Sheet Metal Punch iFeatures

Overview

This lesson describes punch iFeatures and their use in sheet metal parts. You use punch iFeatures to simplify the creation of common and specialty cut and embossed features in your parts.

In the fabrication of sheet metal parts, punches are commonly used. Many companies have their own designations or internal identification for punches, as well as standards for how they are displayed in flat pattern layouts and 2D drawings. You can use sheet metal punch iFeatures to incorporate these features in your sheet metal part models.

In the following illustration, the embossed feature was created using a sheet metal punch iFeature.

Objectives

After completing this lesson, you will be able to:

- Describe punch iFeatures and how to use them in sheet metal part models.
- Explain the process of extracting sheet metal punch iFeatures and saving in the iFeatures Catalog.
- Explain the process of authoring table-driven punch iFeatures to define multiple versions of a punch iFeature in a single file.
- Explain the process of inserting sheet metal punch iFeatures into sheet metal part models.
- Create a sheet metal punch iFeature, author a table to control it, insert it into a sheet metal part model, and view the simplified representation in the flat pattern.
About Sheet Metal Punch iFeatures

Sheet metal punch iFeatures provide a convenient way to catalog and reuse cut and embossed features in sheet metal parts. These iFeatures reduce the design cycle by eliminating the need to create the same types of geometry in multiple part models, while enforcing standards and design intent to streamline the sheet metal part design process.

In the following illustration, the dimple in the sheet metal part on the left was created using a sheet metal punch iFeature. By editing the punch iFeature, the size was changed, as shown in the part on the right.

Definition of Sheet Metal Punch iFeatures

A sheet metal punch tool is an iFeature with additional attributes. The sheet metal punch tool cuts simple or complex hole shapes in the face of a sheet metal part, partially penetrates the face of the model leaving an embossed indentation, or both cuts and deforms in a single operation. A sheet metal punch iFeature is one or more sheet metal punch or emboss features that can be saved and reused in other designs. To further leverage the power of the sheet metal punch iFeature, you can author a table to define multiple versions of the punch that can be used to create many iterations of the punch from a single file. To control the display of the punch iFeature in flat patterns and drawings, you can also specify an alternate 2D representation that displays in the place of the actual 3D feature in flat patterns and drawing views.
In the following illustration, the Extract iFeature dialog box is shown during the creation of a sheet metal punch iFeature.

**Example of Sheet Metal Punch iFeatures**

You work as a designer for a company that specializes in fabricating sheet metal parts. Your company has an extensive supply of standard punches that it uses for creating embosses and cutouts of common and custom shapes. Each of these punches receives a name based on a company mandated naming scheme that has been in place for many years. You are charged with transferring all of the punches in the company inventory to sheet metal punch iFeatures to be used in all future sheet metal part designs. You make a punch iFeature of each of the unique punch shapes in the company inventory. In each of the punch iFeature files, you author a table that contains multiple versions of each shape, reducing the total number of files required to document the complete punch library.

In the following illustration, all four of the cut features were created using a single table-driven punch iFeature.
Extracting Sheet Metal Punch iFeatures

When you have decided that a sheet metal cut or emboss feature is worth preserving for reuse, you need to create an iFeature for it. You use the Extract iFeature tool to define the features to be extracted, the parameters and position geometry that will be used to place the punch iFeature, punch ID values, custom punch depths, and alternate punch representations. Knowing the options that are available and how to use them can ensure that your sheet metal punch iFeatures are intuitive for others to use.

In the following illustration, a star-shaped cut feature has been selected for extraction as a sheet metal punch iFeature, with the Extract iFeature dialog box shown.

Access

Extract iFeature

Menu: **Tools > Extract iFeature**
Extract iFeature Dialog Box

In the following illustration, the Extract iFeature dialog box is shown with the Sheet Metal Punch iFeature type selected.

1. Type
   Select the option to specify the type of iFeature you are creating. If you select Sheet Metal Punch iFeature and the sketch for the feature you select does not have a center point, you get a warning.

2. Selected Features Tree
   When you select a feature in the browser or graphics window, the feature appears here with its parameters and dependent geometry.

3. Move/Remove
   Use these buttons to move parameters from the Selected Features tree to the Size Parameters table, or to remove parameters from the Size Parameters table.

4. Size Parameters Table
   - This table lists iFeatures parameters selected to appear in the PunchTool dialog box.
     - **Name** – The parameter may be given a descriptive name. Select the current value to edit.
     - **Value** – The current parameter value is the default. Select the current value to edit with a new value or parameter name. This value is limited by the value in the Limit field.
     - **Limit** – This option restricts entries in the Value field. Click the arrow to list the available options.
     - **Prompt** – The text entered here appears in the PunchTool dialog box. Enter descriptive instructions to clarify what information is needed.
Description of Extracting Sheet Metal Punch iFeatures

Extracting sheet metal punch iFeatures requires creating a feature for extraction or using a feature in an existing sheet metal part. The Extract iFeature tool is then used to select the cut or emboss feature, designate the parameters and geometry that will be used to place and define the iFeature when it is inserted into sheet metal part models, assign custom identification, and alternate representations if required. Sheet metal punch iFeatures are saved with a file extension of .ide and can be opened and edited in Autodesk® Inventor™. When saving a sheet metal punch iFeature, the default location is the Punches folder located in the Inventor Catalog.

In the following illustration, a sheet metal punch is shown being extracted with renamed parameters and prompts so that it is clear what to define when inserting the sheet metal punch iFeature.
Process: Extracting Sheet Metal Punch iFeatures

The following steps provide an overview of extracting sheet metal punch iFeatures.

1. Open a sheet metal part with cut or emboss features, or create a new sheet metal part and create the features you want to extract.

2. Start the Extract iFeature tool and select the feature to extract.

3. In the Extract iFeature dialog box, select the Sheet Metal Punch iFeature type, edit values in Size Parameters and Position Geometry, and define a punch ID and custom punch depth. Select a sketch to use as an alternate representation, if required.
4. Save the punch iFeature to the Punches folder of the Inventor Catalog.

Guidelines for Extracting Sheet Metal Punch iFeatures

Remember the following guidelines when extracting sheet metal punch iFeatures:

- The 2D sketch profile for the feature you choose to extract must have one center point. If there is no center point or more than one center point in the feature’s sketch, you are given a warning in the Extract iFeature dialog box that if you select the Sheet Metal Punch iFeature type and the feature will not be accepted.

- If you select a sketch as a simplified representation, it must contain one center point. If there is no center point or more than one center point in the selected sketch, you are given a warning and the sketch will not be accepted.

- When you select a sketch as a simplified representation in the Extract iFeature dialog box, its parameters can be moved to the Size Parameters table so that you can control the size of the sketch when inserting the sheet metal punch iFeature.

- The default folder for the sheet metal punch iFeatures is the Punches folder in the iFeature Catalog. You can map to a different location on the iFeature tab of the Application Options dialog box.
Authoring Table-Driven Punch iFeatures

When you have extracted a sheet metal punch iFeature, you can create a family of punches that are driven by a table. Using a table to drive your sheet metal, you can easily create punch iFeatures of different sizes in one step in your sheet metal part models.

In the following illustration, a sheet metal punch iFeature is shown with the Punch iFeature Author.

Access

iFeature Author Table

Panel Bar: iFeature Panel
Punch iFeature Author Dialog Box

In the following illustration, the Punch iFeature Author dialog box is shown.

1. Parameters: Select this tab to list variables defined in the sheet metal punch iFeature. These variables cannot be added or removed.
2. Geometry: Select this tab to list placement geometry defined in the sheet metal punch iFeature. These geometry objects cannot be added or removed.
3. Properties: Select this tab to list file properties to add to the sheet metal punch iFeature.
4. Manufacturing: Select this tab to list PunchIDs, custom punch depths, and available simplified representations to include or exclude.
5. Other: Select this tab to enter custom items to add to the sheet metal punch iFeature.
6. Left Pane: In this pane, parameters, placement geometry, or properties display according to the tab you select. Parameter and placement from the Parameters and Geometry tabs cannot be moved. For other tabs, select the object to move and click the right arrow to add to the right pane.
7. Right Pane: In this pane Name and Prompt columns appear according to the type of information displayed from the selected tab. Select an entry to edit with a custom Name or Prompt.
8. Table: In the table, right-click a numbered cell to add or delete rows, or set a row as the default row. Right-click a column heading to set as a key value, custom column, or to delete a column. Click in cells and enter values to create a unique variation of an iFeature.
9. Options/Verify: Click Options to set the parameters for display of the PunchID in the punch iFeature table. Click Verify to confirm that the edits in the table will work as shown.
Description of Authoring Sheet Metal Punch iFeatures

When you create a sheet metal punch iFeature, you can define multiple variations of the iFeatures. You use the Punch iFeature Author to set variations of parameters, change parameter names and prompts, add file properties and manufacturing information, include or exclude simplified representations, and add custom properties to the sheet metal punch iFeature.

In the following illustration, a sheet metal punch iFeature is shown with the key values from the authored table showing in the browser.

Process: Authoring Table-Driven Punch iFeatures

The following table provides an overview of authoring table-driven punch iFeatures.

1. Open a sheet metal punch iFeature for edit.
2. Start the iFeature Author Table tool.

3. In the Punch iFeature Author dialog box, select tabs to edit parameters, names, prompts, and properties as required. Add rows to the table and edit cells to create variations of the sheet metal punch iFeature.

4. Click OK to save edits and exit the dialog box.
Inserting Sheet Metal Punch iFeatures

After you have extracted your sheet metal punch iFeatures and authored your table-driven punch iFeatures, you can insert them into your sheet metal part models.

In the following illustration, a sheet metal punch iFeature is shown being inserted into a sheet metal part model with adjustments made in the PunchTool dialog box.

**Access**

- **PunchTool**
  - Panel Bar: Sheet Metal Features
  - Toolbar: Sheet Metal Features
PunchTool Dialog Box

In the following illustration, the PunchTool dialog box is shown.

1. **Preview**
   On the Preview tab, a list of the available punch iFeatures in the Punches folder of the Catalog is shown. When you select an item, a preview is shown in the window on the left side of the tab.

2. **Punch**
   This tab appears only when a table-driven sheet metal punch iFeature is selected. Select from one of the versions listed to insert into the sheet metal part model.

3. **Geometry**
   On this tab select hole centers where you want to insert the sheet metal punch iFeature. Press CTRL and click a hole center to deselect it. Enter a planar angle to position the punch iFeature. Select Refresh to redraw the iFeature with the geometry requirements fulfilled.

4. **Size**
   On this tab, change the size of the punch iFeature by modifying its parameters. Double-click a value to edit it. If a table driven part is selected, no values display on this tab. Select Refresh to redraw the iFeature with the geometry requirements fulfilled.
**Description of Inserting Sheet Metal Punch iFeatures**

When you insert a sheet metal punch iFeature, you use the PunchTool tool to punch a 3D shape into a sheet metal face. At least one hole center must exist on the sheet metal face you select. If there is no table in the sheet metal punch iFeature, you adjust the parameters that define the punch iFeature. However, if the punch iFeature is table-driven, you select the version you want to insert.

In the following illustration, a table-driven sheet metal punch iFeature is shown being inserted into a sheet metal part model.

![PunchTool](image)

**Process: Inserting Sheet Metal Punch iFeatures**

The following steps provide an overview of inserting sheet metal punch iFeatures.

1. Open a sheet metal part model or create a new sheet metal part with at least one face.
2. Create a sketch with center points at the locations where you want punch iFeatures.

3. Start the PunchTool. In the PunchTool Directory dialog box, select the punch iFeature you want.

4. If the punch iFeature is table-driven, select a version on the Punch tab and define an angle on the Geometry tab if necessary. If the punch iFeature is not table-driven, define an angle on the Geometry tab, if necessary, and edit the parameters on the Size tab to define the punch iFeature size.

5. Click Finish to create the sheet metal punch iFeature.

Guidelines for Inserting Sheet Metal Punch iFeatures

Remember the following guidelines when inserting sheet metal punch iFeatures:

- When inserting a sheet metal punch iFeature, if there is more than one sketch visible with center points, you can select center points only in a single sketch for placement.
- To edit a sheet metal punch iFeature after it has been inserted, double-click it in the browser, or right-click and select Edit Feature.
Exercise: Create and Reuse Punch iFeatures

In this exercise, you create a punch iFeature, make it a table-driven feature and insert it into a sheet metal part using alternate representations.

Create a Punch iFeature

In this portion of the exercise, you create a punch iFeature and edit the iFeature to create a table-driven feature.

1. Open PunchiFeatures.ipt.

2. Use the zoom tools to adjust your view, as shown.

3. Click Tools menu > Extract iFeature.

4. In the browser, click Cut5.

5. In the Extract iFeature dialog box:
   - Click Sheet Metal Punch iFeature.
   - In the Selected Features tree, select d83 (5 mm). Click the double right arrows to move the parameter to the Size Parameters table.
   - Under Size Parameters, click d83 and enter PunchDia.
   - In the Position Geometry table, under Prompt, enter Pick Insertion Plane.
6. In the Extract iFeature dialog box:
   - Under Specify Punch ID, enter **PID1005**.
   - Under Custom, enter **Thickness * 1.25**, exactly as shown.
   - Click Select Sketch and select Sketch13 in the browser.

7. In the Extract iFeature dialog box:
   - In the Selected Features tree, select **d86 [6 mm]**. Click the double right arrows to move the parameter to the Size Parameters table.
   - In the Size Parameters table, select **d86** and enter **AltRepSize**.
   - Under Size Parameters, click **Enter d86** and enter **Enter Alternate Rep Size**.
   - Click Save.

8. In the Save As dialog box:
   - Double-click the Punches folder.
   - For File name, enter **RoundPunch**.

9. In the browser, drag the End of Folded marker above Cut5.

10. On the Sheet Metal Features panel bar, click **View Catalog**.

11. In the Catalog window, select the Punches folder. Double-click **RoundPunch.ide**.

12. On the iFeature Panel, click **iFeature Author Table**.

13. In the Punch iFeature Author dialog box, in the lower window, right-click Row 1. Click **Insert Row**.

14. Repeat step 12 to insert a third row.

15. Click Options. In the Options dialog box:
   - Match the settings, as shown.
   - Click OK.
   - In the dialog box, click Yes.

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16. In row 2:
   - In the PunchDia cell, enter 10 mm.
   - In the AltRepSize cell, enter 8 mm.

17. In row 3:
   - In the PunchDia cell, enter 15 mm.
   - In the AltRepSize cell, enter 10 mm.
   - Click OK.

18. Close RoundPunch.ide and save changes.

Insert Punch iFeatures and View Alternate Representations

In this portion of the exercise, you insert the punch iFeature into the sheet metal part, and view the alternate representation of the punch feature in the flat pattern.

1. In the browser, right-click Sketch8. Click Visibility.
2. In the Sheet Metal Features panel bar, click PunchTool.
3. In the PunchTool Directory dialog box, click RoundPunch.ide and click Open.
4. On the Punch tab, for PunchID, select PID1005-10. Click Finish.
5. Confirm that your part matches the illustration.
6. In the Sheet Metal Features panel bar, click Flat Pattern.
7. Right-click in the graphics window. Click Edit Flat Pattern Definition.
8. In the Flat Pattern dialog box:
   - On the Orientation tab, under Base Face, click Flip.
   - On the Punch Representation tab, select 2D Sketch Representation.
   - Click OK.
9. Confirm that your flat pattern matches the illustration.
10. In the browser, double-click Folded Model.
11. In the browser, right-click iFeature1. Click Edit Feature.
12. In the PunchTool dialog box:
   - Click Finish.
13. Notice that the punch feature updates to the new size.

14. In the browser, double-click Flat Pattern. Notice that the alternate representation size is updated also.

15. Exit the drawing. Do not save changes.