Bonus Chapter 7: Creating Custom Linetypes, Shapes, and Hatch Patterns

In This Chapter

- **Using simple and complex linetypes**
- **Understanding shapes**
- **Creating custom hatch patterns**

AutoCAD gives you the flexibility to define how objects look through the use of properties such as color, lineweight, and linetypes. You can select one of the predefined linetypes that come with AutoCAD, but if it doesn't provide the look you want, create a custom linetype that's made up of dashes and gaps, or that includes a shape or a text string. In this chapter, I also cover how to create shapes that can be used in complex linetypes and even how to create a custom font. Along with linetypes, you can create your own custom hatch patterns to control the linework that is used to fill a closed boundary.

It's All in the Linetype

Linetypes are repeating patterns used to help convey design ideas. Whether the drawings you create are architectural or mechanical, you most likely use more than one linetype in a drawing. Linetypes come in two different classifications: simple and complex. Complex linetypes are the same as simple linetypes with additional support for shapes and text strings.

Linetype files are plain text files that can be edited with a text editor and have the LIN file extension. AutoCAD ships with two linetype files, acad.lin (acadlt.lin) and acadiso.lin (acadltiso.lin). The acad.lin (acadlt.lin) file is used for imperial unit drawings, whereas acadiso.lin (acadltiso.lin) is used for metric-based drawings. A linetype pattern is defined by using two different lines in the LIN files.

The first line of a linetype file contains the Name and Description line; the second is the descriptor line that tells AutoCAD how to create the pattern. Linetype files also support the use of comments to help keep track of when

changes were last made. Comments are defined with a semicolon; AutoCAD ignores everything to the right of the semicolon. A section of the acad.lin file that ships with AutoCAD appears next:

```
;; Note: in order to ease migration of this
;; file when upgrading to a future version of
;; AutoCAD, it is recommended that you add
;; your customizations to the User Defined
;; Linetypes section at the end of this file.
;;
*BORDER,Border __ __ . __ __ . __ __ . __ __ . __ __ .
A,.5,-.25,.5,-.25,0,-.25
```

The PSLTSCALE system variable determines how linetype patterns appear when objects are displayed through a viewport. If the PSLTSCALE system variable is set to a value of 0, the linetype scale is determined by the LTSCALE system variable. If the system variable is set to a value of 1, linetype scaling is controlled by the scale factor of the viewport. See Book I, Chapter 6 for more information about linetype scales.

Express Tools comes with a utility that allows you to make a linetype out of geometry in a drawing. This utility is great when you are trying to find out how to create your own linetypes. The utility can be found on the menu browser or menu bar under Express➪Tools➪Make Linetype. AutoCAD LT does not support Express Tools.

Simple linetypes

Simple linetypes are made up of only dashes, dots, and spaces and are the most commonly used linetypes. Examples of simple linetypes are CENTER (____ _ ____ _ ____) and HIDDENX2 (____ ____ ____).

Simple linetype structure

The best way to understand how a simple linetype is created is to take a look at one of the linetypes that comes with AutoCAD. One of the most commonly used linetypes is CENTER:

```
*CENTER,Center ____ _ ____ _ ____ _ ____ _ ____ _ ___
A,1.25,-.25,.25,-.25
```

Line 1 of the CENTER linetype's definition follows:

- `*` designates the start of the linetype.
- `CENTER,` is the name of the linetype pattern. This name must be unique in the file; otherwise, AutoCAD uses only the first linetype with the name in the file and ignores all other instances. A comma is used to separate the name of the linetype from its description.

- `Center ____ _ ____` is the description of the linetype pattern. The description is displayed in Linetype Manager, the Layer Properties Manager palette, the Properties Palette, the Properties toolbar, and other places in the application where you might work with linetypes. The description is optional and must not exceed 47 characters in length.

Line 2 of the CENTER linetype's definition follows:

- `A,` is the alignment flag is used to force AutoCAD to start and end the linetype with a dash rather than a space or dot. A comma is used to separate each data element.
- `1.25,` is the length of a dash when LTSCALE is equal to 1. Dashes are represented by a positive value.
- `-.25,` is the length of a space when LTSCALE is equal to 1. Spaces are represented by a negative value.
- `.25,` is the length of a dash.
- `-.25,` is the length of a space.

One of the other elements that is part of a simple linetype is a dot, which is presented by a value of 0 in a linetype pattern. You should place a gap on the left and right side of a dot so it stands out in the linetype pattern.

Creating a simple linetype

Because linetype files are plain text files, they can be created and edited with an application such as Notepad. Follow these steps to create a new simple linetype:

1. **Click Start➪[All] Programs➪Accessories➪Notepad.**

   Notepad is launched and a blank document is created.

2. **On the menu bar in Notepad, click File➪Open.**

   The Open dialog box is displayed.

3. **In the Save As Type drop-down list, select All Files.**

   You should be able to see all file types and not just those with the extension .TXT.

4. **Browse to the location of acad.lin (acadlt.lin) and select the file, and then click Open.**

   The acad.lin (or acadlt.lin) file should open into Notepad. By default, acad.lin is in the folder C:\Documents and Settings\<*user name*>\Application Data\Autodesk\AutoCAD 2009\R17.2\enu\Support. If you are using AutoCAD LT, acadlt.lin is in the folder C:\Documents and Settings\<*user name*>\Application Data\Autodesk\AutoCAD LT 2009\R14\enu\Support.

5. **Scroll all the way to the bottom of the linetype file and position the cursor on the last blank line in the file.**

   Above the last couple of blank lines, you should see a set of comments that begins with the comment `;; User Defined Linetypes`.

6. **Enter the new linetype pattern.**

   The linetype pattern file should now include the name and description for the linetype on one line and a descriptor on the next line.

7. **On the menu bar in Notepad, click File➪Save.**

   The updated contents of the linetype file are saved to file.

8. **Load and use the linetype just as you would any other linetype that comes with AutoCAD.**

   The linetype works just like any of the linetypes that come with AutoCAD.

Using a custom linetype file

Adding custom linetypes to one of the linetype files that comes with AutoCAD is the easiest way to go, but at times you might want to keep your custom linetypes in a separate file. Follow these steps to load a linetype from a custom linetype file:

1. **In AutoCAD, on the menu browser or menu bar, click Format menu➪Linetype.**

   The Linetype Manager dialog box is displayed.

2. **Click Load.**

   The Load or Reload Linetypes dialog box is displayed.

3. **Click File.**

   The Select Linetype File dialog box is displayed.

4. **Browse to the location of the custom linetype file and select it. Click Open.**

   The Select Linetype File dialog box closes and the linetypes are displayed in the list box.

5. **In the Load or Reload Linetypes dialog box, select the linetypes that you want to use in the drawing and then click OK.**

   The selected linetypes are loaded into the current drawing and are ready for use. You return to the Linetype Manager dialog box.

6. **In the Linetype Manager dialog box, click OK.**

   The Linetype Manager dialog box is closed.

Complex linetypes

Complex linetypes are made up of dashes, dots, and spaces, along with text strings or shapes. Examples of complex linetypes are

```
TRACKS ( Tracks -|-|-|- )
HOT_WATER_SUPPLY ( Hot water supply - - HW - -)
```

The best way to understand how a complex linetype is created is to take a look at one of the linetypes that comes with AutoCAD. Complex linetypes are not as common as simple linetypes, but one that is commonly used is HOT_WATER_SUPPLY, which is a linetype with a text string in it:

```
*HOT_WATER_SUPPLY,Hot water supply ---- HW ---- HW ---- HW --
    --
A,.5,-.2,["HW",STANDARD,S=.1,R=0.0,X=-0.1,Y=-.05],-.2
```

Line 1 of the HOT_WATER_SUPPLY linetype's definition is

- `*` designates the start of the linetype.
- `HOT_WATER_SUPPLY,` is the name of the linetype pattern.
- `Hot water supply - - HW - -` is the description of the linetype pattern.

Line 2 of the HOT_WATER_SUPPLY linetype's definition follows:

- `A,` is the alignment flag.
- `.5,` is the length of a dash.
- `-.2,` is the length of a space.
- `[ ],` designates the beginning and end of complex data in the linetype.
- `"HW",` is the text string displayed in the linetype.
- `STANDARD,` is the text style that should be used to format the text string. If the text style is missing when the linetype is used, the current text style in the TEXTSTYLE system variable is used as a substitute.
- `S=.1,` is the **s**cale multiplier used to calculate the height of the text.
- `R=0.0,` is the rotation angle relative to the line.
- `X=-0.1,` is the X-offset value, the amount the text is shifted in the X-direction.
- `Y=.-05,` is the Y-offset value, the amount the text is shifted in the Y-direction.
- `-.2` is the length of a space.

Displaying a shape isn't much different from displaying a text string in a complex linetype. To display a shape in a linetype, you use the name of the shape in the same location as the text string, and the shape file that contains the shape in place of the text style name. Shapes are stored in compiled files with the SHX file extension. Here is an example of a complex linetype using a shape file:

```
*FENCELINE2,Fenceline square ----[]-----[]----[]-----[]----[]---
A,.25,-.1,[BOX,ltypeshp.shx,x=-.1,s=.1],-.1,1
```

Getting Familiar with Shapes

Shape files were the only way to create a blocklike object in early releases of AutoCAD. Shapes are not as commonly used now that AutoCAD has a true block object, but they are still used with complex linetypes and are very efficient. A shape is defined through a series of lines, arcs, and circles, but these elements are defined through a series of codes.

A shape is comprised of three components: a shape number, definition bytes, and the shape name. The syntax of a shape as it appears in a shape file is

```
*shapenumber, definitionbytes, shapename
```

An example of a shape that looks like an equilateral triangle is

```
*139,5,TRIGEQ
1,013,01D,018,0
```

To find out more about creating shape files, refer to the "Create Shape Definition Files" topic in the AutoCAD online Help files.

AutoCAD LT does not support the creation of shape files because it lacks the COMPILE command. The COMPILE command is used to generate a compiled shape file (SHX) from a shape file (SHP).

Express Tools comes with a utility that allows you to make a shape out of geometry in a drawing. This utility is great when trying to find out how to create your own shapes. The utility can be found on the menu browser or menu bar under Express menu➪Tools➪Make Shape. AutoCAD LT does not support Express Tools.

Creating Custom Patterns

Hatch patterns are repeating patterns used to help convey design ideas. Whether you create drawings that are used to construct a building or manufacture a gear, you've most likely used the HATCH command. The HATCH

command uses pattern files to define how the geometry is arranged when a specified area is filled.

Hatch pattern files are plain text files that can be edited with a text editor and have the PAT file extension. AutoCAD ships with two hatch pattern files: acad.pat (acadlt.pat) and acadiso.pat (acadltiso.pat). The acad.pat (acadlt.pat) file is used for Imperial unit drawings, whereas acadiso.pat (acadltiso.pat) is used for metric-based drawings.

A hatch pattern is defined by the first line containing the name and description for the pattern followed by single or multiple descriptor lines used to tell AutoCAD how to generate the pattern. Hatch pattern files also support the use of comments to help keep track of when changes were last made. Comments are defined with a semicolon; AutoCAD ignores everything to the right of the semicolon. Here is a section of the acad.pat file that ships with AutoCAD:

```
;; Note: in order to ease migration of this
;; file when upgrading to a future version of
;; AutoCAD, it is recommended that you add
;; your customizations to the User Defined
;; Hatch Patterns section at the end of this file.
;;
*SOLID, Solid fill
45, 0,0, 0,.125
```


The structure of a hatch pattern

The best way to understand how a hatch pattern is created is to take a look at one of the patterns that comes with AutoCAD. One of the most basic hatch patterns is ANGLE. In this example, you can see some similarities between linetypes and hatch patterns:

```
*ANGLE, Angle steel
0, 0,0, 0,.275, .2,-.075
90, 0,0, 0,.275, .2,-.075
```

Line 1 of the ANGLE hatch pattern's definition follows:

- `*` designates the start of the hatch pattern.
- `ANGLE,` is the name of the hatch pattern. This name must be unique in the file; otherwise, AutoCAD uses only the first hatch pattern with the name in the file and ignores all other instances. A comma separates the name of the hatch pattern from its description.
- `Angle steel` is the description of the hatch pattern. The description is displayed as part of a tooltip for a Hatch tool on a tool palette and also appears in the Description field when the hatch pattern is selected in DesignCenter. The name and description line must not exceed 80 characters.

Line 2 of the ANGLE hatch pattern's definition follows:

- `0,` is the angle to be used for the hatch pattern data to follow on the same line. The specified value is added to the SNAPANG system variable's value to calculate the angle to be used when the geometry is created from the descriptor line.
- `0,` is the X-origin for the starting point of the hatch pattern. The specified value is affected by the SNAPBASE system variable.
- `0,` is the Y-origin for the starting point of the hatch pattern. The specified value is affected by the SNAPBASE system variable.
- `0,` is the X-offset used to determine the distance between line segments.
- `.275,` is the Y-offset used to determine the distance between line segments.
- `.2,` is the length of a dash.
- `-.075` is the length of a space.

The second line draws all the horizontal dash segments of the hatch pattern. The dashes are drawn at a length of 0.2 and then followed by a space of 0.075 in length (see Figure BC7-1). You can get an idea of how the hatch pattern looks if you draw a line that is 0.2 units going in the 0 direction, and then copy that line over 0.275 in the 0 direction. A descriptor line must not exceed 80 characters.

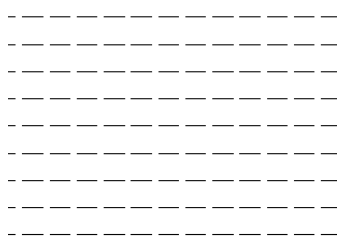

Figure BC7-1: The first part of the ANGLE hatch pattern.

Now for line 3 of the ANGLE hatch pattern's definition:

- `90,` is the angle to be used for the hatch pattern data to follow on the same line.
- `0,` is the X-origin for the starting point of the hatch pattern.
- `0,` is the Y-origin for the starting point of the hatch pattern.
- `0,` is the X-offset used to determine the distance between line segments.
- `.275,` is the Y-offset used to determine the distance between line segments.

- `.2,` is the length of a dash.
- `-.075` is the length of a space.

The third line draws all the vertical dash segments of the hatch pattern. The dashes are drawn at a length of 0.2 and then followed by a space 0.075 in length (see Figure BC7-2).

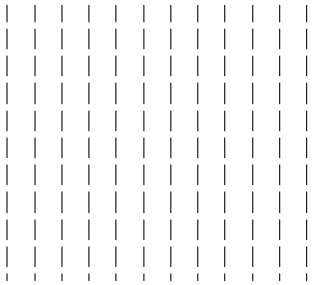

Figure BC7-2: The second part of the ANGLE hatch pattern.

You can get an idea of how the hatch pattern looks if you draw a line that is 0.2 units going 90 degrees from the 0 direction and then copy that line over 0.275 in the 0 direction. Do the same starting in the left corner of each of the horizontal lines that you have drawn previously to determine the look of the horizontal lines. Figure BC7-3 shows what the completed ANGLE hatch pattern looks like when it's used to hatch a filled area.

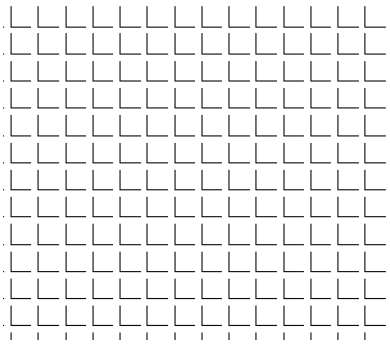

Figure BC7-3: Both lines of the ANGLE hatch pattern.

Creating a hatch pattern

Follow these steps create a new hatch pattern:

1. **Click Start➪[All] Programs➪Accessories➪Notepad.**

   Notepad is launched and a blank document is created.

2. **On the menu bar in Notepad, click File➪Open.**

   The Open dialog box is displayed.

3. **In the Save As Type drop-down list, select All Files.**

   You should be able to see all file types, not just those with the TXT extension.

4. **Browse to the location of acad.pat (acadlt.pat) and select the file, and then click Open.**

   The acad.pat (or acadlt.pat) file should be selected and opened into Notepad. By default, acad.pat is in the folder

   ```
   C:\Documents and Settings\<user name>\Application
      Data\Autodesk\AutoCAD 2009\R17.2\enu\Support
   ```

   If you're using AutoCAD LT, acadlt.pat is in the folder

   ```
   C:\Documents and Settings\<user name>\Application
      Data\Autodesk\AutoCAD LT 2009\R14\enu\Support
   ```

5. **Scroll all the way to the bottom of the hatch pattern file and position the cursor on the last blank line in the file.**

   You should see a set of comments right above the last blank line that starts off with the comment `;; User Defined Hatch Patterns`.

6. **Enter the new hatch pattern header and descriptor lines.**

   The hatch pattern file should now include a header line for the hatch pattern and at least one descriptor line.

7. **On the menu bar in Notepad, click File➪Save.**

   The updated contents of the hatch pattern file are saved to the file.

Express Tools comes with a utility that allows you to use a raster image, a block, an external reference (xref), or a wipeout object as a hatch pattern. This can be a great timesaver because you're using techniques that you already understand to create a custom hatch pattern. The utility can be found on the menu browser or menu bar under Express menu➪Draw➪Super Hatch. AutoCAD LT does not support Express Tools.

If you don't add your custom hatch patterns to one of the hatch pattern files that come with AutoCAD, a hatch pattern file can contain only a single hatch pattern. The pattern name and the file name must be the same. So if you create a file named glass.pat, the pattern in the file must be named GLASS. Adding your custom hatch patterns to one of the standard hatch pattern files that comes with AutoCAD makes using the hatch pattern much easier. Also, the hatch pattern file must be placed in one of the support search paths of AutoCAD for AutoCAD to find it.

Using a custom hatch pattern file

Follow these steps to use a custom hatch pattern that is saved in its own file:

1. **In AutoCAD, on the menu browser or menu bar, click Draw menu⇨Hatch.**

   The Hatch and Gradient dialog box is displayed. If you're using AutoCAD LT, the Hatch dialog box is displayed.

2. **In the Type drop-down list, select Custom.**

   The Custom Pattern drop-down list and Browse button become enabled.

3. **Click the ellipse (. . .) button to the left of the Custom Pattern drop-down list.**

   The Hatch Pattern Palette dialog box is displayed with all the custom hatch pattern files that are in the current support search paths of AutoCAD.

4. **Select one of the custom hatch pattern files in the list.**

   A preview of the pattern is displayed on the right side of the dialog box.

5. **Click OK to select the custom hatch pattern and return to the Hatch and Gradient dialog box.**

   Continue creating the hatch as you would if you were using a predefined pattern.