Palettes

Command: TOOLPALETTES

Toolbar: Standard Annotation > Tool Palettes Window



You can use the **Tool Palettes** window shown in Figure 15-21 to insert predefined hatch patterns and blocks in the drawings. By default, AutoCAD displays **Tool Palettes** as a window on the right of the drawing area. A number of tabs such as **Command Tool Samples**, **Hatches and Fills**, **Civil**, **Structural**, **Electrical**, and so on are available in this window. In this chapter, you will learn to insert **Imperial Hatches**, **ISO Hatches** and **Gradient Samples** in the **Hatches and Fills** tab of the **Tool Palettes** window. The **Imperial Hatches** list provides the options to insert the hatch patterns that are created using the Imperial units. The **ISO**

Hatches list provides the options to insert the hatch patterns that are created using the Metric units. You will notice that the hatch patterns provided in both these lists are similar. The basic difference between the two lists is their scale factor. The **Gradient Samples** list provides option to add the color gradients to objects as hatch.



Tip

The **Tool Palettes** window can be turned on and off by pressing the CTRL+3 keys.

AutoCAD provides two methods to insert the predefined hatch patterns from the **Tool Palettes** window: **Drag and Drop** method and **Select and Place** method. Both these methods are discussed next.

Drag and Drop Method

To insert the predefined hatch pattern from the **Tool Palettes** using this method, move the cursor over the desired predefined pattern in the **Tool Palettes**. You will notice that as you move the cursor over the hatch pattern, the hatch icon gets converted into a 3D icon. Also, a tooltip is displayed that shows the name of the hatch pattern. Press and hold the left mouse button and drag the cursor within the area to be hatched. Release the left mouse button, and you will notice that the selected predefined hatch pattern is added to the drawing.

Select and Place Method

You can also add the predefined hatch patterns to the drawings using the select and place method. To add the hatch pattern, move the cursor over the desired pattern in the **Tool Palettes**; the pattern icon will be changed to a 3D icon. Next, click the left mouse button; the selected hatch pattern will be attached to the cursor and you will be prompted to specify the insertion point of the hatch pattern. Now, move the cursor within the area to be hatched and click the left mouse button; the selected hatch pattern will be inserted at the specified location.

Modifying the Properties of the Predefined Patterns available in the Tool Palettes

To modify the properties of the predefined hatch patterns, move the cursor over the hatch pattern in the **Tool Palettes** and right-click on it to display the shortcut menu. Using the options available in this shortcut menu, you can cut or copy the desired hatch pattern available in one tab of **Tool Palettes** and paste it on the other tab. You can also delete and rename a selected hatch pattern using the **Delete** and **Rename** options, respectively. To update and change the image displayed on the selected hatch pattern, choose the **Update tool image** or **Specify image** option. To modify the properties of the selected hatch pattern, choose **Properties** from the shortcut menu, as shown in Figure 15-22. The **Tool Properties** dialog box will be displayed, as shown in Figure 15-23.

In the **Tool Properties** dialog box, the name of the selected hatch pattern is displayed in the **Name** edit box. You can also rename the hatch pattern by entering a new name in the **Name** edit box. The **Image** area available on the left of the **Name** edit box displays the image of the selected hatch pattern. You can change

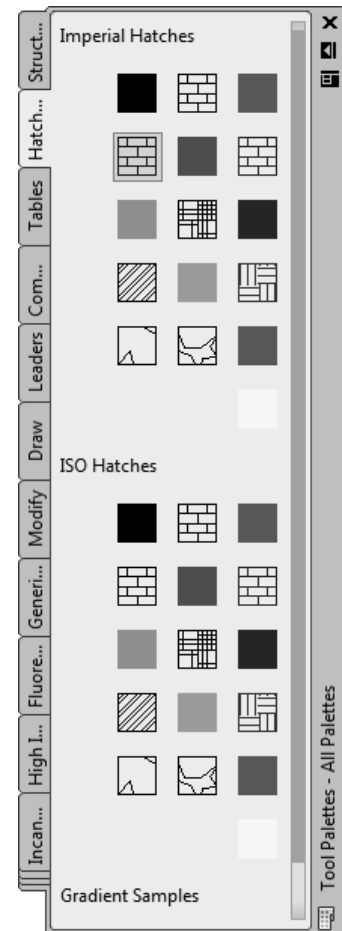


Figure 15-21 The **Hatch** tab of the **Tool Palettes**

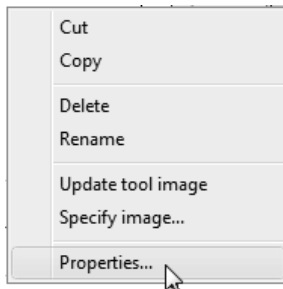


Figure 15-22 Choosing *Properties* from the shortcut menu

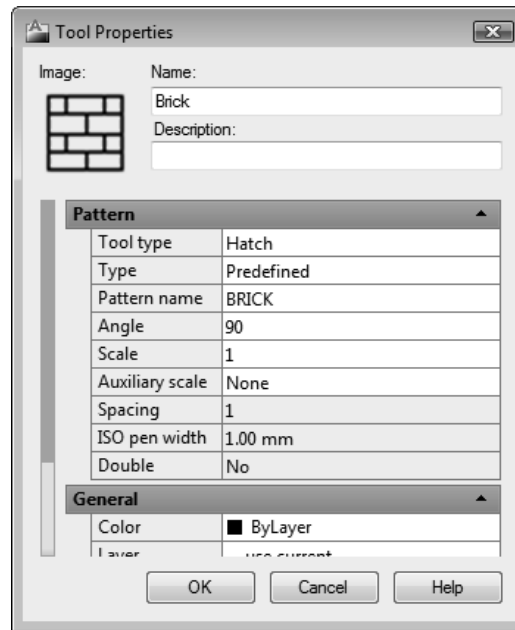


Figure 15-23 The *Tool Properties* dialog box

the display image by choosing the **Specify image** option from the shortcut menu that will be displayed when you right-click on the image. If you enter a description of the hatch pattern in the **Description** text box, it is stored with the hatch definition in the **Tool Palettes**. Now, when you move the cursor over the hatch pattern in **Tool Palettes** and pause for a second, the description of the hatch pattern appears along with its name in the tooltip. The **Tool Properties** dialog box displays the properties of the selected hatch pattern under the following categories.

Pattern

In this category, you can change the pattern type, pattern name, angle, and scale of the selected pattern. You can modify the spacing of the **User defined** patterns in the **Spacing** text box. Also, the ISO pen width of the ISO patterns can be redefined in the **ISO pen width** text box. The **Double** drop-down list is available only for the **User-defined** hatch patterns. You can select Yes or No from the **Double** drop-down list to determine the hatch pattern to be doubled at right angles to the original pattern or not. When you choose the [...] button in the **Type** property field, AutoCAD displays the **Hatch Pattern Type** dialog box. You can select the type of hatch pattern from the **Pattern Type** drop-down list. If the **Predefined** pattern type is selected, you can specify the pattern name by either selecting it from the **Pattern** drop-down list or from the **Hatch Pattern Palette** dialog box displayed on choosing the **Pattern** button. Similarly, if you select the **Custom** pattern type, you can enter the name of the custom pattern in the **Custom Pattern** edit box. If you select the **User defined** pattern type, both the **Pattern** drop-down list and the **Custom Pattern** edit box are not available.

General

In this category, you can specify the general properties of the hatch pattern such as color, layer, linetype, plot style, transparency, and line weight for the selected hatch pattern. The properties of a particular field can be modified from the drop-down list available on selecting that field. Choose **OK** to apply the changes and close the dialog box.

HATCHING AROUND TEXT, DIMENSIONS, AND ATTRIBUTES

When you select a point within a boundary to be hatched and if it contains text, dimensions, and attributes, the hatch lines do not pass through the text, dimensions, and attributes present in the object being hatched by default. AutoCAD places an imaginary box around these objects that does not allow the hatch lines to pass through it. Remember that if you are using the select objects option to select objects to hatch, you must select the text/attribute/shape along with the object in which it is placed when defining the hatch boundary. If multiple line text is to be written, the **Multiline Text** tool is used. You can also select both the boundary and the text when using the window selection method. Figure 15-24 shows you how hatching takes place around multiline text, attributes, and dimensions.

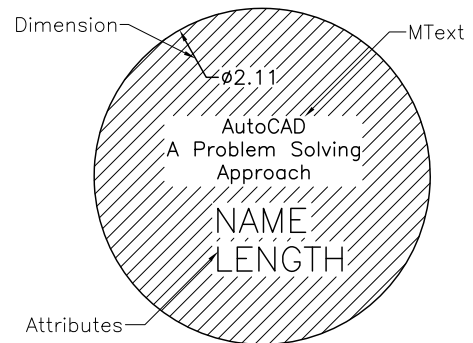


Figure 15-24 Hatching around dimension, multiline text, and attributes

EDITING HATCH PATTERNS

Using the Hatch Editor Tab*

In AutoCAD 2011, on selecting a hatch pattern, the **Hatch Editor** tab will be displayed in the **Ribbon**, as shown in Figure 15-25. The panels and their options in this tab are similar to that of the **Hatch** tab. Change the parameters of the hatch pattern in the corresponding panels; the hatch pattern will be modified instantaneously. Press ESC to exit the **Hatch Editor** tab.

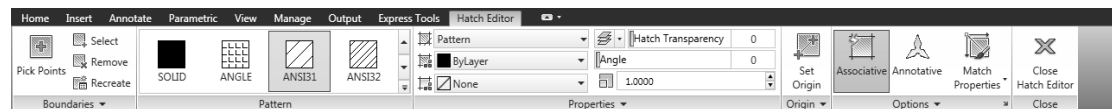


Figure 15-25 The Hatch Editor tab with the options for the Gradient pattern

Using the HATCHEDIT Command

Ribbon: Home > Modify > Edit Hatch

Toolbar: Modify II > Edit Hatch

Tool Palette: Modify > Edit Hatch

Command: HATCHEDIT



The **Edit Hatch** tool is used to edit a hatch pattern. When you invoke this tool and select the hatch for editing, the **Hatch Edit** dialog box will be displayed, as shown in Figure 15-26.

The **Hatch Edit** dialog box is used to change or modify a hatch pattern. This dialog box is the same as the **Hatch and Gradient** dialog box, except that only the options that control the hatch pattern are available. The available options work in the same way as they do in the **Hatch and Gradient** dialog box.

The **Hatch Edit** dialog box has two tabs, just like the **Hatch** and **Gradient** dialog box. They are **Hatch** and **Gradient**. In the **Hatch** tab, you can redefine the type of hatch pattern by selecting another type from the **Type** drop-down list. If you are using the **Predefined** pattern, you can select a new hatch pattern name from the **Pattern** drop-down list. You can also change the scale or angle by entering new values in the **Scale** or **Angle** edit box. When using the **User defined** pattern, you can redefine the spacing between the lines in the hatch pattern by entering a new



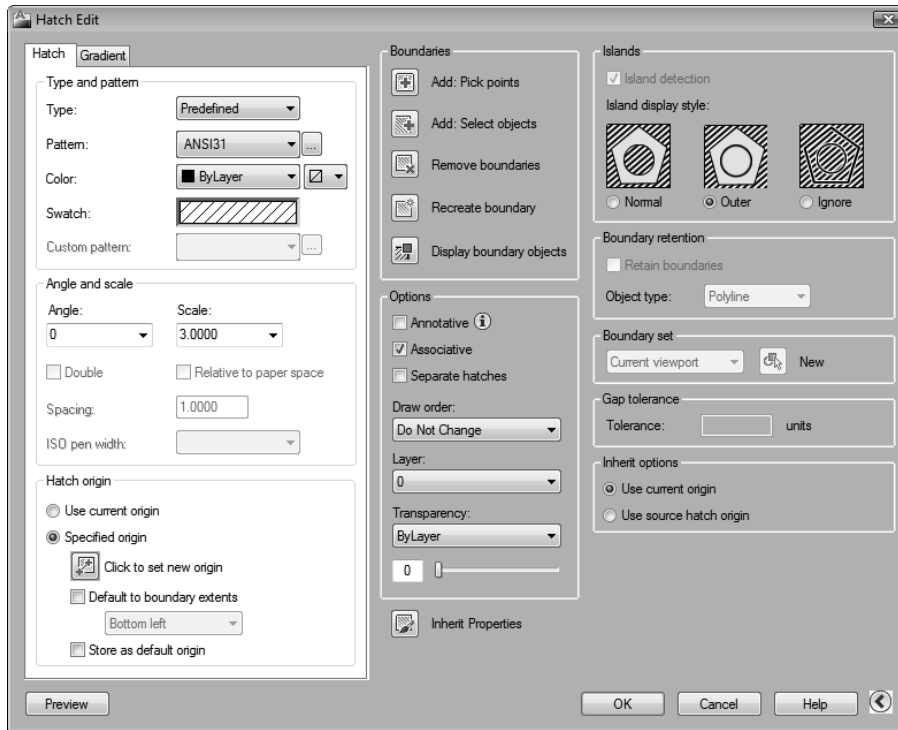


Figure 15-26 The **Hatch** tab of the **Hatch Edit** dialog box

value in the **Spacing** edit box. If you are using the **Custom** pattern type, you can select another pattern from the **Custom pattern** drop-down list. You can also redefine the island detection style by selecting either of the **Normal**, **Outer**, or **Ignore** styles from the **Islands** area of the dialog box. You can also convert a non-annotative hatch into an annotative hatch and vice-versa. If you want to copy the properties from an existing hatch pattern, choose the **Inherit Properties** button, and then select the hatch whose properties you want to be inherited. You can also change the draw order of the hatch pattern using the options available in the **Draw order** area. If the **Associative** radio button in the **Options** area of the dialog box is selected, the pattern is associative. This implies that whenever you modify the hatch boundary, the hatch pattern is automatically updated. The appearance of the gradient fill can be specified using the **Gradient** tab of the dialog box. You can specify the gradient fill comprising different shades and tints of a single color or double colors by selecting the **One color** and **Two color** radio buttons, respectively. You can also specify the color of the gradient fill or the shade and tint of a single color using the color swatch and the **Shade and Tint** Slider. If the **Centered** button is selected, AutoCAD will apply a symmetrical gradient fill. Also, AutoCAD provides you with an option to select the desired display pattern of the gradient fill by selecting any one of the nine fixed patterns for the gradient fill.



Note

If a hatch pattern is associative, the hatch boundary can be edited using grips and editing commands and the associated pattern is modified accordingly. This is discussed later.

In Figure 15-27, the object is hatched using the **ANSI31** hatch pattern. With the **HATCHEDIT** command, you can edit the hatch using the **Hatch Edit** dialog box to change the hatch to the one shown in Figure 15-28. You can also edit an existing hatch through the command line by entering **-HATCHEDIT** at the Command prompt.

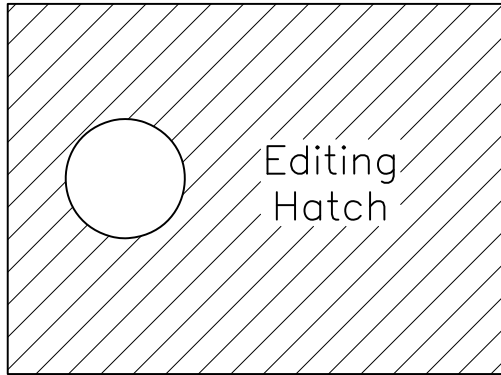
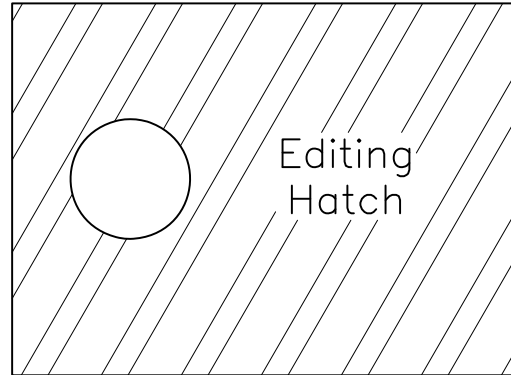


Figure 15-27 ANSI31 hatch pattern

Figure 15-28 The modified hatch pattern using the *Edit Hatch* tool

Using the PROPERTIES Command

Quick Access Toolbar: Properties (*Customize to Add*)

Ribbon: View > Palettes > Properties

Command: PROPERTIES



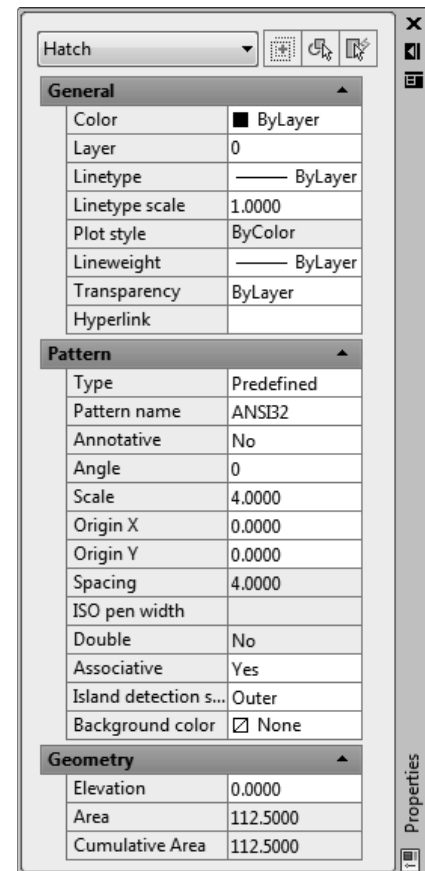
You can also use the **PROPERTIES** command to edit a hatch pattern. When you select a hatch pattern for editing, and invoke the **PROPERTIES** command, AutoCAD displays the **Properties** palette for the hatch, see Figure 15-29. You can also invoke the **Properties** palette by selecting the hatch pattern and right-clicking to display a shortcut menu. Choose **Properties** from the shortcut menu; the **Properties** palette is displayed. This palette displays the properties of the selected pattern under the following categories.

General

In this category, you can change the general pattern properties like color, layer, linetype, linetype scale, lineweight, and so on. When you click on the field corresponding to a particular property, a drop-down list is displayed from where you can select an option or value. Whenever a drop-down list does not get displayed, you can enter a value in the field.

Pattern

In this category, you can change the pattern type, pattern name, annotative property, annotation scale, angle, scale, spacing, associativity, and island detection style properties of the pattern. In the case of ISO patterns, you can redefine the ISO pen width of the pattern modify the spacing of the **User defined** patterns. You can also determine whether you want to have a **User defined** pattern as double or not. When you choose the [...] button in the **Type** property field, AutoCAD displays the **Hatch Pattern Type** dialog box, see Figure 15-30. Here, you can select the type of hatch pattern from the **Pattern Type** drop-down list. If you have selected a **Predefined** pattern type, you can select a pattern name from the **Pattern** drop-down list or choose the **Pattern** button to display the **Hatch Pattern Palette** dialog box. You can then select

Figure 15-29 The *Properties* palette (Hatch)

a pattern here in one of the tabs and then choose **OK** to exit the dialog box. Now, choose **OK** in the **Hatch Pattern Type** dialog box to return to the **Properties** palette. You will notice that the pattern name you have selected is displayed in the **Pattern** name field. Similarly, if you select the **Custom** pattern type, you can enter the name of the custom pattern in the **Custom Pattern** edit box. If you select a **User defined** pattern type, both the **Pattern Type** drop-down list and the **Custom Pattern** edit box will not be available. When you click in the **Pattern name** property field, the [...] button is displayed. When you choose the [...] button, the **Hatch Pattern Palette** dialog box is displayed with the ANSI31 pattern selected. Select the **Yes** or **No** option from the **Annotative** drop-down list to convert the existing hatch into annotative or non-annotative respectively. When you click on the **Annotation scale** property field, the [...] button will be displayed. On choosing the [...] button, the **Annotation Object Scale** dialog box will be invoked. You can add other annotation scales to the selected hatch with the help of this dialog box. The values of the angle, scale, and spacing properties can be entered in the corresponding fields. A value for the ISO pen width can be selected from the **ISO pen width** drop-down list. For the user-defined hatch patterns, you can select **Yes** or **No** from the **Double** drop-down list to specify if you want the hatch pattern to double at right angle to the original pattern or not. You can also select **Yes** or **No** from the **Associative** drop-down list to determine if a pattern is associative or not. Similarly, you can select an island detection style from the **Island detection style** drop-down list.

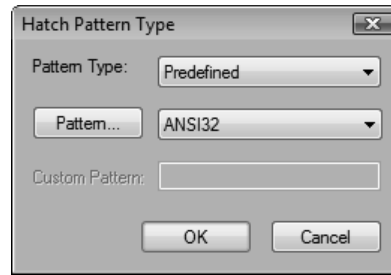


Figure 15-30 The **Hatch Pattern Type** dialog box



Tip

*It is more convenient to choose the [...] button in the **Pattern Type** edit box to display the **Hatch Pattern Type** dialog box and enter both the type and name of the pattern at the same time.*

Geometry

In this category, the elevation of the hatch pattern can be changed. A new value of elevation for the hatch pattern can be entered in the **Elevation** field. This category also displays the area and the cumulative area of the hatch.

EDITING THE HATCH BOUNDARY

Using Grips

One of the ways you can edit the hatch boundary is by using grips. You can select the hatch pattern or hatch boundaries. If you select the hatch pattern, the hatch highlights and a grip is displayed at the centroid of the hatch. A centroid for a region that is coplanar with the *XY* plane is the center of that particular area. However, if you select an object that defines the hatch boundary, the object grips are displayed at the defining points of the selected object. Once you change the boundary definition, and if the hatch pattern is associative, AutoCAD will reevaluate the hatch boundary and then hatch the new area. When you edit the hatch boundary, make sure that there are no open spaces in it. AutoCAD will not create a hatch if the outer boundary is not closed. Figure 15-31 shows the result of moving the circle and text, and shortening the bottom edge of the hatch boundary of the object shown in Figure 15-28. The objects were edited by using grips and since the pattern is associative, when modifications are made to the boundary object, the pattern automatically fills up the new area. If you select the hatch pattern, AutoCAD will display the hatch object grip at the centroid of the hatch. You can select the grip to make it hot and then edit the hatch object. You can stretch, move, scale, mirror, or rotate the hatch pattern. Once an editing operation takes place on the hatch pattern then, the associativity is lost and AutoCAD displays the message: “**Hatch boundary associativity removed**” in the prompt window.

While creating the hatch, the **Don't Retain Boundaries** option is selected in the **Retain Boundary Objects** drop-down list of the **Hatch Creation** panel. Therefore, all objects selected or found by the selection or point selection processes during hatch creation are associated with the hatch as boundary objects. And, editing any of them may affect the hatch. If, however, the **Retain Boundaries - Polyline** or the **Retain Boundaries - Region** check boxes was selected when the hatch was created, only the retained polyline boundary created by **HATCH** is associated with the hatch as its boundary object. Editing it will affect the hatch, and editing the objects selected or found by selection or point selection processes during the hatch created will have no effect on the hatch. You can, of course, select and simultaneously edit the objects selected or found by the selection or point selection processes, as well as the retained polyline boundary created by the **Hatch** tool.

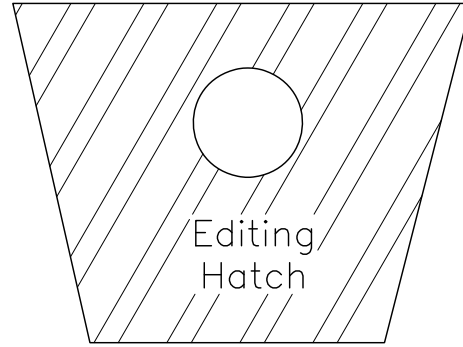


Figure 15-31 The result of using grips to edit the hatch boundary of the object shown in Figure 15-28

Trimming the Hatch Patterns

You can trim the hatch patterns by using a cutting edge. For example, refer to Figure 15-32. This figure shows a drawing before trimming the hatch. In this drawing, the outer loop was selected as the object to be hatched. This is the reason the space between the two vertical lines on the right is also hatched. Figure 15-33 shows the same drawing after trimming the hatch using the vertical lines as the cutting edge. You will notice that even after trimming some of the portions of the hatch, it is a single entity.

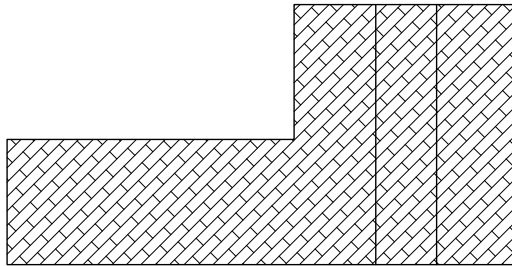


Figure 15-32 Before trimming the hatch

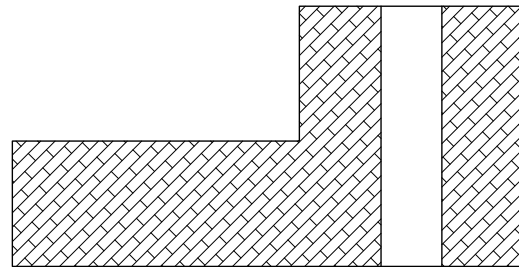


Figure 15-33 After trimming the hatch by using the vertical lines as the cutting edge

Using AutoCAD Editing Tools

When you use the editing tools such as **Move**, **Rotate**, **Scale**, and **Stretch**, associativity is maintained, provided all objects that define the boundary are selected for editing. If any of the boundary-defining objects is missing, the associativity will be lost and AutoCAD will display the message **Hatch boundary associativity removed**. When you rotate or scale an associative hatch, the new rotation angle and the scale factor are saved with the hatch object data. This data is then used to update the hatch. When using the **Array**, **Copy**, and **Mirror** tools, you can array, copy, or mirror just the hatch boundary, without the hatch pattern. Similarly, you can erase just the hatch boundary, using the **Erase** tool and associativity is removed. If you explode an associative hatch pattern, the associativity between the hatch pattern and the defining boundary is removed. Also, when the hatch object is exploded, each line in the hatch pattern becomes a separate object.

When the original boundary objects are being edited, the associated hatch gets updated, but new boundary objects do not have any effect. For example, when you have a square island within a circular boundary and then you erase the square, the hatch pattern is updated to fill up the entire circle. But, once the island is removed, another island cannot be added, since it was not calculated as a part of the original set of boundary objects.

HATCHING BLOCKS AND XREF DRAWINGS

When you apply hatching to inserted blocks and xref drawings, their internal structure is treated as if the block or xref drawing were composed of independent objects. This means that if you have inserted a block that consists of a circle within a rectangle and you want the internal circle to be hatched, you need to invoke the **Hatch** tool and then specify a point within the circle to generate the hatch, see Figure 15-34. However, if you choose the **Select** option from the **Boundaries** panel of the **Hatch Creation** tab, you will be prompted to select an object. Select an object; the entire block will be selected and a hatch will be created, as shown in Figure 15-36.

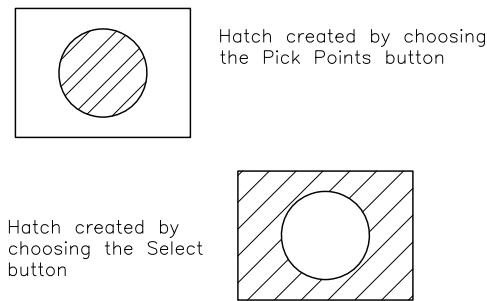


Figure 15-34 Hatching inserted blocks

When you xref a drawing, you can hatch any part of the drawing that is visible. Also, if you hatch an xref drawing and then use the **XCLIP** command to clip it, the hatch pattern is not clipped, although the hatch boundary associativity is removed. Similarly, when you detach the xref drawing, the hatch pattern and its boundaries are not detached, although the hatch boundary associativity is removed.

CREATING A BOUNDARY USING CLOSED LOOPS

Ribbon: Home > Draw > Boundary

Command: BOUNDARY



The **Boundary** tool is used to create a polyline or region around a selected point within a closed area, in a manner similar to the one used for defining a hatch boundary.

When this tool is invoked, AutoCAD displays the **Boundary Creation** dialog box, as shown in Figure 15-35.

The options in the **Boundary Creation** dialog box are similar to those in the **Boundaries** tab of the **Hatch Creation** tab discussed earlier. Although, only the options related to boundary selections are available, the **Pick Points** button in the **Boundary Creation** dialog box is used to create a boundary by selecting a point inside the object, whose boundary you want to create.

When you choose the **Pick Points** button, the dialog box disappears temporarily and you are prompted to select the internal point. Select a point that lies within the boundary of the object. Once you select an internal point, a polyline or a region will be formed around the boundary (Figure 15-36). To end this process, press ENTER or right-click at the **Pick internal point** prompt. Whether the boundary created is a polyline or a region is determined by the option you have selected from the **Object type** drop-down list in the **Boundary retention** area. **Polyline** is the default option. You can edit the boundary that has been created with the editing commands. The boundary is selected by using the **Last** object selection option.

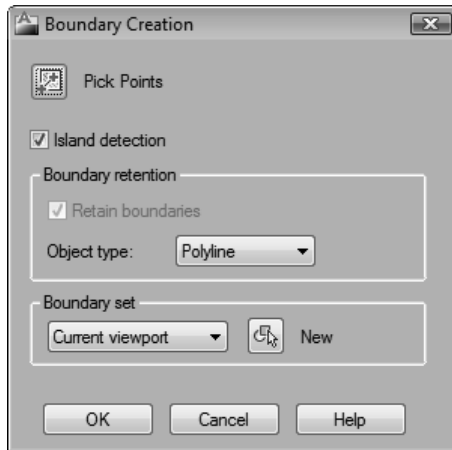


Figure 15-35 The **Boundary Creation** dialog box

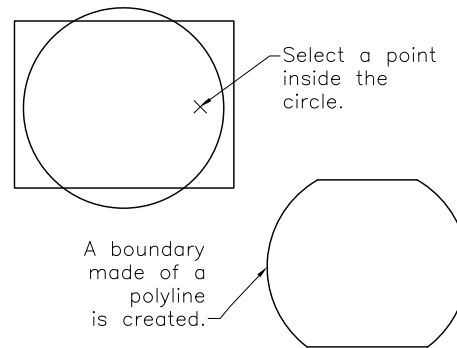


Figure 15-36 Using the **BOUNDARY** command to create a polyline boundary

Similar to the **Hatch** tool, you can also define a boundary set here by choosing the **New** button in the **Boundary set** area of the dialog box. The dialog box will temporarily close to allow you to select objects to be used to create a boundary. The default boundary set is **current viewport**, which means everything visible in the current viewport consists of the boundary set. As discussed earlier, the boundary set option is especially useful when you are working with large and complex drawings, where examining everything on the screen becomes a time-consuming process.

The **Boundary Creation** dialog box also provides you the option of determining the island detection method. The **Island detection** check box is available below the **Pick Points** button and is selected by default. As a result, the island detection method is Flood type and islands are included as boundary objects. If you clear this check box, the Ray casting method of island detection is enabled, where rays shall be cast from the selected internal point in all directions (by default, using the dialog box). The nearest closed object it encounters is used for boundary creation. If the selected point does not lie within the encountered boundary, a **Boundary Definition Error** dialog box is displayed and you have to select another internal point.



Note

The **HPBOUND** system variable controls the type of boundary object created using the **Boundary** tool. If the value is 1, the object created is a polyline and if the value is 0, the object created is a region.

OTHER FEATURES OF HATCHING

1. In AutoCAD, the hatch patterns are separate objects. The objects store the information about the hatch pattern boundary with reference to the geometry that defines the pattern for each hatch object.
2. When you save a drawing, the hatch patterns are stored with the drawing. Therefore, the hatch patterns can be updated even if the hatch pattern file that contains the definitions of hatch patterns is not available.
3. If the system variable **FILLMODE** is 0 (Off), the hatch patterns are not displayed. To see the effect of a changed **FILLMODE** value, you must use the **REGEN** command to regenerate the drawing after the value has been changed.

4. You can edit the boundary of a hatch pattern even when the hatch pattern is not visible (**FILLMODE**=0).
5. The hatch patterns created in the earlier releases are automatically converted into AutoCAD 2010 hatch objects when the hatch pattern is edited.
6. When you save an AutoCAD 2011 drawing in Release 12 format (DXF), the hatch objects are automatically converted to Release 12 hatch blocks.
7. You can use the **CONVERT** command to change the pre-Release 14 hatch patterns to AutoCAD 2011 objects. You can also use this command to change the pre-Release 14 polylines to AutoCAD 2011 optimized format to save memory and disk space.

EXERCISE 4

Boundary

See Figure 15-37 and then create the drawing shown in Figure 15-38 using the **Boundary** tool to create a hatch boundary. Copy the boundary from the drawing shown in Figure 15-38, and then hatch.

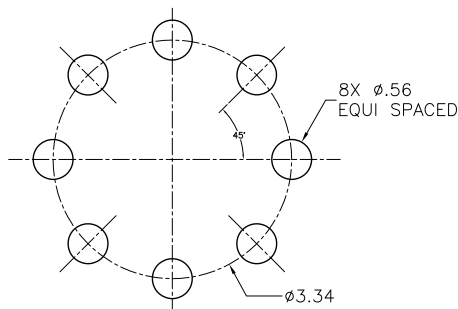


Figure 15-37 Drawing for Exercise 4

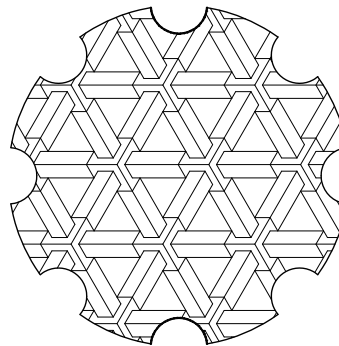


Figure 15-38 Final drawing for Exercise 4

Self-Evaluation Test

Answer the following questions and then compare them to those given at the end of this chapter:

1. Different filling patterns make it possible to distinguish between different parts or components of an object. (T/F)
2. If AutoCAD does not locate the entered pattern in the *acad.pat* file, it searches for it in a file with the same name as the pattern. (T/F)
3. When a boundary set is formed, it does not become the default boundary set for hatching. (T/F)
4. You can edit the hatch boundary and the associated hatch pattern by using grips. (T/F)
5. If you need to hatch a drawing that has a gap, then specify the gap value in the _____ edit box in the **Hatch Creation** tab.
6. One of the ways to specify a hatch pattern from the group of stored hatch patterns is by selecting one from the _____ drop-down list.

7. The value that you enter in the _____ edit box lets you rotate a hatch pattern with respect to the X axis of the current UCS.
8. The _____ option in the **Hatch Creation** tab lets you select the objects that form a boundary for hatching.
9. While hatching, you can select the _____ option in the **Hatch Type** drop-down list to fill the boundary in a set pattern of colors.
10. The **ISO Pen Width** drop-down list is available in the **Hatch Creation** tab only for the _____ patterns.

Review Questions

Answer the following questions:

1. The **Hatch** tool does not allow you to hatch a region enclosed within a boundary (closed area) by selecting a point inside the boundary. (T/F)
2. A Boundary Definition Error message box is displayed if AutoCAD finds that the selected point is not inside the boundary or that the boundary is not closed. (T/F)
3. The **Tolerance** edit box is used to set the value up to which the open area will be considered closed when selected for hatching using the **Pick Points** method. (T/F)
4. When you use editing tools such as **Move**, **Scale**, **Stretch**, and **Rotate**, associativity is lost, even if all the boundary objects are selected. (T/F)
5. The hatching procedure in AutoCAD does not work on inserted blocks. (T/F)
6. Patterns drawn using the **Hatch** tool are associative. (T/F)
7. Which of the following system variables has to be set to 1, if the **Double** hatch box is selected?

(a) HPSPACE	(b) HPDOUBLE
(c) HPANG	(d) HPSCALE
8. For which of the following hatch patterns will the **ISO pen width** drop-down list be available?

(a) ANSI	(b) Predefined
(c) Custom	(d) ISO
9. Which of the following options should be chosen if you want to have the same hatching pattern, style, and properties as that of the existing hatch?

(a) Match Properties	(b) Select
(c) Pick points	(d) Inherit Properties
10. Which of the following variables can be used to align the hatches in adjacent hatch areas?

(a) SNAPBASE	(b) FILLMODE
(c) SNAPANG	(d) HPANG

11. In which of the following system variables will the specified hatch spacing value be stored?
- (a) **HPDOUBLE** (b) **HPANG**
 (c) **HPSCALE** (d) **HPSPACE**
12. One of the advantages of using the _____ tool is that you don't have to select each object comprising the boundary of the area you want to hatch, as in the case of the _____ tool.
13. To select a custom hatch pattern, first select **Custom** from the **Hatch Type** drop-down list and then select the name of a previously stored hatch pattern from the _____ drop-down list.
14. There are three hatching styles from which you can choose: _____, _____, and _____.
15. If you select the _____ style, all areas bounded by the outermost boundary are hatched, ignoring any hatch boundaries that lie within the outer boundary.

EXERCISE 5

Hatch Pattern

Hatch the drawings shown in Figures 15-39 and 15-40 using the hatch pattern to match.

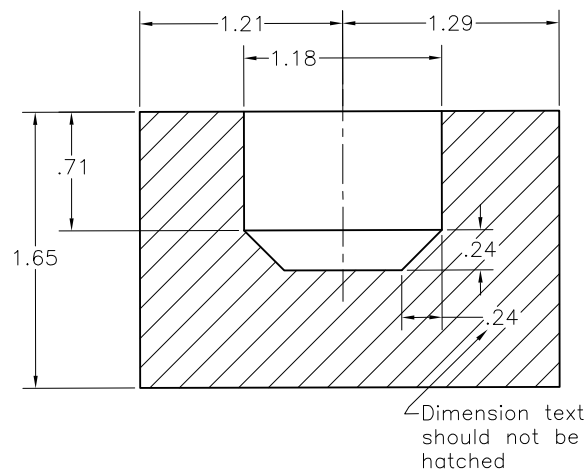


Figure 15-39 Drawing for Exercise 5

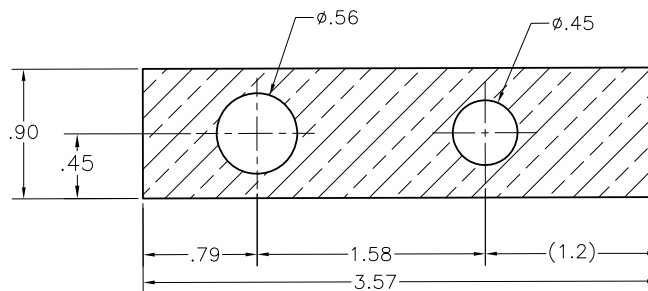


Figure 15-40 Drawing for Exercise 5

EXERCISE 6**Hatch Align**

Hatch the drawing shown in Figure 15-41 using the hatch pattern **ANSI31**. Use the **SNAPBASE** variable to align the hatch lines, as shown in the drawing.

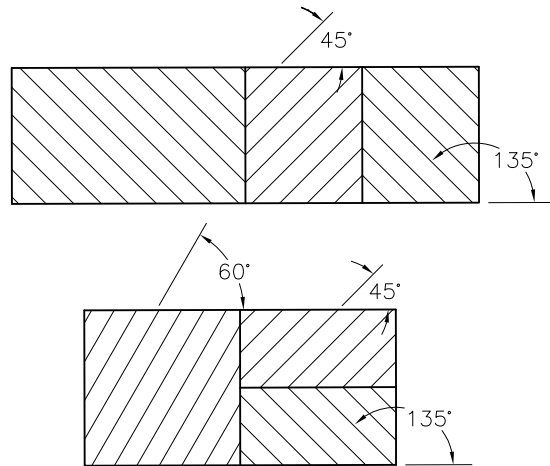


Figure 15-41 Drawing for Exercise 6

EXERCISE 7**Hatch**

Figure 15-42 shows the top and front views of an object. It also shows the cutting plane line. Based on the cutting plane line, hatch the front views in section. Use the hatch pattern of your choice.

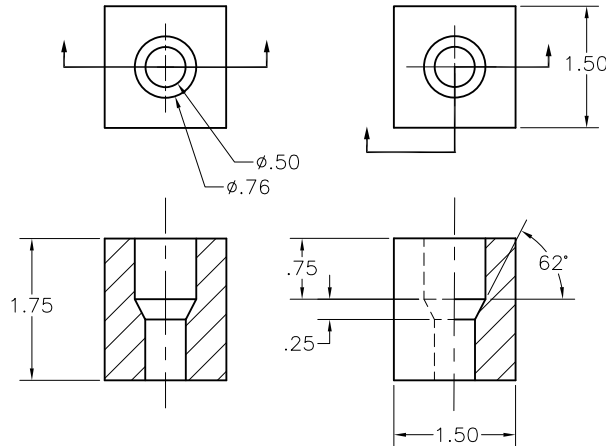


Figure 15-42 Drawing for Exercise 7

EXERCISE 8**Hatch**

Figure 15-43 shows the top and front views of an object. Hatch the front view in full section. Use the hatch pattern of your choice.

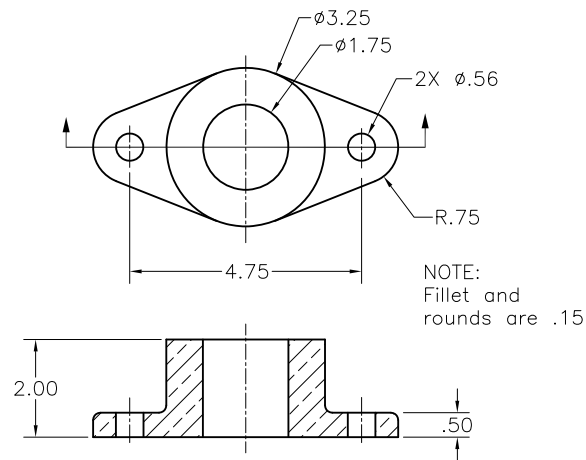


Figure 15-43 Drawing for Exercise 8

EXERCISE 9**Hatch**

Figure 15-44 shows the front and side views of an object. Hatch the side view in half section. Use the hatch pattern of your choice.

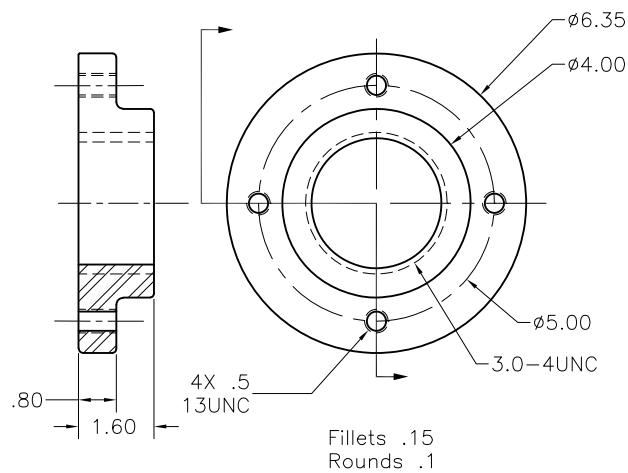


Figure 15-44 Drawing for Exercise 9

EXERCISE 10

Hatch

Figure 15-45 shows the front view with the broken section and top views of an object. Hatch the front view as shown. Use the hatch pattern of your choice.

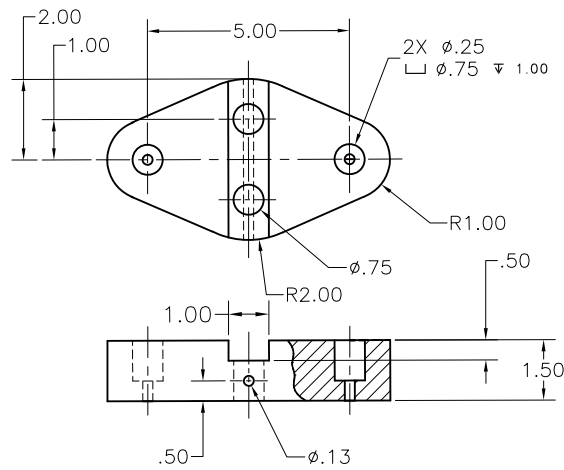


Figure 15-45 Drawing for Exercise 10

EXERCISE 11

Hatch

Figure 15-46 shows the front, top, and side views of an object. Hatch the side view in section using the hatch pattern of your choice.

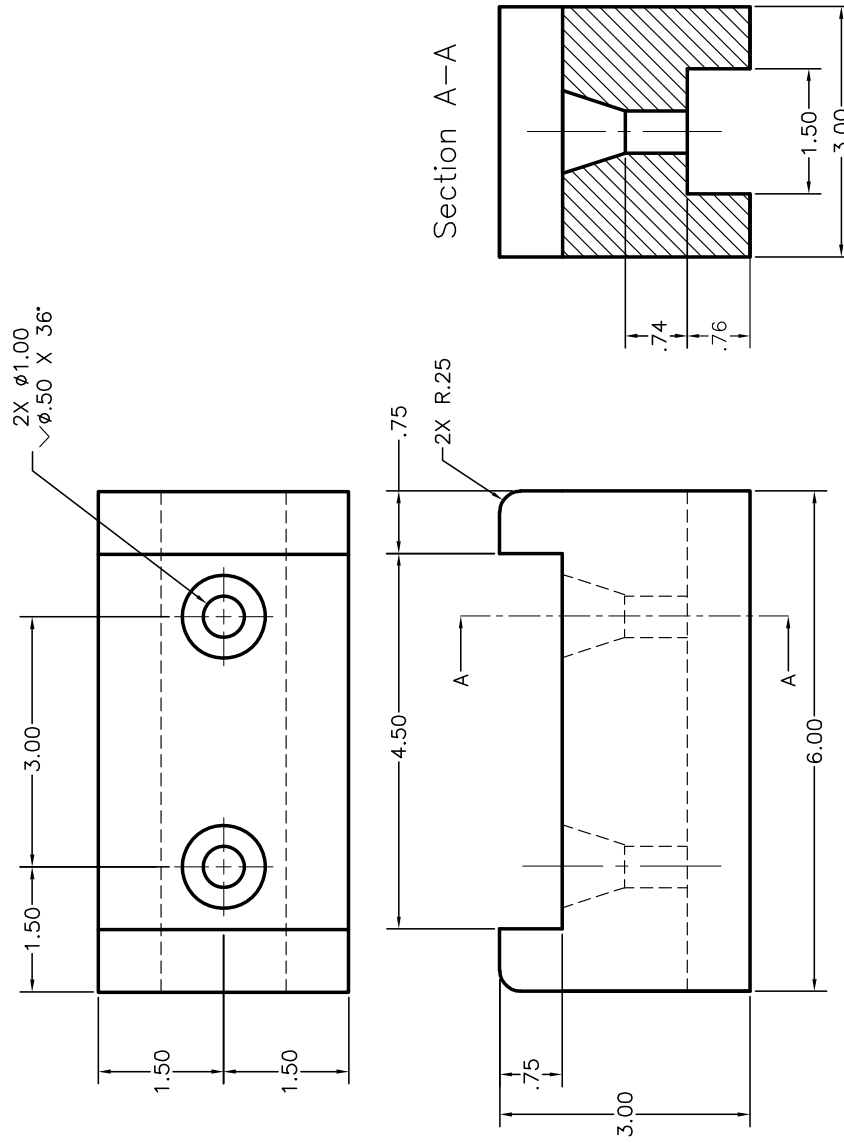


Figure 15-46 Drawing for Exercise 11

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Problem-Solving Exercise 1

Figure 15-47 shows an object with front and side views with aligned section. Hatch the side view using the hatch pattern of your choice.

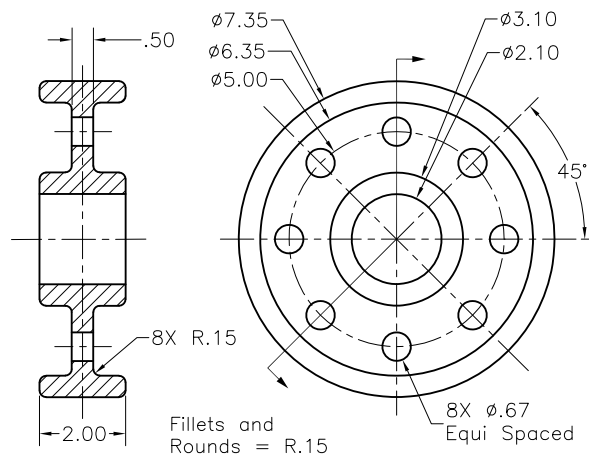


Figure 15-47 Drawing for Problem-Solving Exercise 1

Problem-Solving Exercise 2

Figure 15-48 shows the front view, side view, and the detail "A" of an object. Hatch the side view and draw the detail drawing as shown.

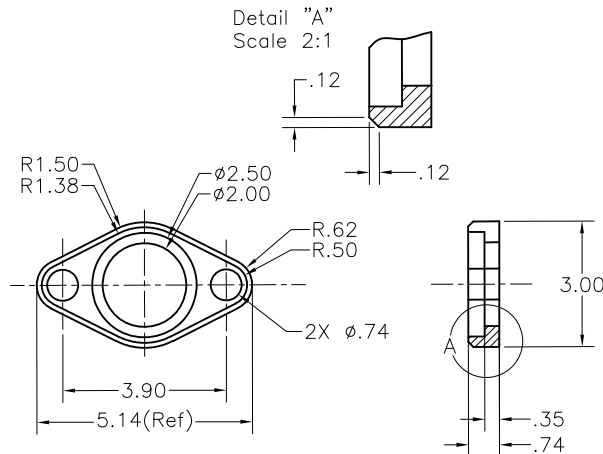


Figure 15-48 Drawing for Problem-Solving Exercise 2

Problem-Solving Exercise 3

Create the drawing shown in Figure 15-49. Assume the missing dimensions.

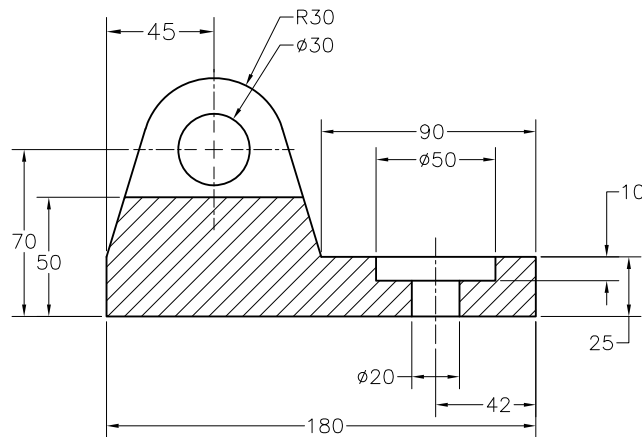


Figure 15-49 Drawing for Problem-Solving Exercise 3

Problem-Solving Exercise 4

Create the drawing shown in Figure 15-50. Assume the missing dimensions.

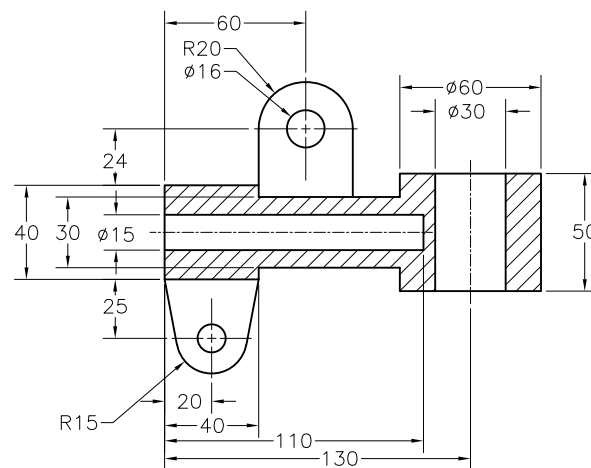


Figure 15-50 Drawing for Problem-Solving Exercise 4

Problem-Solving Exercise 5

Draw a detail drawing whose top, side, and section views are given in Figure 15-51. Then, hatch the section view. **

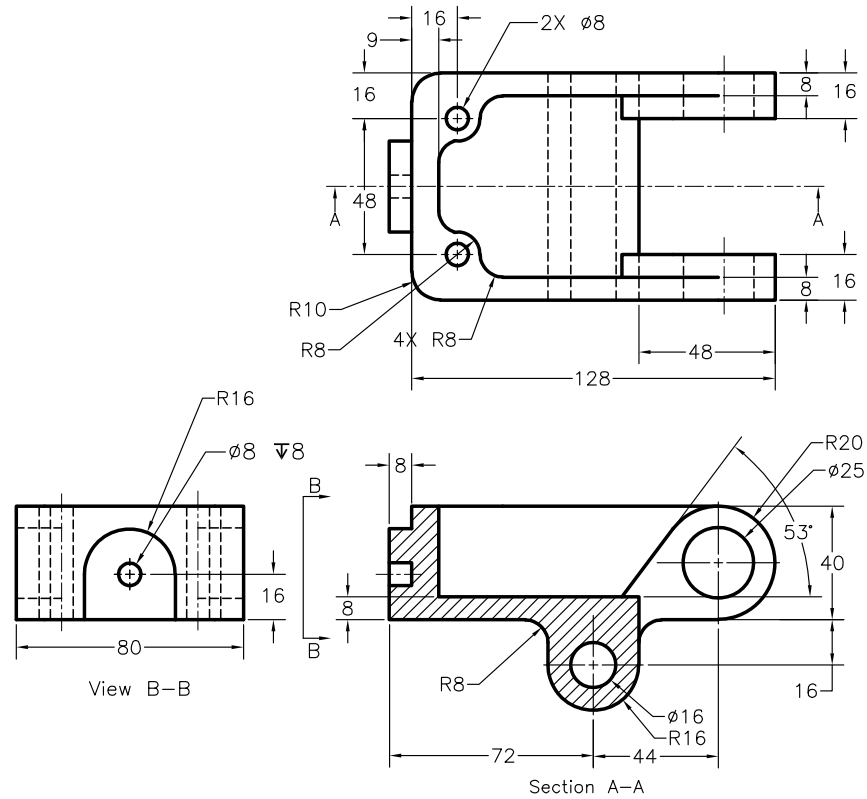


Figure 15-51 Views and dimensions of the drawing for Problem-Solving Exercise 5

Answers to Self-evaluation Test

1. T, 2. T, 3. F, 4. T, 5. Tolerance, 6. Pattern, 7. Angle, 8. Select objects, 9. Gradient, 10. ISO hatch