

# Autodesk® Revit® MEP 2012 Fundamentals



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# Chapter 2

## Basic Drawing and Editing Tools

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In this chapter you learn about drawing aids, selecting elements, using controls and temporary dimensions. You also learn how to use editing commands including Move, Copy, Rotate, Array, Align, Split, Trim, and Offset.

This chapter introduces:

- ✓ **General Drawing Tools**
- ✓ **Editing Revit MEP Elements**
- ✓ **Basic Modifying Tools**
- ✓ **Additional Editing Tools**



# 2.1 General Drawing Tools

When you start a drawing command, the contextual Ribbon, Options Bar, Type Selector and Properties palette enable you to set up features for each element you are placing in the drawing. As you are drawing, several features called *drawing aids* display, as shown in Figure 2–1. They help you to create designs quickly and accurately.

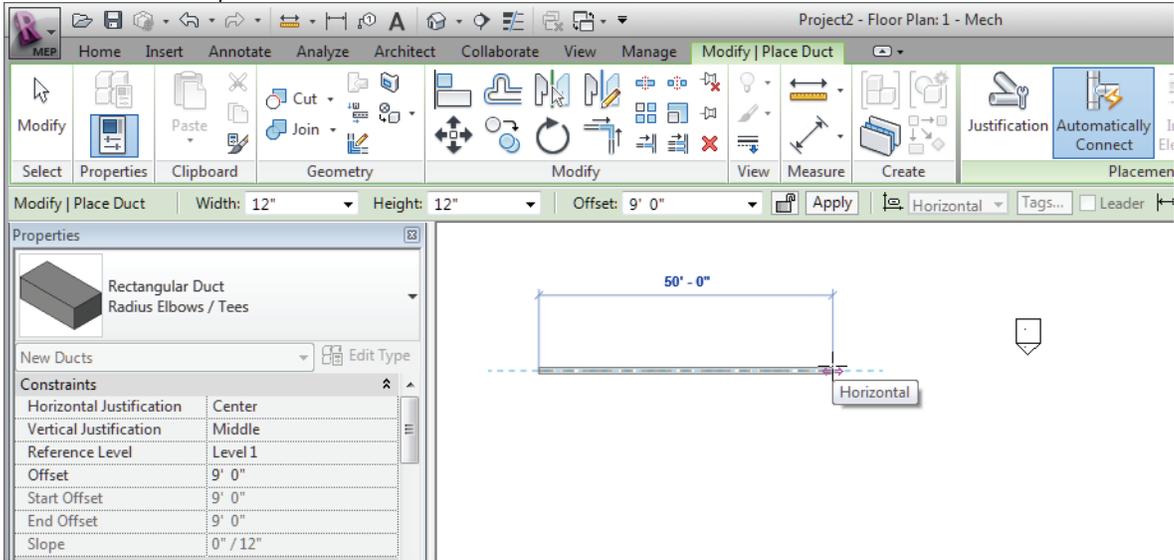


Figure 2–1

## User Interface Tools

### Contextual Ribbon

When you select a command, the Ribbon displays the *Modify* tab with the contextual tools. For example, when you start the **Duct** command, the *Modify | Place Duct* tab opens, as shown in part in Figure 2–2.

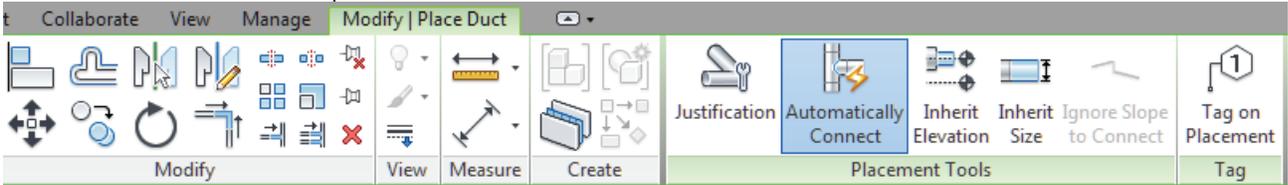


Figure 2–2

- The Modify tools are always displayed to the left of the Ribbon and the contextual tools to the right with a green panel title.
- In the Select panel, click  (Modify) to end the command and return to the main tab at any time.

## Options Bar

The Options Bar displays the most used options for an element, as shown in Figure 2–3. These options are also typically found in the Properties palette.



Figure 2–3

## Properties Palette

The Properties palette and the Type Selector display the current element type. You can select other types and modify some of the related parameters for the selected object, as shown in Figure 2–4.

*Some of the properties parameters are only available when you are editing an element. They are grayed out when you are creating an element.*

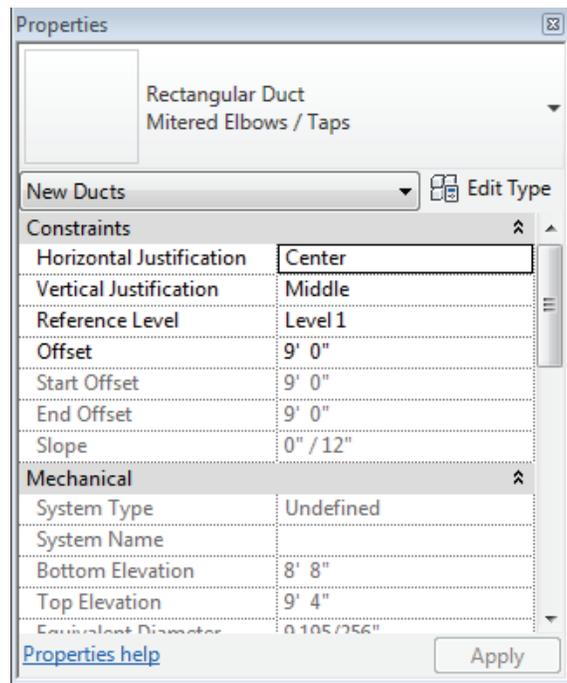


Figure 2–4

- The Properties palette can be floated and moved around the screen. If it is turned off, you can open it by starting a command. You can also type **PP** to toggle the Properties palette on or off.
- Changes in the palette do not take effect until you click  or move your cursor onto the screen. If you click in the window, it applies the change but also deselects the element.

## Drawing Aids

Angles display at 90, 45, 15, 5, and 1 degree increments. The order of the angle list controls the power level of the snap. For example, the 90 degree angle is most likely to display if you are close to horizontal or vertical.

You can move the cursor to the exact dimension, or place it approximately and then modify the dimension as needed. This enables you to sketch the building and then come back and use the parametric engine to update the model with greater precision.

As soon as you start drawing in Autodesk® Revit® MEP program, three drawing aids display on the screen: *alignment lines*, *temporary dimensions*, and *snaps*. These are available with most drawing and many modification commands.

### Alignment Lines

Dashed *alignment lines* display as soon as you select your first point, as shown in Figure 2–5. They help keep lines horizontal, vertical, or at a specified angle. They also line up with the implied intersections of walls and other elements.

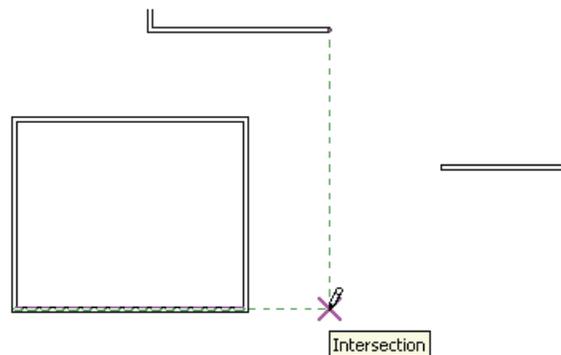


Figure 2–5

- Hold down <Shift> to force the alignments to be orthogonal.

### Temporary Dimensions

Along with alignment lines, *temporary dimensions* display as you draw to help you place linear elements (such as walls) at the proper length and location, as shown in Figure 2–6.

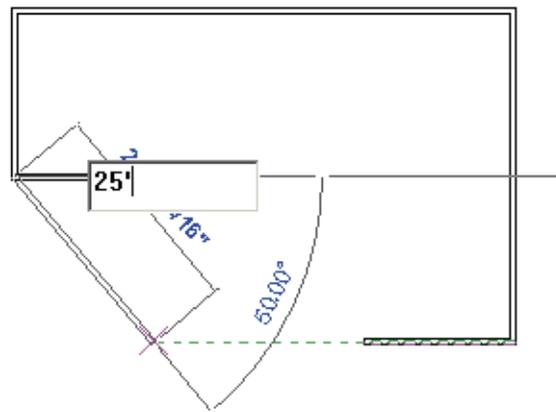


Figure 2–6

- Temporary dimensions only work in the active file, not against elements in a linked file.

*Dimensions are a powerful tool to help you create and annotate the model.*

- For Imperial measurements (feet and inches), Revit MEP program understands a default of feet. For example, when you type **4**, it assumes 4'-0". To indicate inches, type the inch mark (") after the distance. For a distance such as 4'-6", you can type any of the following: **4'-6"**, **4'6**, **4-6**, or **4 6** (numbers separated by a space).
- The increments displayed for dimensions change as you zoom in closer to the elements. These *dimension snap* increments are for both linear and angular dimensions, and can be set in the Snaps dialog box.
- Temporary dimensions disappear as soon as you finish drawing linear elements. If you want to make them permanent, select the control shown in Figure 2–7.



**Figure 2–7**

- The size of the temporary dimensions, in pixels, can be set in the Options dialog box in the *Graphics* tab.

## Snaps

Snaps are key points that help you reference existing elements to exact points when drawing, as shown in Figure 2–8.



**Figure 2–8**

*The Point Snap is used to snap to the various pipe, duct, and electrical connectors.*

They include **Endpoints**, **Midpoints**, **Nearest**, **Work Plane Grid**, **Quadrants**, **Intersections**, **Centers**, **Perpendicular**, **Tangents**, and **Points**. When you move your cursor over an element, the **Snap** symbol displays. Each snap location type displays with a different symbol.

- To modify the snap settings, in the *Manage* tab>Settings panel, click  (Snaps). This opens the Snaps dialog box, in which you can set which snap points are active, as well as the snap distances (for dimension and angular increments). It also displays the keyboard shortcuts for each snap, which you can use to override the automatic snapping.

## Reference Planes

As you develop designs in Revit MEP program, there are times when you need additional temporary lines to help you define certain locations. You can draw *reference planes* (the dashed lines) to host the height of sinks or to help you define centerlines and paths for ductwork, as shown in Figure 2–9. You can snap to reference planes and they display in associated views.

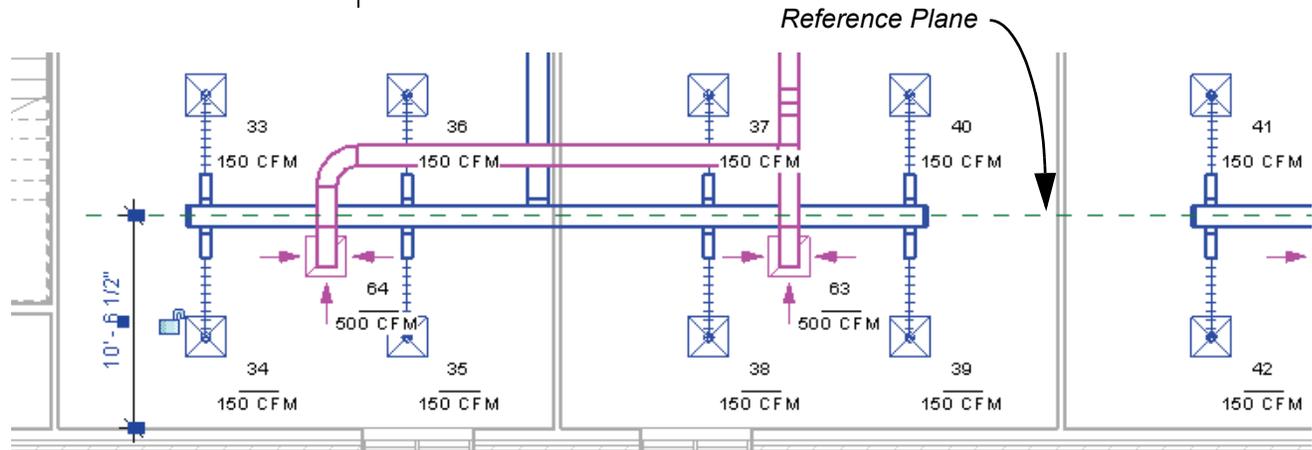


Figure 2–9

### How to:

#### Sketch with Reference Planes

1. In the *Home* tab>Work Plane panel, click  (Ref Plane).
2. In the *Modify | Place Reference Plane* tab>Draw panel, click  (Line) or  (Pick Lines) and create the reference planes.
3. Click  (Modify) when you have created all of the required reference planes.
  - If you create reference planes while working in a sketch (e.g., a floor), the reference planes only display in sketch mode.
  - You can name reference planes. Select the reference plane and in the *Identity Data* area in Properties, type a name.

## 2.2 Editing Revit MEP Elements

Building design projects typically involve extensive changes to the positions of walls, floors, and ceilings, and thus to the mechanical, electrical, and plumbing layout. Revit MEP program has been designed to make such changes easy. First, you select the element(s) you want to modify and then select from a variety of options including temporary dimensions, controls, and contextual tools in the Ribbon.

- To start editing elements, click  (Modify). It is on the far left in every Ribbon tab. This command works with all of the different element types.

### Selecting Elements

You can select elements in several ways:

- To select a single element, place your cursor over it and select it.
- To add another element to a selection set, hold down <Ctrl> and select another item.
- To remove an element from a selection set, hold down <Shift> and select the element.
- If you click and drag the cursor to *window* around elements, you have two selection options, as shown in Figure 2–10. If you drag from left to right, you only select the elements completely inside the window. If you drag from right to left, you select elements both inside and crossing the window.

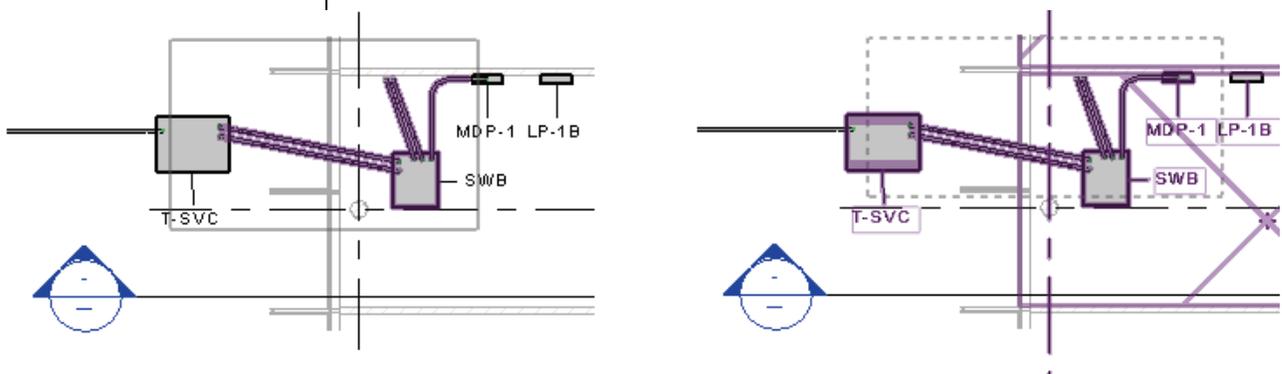


Figure 2–10

- Revit MEP program filters architectural categories from Window selections.

## Standard Editing Tools

- If several elements are on or near each other, press <Tab> to cycle through them before you click. If there are elements that might be linked to each other, such as connected ductwork, press <Tab> to select the chain of elements.
- Press <Ctrl> + <Left Arrow> to reselect the previous selection set. You can also right-click in the drawing window with nothing selected and select **Select Previous**.
- To select all of the elements of a specific type, right-click on an element and select **Select All Instances>Visible in View** or **In Entire Project**, as shown in Figure 2–11.

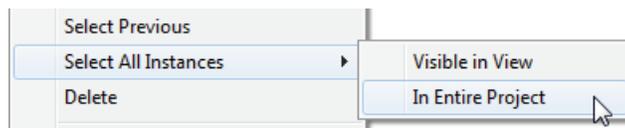


Figure 2–11

- MEP elements in views often cannot be selected when Architectural objects are displayed in the **Hidden Line** Visual Style. Change the *Visual Style* to **Wireframe**.

With the **Modify** command active, there are a number of ways to change an element when you select it, as shown in Figure 2–12:

- Modify commands and element-specific tools display in the contextual tab in the Ribbon.
- The Properties palette displays the element type and associated parameters.
- Temporary dimensions enable you to change the element's dimensions.
- Controls enable you to drag, flip, lock, and rotate the element.

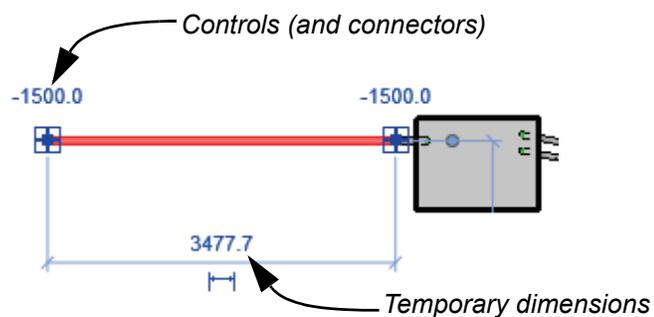


Figure 2–12

- When you hover your cursor over an element, a tooltip displays information about it.

- Connectors are frequently linked to controls. Therefore, when the control is moved the connector is as well. Be careful not to disconnect systems when moving these controls.
- To delete an element, select it and press <Delete> or click  (Delete) in the Modify panel.
- When working with temporary dimensions, the default location of the dimension line might not be correct. For example, as shown on the left in Figure 2–13, instead of setting the distance of the selected element from the center of the left wall, you might want to modify the distance from the grid line. Drag the control (also called the witness line) to the grid line, as shown on the right in Figure 2–13.

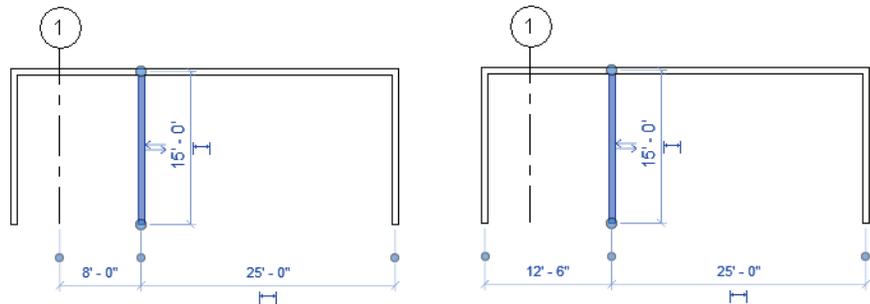


Figure 2–13

- You can click on the control to move the witness line from one part of the selected wall to another.
- The new location of a temporary dimension is remembered as long as you are in the same Revit MEP session.

#### Hint: Press & Drag

You can move elements by dragging them to a new location. To do this without selecting them first, make sure the **Press & Drag** option is selected in the Status Bar, as shown in Figure 2–14.

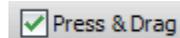


Figure 2–14

- Since temporary dimensions do not respond to linked architectural data, place permanent dimensions between linked objects and MEP elements. Then the designer can to select and edit objects through the temporary dimensions connected to the permanent dimensions.

## Modifying Multiple Elements

When multiple element types are selected, the *Multi-Select* contextual tab opens in the Ribbon, as shown in Figure 2–15. This gives you access to all of the Modify tools and the **Filter** command.

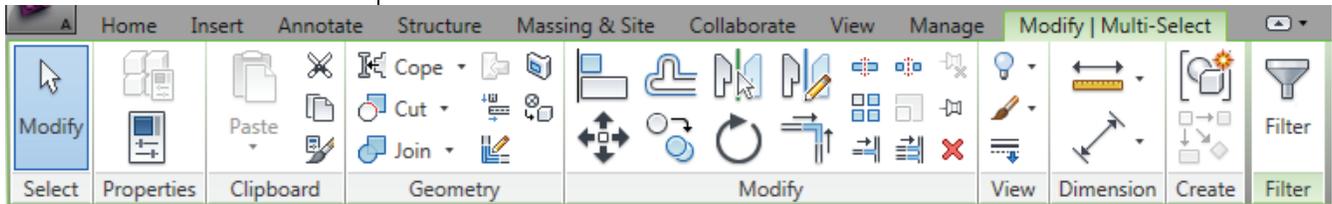


Figure 2–15

- The Properties palette displays tools that are common to all available element types. You can also just select one type and make modifications to its properties, as shown in Figure 2–16.

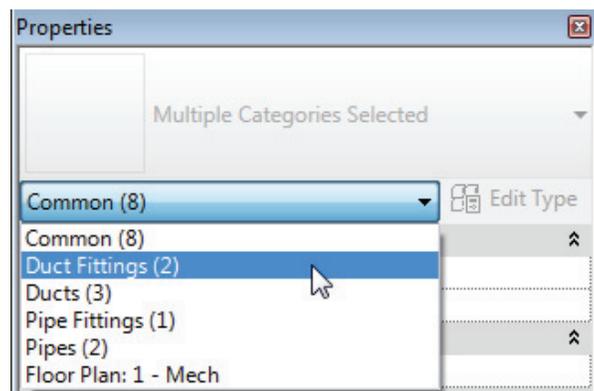


Figure 2–16

## Filtering Selection Sets

The **Filter** command enables you to specify the types of elements to select. For example, you might only want to select lighting fixtures, as shown in Figure 2–17.

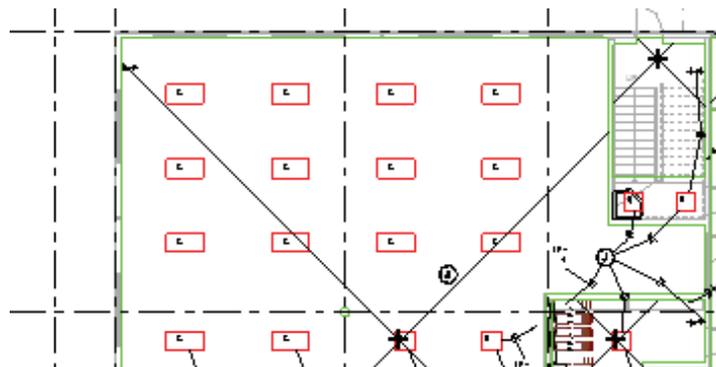
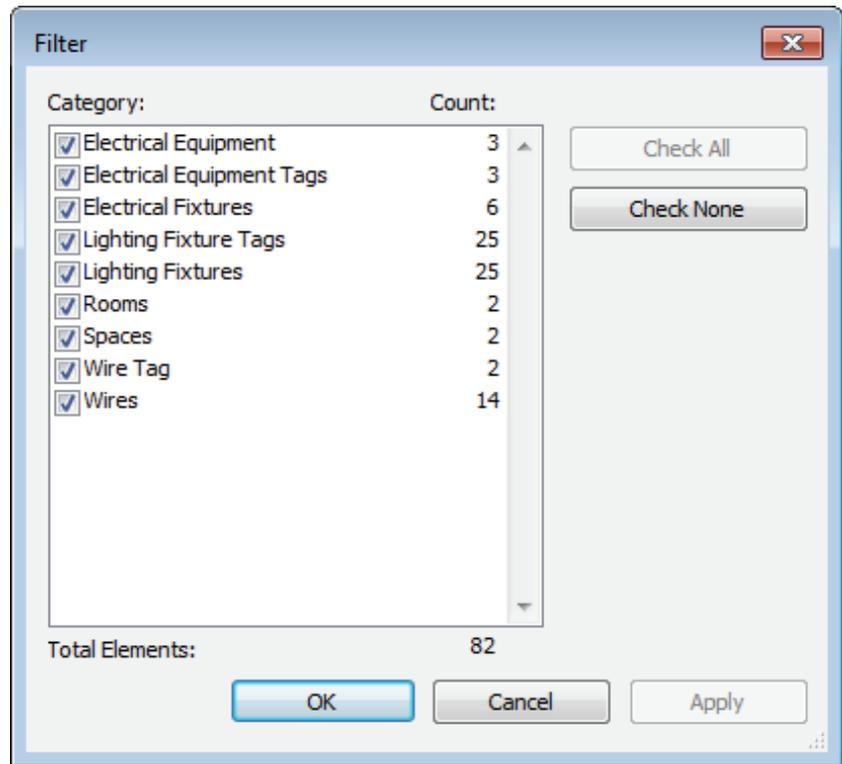


Figure 2–17

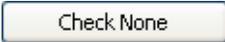
**How to:****Filter a Selection Set**

1. Select everything in the required area.
2. In the *Modify | Multi-Select* tab or in the Status Bar, click  (Filter). The Filter dialog box opens, as shown in Figure 2–18.

*The Filter dialog box displays all of the element types in the original selection.*



**Figure 2–18**

3. Click  to clear all of the options and then select the element types that you want to include in the selection.
4. Click . The selection set is now limited to the specified elements.
  - In the Status Bar,  (Filter) displays the number of elements you have selected.

## 2.3 Basic Modifying Tools

Revit MEP software contains controls and temporary dimensions that enable you to edit elements. Additional modifying tools can be used with individual elements or any selection of elements. They are found in the *Modify* tab>Modify panel, as shown in Figure 2–19, and in contextual tabs.

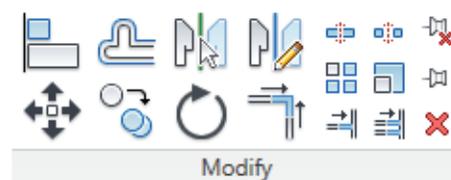


Figure 2–19

You can either select the elements and start the command or start the command, select the elements, and press <Enter> to finish the selection set.

### Moving and Copying Elements

The **Move** and **Copy** commands enable you to select the element(s) and move or copy them from one place to another. You can use alignment lines, temporary dimensions, and snaps to help place the elements, as shown in Figure 2–20.

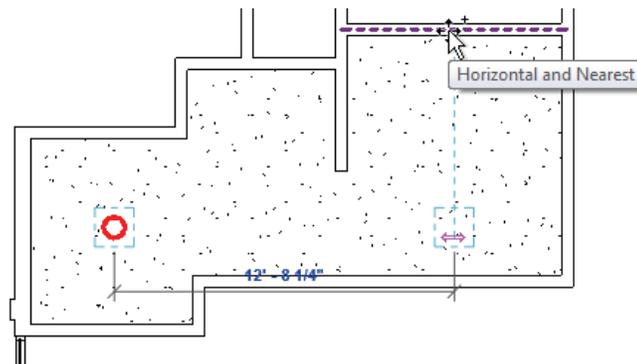


Figure 2–20

#### How to:

If you start  (Move) and hold down <Ctrl>, the elements are copied.

#### Move or Copy Elements

1. Select the elements that you want to move or copy.
2. In the Modify panel, click  (Move) or  (Copy). A boundary box displays around the selected elements.
3. Select a move start point on or near the element.
4. Select a second point. Use alignment lines and temporary dimensions to help place the elements.
5. The last copied elements remain highlighted, enabling you to copy them again, start another command, or press <Esc> to end the command.

## Move/Copy Elements

The **Move** and **Copy** commands have several options that display in the Options Bar, as shown in Figure 2–21.

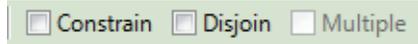


Figure 2–21

<b>Constrain</b>	Restricts the movement of the cursor to horizontal or vertical, or along the axis of an item that is at an angle. This keeps you from selecting a point at an angle by mistake. <b>Constrain</b> is off by default.
<b>Disjoin</b> (Move only)	Breaks any connections between the elements being moved and other elements. If <b>Disjoin</b> is on, the elements move separately. If it is off, the connected elements also move or stretch. <b>Disjoin</b> is off by default.
<b>Multiple</b> (Copy only)	Enables you to make multiple copies of one selection. <b>Multiple</b> is off by default.

- With the exception of the **Multiple** option, the options revert to their defaults each time you restart the command.
- These commands only work within the current view, not between views or projects. To copy between views or projects, use  (Copy to Clipboard) and  (Paste).

### Hint: Pinning Elements

If you do not want elements to be moved, you can  (Pin) them in place, as shown in Figure 2–22. Pinned elements can still be copied.

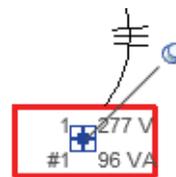


Figure 2–22

Select the element and click  (Unpin) to free it.

- Pinned elements can be deleted or changed to another type.

## Rotating Elements

How to:

The Rotate command enables you to rotate selected elements around a center point or origin. You can use alignment lines, temporary dimensions, and snaps to help specify the origin point and rotation. You can also create copies of the element that is rotated.

### Rotate Elements

1. Select the element(s) you want to rotate.
2. In the Modify panel, click  (Rotate) or type RO.
3. The origin is automatically set to the center of the element or group of elements, as shown on the left in Figure 2–23. To change the origin as shown on the right in Figure 2–23, use the following steps:
  - Click  (Center of Rotation) control and drag it to a new point.
  - In the Options Bar, next to *Origin*, click  and use snaps to move the origin.
  - Press the <Spacebar> to select the origin.

*NEW IN 2012!*

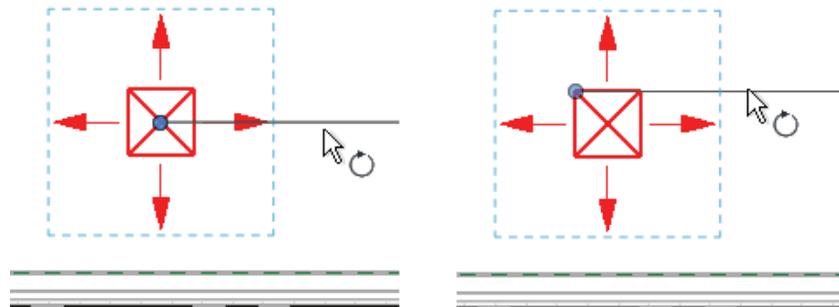


Figure 2–23

- To start the **Rotate** command with an automatic prompt that enables you to select the center of rotation, type **R3**.
4. In the Options Bar, specify if you want to make a *Copy* and type an angle in the *Angle* field, as shown in Figure 2–24, and press <Enter>. You can also specify the angle on screen.

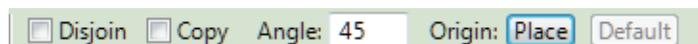


Figure 2–24

5. The rotated element(s) remain highlighted, enabling you to start another command, or press <Esc> to finish.
  - The **Disjoin** option breaks any connections between the elements being rotated and other elements. If **Disjoin** is on, the elements rotate separately. If it is off, the connected elements also move or stretch. **Disjoin** is off by default.

To specify the angle on screen, select a point for the **rotate start ray**—the reference line for the rotation angle. Then select a second point, using the temporary dimension to help you set the angle.

## Mirroring Elements

The **Mirror** command enables you to mirror elements, as shown in Figure 2–25, about an axis defined by a selected element or by selected points.

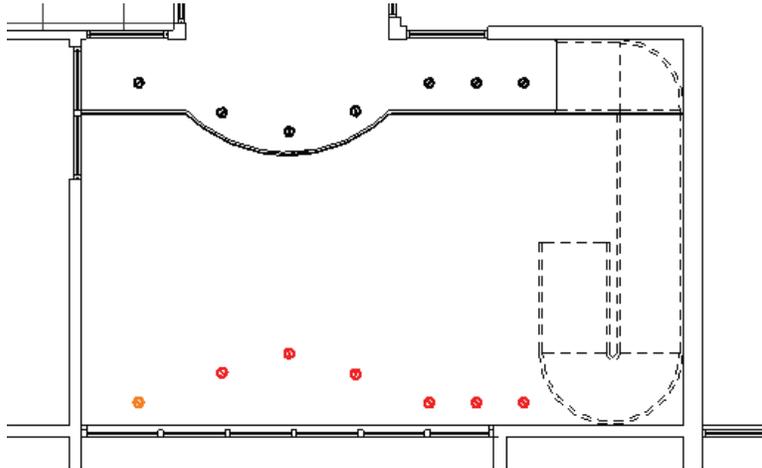


Figure 2–25

### How to:

#### Mirror Elements

1. Select the element(s) to mirror.
2. In the Modify panel, select the method you want to use:
  - Click  (Mirror - Pick Axis) or type **MM**. This prompts you to select an element as the **Axis of Reflection** (mirror line).
  - Click  (Mirror - Draw Axis) or type **DM**. This prompts you to select two points to define the axis about which the elements mirror.
3. The new mirrored element(s) remain highlighted, enabling you to start another command, or press <Esc> to end the command.
  - By default, the original elements that were mirrored remain. To delete the original elements, clear the **Copy** option in the Options Bar.

#### Hint: Scale

Revit MEP program is designed with full-size elements.

Therefore, not much can be scaled. However, you can use  (Scale) in reference planes, images, and imported files from other programs.

## Creating Linear and Radial Arrays

The **Array** command creates multiple copies of selected elements in a linear or radial pattern, as shown in Figure 2–26. For example, you can array a row of columns to create a row of evenly spaced columns on a grid, or array a row of parking spaces. The arrayed elements can be grouped or placed as separate elements.

- A linear array creates a straight line pattern of elements, while a radial array creates a circular pattern around a center point.

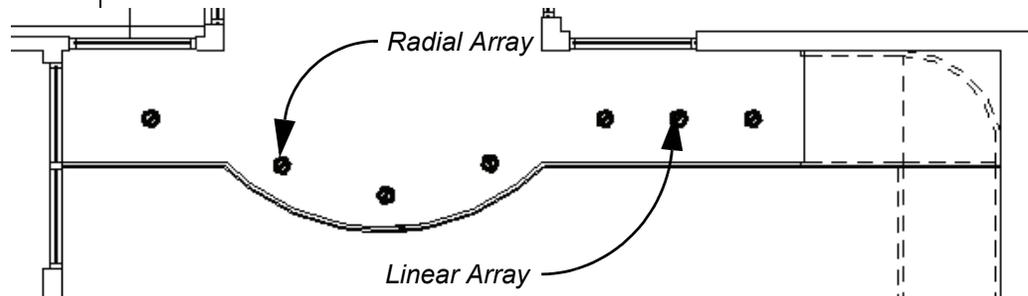


Figure 2–26

### How to:

#### Create a Linear Array

1. Select the element(s) to array.
  2. In the Modify panel, click  (Array).
  3. In the Options Bar, click  (Linear).
  4. Specify the other options as needed.
  5. Select a start point and an end point to set the spacing and direction of the array. The array is displayed.
- If you have the **Group and Associate** option toggled on, you are prompted again for the number of items, as shown in Figure 2–27.

Type a new number or click on the screen to end the command.

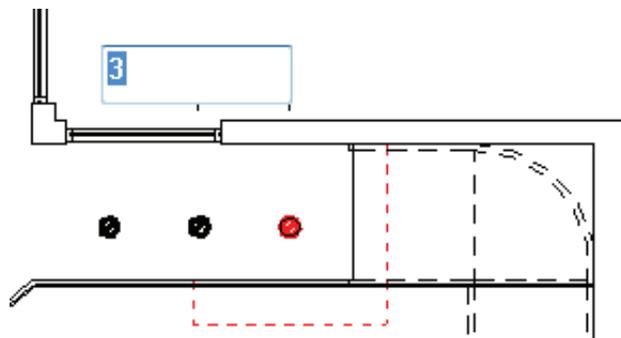


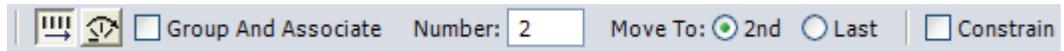
Figure 2–27

- To make a linear array in two directions, you need to array one direction first, select the arrayed elements, and then array them again in the other direction.

### Array Options

In the Options Bar, set up the Array options for the **Linear Array** or **Radial Array**, as shown in Figure 2–28.

**Linear Array Options**



**Radial Array Options**



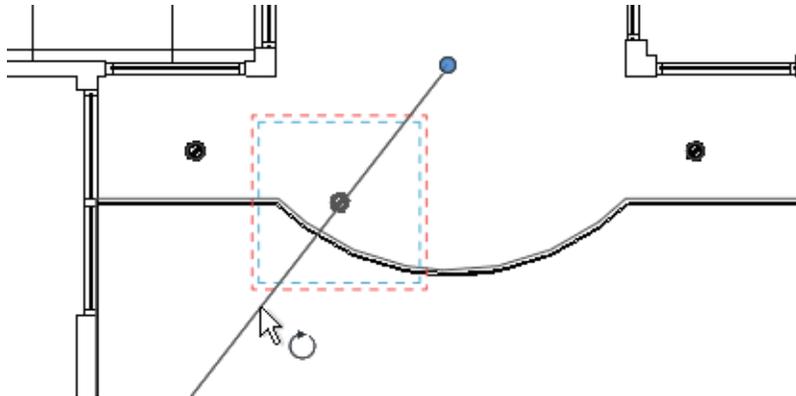
**Figure 2–28**

<b>Group and Associate</b>	Creates a group element out of all arrayed elements. Groups can be selected by selecting any element in the group.
<b>Number</b>	Specifies how many instances you want in the array.
<b>Move To:</b>	<b>2nd</b> specifies the distance or angle between the center points of the two elements. <b>Last</b> specifies the overall distance or angle of the entire array.
<b>Constrain</b>	Restricts the direction of the array to only vertical or horizontal (Linear only).
<b>Angle</b>	Specifies the angle (Radial only).
<b>Origin</b>	Specifies a location for the origin of rotation (Radial only).

**How to:****Create a Radial Array**

1. Select the element(s) to array.
2. In the Modify panel, click  (Array).
3. In the Options Bar, click  (Radial).
4. Click and drag the  (Center of Rotation) control or use **Place** to move the origin to the appropriate location, as shown in Figure 2–29.

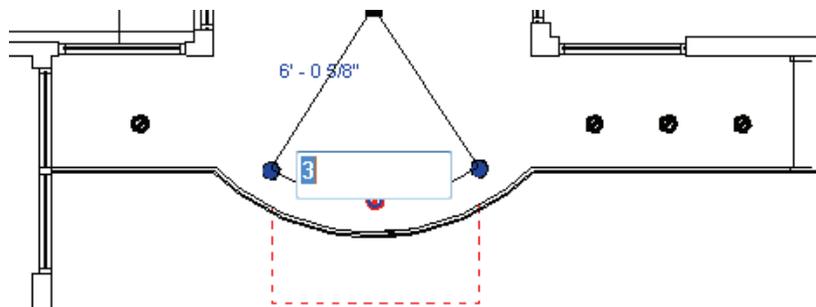
*Remember to set the center point rotation control first, because it is easy to forget to move it before specifying the angle.*

**Figure 2–29**

5. Specify the other options as needed.
6. In the Options Bar, type an angle and press <Enter>, or specify the rotation angle by selecting points on the screen.

**Modifying Arrays**

When you select an element in an array that is created as a group, the associated shape controls and dimensions display, as shown in Figure 2–30. You can modify the number of instances and, for radial arrays, the distance to the center.

**Figure 2–30**

- To remove the constraint on the group, select one of the elements in the group and click  (Ungroup) in the Group panel contextual tab.

## 2.4 Additional Editing Tools

As you work on a project, some additional tools in the *Modify* tab>Modify panel, as shown in Figure 2–31, can help you with placing, modifying, and constraining elements. **Align**, **Split**, **Trim**, and **Offset** can be used with ducts and other elements.

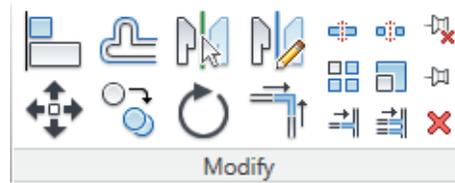


Figure 2–31

### Aligning Elements

The **Align** command enables you to line up one element with another, as shown in Figure 2–32. Most Revit MEP elements can be aligned.

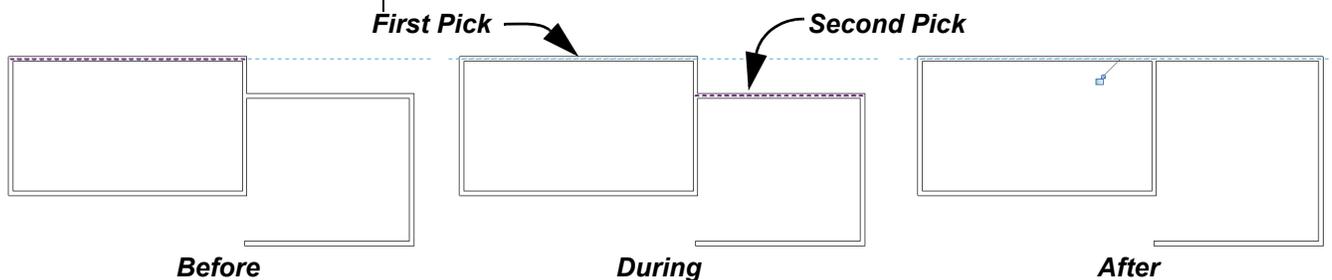


Figure 2–32

#### How to:

#### Align Elements

1. In the *Modify* tab>Modify panel, click  (Align) or type the shortcut **AL**.
  2. Select a line or point on the element that is going to remain stationary. For walls, make sure you select the proper wall face. For ducts or pipes, press <Tab> to select the edges or center lines.
  3. Select a line or point on the element to be aligned. The second element moves into alignment with the first one.
- The **Align** command works in both plan and elevation views.
  - The **Align** command also works in 3D views. Make sure you select the correct component of the elements to align. For example, to line up two windows vertically, select the side of the frame of each window. Zoom in if needed.

- You can lock alignments so that the elements move together if either one is moved. Once you have created the alignment, a padlock is displayed. Click on the padlock to lock it, as shown in Figure 2–33.

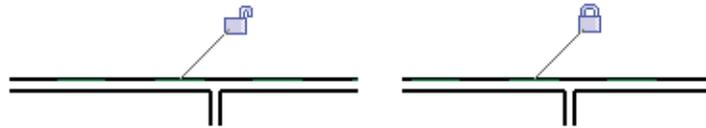


Figure 2–33

- Select the **Multiple Alignment** option to select multiple elements to align with the first element, as shown in Figure 2–34. You can also hold down <Ctrl> to make multiple alignments.
- For walls, you can specify whether you want the command to prefer **Wall centerlines**, **Wall faces**, **Center of core**, or **Faces of core**, as shown in Figure 2–34. The core refers to the structural members of a wall as opposed to facing materials, such as sheetrock.

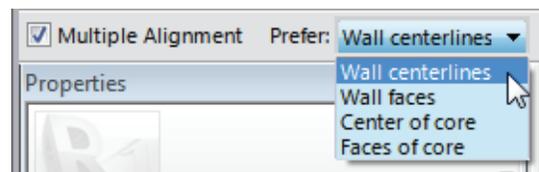


Figure 2–34

## Splitting Linear Elements

The **Split** command enables you to break a duct, wall, or line at a specific point. You can use alignment lines, snaps, and temporary dimensions to help place the split point. After you have split the element, you can use other editing commands to modify it, such as changing the wall type in one section, as shown in Figure 2–35.

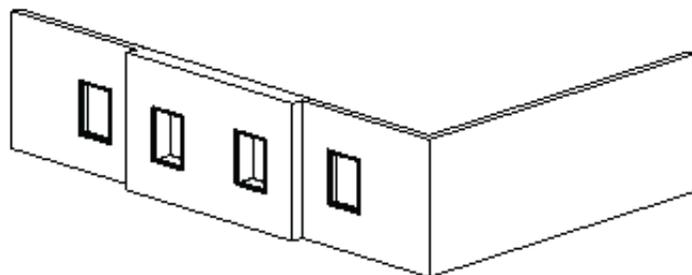


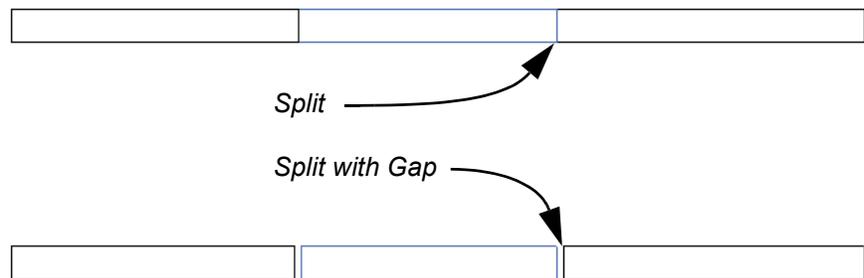
Figure 2–35

- There are two commands:  (Split Element) and  (Split with Gap).

**How to:****Split an Element**

1. In the *Modify* tab>Modify panel, click  (Split Element) or type the shortcut **SL**.
2. In the Options Bar, select or clear the **Delete Inner Segment** option, as needed.
3. Move the cursor to the point you want to split and select the point.
4. Repeat for any additional split locations.
5. Modify the items that were split, as needed.

- The **Delete Inner Segment** option is used when you select two split points along an element. When the option is selected, the segment between the two split points is automatically removed.
-  (Split with Gap) splits a wall at the point you select, as shown in Figure 2–36, but also creates a **Joint Gap** specified in the Options Bar.

**Figure 2–36**

- Ducts and Pipes add a transition fitting to the open end of the split segments. Typically, you need to delete these fittings before doing any further editing.

## Trim and Extend

The **Trim** command enables you to either trim or extend elements. There are three trim methods: **Trim/Extend to Corner**, **Trim/Extend Single Element**, and **Trim/Extend Multiple Elements**.

- When selecting elements to trim, click the part of the element that you want to keep. The opposite part of the line is then trimmed.

### How to:

#### Trim/Extend to Corner

1. In the *Modify* tab>Modify panel, click  (Trim/Extend to Corner) or type the shortcut **TR**.
2. Select the first element on the side you want to keep.
3. Select the second element on the side you want to keep, as shown in Figure 2–37.

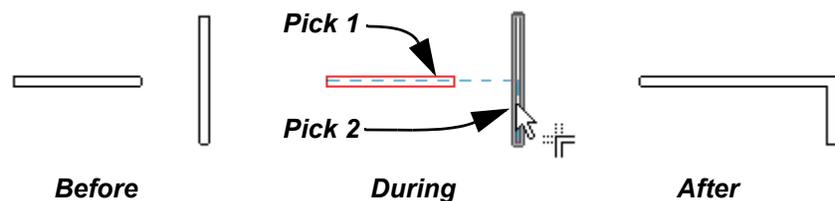


Figure 2–37

### How to:

#### Trim/Extend a Single Element

1. In the *Modify* tab>Modify panel, click  (Trim/Extend Single Element).
2. Select the cutting or boundary edge.
3. Select the element to be trimmed or extended, as shown in Figure 2–38.

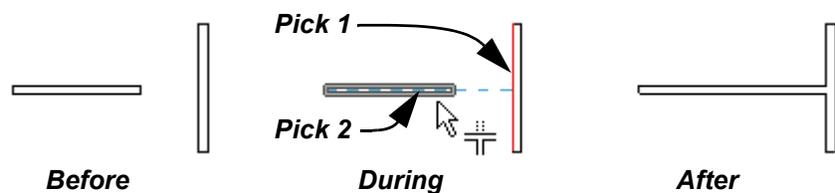


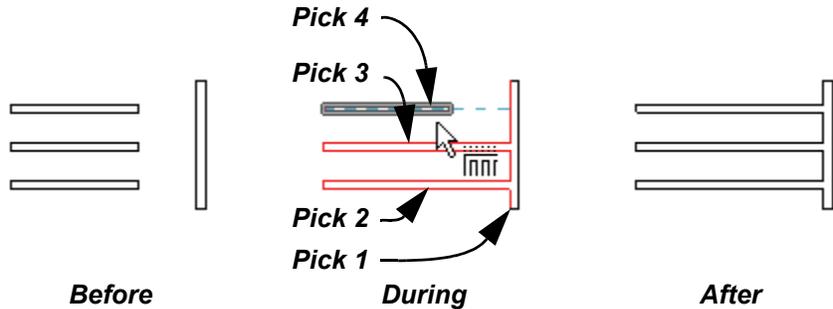
Figure 2–38

- Ducts, Pipes, Conduit, and Cable Tray create fittings at each connection point based on the family types being edited.

**How to:**

**Trim/Extend Multiple Elements**

1. In the *Modify* tab>Modify panel, click  (Trim/Extend Multiple Elements).
2. Select the cutting or boundary edge.
3. Select the elements that you want to trim or extend. For trimming, select the side you want to keep, as shown in Figure 2–39.

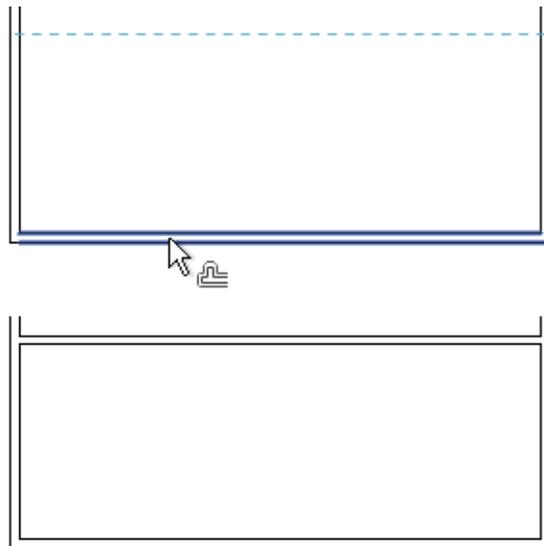


**Figure 2–39**

- You can click in a blank space to clear the selection and select another cutting edge or boundary.

**Offsetting Elements**

The **Offset** command is an easy way of creating parallel copies of elements at a specified distance, as shown in Figure 2–40. Beams, braces, and lines can also be offset.



**Figure 2–40**

The offset distance can be set by typing the distance (**Numerical** method shown in Figure 2–41) or by selecting points on the screen (**Graphical** method).



Figure 2–41

### How to:

*The **Copy** option (on by default) makes a copy of the element being offset. If this option is off, the **Offset** command moves the element.*

### Offset using the Numerical Method

1. In the *Modify* tab>Modify panel, click  (Offset) or type the shortcut **OF**.
2. In the Options Bar, select the **Numerical** option.
3. In the Options Bar, type the required distance in the *Offset* field.
4. Move the cursor over the element you want to offset. A dashed line previews the offset location. Move the cursor to flip the sides, as needed.
5. Click to create the offset.
6. Repeat Steps 4 and 5 to offset other elements by the same distance, or to change the distance for another offset.
7. Press <Esc> or start another command to finish.

### How to:

### Offset using the Graphical Method

1. In the *Modify* tab>Modify panel, click  (Offset) or type the shortcut **OF**.
  2. In the Options Bar, select the **Graphical** option.
  3. Select the element to offset.
  4. Select two points that define the distance of the offset and which side to apply it. You can type an override for the temporary dimension for the second point.
- With the **Numerical** option, you can select multiple connected elements for offsetting. Hover your cursor over one element and press <Tab> until the required elements are highlighted. Select the elements to offset them. This enables you to offset all of them at once.
  - Elements connected at a corner, if offset to the outside of the corner, automatically extend to meet at the offset distance as shown in Figure 2–42.



Figure 2–42



## Practice 2a

Estimated time for completion: 15 minutes

## Basic Drawing and Editing

In this practice you will use temporary dimensions, controls, and snaps to modify the location of elements. You will then copy and move elements as well as rotate and align elements. The final version of the project is shown in Figure 2–44.

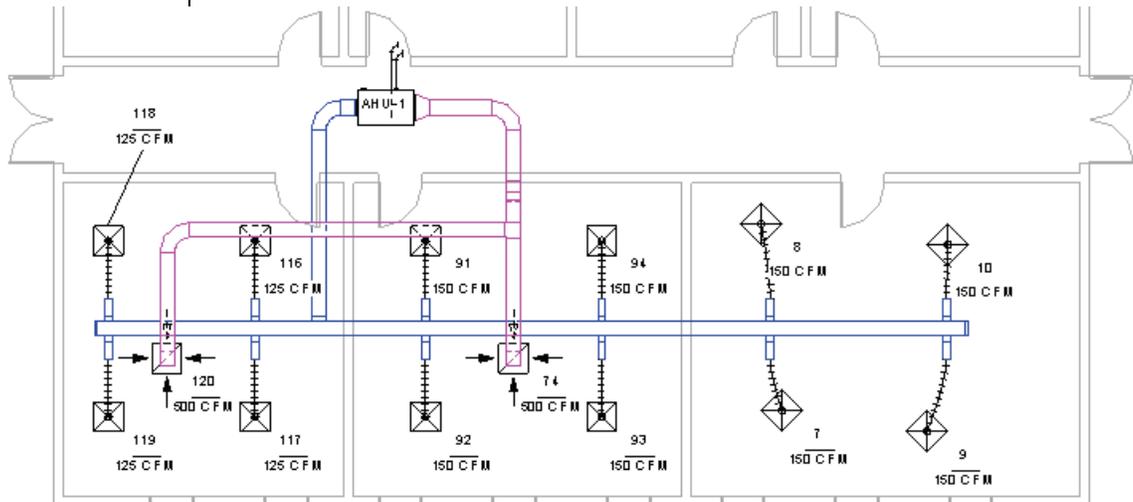


Figure 2–44

### Task 1 - Use temporary dimensions and controls to modify elements.

1. Open the project file **Simple-Building.rvt**, found in the *Chapter 2* folder of your class folder.
2. Select the **AHU-1** unit in the hall of the building.
3. Zoom in to the connectors/controls. Select the temporary dimension above the unit and change the *distance* to **2'-0"**, as shown in Figure 2–45.

The temporary dimensions work with the walls in this project because they are part of the project, not linked in.

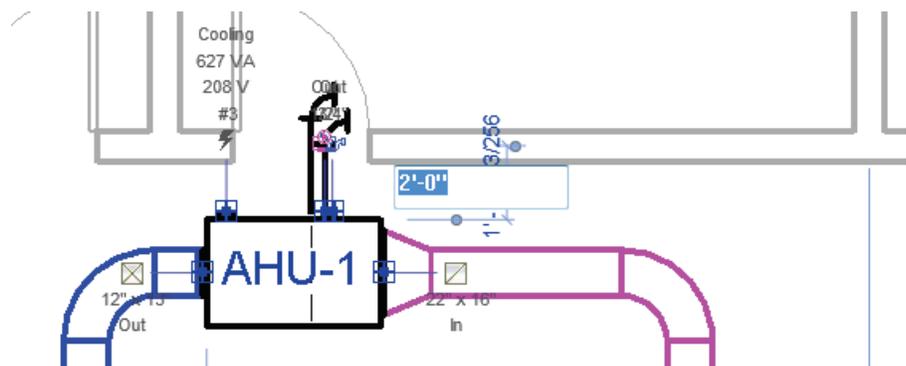


Figure 2–45

4. The unit moves and the ducts move with it because the connectors control the location of the duct fittings and ducts.
5. Pan over to the lower left room in the building. Select the tag that overlaps the ductwork as shown on the left in Figure 2–46.
6. In the Options Bar, select **Leader**.
7. Use the **Move** control to move the tag outside the room to a position in which it is not overlapping anything as shown on the right in Figure 2–46.

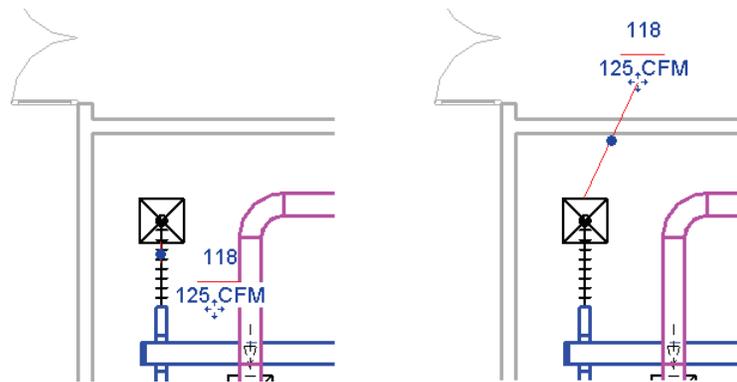


Figure 2–46

8. Zoom out to display the entire building.
9. Select the blue horizontal duct and use the Drag control to lengthen the duct so that it reaches into the room on the far right.
10. Click in empty space to clear the duct selection.
11. The Endcap of the duct did not move, as shown in Figure 2–47. Select and drag it to the endpoint of the duct.

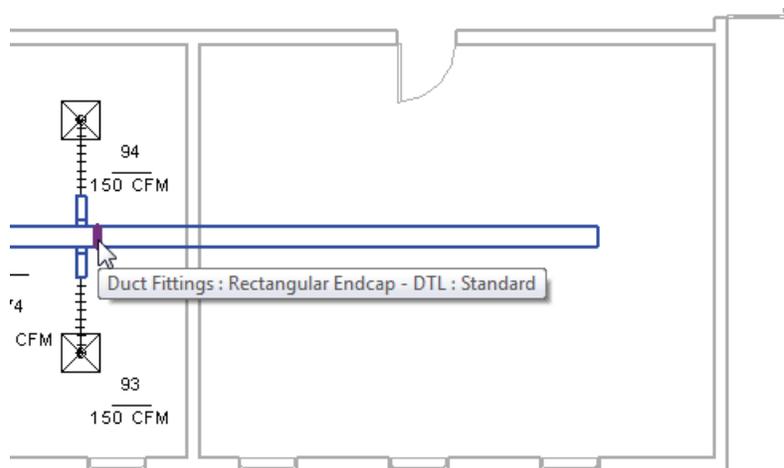


Figure 2–47

*Because there is only one type of element selected, the specific type of element is displayed in the contextual tab.*

12. Undo the change in duct length.
13. Select the duct endcap.
14. In the *Modify | Duct Fittings* tab>Modify panel, click  (Move).
15. For the base point, select the duct endpoint.
16. Move it into the other room again. This time the endcap moves and the duct, which has a connector to the endcap, resizes as well.

## Task 2 - Copy elements.

1. Select the **Air Terminals** and associated ductwork as shown in Figure 2–48.

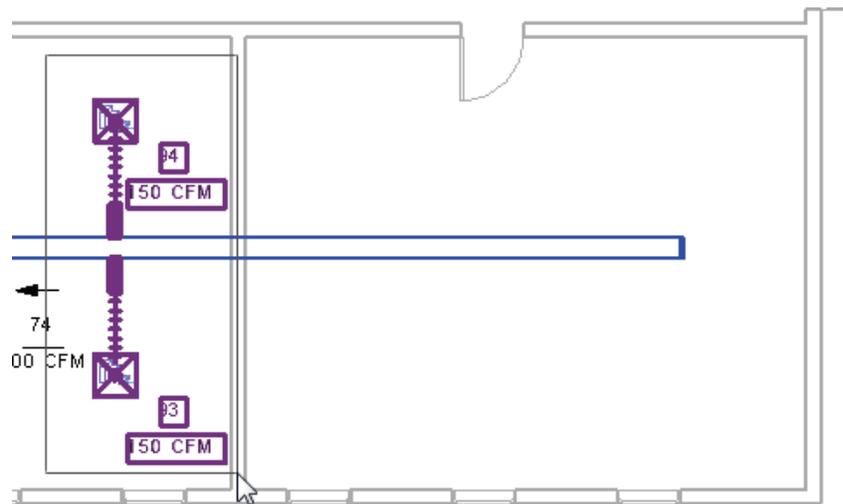


Figure 2–48

*Because there is more than one type of element selected the contextual tab displays as Multi-Select.*

2. In the *Modify | Multi-Select* tab>Modify panel, click .
3. In the Options Bar, select the **Multiple** option.

4. For the base point, select the endpoint of one of the vertical ducts as shown in Figure 2–49.
5. Copy the elements into the last room, as shown in Figure 2–49.

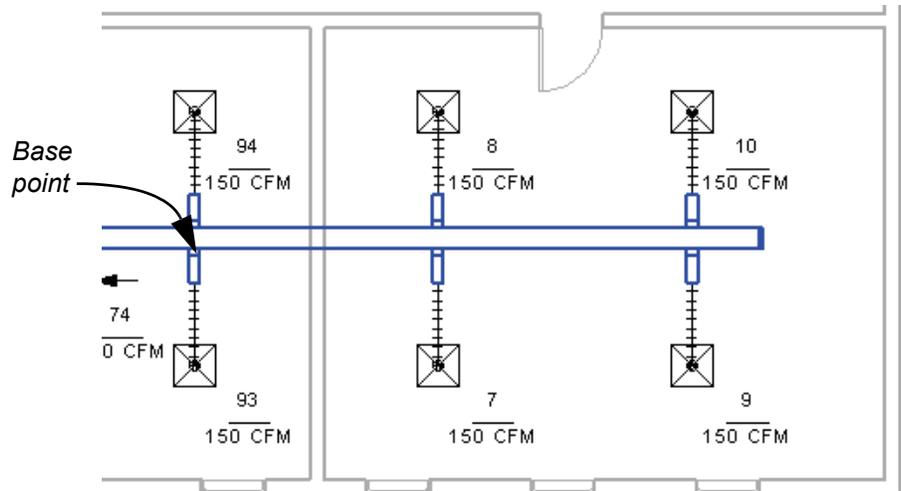


Figure 2–49

6. Press <Esc> twice to end the command.

**Task 3 - Align and rotate elements.**

1. In the Project Browser, open the view **1- Ceiling Mech** (found in the Mechanical>HVAC>Ceiling Plans folder).
2. The air terminal locations do not match the ceiling grids as shown in Figure 2–50.

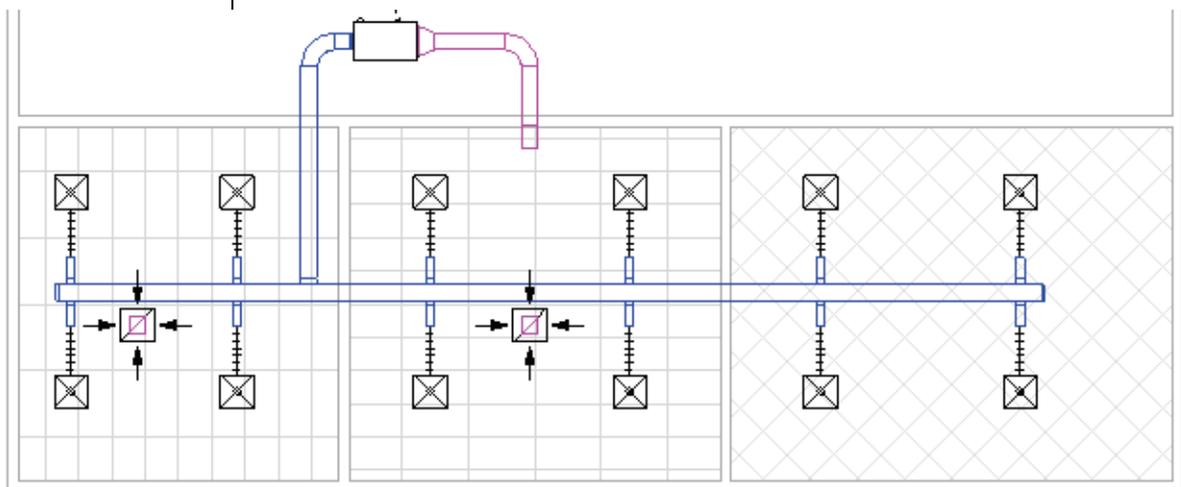


Figure 2–50

3. Zoom in on the room to the left.

4. In the *Modify* tab>Modify panel, click  (Align).
5. Select a vertical grid line and then the edge of the air terminal as shown in Figure 2–51. The air terminal now lines up with the vertical pattern of the ceiling grid.

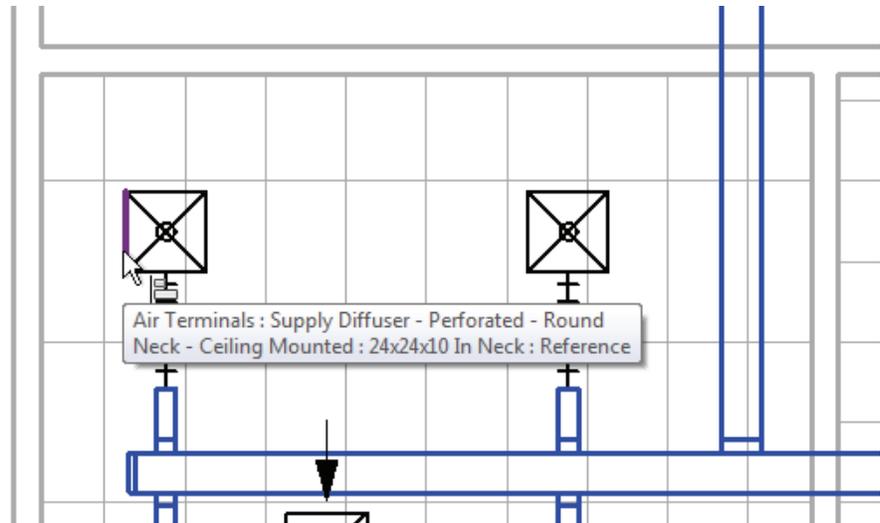


Figure 2–51

6. Repeat the process with the air terminal and the horizontal grid location. Select the edge of the grid line first and then the air terminal.
7. Repeat the process in both rooms so that the air terminals line up with the grids shown in Figure 2–52.

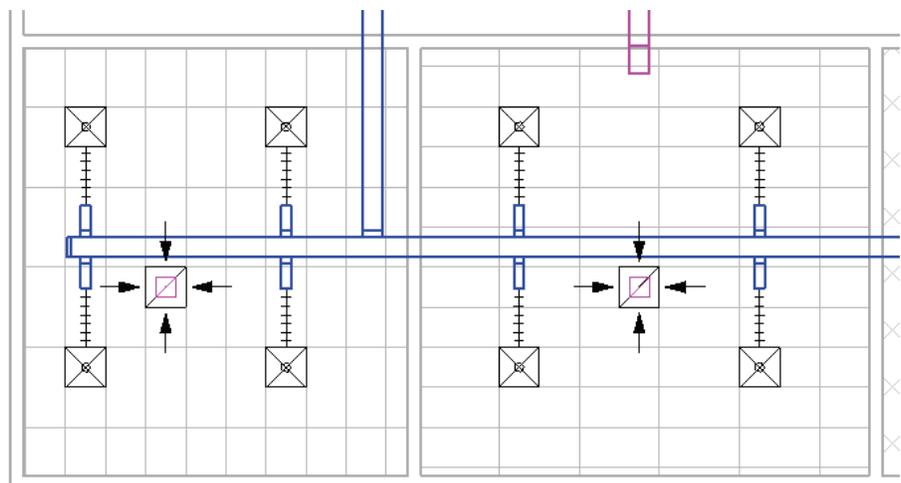


Figure 2–52

8. In the last room the ceiling grid is rotated. In this case you need to rotate the air terminals as well.

9. Select one of the air terminals in the room with the rotated ceiling grid.
10. In the *Modify | Air Terminals* tab>Modify panel, click  (Rotate).
11. In the Options Bar, set the *angle* to **45**.
12. Use the **Align** command to move the air terminal to match the ceiling grid location. First you will select the ceiling grid line and then the edge of the air terminal.
13. The flex duct moves with the air terminal as shown Figure 2–53.

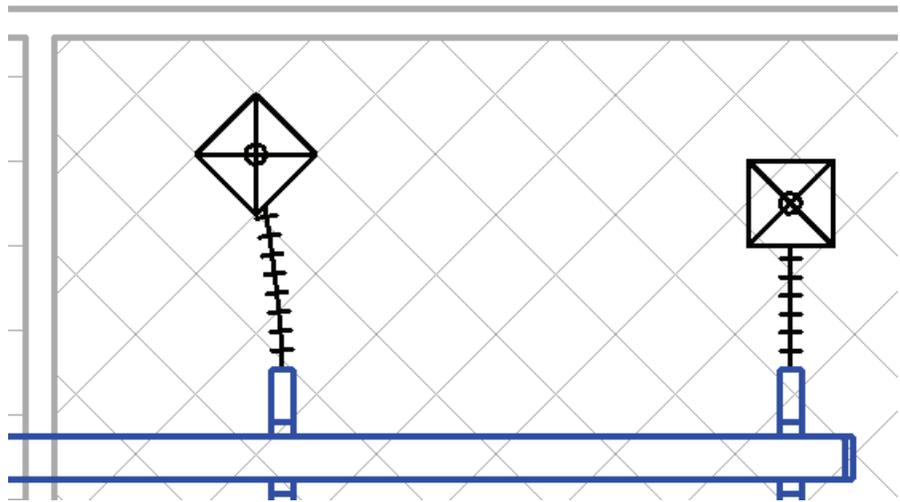
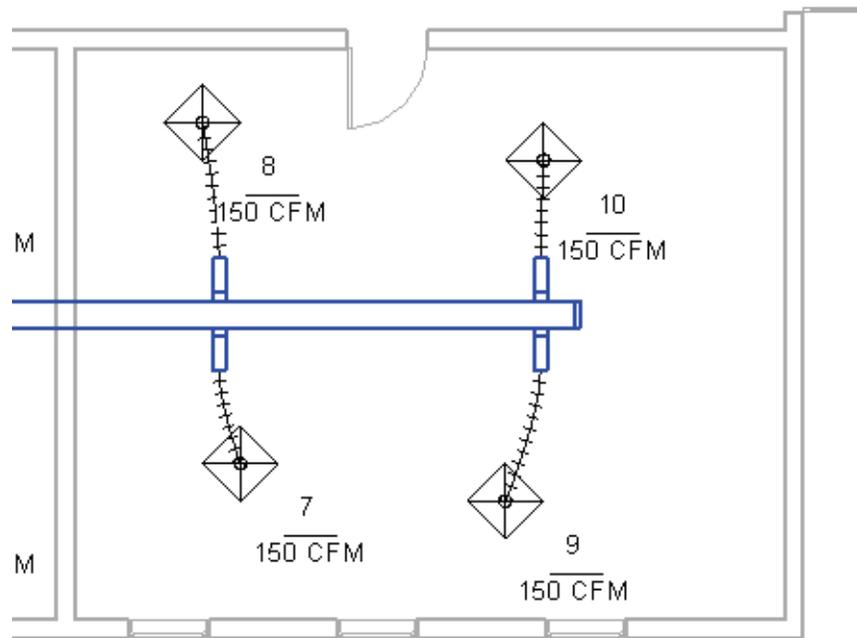


Figure 2–53

14. Without rotating the air terminal, start  (Align).
15. Select a grid line close to one of the other air terminals and then select the edge of the air terminal. The air terminal moves to touch the grid line and also rotates to match the angle of the grid line.
16. Finish aligning all of the air terminals in this room. The exact location is up to you.
17. Zoom out to display the entire building.

18. Switch to the **1 - Mech** floor plan view. The rotated terminals and flex duct display correctly in this view as well as shown in Figure 2–54.



**Figure 2–54**

19. Zoom out to display the entire building.
20. Save the project.

## Chapter Review Questions

1. What is the purpose of an alignment line?
2. How do you edit a temporary dimension when you are drawing?
3. How do you only select Air Terminals in a view?
4. Where do you change an element's type?
5. Which editing command would you use to remove part of a duct?

# Command Summary

Button	Command	Location
	<b>Align</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Align</li> <li>■ <b>Shortcut:</b> AL</li> </ul>
	<b>Array</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Array</li> <li>■ <b>Shortcut:</b> AR</li> </ul>
	<b>Copy</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Copy</li> <li>■ <b>Shortcut:</b> CO</li> </ul>
	<b>Copy to Clipboard</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Clipboard panel&gt;Copy to Clipboard</li> <li>■ <b>Shortcut:</b> &lt;Ctrl&gt;+C</li> </ul>
	<b>Delete</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Delete</li> <li>■ <b>Shortcut:</b> DE</li> </ul>
	<b>Filter</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i>   <i>Multi-Select</i> tab&gt;Filter panel&gt;Filter</li> <li>■ <b>Status Bar</b></li> </ul>
	<b>Mirror - Draw Axis</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Mirror</li> <li>■ <b>Shortcut:</b> DM</li> </ul>
	<b>Mirror - Pick Axis</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Mirror</li> <li>■ <b>Shortcut:</b> MM</li> </ul>
	<b>Move</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Move</li> <li>■ <b>Shortcut:</b> MV</li> </ul>
	<b>Offset</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Offset</li> <li>■ <b>Shortcut:</b> OF</li> </ul>
	<b>Paste</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Clipboard panel&gt;Paste</li> <li>■ <b>Shortcut:</b> &lt;Ctrl&gt;+V</li> </ul>
	<b>Pin</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Pin</li> <li>■ <b>Shortcut:</b> PN</li> </ul>
	<b>Reference Plane</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Home</i> tab&gt;Work Plane panel</li> </ul>
	<b>Rotate</b>	<ul style="list-style-type: none"> <li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Rotate</li> <li>■ <b>Shortcut:</b> RO and R3</li> </ul>

	<b>Scale</b>	<ul style="list-style-type: none"><li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Scale</li><li>■ <b>Shortcut:</b> RE</li></ul>
	<b>Split</b>	<ul style="list-style-type: none"><li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Split</li><li>■ <b>Shortcut:</b> SL</li></ul>
	<b>Trim/Extend to Corner</b>	<ul style="list-style-type: none"><li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Trim/Extend to Corner</li><li>■ <b>Shortcut:</b> TR</li></ul>
	<b>Trim/Extend Multiple Elements</b>	<ul style="list-style-type: none"><li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Trim/Extend Multiple Elements</li></ul>
	<b>Trim/Extend Single Element</b>	<ul style="list-style-type: none"><li>■ <b>Ribbon:</b> <i>Modify</i> tab&gt;Modify panel&gt;Trim/Extend Single Element</li></ul>