Autodesk® Revit® 2015

MEP Fundamentals

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Chapter 2

Basic Drawing and Modify Tools

In this chapter you learn how to use the basic drawing and modify tools that apply to almost all types of elements. These tools include alignment lines, temporary dimensions, snaps, and the Properties palette. You learn how to select elements for editing and how to move, copy, rotate, mirror, and array them. You also learn to align, split, trim, extend, and offset elements.

This chapter contains the following topics:

- **Using General Drawing Tools**
- **Editing Elements**
- **Working with Basic Modify Tools**
- **Working with Additional Modify Tools**

2.1 Using General Drawing Tools

Learning Objectives

- Use contextual Ribbon tabs, the Options Bar and Properties as you draw and modify.
- Draw elements using draw and pick tools.
- Use drawing aids including alignment lines, temporary dimensions and snaps.

When you start a command, the contextual Ribbon tab, Options Bar, and Properties palette enable you to set up features for each new element you are placing in the project. 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.
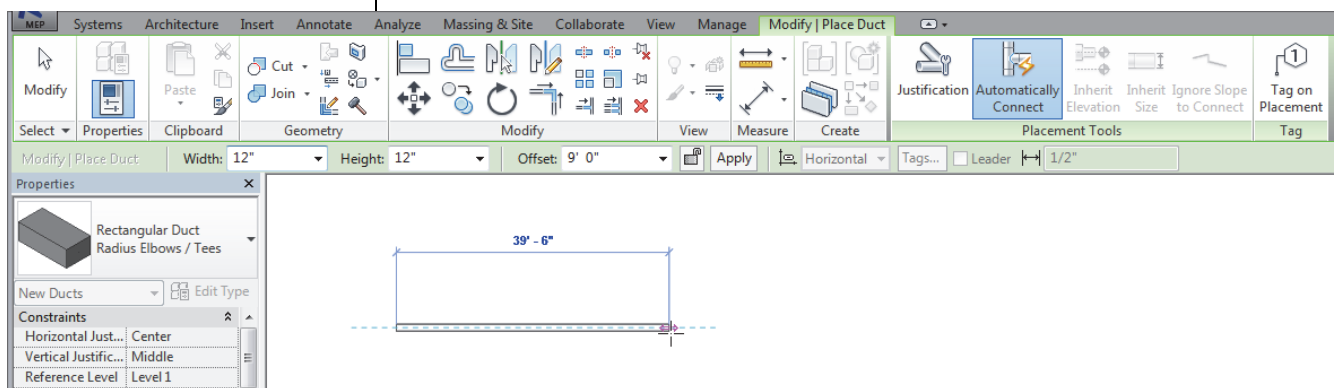

Figure 2–1

Contextual Ribbon

When you select a command or an element in the model, the *Modify* tab displays with additional contextual tools. For example, when you start the ⬭ (Wall) command, the *Modify | Place Wall* tab displays, as shown in Figure 2–2.
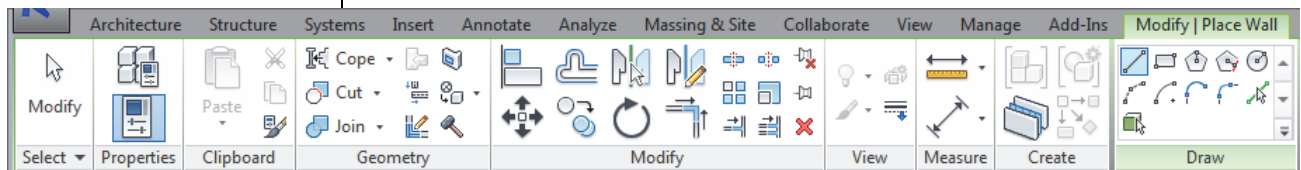

Figure 2–2

- The standard Modify tools are always displayed to the left in the ribbon, while the contextual tools are displayed to the right with a green panel title.

- To finish a command and return to the standard ribbon tabs at any time, in the *Select* panel, click (Modify).

Options Bar

The Options Bar, located just below the ribbon, displays the most used options for the element, as shown in Figure 2–3. Some of these options are also found in the Properties palette.
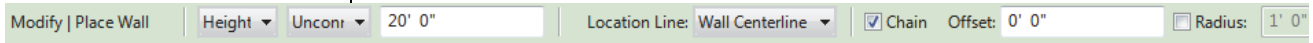

| Modify | Place Wall | Height ▼ | Uncon ▼ | 20' 0" | Location Line: Wall Centerline ▼ | ☑ Chain Offset: 0' 0" | ☐ Radius: 1' 0" |

Figure 2–3

Properties Palette

The Properties palette displays the current element's family and type in the *Type Selector*. Click the Type Selector to expand the list of available families and types. In the lower part of the properties palette you can modify parameters for the selected object, as shown in Figure 2–4.

Some parameters are only available when you are editing an element. These parameters are grayed out when you are creating an element.
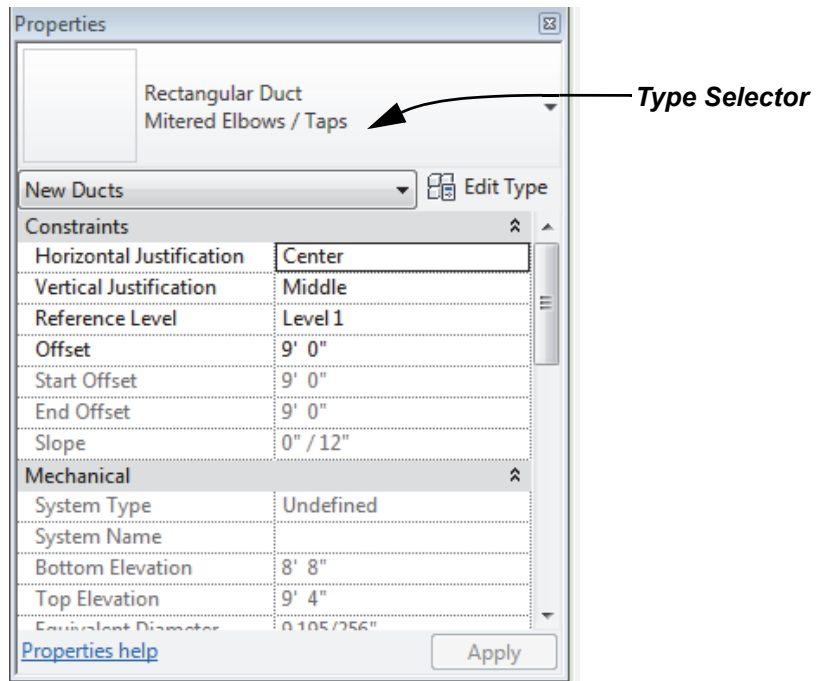

Figure 2–4

- Changes in the palette do not take effect until you click Apply or move the cursor away from the palette.

To dock the palette, drag the titlebar over the titlebar of the other browser.

- The Properties palette can be floated and moved around the interface. You can also dock it on top of other browsers and then switch between them using the tabs at the bottom of the palette, as shown in Figure 2–5.
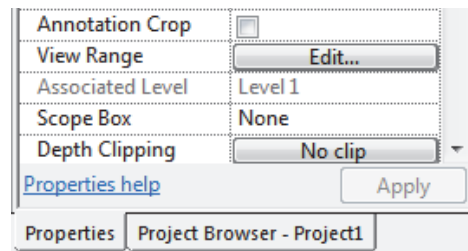

Figure 2–5

The Properties palette can be toggled on and off using the following methods:

- Right-click and select **Properties** in the contextual menu.

- In the *Modify* tab>Properties panel click (Properties).

- In the *View* tab, expand (User Interface), and select **Properties**.
- Use the shortcut by pressing <P> twice.

Drawing Aids

As soon as you start drawing in the software, three drawing aids display: *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 2–6. They help keep lines horizontal, vertical, or at a specified angle. They also line up with the implied intersections of walls and other elements.
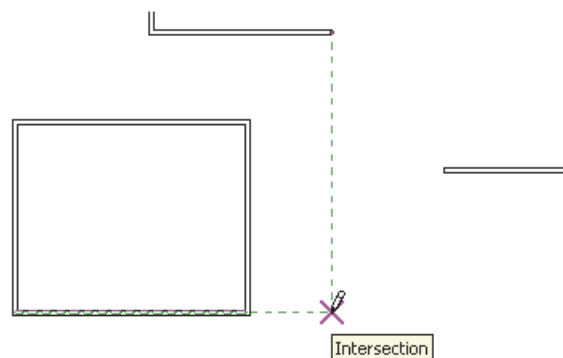

Figure 2–6

- Hold <Shift> to force the alignments to be orthogonal (90 degree angles only).

Temporary Dimensions

Along with alignment lines, *temporary dimensions* display as you draw to help place linear elements at the correct length, angle and location, as shown in Figure 2–7.

You can type in the dimension, move the cursor until you see the dimension you want, or place the element and then modify the dimension as required.
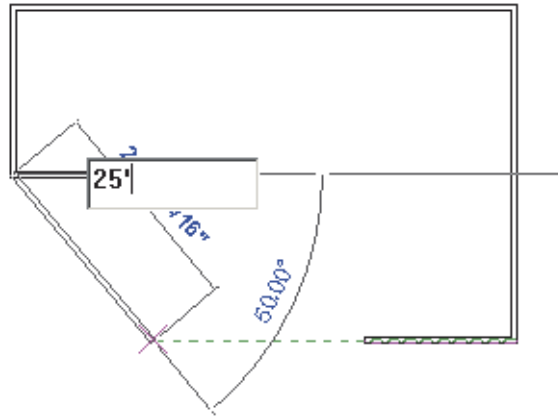

Figure 2–7

- For Imperial measurements (feet and inches), the software understands a default of feet. For example, when you type **4** and press <Enter>, it assumes 4'-0". For a distance such as 4'-6", you can type any of the following: **4'-6"**, **4'6**, **4-6**, or **4 6** (the numbers separated by a space). To indicate distances less that one foot, type the inch mark (") after the distance, or enter **0**, a space, and then the distance.

- The increments displayed for temporary dimensions change as you zoom in or out on 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 2–8.

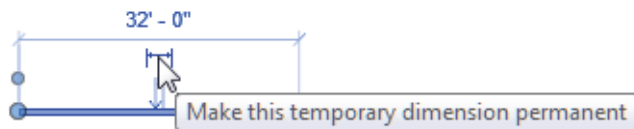*Dimensions are a powerful tool to help create and annotate the model.*

Figure 2–8

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

Snaps

Snaps are key points that help you reference existing elements to exact points when drawing, as shown in Figure 2–9.
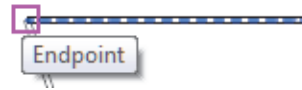

Figure 2–9

They include *Endpoints*, *Midpoints*, *Nearest*, *Work Plane Grid*, *Quadrants*, *Intersections*, *Centers*, *Perpendicular*, *Tangents*, and *Points*. When you move the 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, where 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.

Hint: Snap Overrides

You can use shortcut key combinations (displayed in the Snaps dialog box) or right-click and select **Snap Overrides** to temporarily override snap settings. Temporary overrides only affect a single pick but can be very helpful when there are snaps nearby other than the one you want to use.

Reference Planes

As you develop designs in Autodesk Revit, there are times when you need lines that don't print to help you define certain locations. You can draw *reference planes* (displayed as dashed green lines) to host the height of sinks or to help you define the centerlines and paths for ductwork, as shown in Figure 2–10.
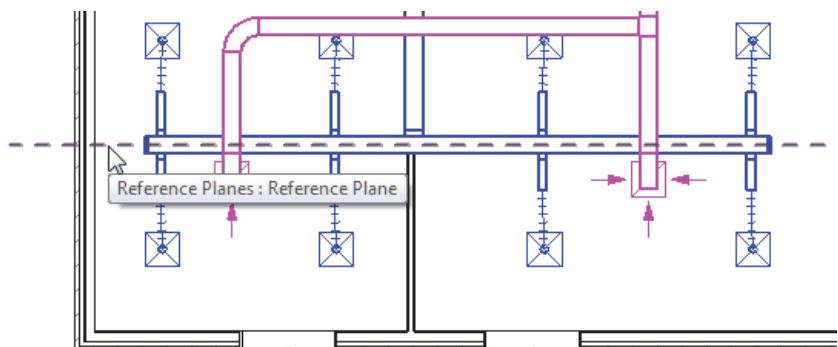

Figure 2–10

- Reference lines display in associated views because they are infinite planes, and not just lines. However, reference planes do not display in 3D views.

How To: Sketch with Reference Planes

1. In the *Architecture* tab>Work Plane panel, click ✎ (Ref Plane) or use the shortcut by pressing <R> and then pressing <P>.
2. In the *Modify | Place Reference Plane* tab>Draw panel, click

   ✎ (Line) or ✎ (Pick Lines).

   - For ✎ (Line), select two points that define the reference plane.

   - For ✎ (Pick Lines), select any linear element and a reference plane is created that matches the length of that element.

   - In the Options Bar, the *Offset* field enables you to enter values to draw the reference plane at a specified distance from a selected point. For example, set *Offset* to **10'-0"** and select the end points of an existing wall to create a reference plane 10'-0" away. You can also use *Offset* with **Pick Lines**.

3. When you have created all of the required reference planes, end the command by clicking ☐ (Modify) or by using one of the other options.

- To change the length of a reference plane, drag the circle at either end.

- You can name reference planes to keep track of their purpose. This also enables you to use a reference plane as a work plane when creating or placing other elements in the project. Select the reference plane and in the Properties palette, in the *Identity Data* area, enter a name, as shown in Figure 2–11.
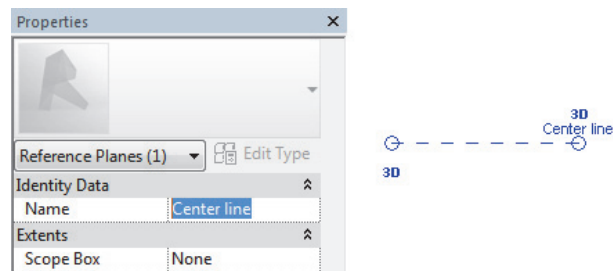

Figure 2–11

Draw Tools

MEP tools (i.e., ducts, pipes, and conduits) are strictly straight, linear elements that are automatically connected to elbows or tees. However, if you are working with walls (as shown in Figure 2–12) or lines used in details, legends, and schematic drawings, additional tools are available. These tools display in the contextual Ribbon, and vary according to the element being drawn.
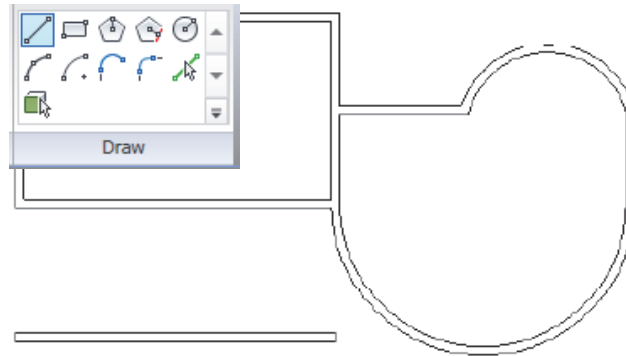

Figure 2–12

- Two styles of tools are available: one where you *draw* the element using a geometric form, and another where you *pick* an existing element (such as a line, face, or wall) as the basis for the new element's geometry.

How To: Draw Linear Elements

1. Start the command you want to use, such as (Wall).
2. In the contextual tab>Draw panel, select a drawing tool, such as (Line), as shown in Figure 2–13. Select points to define the elements using other drawing aids, such as temporary dimensions, alignment lines, and snaps.
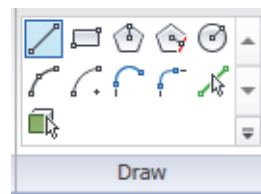
You can change from one Draw tool shape in the middle of a command.

Figure 2–13

* (Pick Face) is used with conceptual mass elements and is only available in a 3D view.*

- Use (Pick Lines) to create an element by selecting an existing wall, line or edge. This is often used with an offset distance to add the element a specified distance away from the selected element.

3. Finish the command. You can click (Modify), press <Esc> twice, or right-click and select **Cancel** twice.

Draw Tools

	Line	Draws a straight linear element defined by the first and last points. If Chain is enabled, you can continue selecting end points for multiple segments.
	Rectangle	Draws four linear elements defined from two opposing corner points. You can adjust the dimensions after selecting both points.
	Inscribed Polygon	Draws a polygon inscribed in a hypothetical circle with the number of sides specified in the Options Bar.
	Circumscribed Polygon	Draws a polygon circumscribed around a hypothetical circle with the number of sides specified in the Options Bar.
	Circle	Draws a circular linear element defined by a center point and radius.
	Start-End-Radius Arc	Draws a curved linear element defined by a start, end, and radius of the arc. The outside dimension shown is the included angle of the arc. The inside dimension is the radius.
	Center-ends Arc	Draws a curved linear element defined by a center, radius, and included angle. The selected point of the radius also defines the start point of the arc.
	Tangent End Arc	Draws a curved linear element tangent to another element. Select an end point for the first point, but do not select the intersection of two or more elements. Then select a second point based on the included angle of the arc.
	Fillet Arc	Draws a curved linear element defined by two other linear elements and a radius. Because it is difficult to select the correct radius by clicking, this command automatically moves to edit mode. Select the dimension and then modify the radius of the fillet.
	Spline	Draws a curved linear element based on selected points. The curve does not actually touch the points (Model and Detail Lines only).
	Ellipse	Draws an ellipse from a primary and secondary axis (Model and Detail Lines only).
	Partial Ellipse	Draws only one side of the ellipse, like an arc. A partial ellipse also has a primary and secondary axis (Model and Detail Lines only).

Pick Tools

	Pick Lines	Use this option to select existing linear elements in the project. This is useful when you start the project from an imported 2D drawing.
	Pick Face	Use this option to select the face of a 3D massing element (walls and 3D views only).
	Pick Walls	Use this option to select an existing wall in the project to be the basis for a new sketch line (floors, ceilings, etc.).

Draw Options

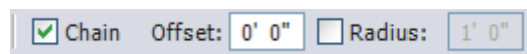*Different options display according to the type of element that is selected, or the command that is active.*

When you are in Drawing mode, several options display in the Options Bar, as shown in Figure 2–14.

Figure 2–14

- The **Chain** option controls how many segments are drawn in one process. If it is not selected, the **Line** and **Arc** tools only draw one segment at a time. If it is selected, you can continue drawing segments until you select the command again.

- The *Offset* field enables you to enter values to draw the linear elements at a specified distance from the selected points.

- When using a radial draw tool, you can select the **Radius** option and add a radius in the edit field.

- To draw angled lines, move the cursor to the desired angle shown by the temporary dimensions, and type the distance value. The angle increments shown vary depending on how far in or out the view is zoomed.

2.2 Editing Elements

Learning Objectives

- Select elements to modify.
- Modify elements using the Ribbon, Properties, temporary dimensions, and controls.
- Filter selection sets.

Building design projects typically involve extensive changes to the positions of walls, doors, and other elements. The Autodesk Revit software was designed to make such changes quickly and efficiently. When you select an element there are a number of ways to change it, as shown in Figure 2–15:

When you hover the cursor over an element, a tooltip displays its family and type.

- *Controls* enable you to drag, flip, lock, and rotate the element.
- *Temporary dimensions* enable you to change the element's dimensions.
- Modify commands and element-specific tools display in the contextual tab in the Ribbon.
- The Properties palette displays the Type Selector and associated parameters.
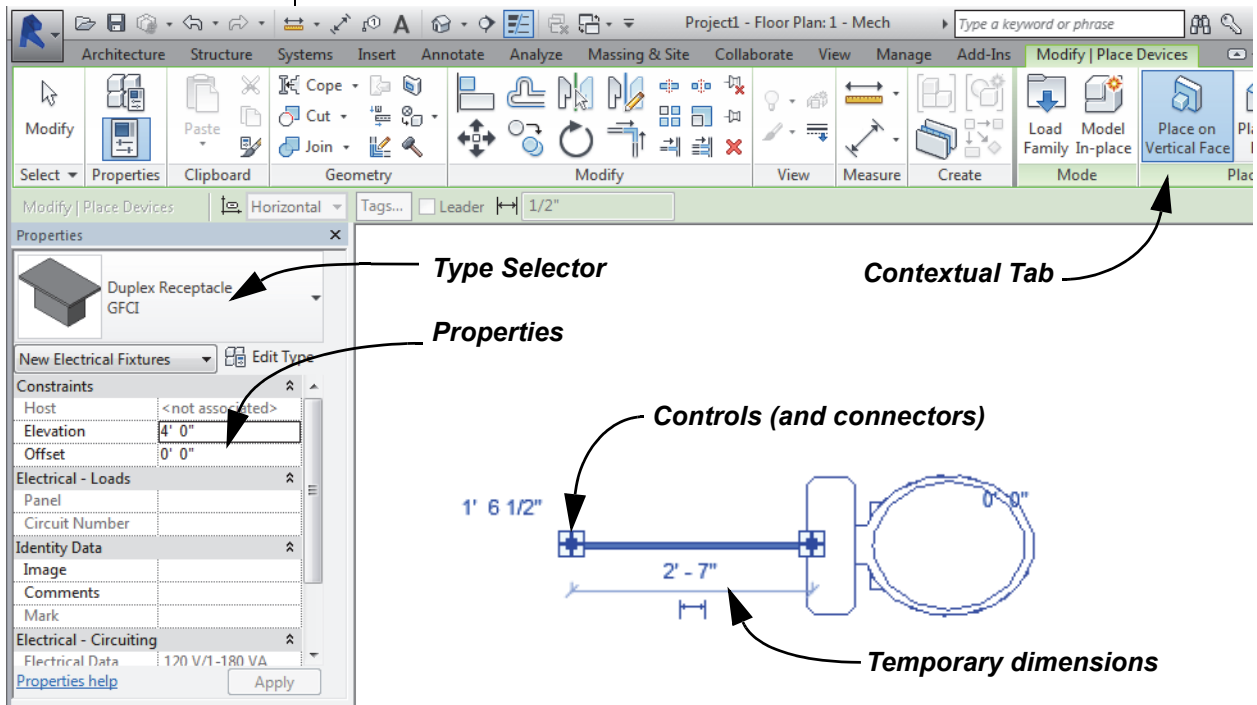
Figure 2–15

- Connectors are frequently linked to controls. When a control is moved, the connector is moved with it. You should not disconnect systems when moving a control.

- To delete an element, select it and press <Delete>, right-click and select **Delete**, or in the Modify panel, click ✖ (Delete).

- When working with temporary dimensions, the default location of the dimension line might not be where you need it to be. You can click on the circular control to move the witness line to another part of the element (such as a different layer in a multilayer wall), or drag it to a new element. In the example shown on the left in Figure 2–16, the dimension is from the center of the left wall to the selected wall. To change the dimension so that it touches the grid line, drag the circular control (also called the witness line) so that it touches the grid line, as shown on the right in Figure 2–16.
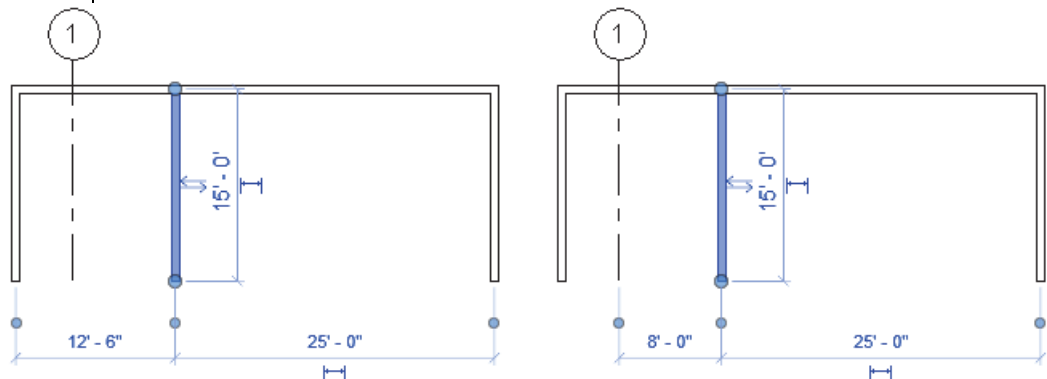
Figure 2–16

- The new location of a temporary dimension for an element is remembered as long as you are in the same session of the software.

Hint: Nudge

Nudge enables you to move an element in short increments. When an element is selected, you can press one of the four arrow keys to move the element in that direction. The distance the element moves depends on how far in or out you are zoomed. This is very useful with annotation elements.

Selecting Elements

You can select elements in several ways:

- To select a single element, place the cursor on the edge of the element and click to select.

- To add another element to a selection set, hold <Ctrl> and select another item.

- To remove an element from a selection set, hold <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 2–17. 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.
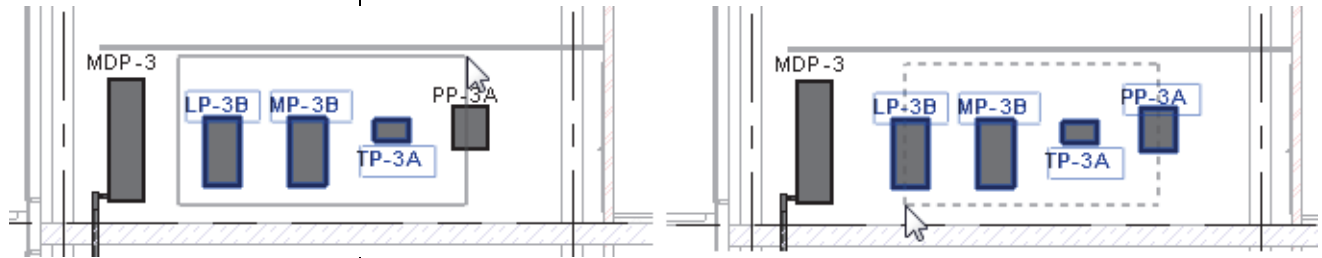

Figure 2–17

- 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 walls that are connected, pressing <Tab> selects 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 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 2–18.
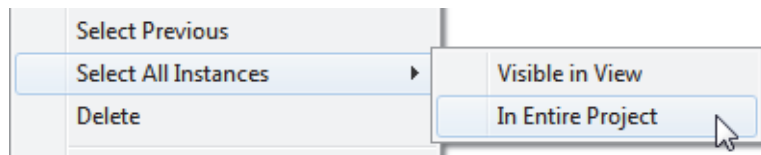
Figure 2–18

Hint: Selection Options

You can control how the software selects specific elements in a project by toggling them on and off on Status Bar, or in any Ribbon tab expand the *Select* panel's title as shown in Figure 2–19.
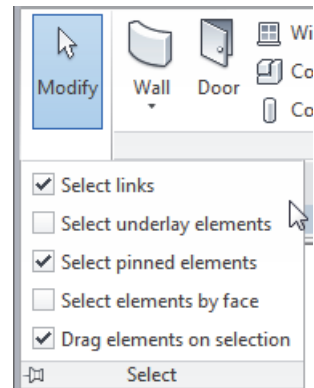
Figure 2–19

- **Select links:** When toggled on, you can selected linked drawings or Autodesk Revit models. When it is toggled off you cannot select them when using **Modify** or **Move**.

- **Select underlay elements:** When toggled on, you can select underlay elements. When toggled off, you cannot select them when using **Modify** or **Move**.

- **Select pinned elements:** When toggled on, you can selected pinned elements. When toggled off, you cannot select them when using **Modify** or **Move**.

- **Select elements by face:** When toggled on you can select elements (such as the floors or walls in an elevation) by selecting the interior face or selecting an edge. When toggled off, you can only select elements by selecting an edge.

- **Drag elements on selection:** When toggled on, you can hover over an element, select it, and drag it to a new location. When toggled off, the Crossing or Box select mode starts when you press and drag, even if you are on top of an element. Once elements have been selected they can still be dragged to a new location.

Selecting Multiple Elements

When multiple element types are selected, the *Multi-Select* contextual tab opens in the Ribbon, as shown in Figure 2–20. This gives you access to all of the Modify tools, as well as the **Filter** command.
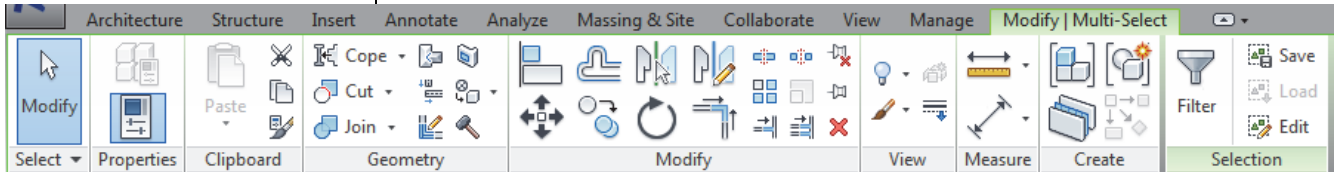
Figure 2–20

• The Properties palette displays tools that are common to all element types if they are available. You can also select just one type and make modifications, as shown in Figure 2–21.
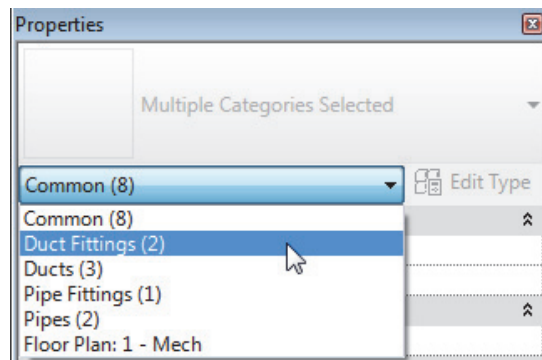

Figure 2–21

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 2–22.
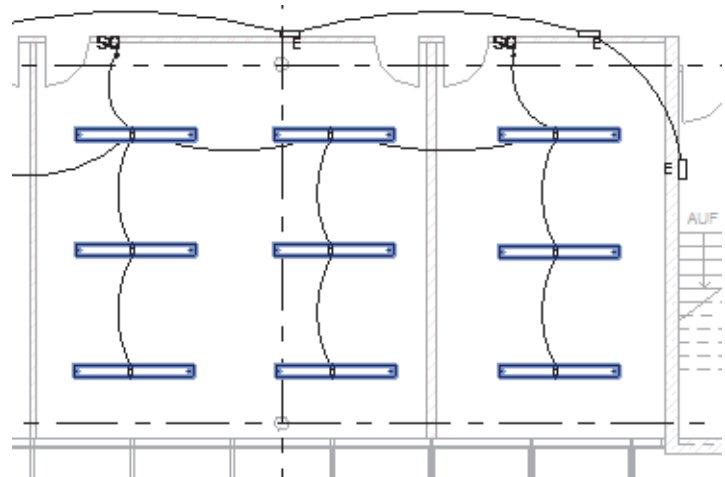
Figure 2–22

How To: Filter a Selection Set

1. Select everything in the required area.
2. in the *Modify | Multi-Select* tab>Selection panel, or in the Status Bar, click ![Filter icon] (Filter). The Filter dialog box opens, as shown in Figure 2–23.

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

Category:	Count:	
☑ Electrical Equipment	3	Check All
☑ Electrical Equipment Tags	3	
☑ Electrical Fixtures	6	Check None
☑ Lighting Fixture Tags	25	
☑ Lighting Fixtures	25	
☑ Rooms	2	
☑ Spaces	2	
☑ Wire Tag	2	
☑ Wires	14	

Total Elements: 82

OK   Cancel   Apply
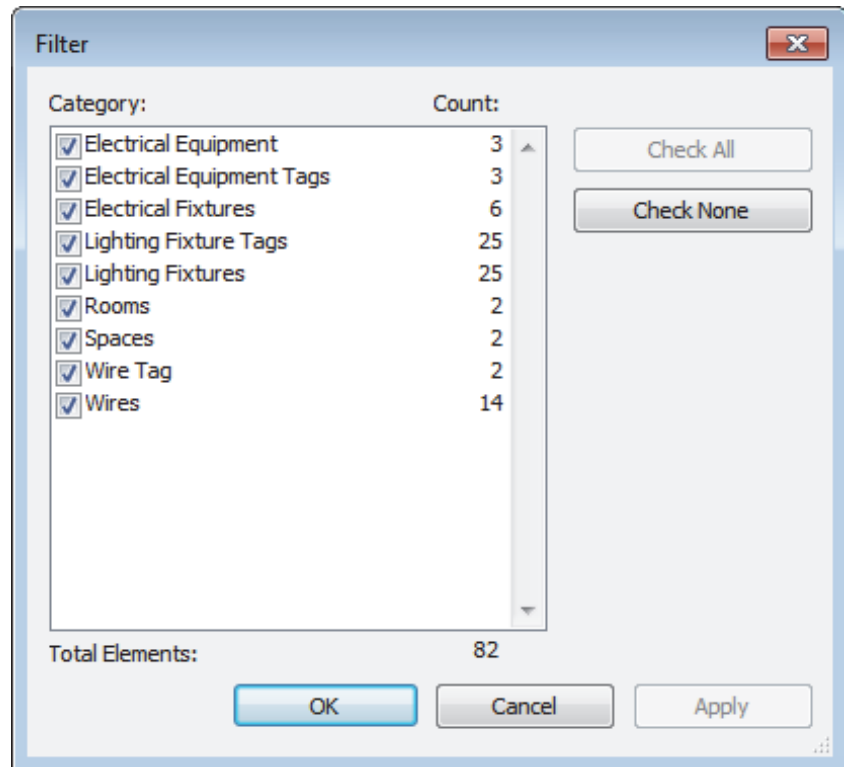
Figure 2–23
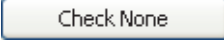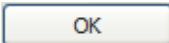
3. Click **Check None** to clear all of the options and then select the element types that you want included in the selection.

4. Click **OK**. The selection set is now limited to the elements you specified.

• In the Status Bar, the number of elements selected displays beside the Filter icon, as shown in Figure 2–24. You can also see the number of selected elements in the Properties palette.

Figure 2–24

2.3 Working with Basic Modify Tools

Learning Objectives

- Move and copy elements.
- Rotate elements around the center or an origin.
- Mirror elements by picking an axis or by drawing an axis.
- Create Linear and Radial Arrays of elements.

The Autodesk Revit 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 2–25, and in contextual tabs.
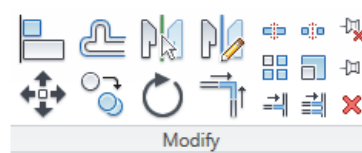
Figure 2–25

- The **Move**, **Copy**, **Rotate**, **Mirror**, and **Array** commands are covered in this topic. Other tools are covered later.

- For most modify commands, you can either select the elements and start the command, or start the command, select the elements, and press <Enter> to finish the selection and move to the next step in the command.

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 2–26.

Figure 2–26

How To: Move or Copy Elements

1. Select the elements you want to move or copy.
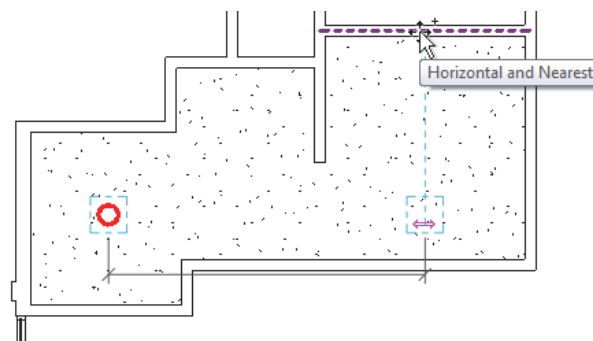
*You can also use the shortcut for the **Move** command by pressing <M> and pressing <V>, or for the **Copy** command by pressing <C> and pressing <O>.*

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. When you are finished, you can start another modify command using the elements that remain selected, or switch back to **Modify** to end the command.

• If you start the **Move** command and hold <Ctrl>, the elements are copied.

Move/Copy Elements

The **Move** and **Copy** commands have several options that display in the Options Bar, as shown in Figure 2–27.

☐ Constrain ☐ Disjoin ☐ Multiple
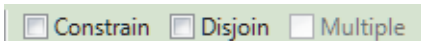
Figure 2–27

Constrain	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. **Constrain** is off by default.
Disjoin (Move only)	Breaks any connections between the elements being moved and other elements. If **Disjoin** is on, the elements move separately. If it is off, the connected elements also move or stretch. **Disjoin** is off by default.
Multiple (Copy only)	Enables you to make multiple copies of one selection. **Multiple** is off by default.

• 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).

Enhanced in 2015

Hint: Pinning Elements

If you do not want elements to be moved, you can pin them in place, as shown in Figure 2–28. Select the elements and in the *Modify* tab, in the Modify panel, click ⊹ (Pin). Pinned elements can be copied, but not moved. If you try to delete a pinned element, a warning dialog displays reminding you that you must unpin the element before the command can be started.
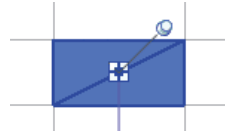
Figure 2–28

Select the element and click ⊹ (Unpin) or use the shortcut by pressing <U> and pressing <P> to free it.

Rotating Elements

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 center of rotation and the angle. You can also create copies of the element as it is being rotated.

How To: Rotate Elements

1. Select the element(s) you want to rotate.

2. In the Modify panel, click ○ (Rotate) or use the shortcut by pressing <R> and pressing <O>.

3. The center of rotation is automatically set to the center of the element or group of elements, as shown on the left in Figure 2–29. To change the center of rotation, as shown on the right in Figure 2–29, use the following:

   • Drag the ○ (Center of Rotation) control to a new point.

   • In the Options Bar, next to **Center of rotation**, click `Place` and use snaps to move it to a new location.

   • Press the <Spacebar> to select the center of rotation and click to move it to a new location.
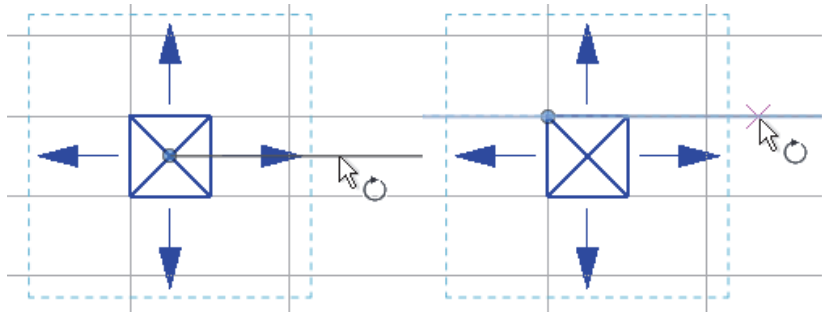
Figure 2–29

- To start the **Rotate** command with an automatic prompt to select the center of rotation, select the elements first and type **R3**.

4. In the Options Bar, specify if you want to make a Copy (select **Copy** option), type an angle in the *Angle* field (as shown in Figure 2–30), and press <Enter>. You can also specify the angle on screen.

*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.*
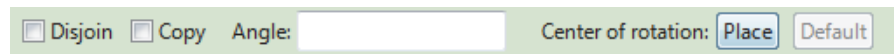
Figure 2–30

5. The rotated element(s) remain highlighted, enabling you to start another command, or return to **Modify** to finish.

- The **Disjoin** option breaks any connections between the elements being rotated and other elements. If **Disjoin** is on (selected), the elements rotate separately. If it is off (cleared), the connected elements also move or stretch. **Disjoin** is off by default.

Mirroring Elements

The **Mirror** command enables you to mirror elements about an axis defined by a selected element, as shown in Figure 2–31, or by selected points.
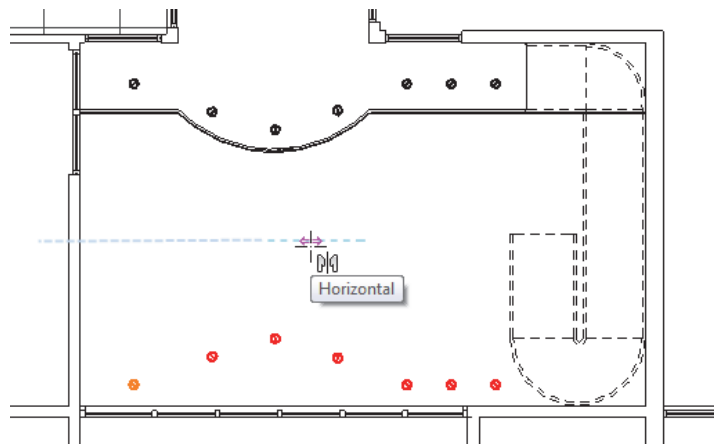
Figure 2–31

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 use the shortcut by pressing <M> twice. This prompts you to select an element as the **Axis of Reflection** (mirror line).

   • Click ⬛ (Mirror - Draw Axis) or use the shortcut by pressing <D> and pressing <M>. 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 return to **Modify** to finish.

• By default, the original elements that were mirrored remain. To delete the original elements, clear the **Copy** option in the Options Bar.

Hint: Scale

The Autodesk Revit software 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 2–32. 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.
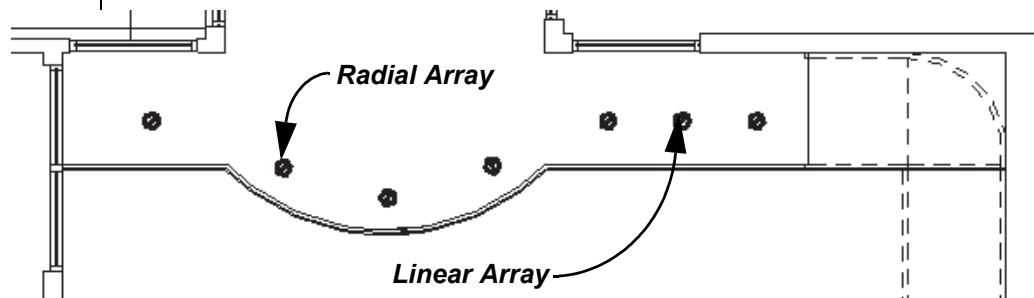
Figure 2–32

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 required.
5. Select a start point and an end point to set the spacing and direction of the array. The array is displayed.
6. If the **Group and Associate** option is selected, you are prompted again for the number of items, as shown in Figure 2–33. Type a new number or click on the screen to finish the command.
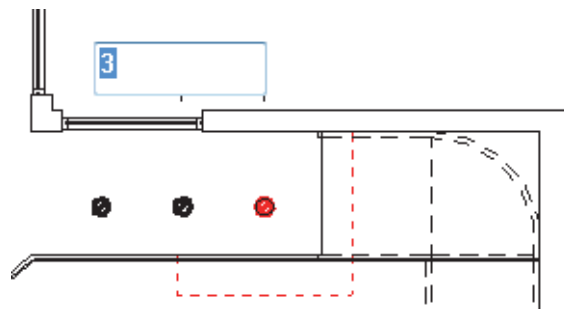
Figure 2–33

- 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 **Linear Array** (top of Figure 2–34) or **Radial Array** (bottom of Figure 2–34).
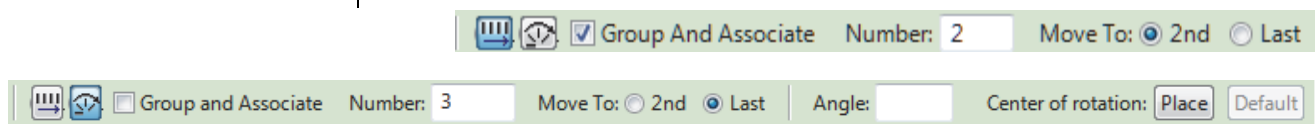
Figure 2–34

Group and Associate	Creates an array group element out of all arrayed elements. Groups can be selected by selecting any elements in the group.
Number	Specifies how many instances you want in the array.
Move To:	**2nd** specifies the distance or angle between the center points of the two elements. **Last** specifies the overall distance or angle of the entire array.

Constrain	Restricts the direction of the array to only vertical or horizontal (Linear only).
Angle	Specifies the angle (Radial only).
Center of rotation	Specifies a location for the origin about which the elements rotate (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. Drag ↻ (Center of Rotation) or use [Place] to the move the center of rotation to the appropriate location, as shown in Figure 2–35.

*Remember to set the **Center of Rotation** control first, because it is easy to forget to move it before specifying the angle.*
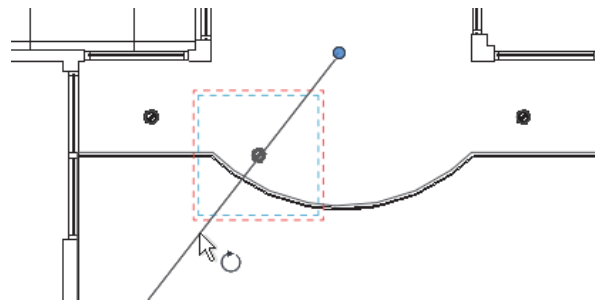
Figure 2–35

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

Modifying Array Groups

When you select an element in an array that has been grouped, you can change the number of instances in the array, as shown in Figure 2–36. For radial arrays you can also modify the distance to the center.
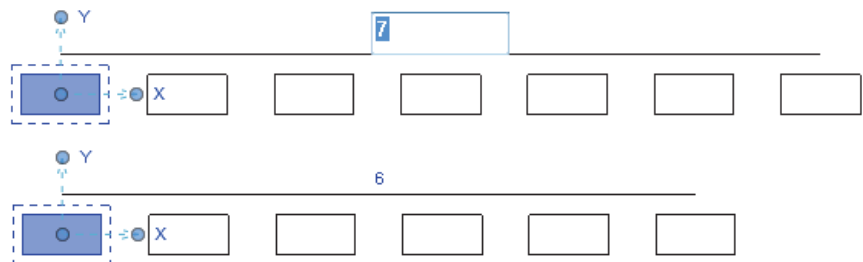
Figure 2–36

- Dashed lines surround the element(s) in a group, and the XY control lets you move the origin point of the group

If you move one of the elements within the array group, the other elements move in response based on the distance and/or angle, as shown in Figure 2–37
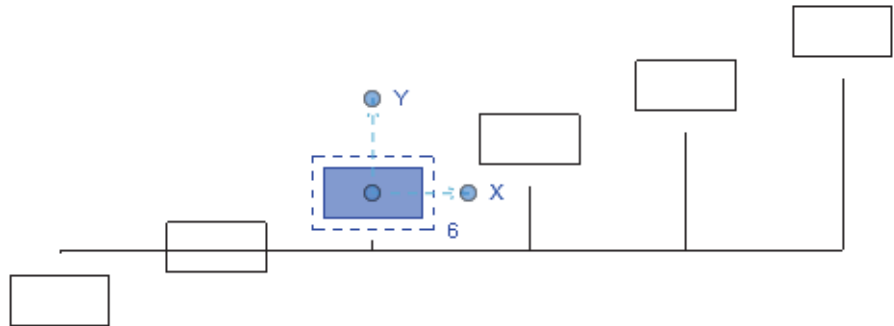
Figure 2–37

- To remove the array constraint on the group, select all of the elements in the array group and, in the *Modify* contextual tab>Group panel, click (Ungroup).

- If you select an individual element in an array and click

  (Ungroup), the element you selected is removed from the array, while the rest of the elements remain in the array group.

- You can use (Filter) to ensure that you are selecting only **Model Groups**.

Practice 2a

Work with Basic Modify Tools

Learning Objectives

- Use various drawing aids to modify the location of elements.
- Move and copy elements.

Estimated time for completion: 15 minutes

In this practice you will use temporary dimensions and controls to modify the location of elements. You will than move and copy elements, as shown in Figure 2–38.
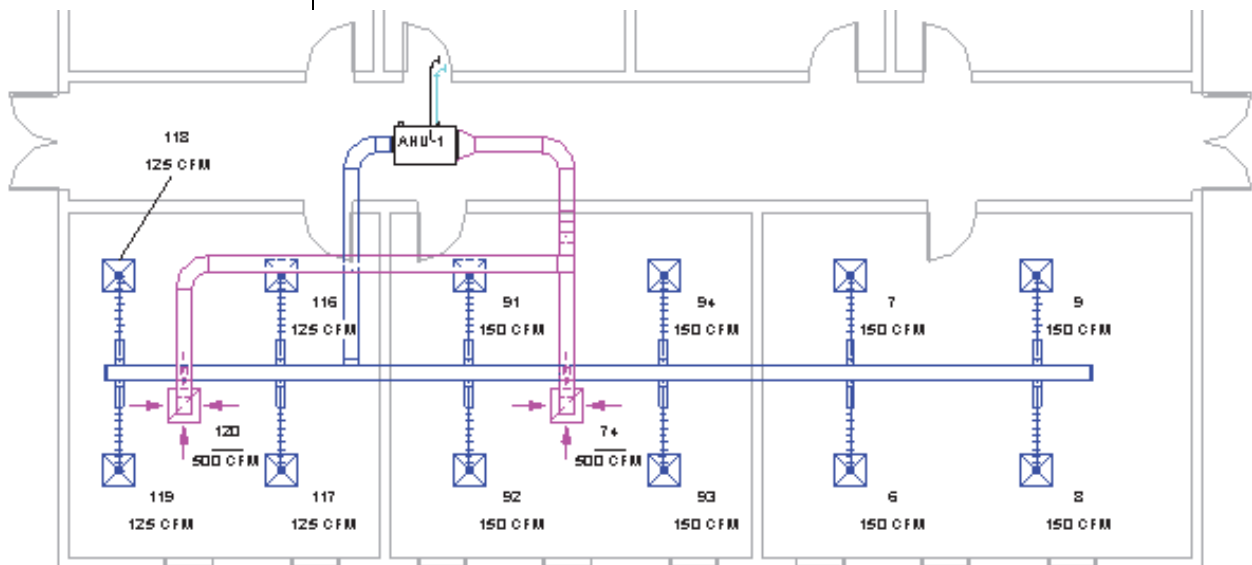
Figure 2–38

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

1. In the *C:\Autodesk Revit 2015 MEP Fundamentals Class Files\Basics* folder, open **Simple-Building.rvt**.

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 **3'-0"**, as shown in Figure 2–39.

The temporary dimensions work with the walls in this project because they are part of the project, not linked in.
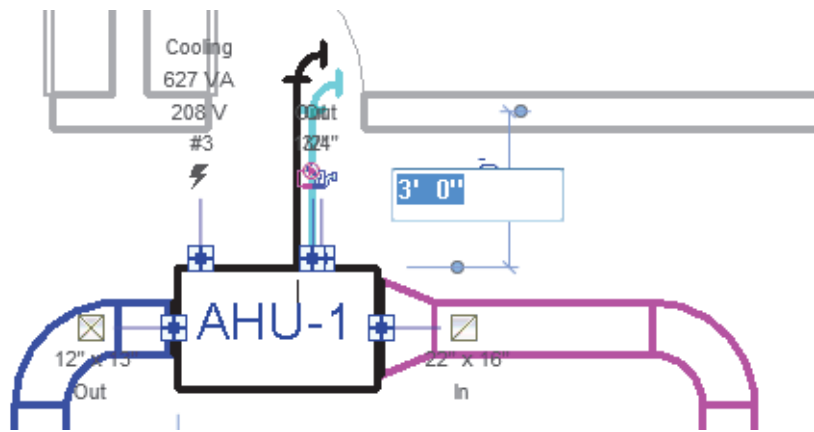
Figure 2–39

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 2–40.

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 2–40.
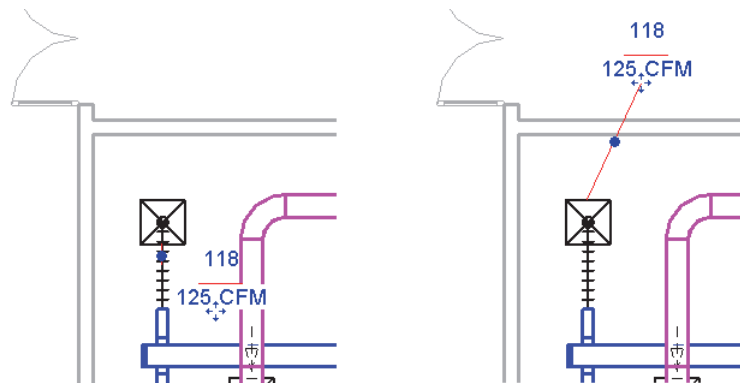
Figure 2–40

8. Zoom out to display the entire building. (Hint: Double-click the mouse wheel.)

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 2–41. Select and drag it to the endpoint of the duct.
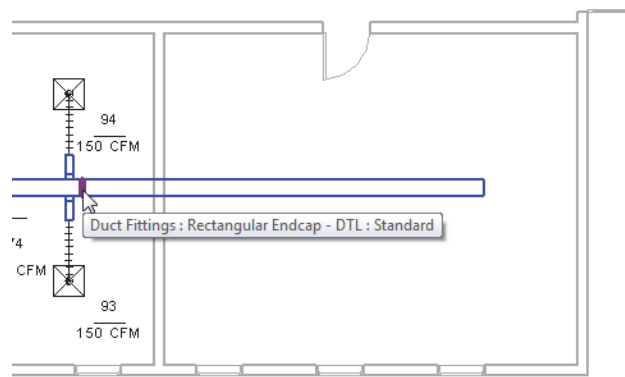
Figure 2–41

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.

17. Save the project.

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

Task 2 - Copy elements.

1. Select the two **Air Terminals**, associated ductwork, and tags, as shown in Figure 2–42.
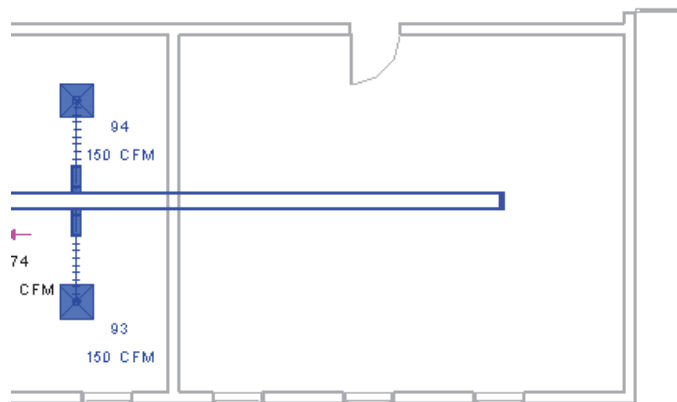
Figure 2–42

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
   (Copy).

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 2–43.

5. Copy the elements into the last room, as shown in Figure 2–43.
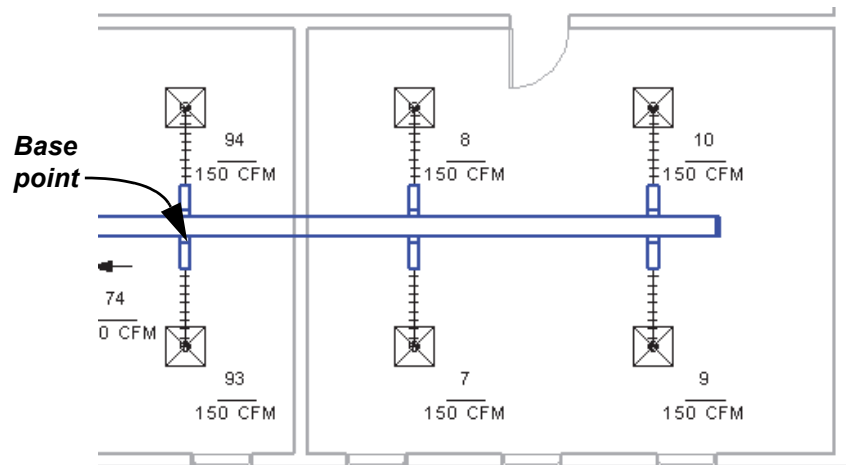
Figure 2–43

*To end a command, you can also right-click and select **Cancel** twice, or in the Select panel, click*

(Modify). Some commands require you to cancel twice, while others end after one cancel command.

6. Press <Esc> twice to end the command

7. Save the project.

2.4 Working with Additional Modify Tools

Learning Objective

- Use modify tools to align, split, trim, and offset walls and other elements.

As you work on a project, some additional tools on the *Modify* tab>Modify panel, as shown in Figure 2–44, can help you with placing, modifying, and constraining elements. **Align** can be used with a variety of elements, while **Split Element**, **Trim/Extend**, and **Offset** can only be used with linear elements.
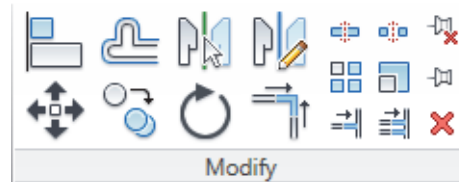
Figure 2–44

Aligning Elements

The **Align** command enables you to line up one element with another. Most elements in the Autodesk Revit software can be aligned. For example, you can line up an air terminal with ceiling grids, as shown in Figure 2–45.
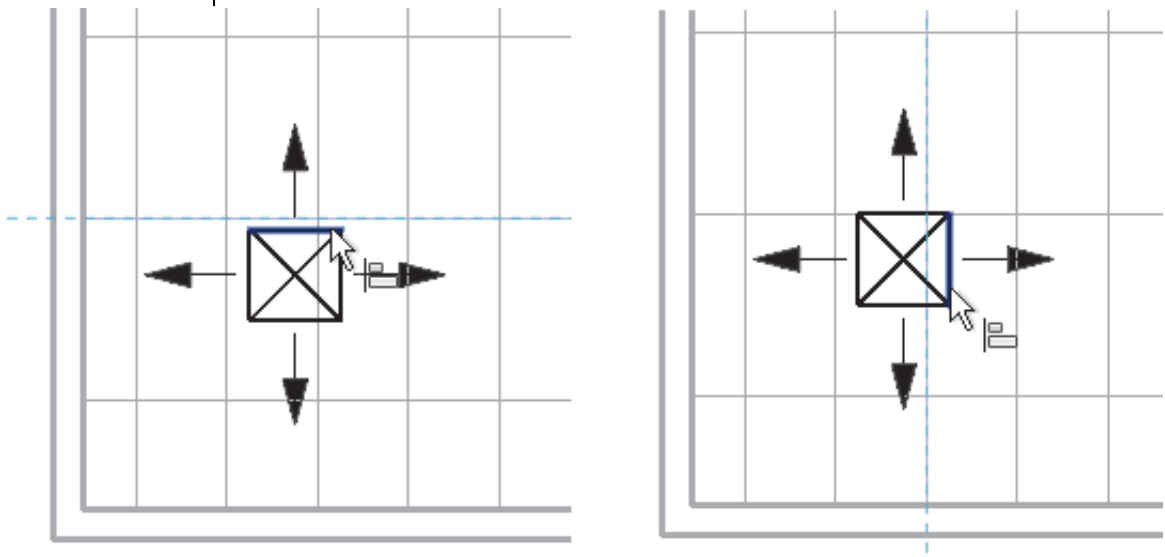
Figure 2–45

How To: Align Elements

1. In the *Modify* tab>Modify panel, click (Align) or use the shortcut by pressing <A> and then pressing <L>.
2. Select a line or point on the element that is going to remain stationary. For walls, press <Tab> to select the correct wall face.
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. Ensure 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 2–46.

Locking elements enlarges the size of the project file, so use this option carefully.
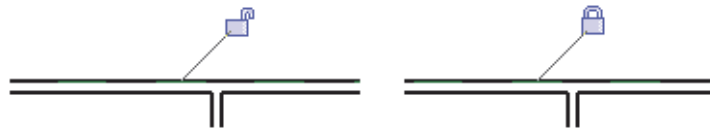
Figure 2–46

• Select the **Multiple Alignment** option to select multiple elements to align with the first element, as shown in Figure 2–47. You can also hold <Ctrl> to make multiple alignments.

• For walls, you can specify if you want the command to prefer **Wall centerlines**, **Wall faces**, **Center of core**, or **Faces of core**, as shown in Figure 2–47. The core refers to the structural members of a wall as opposed to facing materials, such as sheetrock.

Figure 2–47

Splitting Linear Elements

The **Split** Element command enables you to break a linear element at a specific point. You can use alignment lines, snaps, and temporary dimensions to help place the split point. After you have split the linear element, you can use other editing commands to modify the two parts, or change the type of one part, as shown with walls in Figure 2–48.
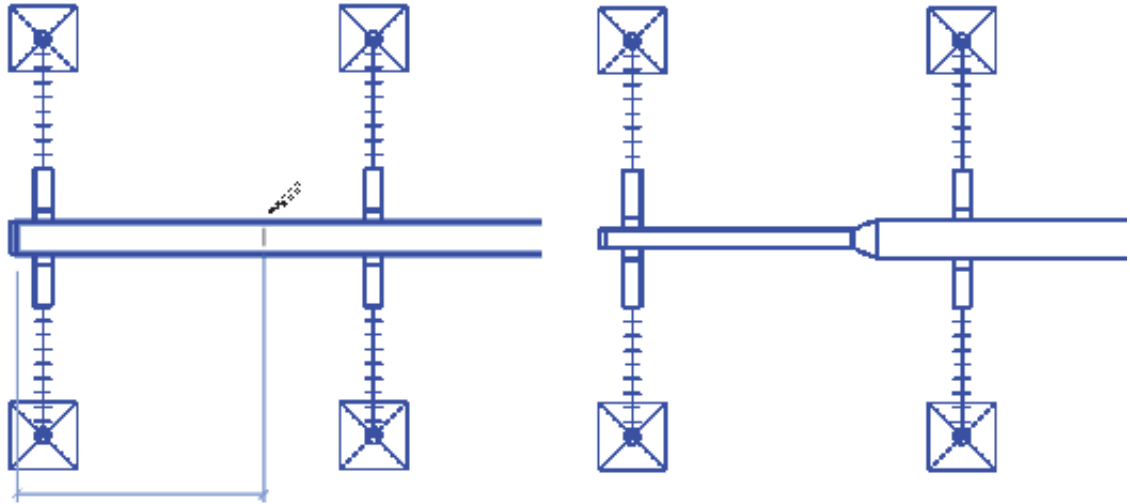
Figure 2–48

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

How To: Split Linear Elements

1. In the *Modify* tab>Modify panel, click ⊞ (Split Element) or use the shortcut by pressing <S> and pressing <L>.
2. In the Options Bar, select or clear the **Delete Inner Segment** option.
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 elements that were split, as required.

- The **Delete Inner Segment** option is used when you select two split points along a linear element. When the option is selected, the segment between the two split points is automatically removed.

- ▫▫ (Split with Gap) splits the linear element at the point you select (as shown in Figure 2–49), but also creates a *Joint Gap* specified in the Options Bar.

This command is typically used with structural precast slabs.

Figure 2–49

Trimming and Extending
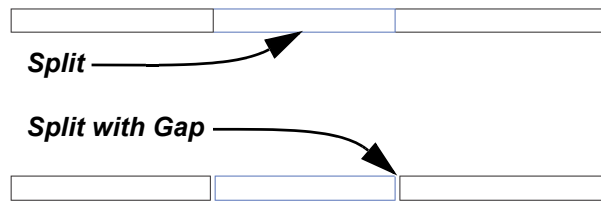
There are three trim/extend methods that you can use with linear elements: **Trim/Extend to Corner**, **Trim/Extend Single Element**, and **Trim/Extend Multiple Elements**.

- 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 use the shortcut by pressing <T> and pressing <R>.
2. Select the first linear element on the side you want to keep.
3. Select the second linear element on the side you want to keep, as shown in Figure 2–50.
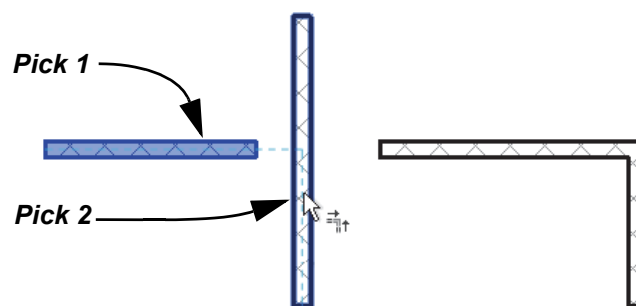
Figure 2–50

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 linear element to be trimmed or extended, as shown in Figure 2–51.
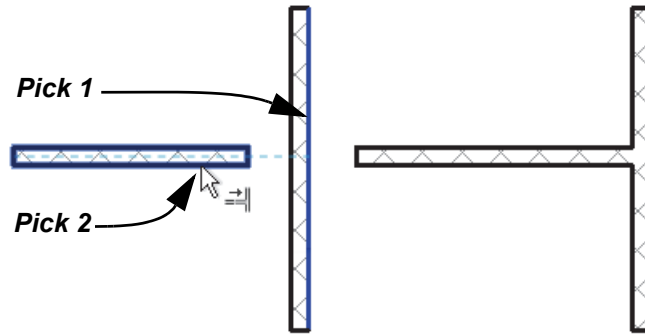
Figure 2–51

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 linear elements that you want to trim or extend by selecting one at a time, or by using a crossing window, as shown in Figure 2–52. For trimming, select the side you want to keep.

Enhanced in 2015
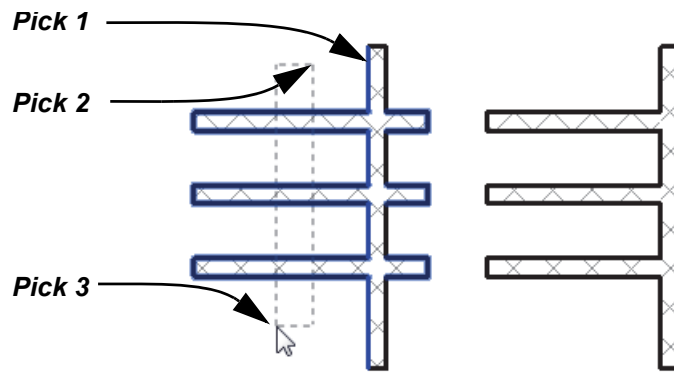
Figure 2–52

• You can click in an empty 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 linear elements at a specified distance, as shown in Figure 2–53. Walls, beams, braces, and lines are among the elements that can be offset.
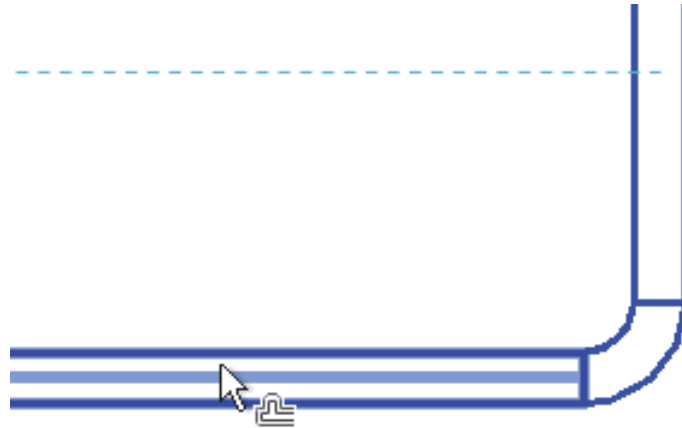
Figure 2–53

- If you offset a wall that has a door or window embedded in it, the elements are copied with the offset wall.

The offset distance can be set by typing the distance (**Numerical** method shown in Figure 2–54) or by selecting points on the screen (**Graphical** method).
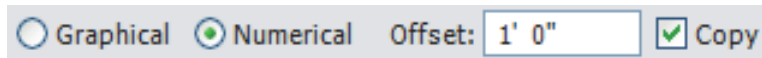
Figure 2–54

How To: Offset using the Numerical Method

1. In the *Modify* tab>Modify panel, click (Offset) or use the shortcut by pressing <O> and pressing <F>.
2. In the Options Bar, select the **Numerical** option.
3. In the Options Bar, type the desired 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 required.
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.

*The **Copy** option (which is on by default) makes a copy of the element being offset. If this option is not selected, the **Offset** command moves the element the set offset distance.*

- With the **Numerical** option, you can select multiple connected linear elements for offsetting. Hover the cursor over an element and press <Tab> until the other related elements are highlighted, as shown in Figure 2–55. Select the element to offset all of the elements at the same time.

Chain of walls or lines
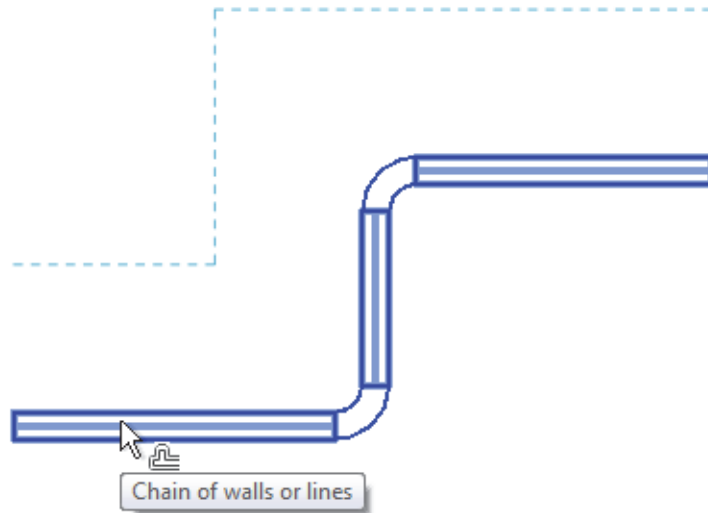
Figure 2–55

How To: Offset using the Graphical Method

1. Start the **Offset** command.
2. In the Options Bar, select the **Graphical** option.
3. Select the linear 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 in the temporary dimension for the second point.

- When working with MEP elements, the offset element might not automatically connect to other nearby elements, as shown on the left in Figure 2–56. To form the connection, drag the end of the new element away from the other element and then back again. It should connect as shown on the right in Figure 2–56.
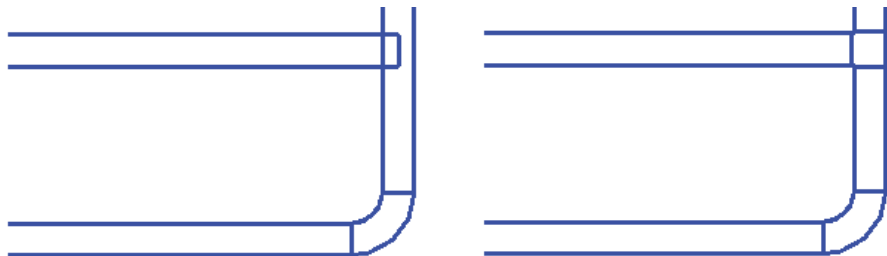
Figure 2–56

Hint: Hiding Elements in Views

As you are working, you can hide individual elements or entire categories of elements to clarify the display. They remain hidden until you display them again. Hidden elements do not print.

- Select the element(s) you want to hide, right-click and select **Hide in view>Elements** or **Hide in view>Category**.

- The **Elements** option hides only the elements that you selected, while the **Category** option hides all elements in that category. For example, you can select one grid line and use **Hide in view>Category** to hide all of the grid lines.

- To display the elements or category again, in the View Control Bar, click (Reveal Hidden Elements). The border and all hidden elements are displayed in magenta, while displayed elements in the view are grayed out, as shown in Figure 2–57. Select the hidden elements you want to restore, right-click, and select **Unhide in View>Elements** or **Unhide in View>Category** or in the *Modify | contextual* tab> Reveal Hidden Elements panel click (Unhide Element) or (Unhide Category).
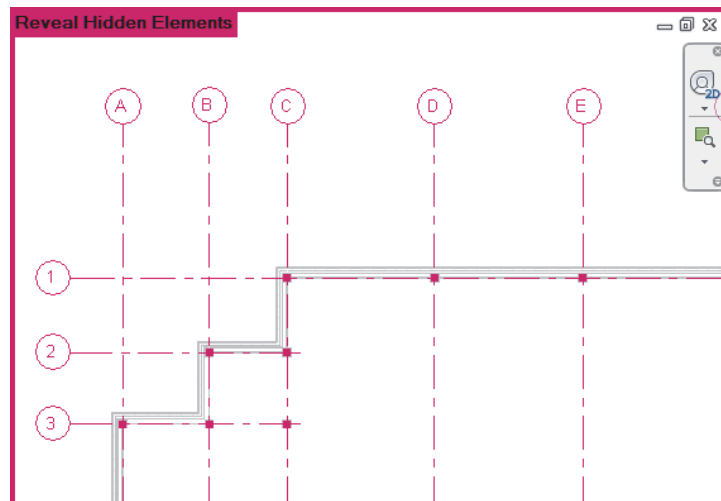
Figure 2–57

When you are finished, in the View Control Bar, click (Close Reveal Hidden Elements) or, in the *Modify | contextual* tab> Reveal Hidden Elements panel click (Toggle Reveal Hidden Elements Mode).

Practice 2b

Work with Additional Modify Tools

Learning Objective

- Align and rotate elements.

Estimated time for completion: 10 minutes

In this practice you will align air terminals to the ceiling grid, as shown in Figure 2–58.
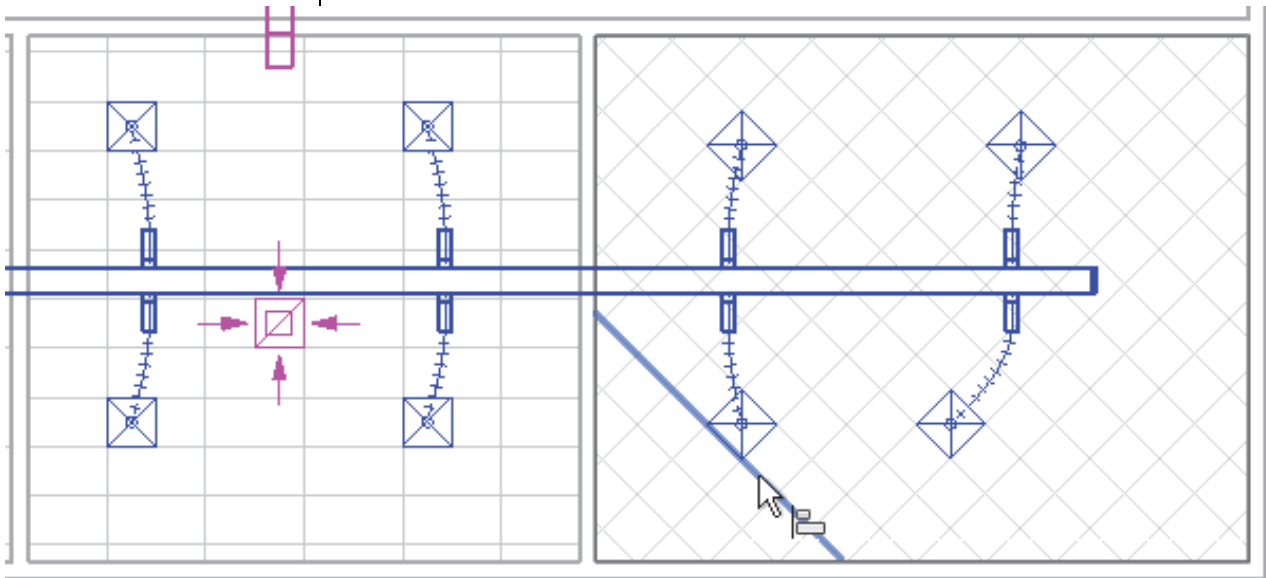
Figure 2–58

Task 1 - Align and rotate elements.

1. In the *C:\Autodesk Revit 2015 MEP Fundamentals Class Files\Basics* folder, open **Simple-Building-1.rvt**.

2. In the Project Browser, open the view Mechanical>HVAC> **Ceiling Plans: 1- Ceiling Mech**.

3. The air terminal locations do not match the ceiling grids as shown in Figure 2–59.
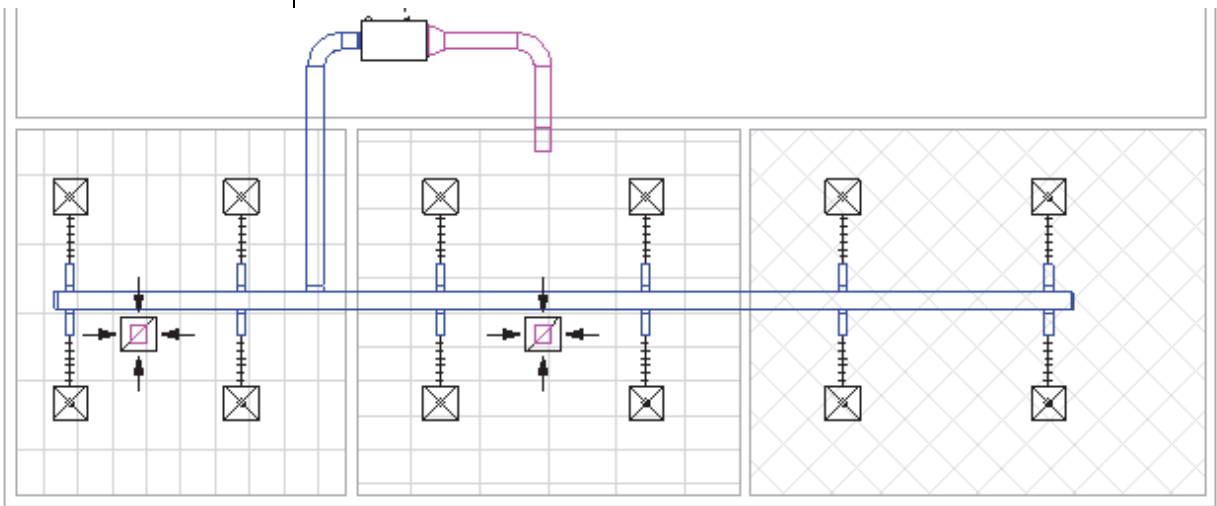
Figure 2–59

4. Zoom in on the room to the left.

5. In the *Modify* tab>Modify panel, click ⬚ (Align).

6. Select a vertical grid line and then the edge of the air terminal as shown in Figure 2–60. The air terminal now lines up with the vertical pattern of the ceiling grid.

Air Terminals : Supply Diffuser - Perforated - Round
Neck - Ceiling Mounted : 24x24x10 In Neck : Reference
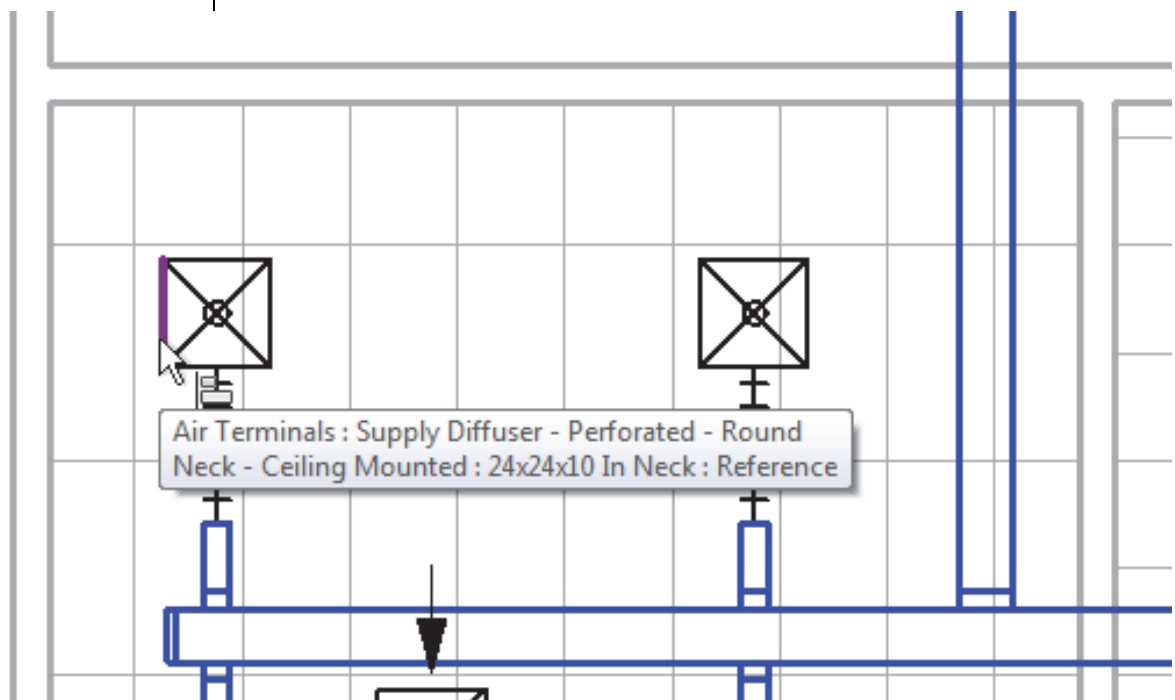
Figure 2–60

7. 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.

8. Repeat the process in both rooms so that the air terminals line up with the grids shown in Figure 2–61.
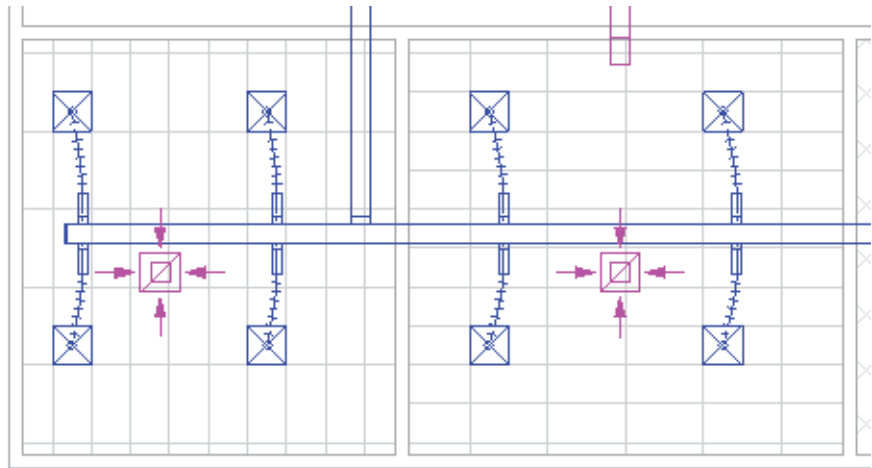
Figure 2–61

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

10. Select one of the air terminals in the room with the rotated ceiling grid.

11. In the *Modify | Air Terminals* tab>Modify panel, click

   ○ (Rotate).

12. In the Options Bar, set the *angle* to **45**.

13. 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.

14. The flex duct moves with the air terminal as shown Figure 2–62.
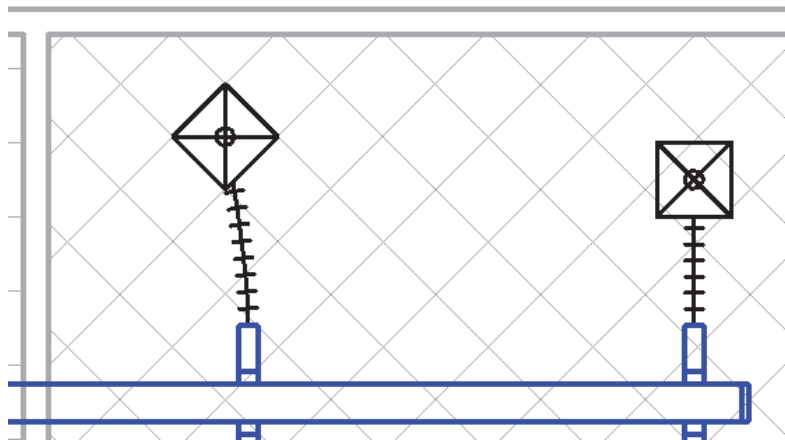
Figure 2–62

15. Without rotating the air terminal, click ⬜ (Align).

16. 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.

17. Finish aligning all of the air terminals in this room. The exact location is up to you.

18. Zoom out to display the entire building.

19. Switch to the Mechanical>HVAC>Floor Plans>**1 - Mech** view. The rotated terminals and flex duct display correctly in this view as well as shown in Figure 2–63.
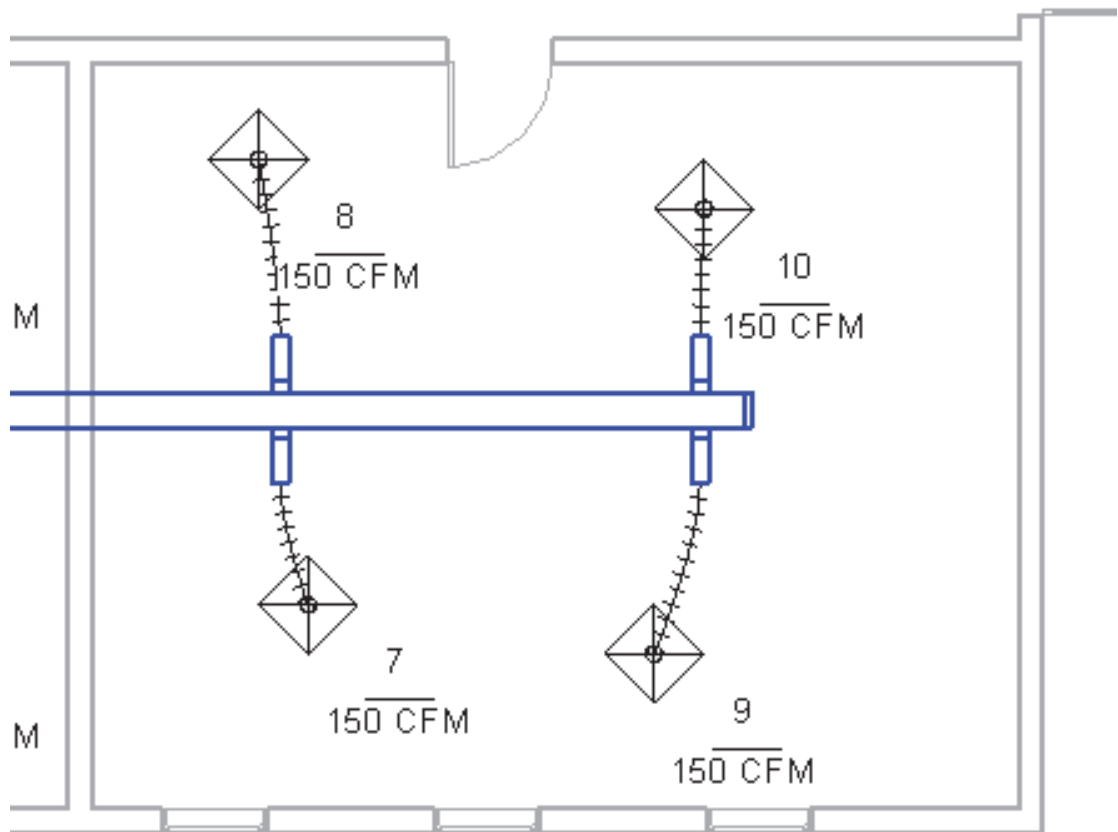
Figure 2–63

20. Zoom out to display the entire building.

21. Save and close the model.

Chapter Review Questions

1. What is the purpose of an alignment line?

   a. Displays when the new element you are placing or drawing is aligned with the grid system.

   b. Indicates that the new element you are placing or drawing is aligned with an existing object.

   c. Displays when the new element you are placing or drawing is aligned with a selected tracking point.

   d. Indicates that the new element is aligned with true north rather than project north.

2. When you are drawing (not editing) a linear element, how do you edit the temporary dimension, as that shown in Figure 2–64?
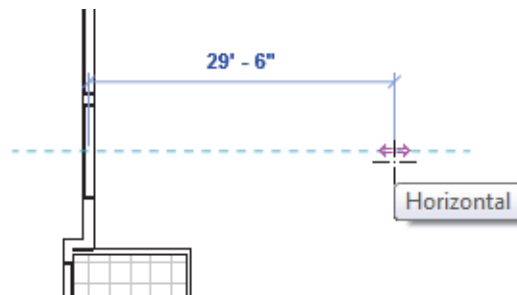
   Figure 2–64

   a. Select the temporary dimension and enter a new value.

   b. Type a new value and press <Enter>.

   c. Type a new value in the Distance/Length box in the Options Bar and press <Enter>.

3. How do you select all lighting fixture types, but no other elements in a view?

   a. In the Project Browser, select the *Lighting Fixture* category.

   b. Select one lighting fixture, right-click and select **Select All Instances>Visible in View**.

   c. Select all of the objects in the view and use (Filter) to clear the other categories.

   d. Select one lighting fixture, and click (Select Multiple) in the Ribbon.
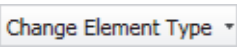
4. What are the two methods for starting ⊕ (Move) or

   ⊙ (Copy)?

   a. Start the command first and then select the objects, or select the objects and then start the command.

   b. Start the command from the *Modify* tab, or select the object and then select **Move** or **Copy** from the shortcut menu.

   c. Start the command from the *Modify* tab, or select the objects and select **Auto-Move**.

   d. Use the **Move/Copy** command or **Cut/Copy** and **Paste** using the Clipboard.

5. Where do you change the type for a selected element, as shown in Figure 2–65?

Figure 2–65

   a. In the *Modify | <contextual>* tab> Properties panel, click

      ⊞ (Type Properties) and select a new type in the dialog box.

   b. In the Options Bar, click `Change Element Type ▾`.

   c. Select the dynamic control next to the selected element and select a new type in the drop-down list.

   d. In Properties, select a new type in the Type Selector drop-down list.

6. Both ⟳ (Rotate) and ⊞ (Array) with ◰ (Radial) have a center of rotation that defaults to the center of the element or group of elements you have selected. How do you move the center of rotation to another point as shown in Figure 2–66? (Select all that apply.)
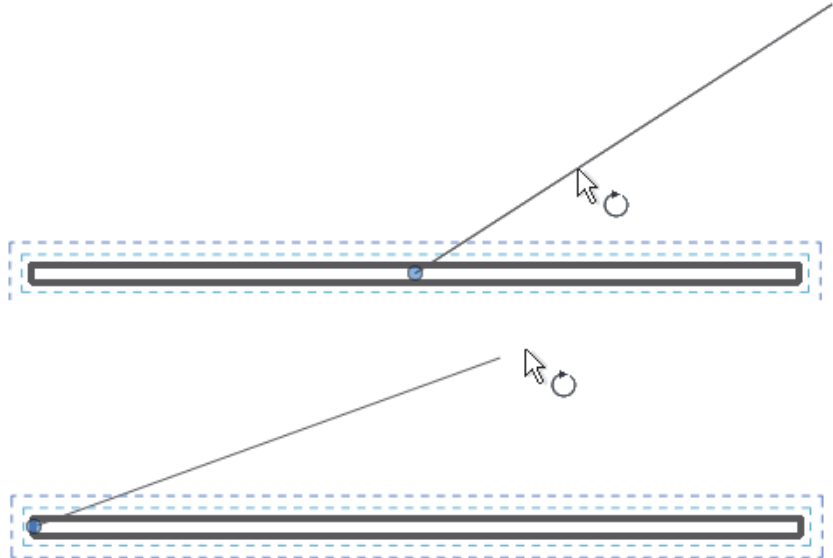
Figure 2–66

a. Select the center of rotation and drag it to a new location.

b. In the Options Bar, click Place and select the new point.

c. In the *Modify* tab> Placement panel, click ◉ (Center) and select the new point.

d. Right-click and select **Snap Overrides>Centers** and select the new point.

7. Which command would you use to break part of a duct so that you can change the duct type?

a. ▣ (Align)

b. ✛ (Split)

c. ⇥ (Trim)

d. ⌐ (Offset)

8. All of the **Trim** commands can also be used to extend elements.

    a. True

    b. False

9. In the **Mirror** command, how do you remove the original element(s) if you do not want to keep them?

    a. You must delete them separately from the command.

    b. Use the **Demolish** tool.

    c. Clear the **Copy** option in the Options Bar.

    d. Select the **Delete Original** option in the Options Bar.

10. Which command do you use if you want two pipes that are not touching to come together, as shown in Figure 2–67?

Before   *After*
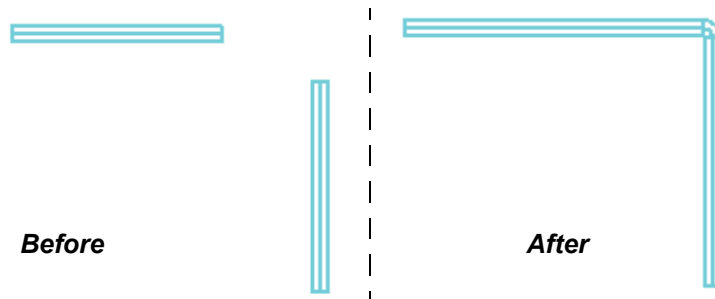
Figure 2–67

    a. (Edit Joins)

    b. (Trim/Extend to Corner)

    c. (Join Geometry)

    d. (Edit Profile)

Command Summary

Button	Command	Location
Draw Tools		
	Line	• **Ribbon:** *Modify | (various linear elements)* tab>Draw panel
	Rectangle	• **Ribbon:** *Modify | (various linear elements)* tab>Draw panel
	Inscribed Polygon	• **Ribbon:** *Modify | (various linear elements)* tab>Draw panel
	Circumscribed Polygon	• **Ribbon:** *Modify | (various linear elements)* tab>Draw panel
	Circle	• **Ribbon:** *Modify | (various linear elements)* tab>Draw panel
	Start-End-Radius Arc	• **Ribbon:** *Modify | (various linear elements)* tab>Draw panel
	Center-ends Arc	• **Ribbon:** *Modify | (various linear elements)* tab>Draw panel
	Tangent End Arc	• **Ribbon:** *Modify | (various linear elements)* tab>Draw panel
	Fillet Arc	• **Ribbon:** *Modify | (various linear elements)* tab>Draw panel
	Spline	• **Ribbon:** *Modify | Place Lines, Place Detail Lines, and various boundary sketches*>Draw panel
	Ellipse	• **Ribbon:** *Modify | Place Lines, Place Detail Lines, and various boundary sketches*>Draw panel
	Ellipse Arc	• **Ribbon:** *Modify | Place Lines, Place Detail Lines, and various boundary sketches*>Draw panel
	Pick Lines	• **Ribbon:** *Modify | (various linear elements)* tab>Draw panel
	Pick Faces	• **Ribbon:** *Modify | Place Wall*> Draw panel
	Pick Walls	• **Ribbon:** *Modify | (various boundary sketches)*>Draw panel
Modify Tools		
	Align	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** <A> and <L>
	Array	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** <A> and <R>
	Copy	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** <C> and <O>
	Copy to Clipboard	• **Ribbon:** *Modify* tab>Clipboard panel • **Shortcut:** <Ctrl>+<C>

✖	**Delete**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<D> and \<E>
▷◁	**Mirror - Draw Axis**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<D> and \<M>
▷◁	**Mirror - Pick Axis**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<M> and \<M>
✛	**Move**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<M> and \<V>
⬐	**Offset**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<O> and \<F>
📋	**Paste**	• **Ribbon:** *Modify* tab>Clipboard panel • **Shortcut:** \<Ctrl>+\<V>
⊸	**Pin**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<P> and \<N>
↻	**Rotate**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<R> and \<O>
⬚	**Scale**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<R> and \<E>
⬥	**Split Element**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<S> and \<L>
⬦	**Split with Gap**	• **Ribbon:** *Modify* tab>Modify panel
⇥	**Trim/Extend to Corner**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<T> and \<R>
⇥	**Trim/Extend Multiple Elements**	• **Ribbon:** *Modify* tab>Modify panel
⇥	**Trim/Extend Single Element**	• **Ribbon:** *Modify* tab>Modify panel
⊷	**Unpin**	• **Ribbon:** *Modify* tab>Modify panel • **Shortcut:** \<U> and \<P>

Select Tools

✛	**Drag elements on selection**	• **Ribbon:** All tabs>Expanded Select panel • **Status Bar**
▼	**Filter**	• **Ribbon:** *Modify* | *Multi-Select* tab> Filter panel>Filter • **Status Bar**
▯	**Select Elements By Face**	• **Ribbon:** All tabs>Expanded Select panel • **Status Bar**
⊗	**Select Links**	• **Ribbon:** All tabs>Expanded Select panel • **Status Bar**

	Select Pinned Elements	• **Ribbon:** All tabs>Expanded Select panel • **Status Bar**
	Select Underlay Elements	• **Ribbon:** All tabs>Expanded Select panel • **Status Bar**
	Selection Sets: Add to Selection	• **Ribbon:** *Edit Selection Set t*ab>Edit Selection panel
	Selection Sets: Load	• **Ribbon:** *Modify	Multi-Select* tab> Selection panel or *Manage* tab> Selection panel
	Selection Sets: Edit	• **Ribbon:** *Modify	Multi-Select* tab> Selection panel or *Manage* tab> Selection panel
	Selection Sets: Remove from Selection	• **Ribbon:** *Edit Selection Set t*ab>Edit Selection panel
	Selection Sets: Save	• **Ribbon:** *Modify	Multi-Select* tab> Selection panel or *Manage* tab> Selection panel