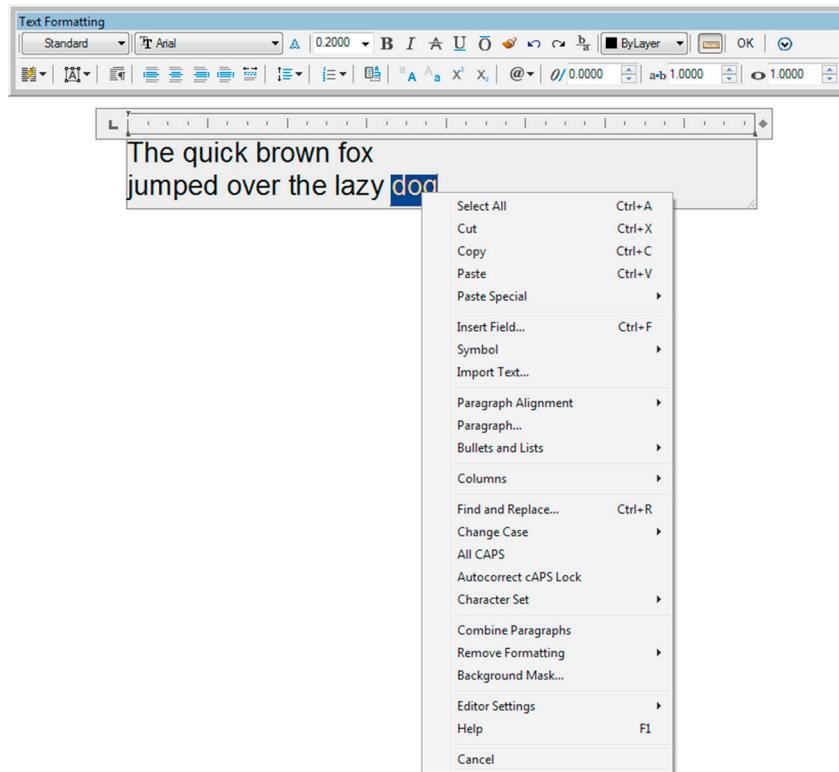


Chapter 4

Text, Mtext, Editing, and Style



Learning Objectives

Text allows your design to communicate beyond what just a line drawing can. In this chapter, we introduce text, mtext, style, and editing and discuss the following topics:

- Text
- Properties and applications of text
- Editing all types of text
- Mtext
- Properties and applications of mtext
- Mtext formatting
- Mtext symbols
- Style
- Spell check
- Nearest OSNAP

At the end of this chapter you will be able to annotate your floor plan as well as add additional features, such as furniture and stairs.

Estimated time for completion of chapter: 2 hours (lesson and project).

4.1 INTRODUCTION TO TEXT AND MTEXT

Adding text to your AutoCAD drawing is the next logical step once you learn how to create and edit basic designs. After all, the purpose of most drawings is to describe how to build something or show what a design looks like. Text goes a long way in assisting in this and, along with dimensions, is usually the next item to be added to a new design.

Text in AutoCAD comes in two versions: regular text (single-line text) and mtext (multiline text). The two share some overlaps and similarities, and we look at how to create and edit both types. We then look at how to choose and set fonts and conclude the chapter by adding text to the previously designed floor plan.

4.2 TEXT

This is your basic text creation command, and it creates a field anywhere you click on the screen, into which you can type whatever text you need. It does have a carriage return that goes to another line upon pressing Enter, so you need to press Enter twice to get out of the field. While an unlimited number of lines of text can be typed, typically regular text is used for only a single line, as multiple lines of text are not joined together in paragraph form and cannot be formatted to any significant extent. Let us summarize:

- Text is used mostly when only one or a few lines are needed.
- The text cannot be formatted nor any effects added, beyond underlining and a few other minor effects.
- Multiple lines of text are not in paragraph form, rather they remain individual lines.

Open a new file, bring up the Text toolbar (Fig. 4.1), and let us create a few sample lines.



FIGURE 4.1 Text toolbar.

Keyboard: Type in text and press Enter
Cascading menus: Draw → Text → Single Line Text
Toolbar icon: Text toolbar
Ribbon: Home tab → Single Line Text →

Step 1. Begin the text command via any of the previous methods.

- AutoCAD says:
Current text style: "Standard" Text height: 0.2000
Annotative: No Justify: Left
Specify start point of text or [Justify/Style]:

Step 2. Left-click anywhere on the screen.

- AutoCAD says: Specify height <0.2000>:

Step 3. Enter a new height if desired, say 1.0, and press Enter.

- AutoCAD says: Specify rotation angle of text <0>:

You can rotate the text, but there really is no need to, so just type in 0 for now, and press Enter.

Step 4. A text field opens up with a blinking cursor. Go ahead and type something, pressing Enter once to go to the next line or twice to finish. Fig. 4.2 shows what the basic text looks like hanging out in the middle of a blank screen (just before you press Enter one last time). If the text is too large to see completely or too small to be even readable, just zoom in or out to fit it nicely on the screen. You can zoom and pan even while you are typing.

Sample **text** on three
lines with the word
"text" highlighted

FIGURE 4.2 Basic text.

The text is still rather simple; we have not yet addressed font, sizing, or any effects. Notice that, once you complete the command, the text is on three separate lines. You can edit, move, copy, or erase any of the lines without affecting the others. So how would you edit this text?

Editing Text

Editing, or changing, what the text says is very simple and follows the same procedure for both text and mtext, so we go over it right away for both cases. The easiest way to edit the text is to *double-click* on it, which opens both the text and mtext fields. This is such an overriding and best method, preferred by most students, that in this particular case you do not see an official command matrix detailing the other methods, just a brief mention of them.

A toolbar icon Edit... does exist on the Text toolbar for editing purposes. Finally, it is worth noting that an older typed-in command also exists, called `ddedit`. If you type that in, press Enter, and click on the text, you can edit it. This may come in handy with older versions of AutoCAD in cases of editing dimension values. A few releases ago you could not edit them via a double-click. This was instead used for properties of the dimensions and not the text values, so `ddedit` came in handy.

Whichever method you use, when you are done editing, just press Enter again. Do not press Esc, as that cancels whatever editing you just did.

Here is a trick with regular text that you will not hear about much anymore. If you want to underline it, type in `%u` just before the text string you want underlined. This old code dates back to DOS days, and it will automatically and immediately add an underline to your basic text. You can also experiment with `%c`, `%p`, and `%d`. See what those three do. None of this is needed with mtext, as discussed next.

4.3 MTEXT

Mtext is short for *multiline* text. In other words, this is the command you use when you anticipate typing in a paragraph as opposed to one or two lines and, more important, when you require some advanced formatting and effects. As of AutoCAD 2010, it even has a spell check built in. Many designers use mtext for all their text needs, just in case formatting needs to be applied to even just one word. The only downsides are that it takes a few seconds longer to set up and the features make it a more complex command. The idea here is to define an area where your text will go. Once you do that, the new paragraph fits into that area. Let us summarize the mtext features and try the command:

- Used primarily for writing paragraphs.
- Has extensive formatting and editing features.
- Has an extensive symbol library and spell check.
- Can accept extensive text importing.

A few releases ago the mtext command was enhanced even further and has inherited more features from a dedicated word processing program, like MS Word, including auto bulleting, better auto stacking of fractions, and other useful tricks.

Keyboard: Type in mtext and press Enter
Cascading menus: Draw→Text→Multiline Text...
Toolbar icon: Text toolbar 
Ribbon: Home tab→Multiline Text→ 

Step 1. Begin the mtext command via any of the previous methods.

- AutoCAD says: Current text style: "Standard" Text height: 0.2000 Annotative: No
Specify first corner

Step 2. Left-click anywhere on the screen, noticing the abc next to the crosshairs. A rectangle with an arrow appears, as shown in Fig. 4.3. Continue to move your mouse down and across to the right, making the rectangle bigger. This is your text field; make it as large or small as you need it to be to hold all the text. As you do this,

- AutoCAD says: Specify opposite corner or [Height/Justify/
Line spacing/Rotation/Style/Width/Columns]:

Step 3. Click again when you have defined the field.

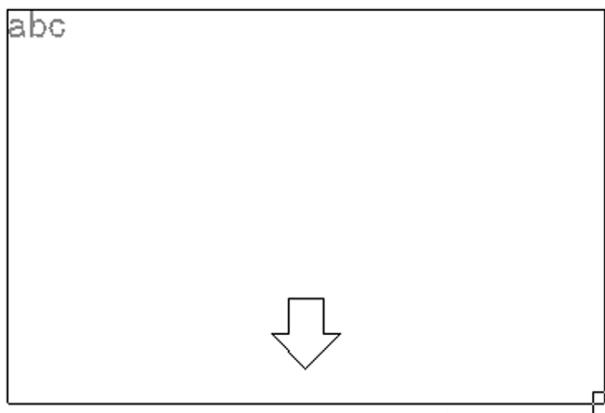


FIGURE 4.3 Mtext field.

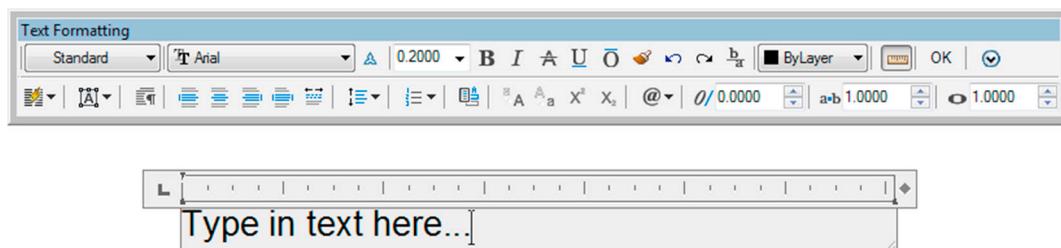


FIGURE 4.4 Text Formatting (no Ribbon).

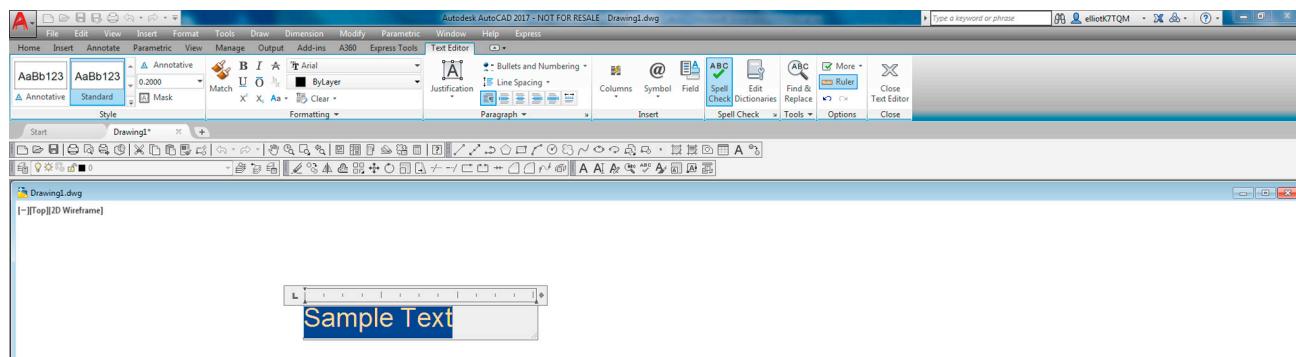


FIGURE 4.5 Text formatting via the Ribbon's Text Editor.

Here, AutoCAD throws you a bit of a twist. If you are *not* using the Ribbon, you will see the text field with a toolset just above it (but not attached to it), as seen in Fig. 4.4, where you can type in your text, press Enter to go to the next line. To finish up, press OK in the upper right of the toolset or just click anywhere outside the field. We go over some of the tools in a moment, but what if you have the Ribbon up?

If you are using the Ribbon, the formatting duties are transferred completely to the Text Editor tab, and all you see below it is the text field, no toolset, as seen in Fig. 4.5 (although you can bring it back, via the Text Editor's Options category). The functionality is essentially the same, only the presentation differs. We cover mtext's extensive formatting tools in the next section.

Formatting Mtext

First of all, notice something: If you click on mtext, it remains a paragraph, a big difference from a few lines of regular text. To edit mtext, as already mentioned, you do the same thing as for regular text, that is, double-click on it, use the icon, or type in `ddedit`.

Now, on to formatting. Mtext has a lot of additional features, and once you input the text, you can modify it significantly. Some intent was made here to mimic MS Word's text editing abilities, and although AutoCAD cannot really come close to a dedicated word-processing program, the available tools are still quite extensive. We take a look at the non-Ribbon toolset first and cover the tools again, this time using the Ribbon's Text Editor (in much less detail, as the tools essentially are the same). Looking at the Text Formatting toolbar from left to right, as shown in Fig. 4.6, we have the following groups:



FIGURE 4.6 Text Formatting groups.

- Group 1.** This is where you set *name, font, and size*, although this is generally done using *style*, to be discussed later. You can also make the text annotative, to be covered in Level 2.
- Group 2.** These are the standard *Bold, Italic, Strikeout, Underline, Overline*, and *Undo/Redo* buttons. This is also where you set *color*, although that is usually done by layer. The Ruler icon turns off the ruler grid; the OK button closes the field; and the down arrow brings up additional options, to be covered soon.
- Group 3.** Here you find a tool for making *columns* and some of the associated settings, *paragraph justification* tools, as well as tools to change *line spacing, numbering, and fields*.
- Group 4.** Here you find tools to change from *upper to lower case* (and vice versa), *superscript* and *subscript* (introduced in AutoCAD 2015), *oblique angle, tracking*, and *width factor tools*. The @ character is used to bring up additional symbols (to be discussed shortly).

You may be familiar with most of these if you ever typed a document in MS Word. Just as in Word, you need to highlight the text to which you want the changes to apply. Experiment with the buttons to see what they all do, and try to duplicate what you see in Fig. 4.7. Notice also how Arial is the default font in AutoCAD.

There is more to the mtext command than just the main toolbar detailed in Fig. 4.6, although the toolbar contains most of the often used commands. Two additional menus are accessed by either right-clicking while inside the mtext box or pressing the @ symbol icon in Group 4. We cover this @ menu first; it introduces a vast array of available symbols.

Fig. 4.8 shows what this menu looks like. Examine it closely; it has interesting and useful options. In architecture and engineering, one typically encounters many industry- or trade-specific symbols. AutoCAD provides a significant database of them for your use. Browse through and try a few by clicking and making them appear in your text field.

In case none of those symbols is what you are looking for, there are more. At the bottom of the menu, click on Other.... A *character map* appears, as shown in Fig. 4.9.

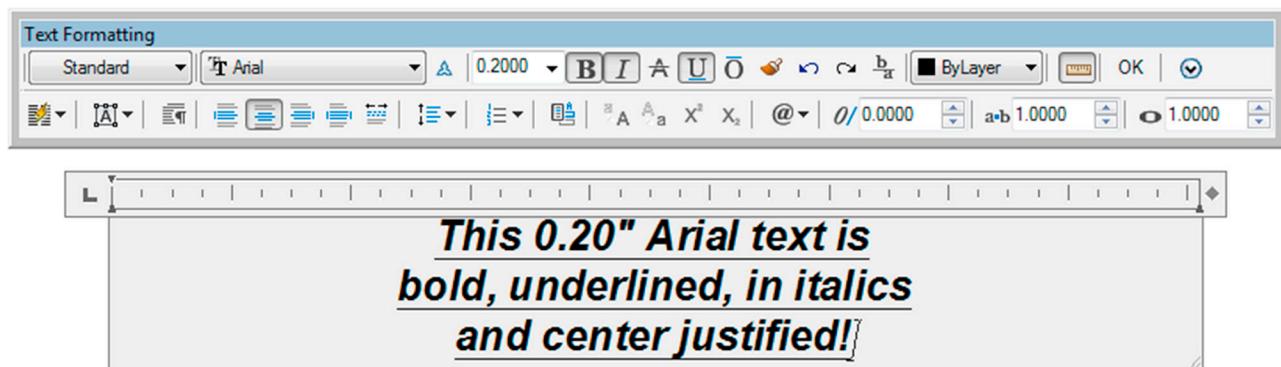


FIGURE 4.7 Mtext sample.

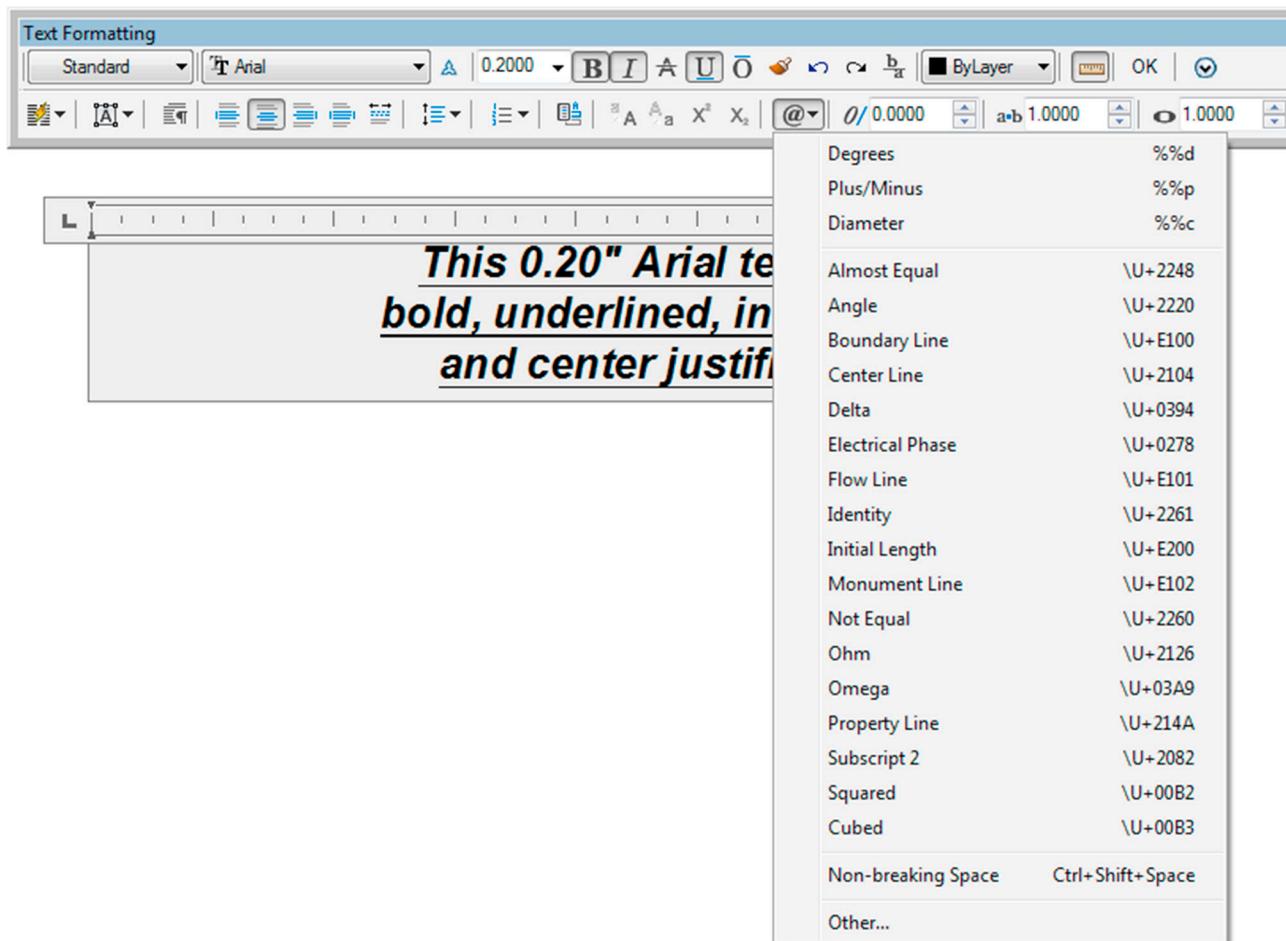


FIGURE 4.8 Mtext symbols.

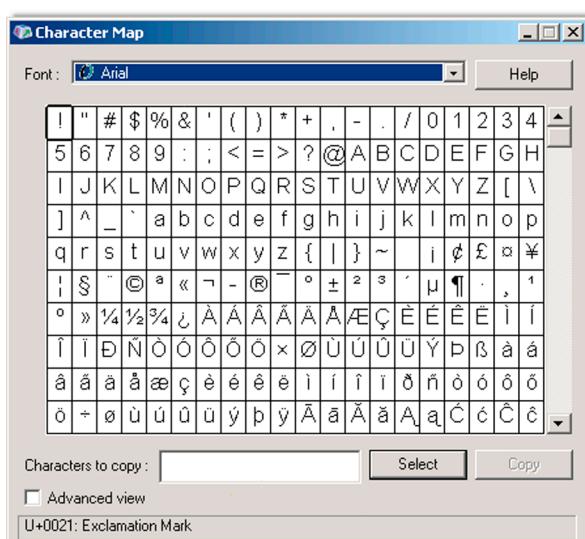


FIGURE 4.9 Character map.

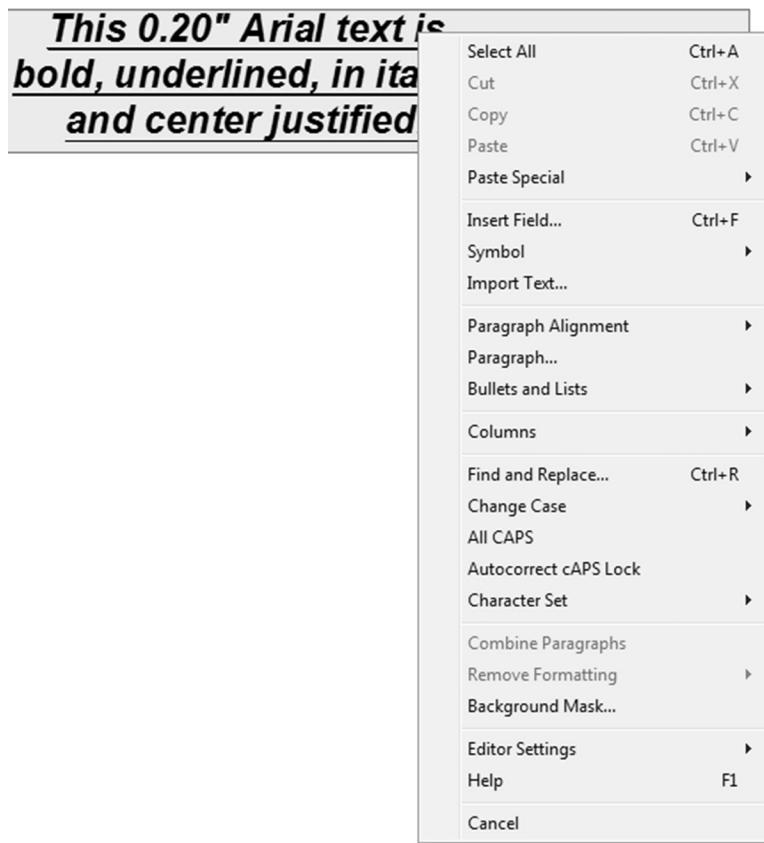


FIGURE 4.10 Mtext right-click menu.

It is similar to the character map used by MS Word and functions the same way. This is basically a database of available letters (in English and several other languages) as well as symbols and characters. The choices change somewhat from font to font. To use this tool, simply click on a symbol you want (it will temporarily increase in size so you can examine it closer), and press the Select button. Then, minimize the Character Map box (or close it if you do not need it anymore), and right-click to paste the symbol into your mtext field.

Character maps are generally for symbols not found in the main list of the drop-down table (Fig. 4.8). If you see the symbol you want there first, use it. To introduce the final menu, right-click in the mtext field and you see the menu in Fig. 4.10.

Some of these menu choices duplicate what is already seen in the main mtext menu bar, and you can access all the symbols through here as well. Aside from some Cut and Paste choices, this menu just presents an alternate way of making option selections. As a final note, be aware that pressing Esc will exit you out of the Mtext window, and you need to save if you want to keep what you did. AutoCAD, of course, prompts you to do this.

Ribbon Text Editing

As mentioned before, Ribbon users are presented with essentially the same formatting tools but in a rearranged manner. Fig. 4.11 is the Ribbon's Text Editor, again with the various drop-down menus “thumbtacked” (by clicking on the tack symbol) on the drawing canvas.

The Ribbon's Text Editor categories are detailed next.

- *Style:* Annotation and size can be changed here.
- *Formatting:* Bold, italics, underline, overline, font, color, background mask (color), oblique, spacing, and width factor can be changed here.
- *Paragraph:* Justification, line spacing, bullets, and numbering can be changed here.

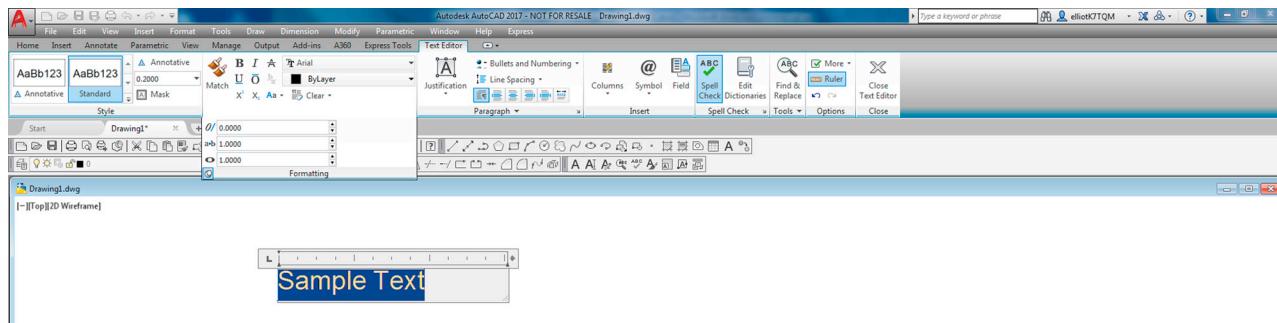


FIGURE 4.11 Ribbon Text Editor, thumbtacked.

- **Insert:** Columns, symbols, and fields can be changed here.
- **Spell Check:** You can run the spell check and set dictionaries and settings here.
- **Tools:** Find and Replace, Import Text, and AutoCAPS are found here.
- **Options:** Here, you can make the Editor toolbar come back (AutoCAD never really gets rid of anything), add the ruler grid, and use Undo/Redo. You can also change the background of the Editor to opaque.
- **Close:** Closes the Editor, similar to the OK button.

Finally, before we move on to discussing style, a new feature needs to be mentioned that was just added in the previous release. You can now put your mtext into a box frame, which was one of the top requests from past AutoCAD users. To do this, call up the Properties palette (first seen in Fig. 3.10). Then click your mtext one time to select it, which will make the Properties palette display four categories. Scroll to the bottom of the Text category and find Text frame on the left. Across from it will be a Yes/No drop-down menu. Select Yes and you are done. Your mtext will have an automatic frame around it, a very useful feature.

4.4 STYLE

The idea behind the style command is very straightforward. Pick a font, give it a name and a size, and use it throughout your drawing. Drawings typically use only one font throughout the main design and perhaps another, fancier one in the title block area for logos and other designations, so it makes sense to set one style and stick to it. You already may have changed the font while learning the mtext command, but it was only for *that* instance. You need to make sure that font is set globally, meaning for the entire drawing.

Prior to AutoCAD 2009, changing the font right away was a necessity, as the default font (Simplex, 0.2) was unattractive and rarely used in practice. With AutoCAD 2017 and the previous eight releases, the default font is Arial (though the default size is still 0.2), so you may want to stay with this popular font and not change it. If you need to, however, here is the procedure:

Keyboard: Type in style and press Enter
Cascading menus: Format→Text Style...
Toolbar icon: Text toolbar 
Ribbon: Annotate tab→Text→arrow

Step 1. Begin the style command via any of the preceding methods. Whichever method you use, the Text Style dialog box of Fig. 4.12 appears. Taking a look at this dialog box, let us say Arial is not what we want here; we would like to set a RomanS font that is 6" high instead.

Step 2. Press the New... button and type in the name and size of the font: RomanS_6.

Step 3. Pick romans.shx from the Font Name: drop-down menu.

Step 4. Highlight the 0.0000 in the Height field and type in 6 (no need for the inch symbol). Press Apply and Close.

All text that you type from now on will be RomanS, 6" font. To create another font just repeat these steps. To size your font up and down, you can also create new font styles, but in this case, it may be more practical to just use the scale

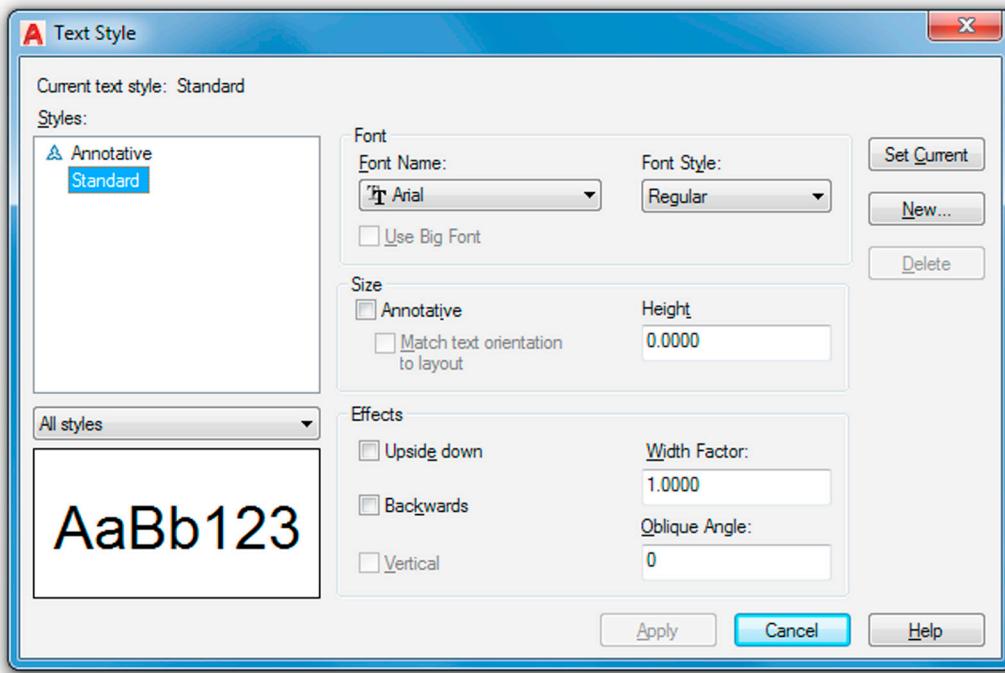


FIGURE 4.12 Text Style dialog box.

command. The additional options in the style dialog box are not used that often, but review them just in case. A list follows. All effects can be previewed in real time in the Preview box in the lower right.

- *Upside down*: Flips the text upside down.
- *Backwards*: Flips the text backwards.
- *Vertical*: Stacks the text vertically.
- *Width Factor*: Widens the text if (>1), narrows text if (<1).
- *Oblique Angle*: Leans the text to the right if positive (+) and to the left if negative (-).
- *Annotative*: An advanced topic for Level 2.

4.5 SPELL CHECK

This section briefly describes AutoCAD's in-place, stand-alone spell checking abilities. Yes, AutoCAD does have spell check, and why not? For the price the software costs, it had better. It is very easy to use, so let us try it out on the misspelled phrase created via regular Text, as shown in Fig. 4.13.

The first thing you notice is that the misspelled word (jumped) is underlined by a dotted line. If you right-click on the word while in editing mode, you get the in-place spell check with suggestions (Fig. 4.14). Simply select the word you want to correct, and AutoCAD obliges.

<i>Keyboard:</i> Type in spell and press Enter
<i>Cascading menus:</i> Tools→Spelling
<i>Toolbar icon:</i> Text toolbar
<i>Ribbon:</i> Annotate tab→Check Spelling

Now, what if you already have a significant amount of text (perhaps from an import) and need to spell check it? Then, you can use the stand-alone utility, as described next.

Using any of these methods, the Check Spelling dialog box appears, as seen in Fig. 4.15.

The quick brown fox jmped over the lazy dog

FIGURE 4.13 Misspelled word.

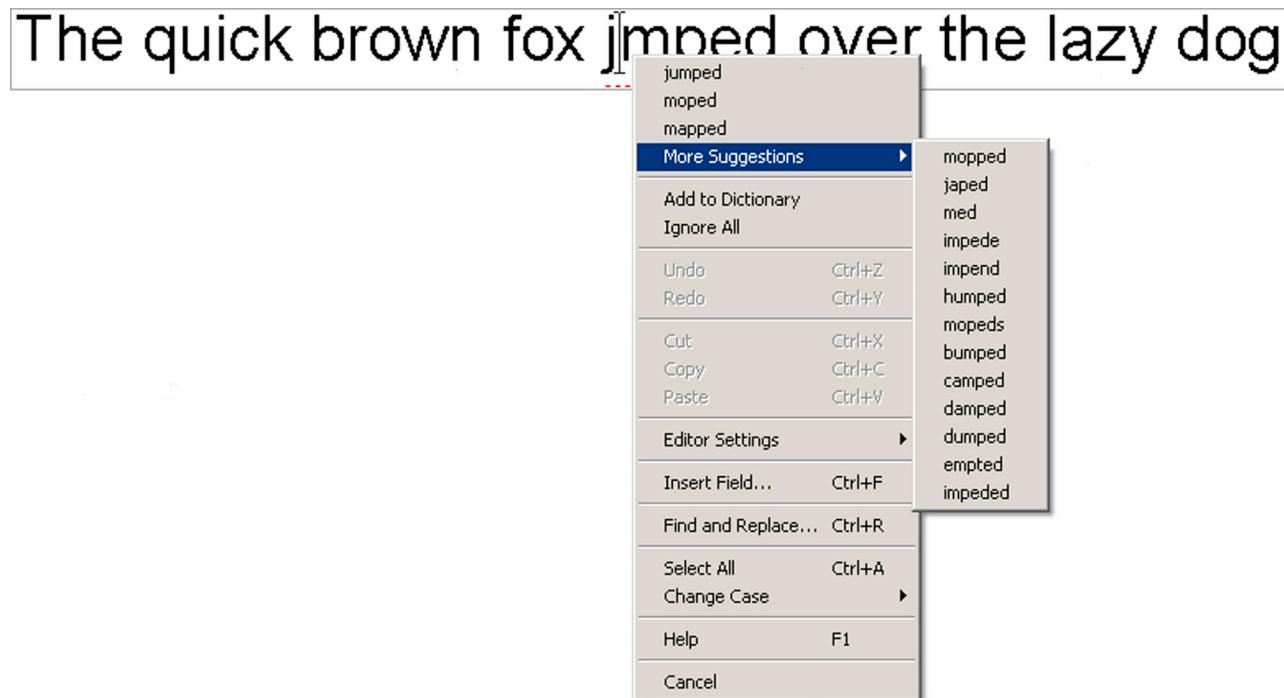


FIGURE 4.14 In-place spell check.

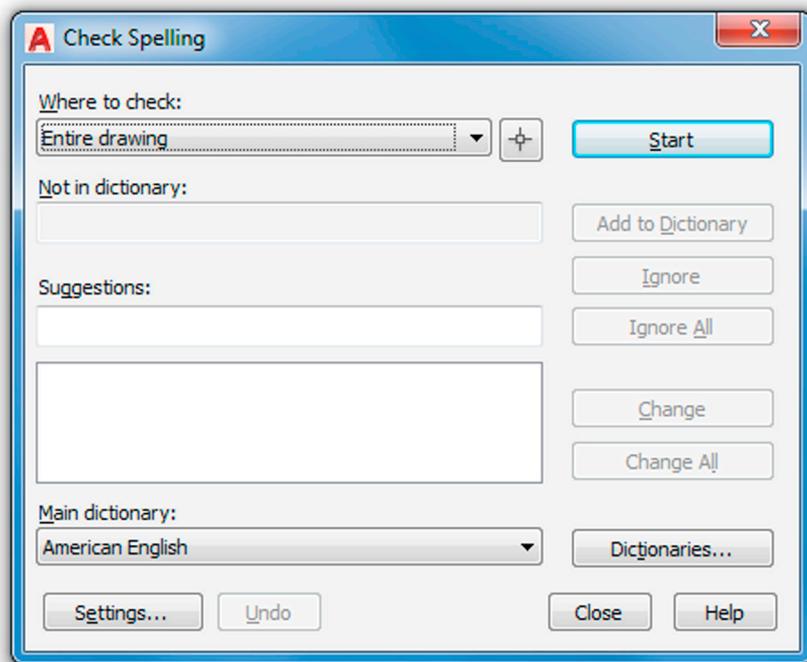


FIGURE 4.15 Check Spelling.

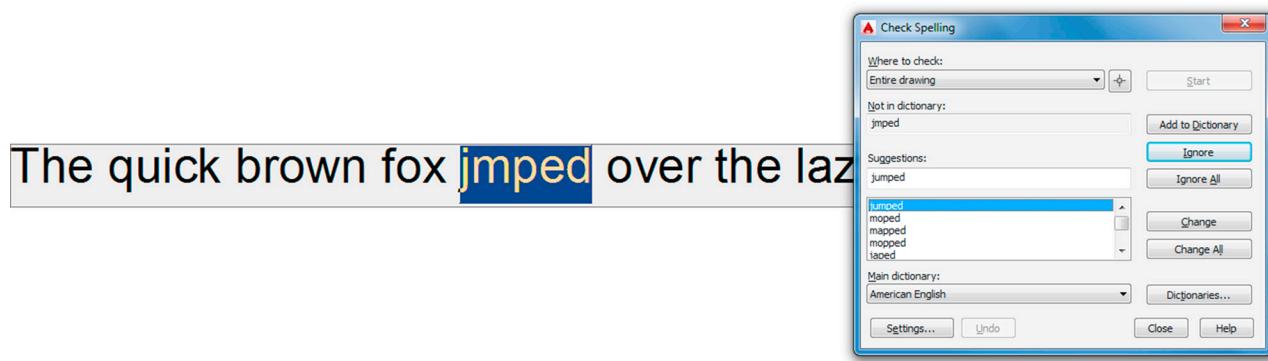


FIGURE 4.16 Check Spelling initiated.

Using the drop-down menu of the Check Spelling dialog box, you can select specific paragraphs or lines of text or just press Start to initiate spell checker for all the text in the drawing. In any case, Check Spelling appears, as seen in Fig. 4.16.

Much as with the MS Word spell checker, you can run through some options, such as ignoring the word, changing it, or adding it to the dictionary so it is not flagged again (good for names and acronyms). Even a variety of languages are available. When done, spell check tells you, and you can close it.

4.6 IN-CLASS DRAWING PROJECT: ADDING TEXT AND FURNITURE TO FLOOR PLAN LAYOUT

Let us now apply what you learned to our floor plan. Shown in Fig. 4.17 is the same floor plan you worked on in Chapter 3, Layers, Colors, Linetypes, and Properties, with the addition of text in the rooms, closet shelving (the dashed lines), new furniture, and appliances.

Here are two general tips before you get started:

- Make your own layers and colors for each set of data, being sure the names are logical. For example, call kitchen appliances something along the lines of A-Appliances and so on.
- None of the furniture is drawn to scale, so approximate all the sizes. However, draft everything carefully, connecting all lines with OSNAP and using Ortho for straight lines. Most shapes are based on rectangles, with some fillets, arcs, and circles. All were done in the simplest manner possible, and you should be able to create them with basic techniques learned in previous chapters. Some hints are listed next.

Some additional specific drawing tips:

- All kitchen furniture on the left side of the kitchen is formed using basic rectangles, drawn to no particular size. At the top left is a refrigerator with a microwave on top. Next to it is a countertop and a sink. Next to that is the range top with four burners. Fig. 4.18 is a suggested procedure for creating the range top. In Chapter 6, Dimensions, we cover some new ways to create center marks, just introduced in AutoCAD 2017, but here is the classic approach.
- To create the kitchen table you could use a rectangle with a small straight guideline sticking out from the midpoint of the left side. That could be the anchor for the second point of the arc. Then, a mirror followed by an “explode” and “erase” finishes it off, as seen in Fig. 4.19.
- Draw rectangles around each of the room text fields; we need this later for hatch.
- The bathtub and toilet are done using the basic ellipse command, introduced in Chapter 2, AutoCAD Fundamentals—Part II.
- The corner desk in the bedroom, the pulled-back bed cover, and all closet shelves are constructed using lines and a new OSNAP point, the second (of three) that was not initially introduced in Chapter 1, AutoCAD Fundamentals—Part I; a description follows.

NEArest OSNAP

You may occasionally need a new OSNAP point called NEArest. It begins or ends shapes (usually new lines) along random spots of other geometry (usually other lines). In a sense, NEArest is the exact opposite of the precise end, mid, and other points you learned. NEArest simply shadows a line or any object and allows you to begin a new object anywhere along that

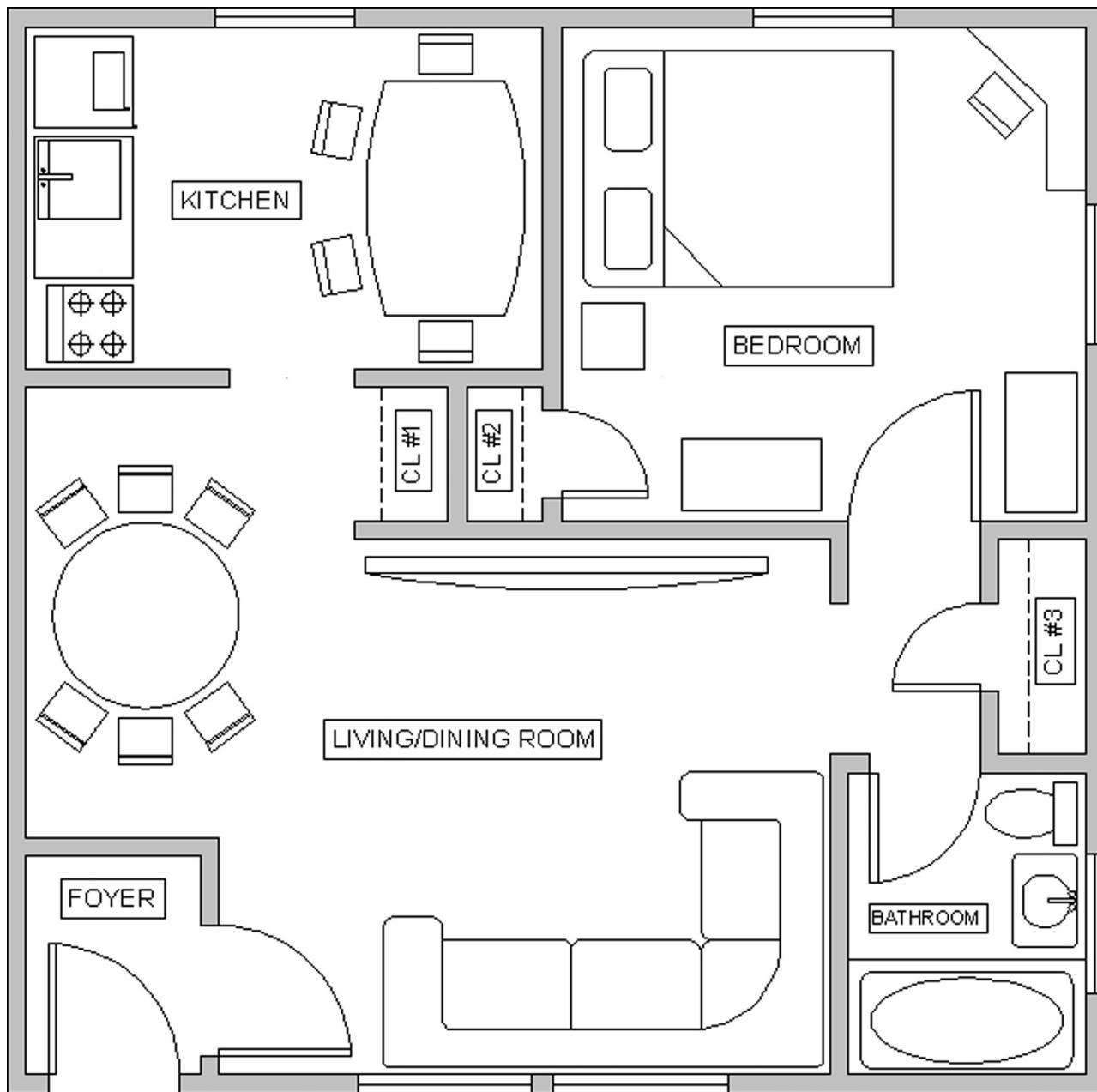


FIGURE 4.17 Floor plan layout.

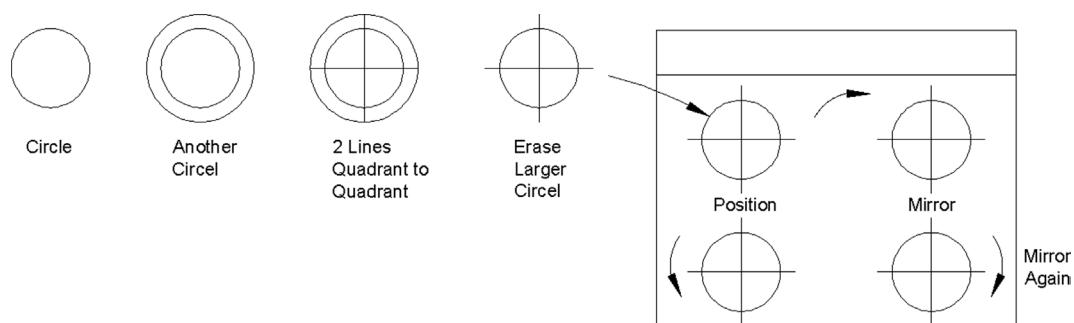


FIGURE 4.18 Constructing the range top.

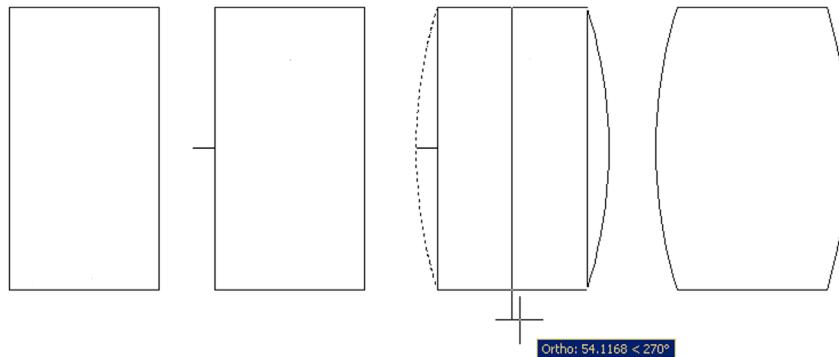


FIGURE 4.19 Constructing the table.

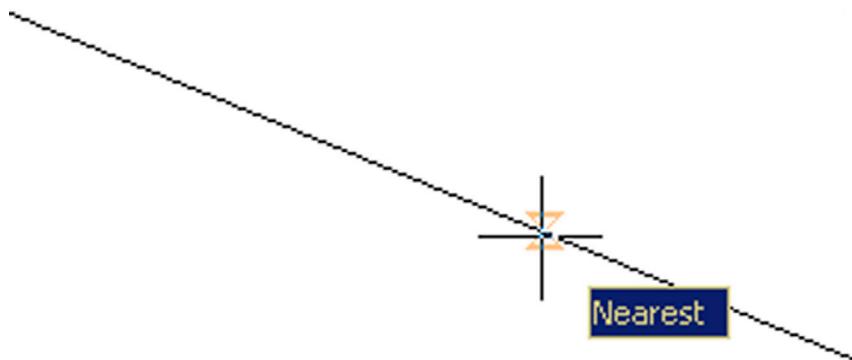


FIGURE 4.20 NEArest OSNAP.

perimeter. We do not generally leave NEArest running along with the other OSNAP points, as it makes using them more difficult; rather, just type in `nea` and press Enter or use the toolbar as needed. An hourglass figure appears; just click on wherever you want to start a line. Fig. 4.20 is a screen shot of the NEArest OSNAP in action.

Finally, we have two more tips. Tip 6 has to do with `ltscale`, something briefly mentioned in Chapter 3, Layers, Colors, Linetypes, and Properties. Tip 7 shows you how to get rid of the UCS icon, something many students ask about.

TIP 6

If you draw your hidden lines for the closet shelving and they look solid not dashed, then the problem may be incorrect linetype scaling, a common error to watch out for. Type in `ltscale`, press Enter, and input a new value (a larger one, since your floor plan is bigger than the default original space of 8.5" × 11"). Do this a few times until you get it to look just right.

TIP 7

Want to get rid of that pesky Universal Coordinate System icon hanging out in the drawing area? It is somewhere near the lower left-hand corner of your screen, looks like a big L, and has a Y and an X on its tips. To make it go away, type in `ucsicon`, press Enter, then type in `off`. Of course, if it does not bother you and you actually like it there, then ignore this whole tip.

4.7 SUMMARY

You should understand and know how to use the following concepts and commands before moving on to [Chapter 5](#), Hatch Patterns:

- Text
 - Creating basic text
- Mtext
 - Creating basic mtext
 - Mtext formatting options
 - Bold
 - Underline
 - Italics
 - Justification
 - Symbols
 - Other
- Editing text
 - Double-click
 - `ddedit`
- Style
 - Font name
 - Font type
 - Font size
 - Width factor
 - Oblique angle
- Spell check
- Nearest OSNAP

TIPS

TIP 6: If you draw your hidden lines for the closet shelving and they look solid not dashed, then the problem may be incorrect linetype scaling, a common error to watch out for. Type in `ltscale`, press Enter, and input a new value (a larger one, since your floor plan is bigger than the default original space of 8.5" × 11"). Do this a few times until you get it to look just right.

TIP 7: Want to get rid of that pesky Universal Coordinate System icon hanging out in the drawing area? It is somewhere near the lower left-hand corner of your screen, looks like a big L, and has a Y and an X on its tips. To make it go away, type in `ucsicon`, press Enter, then type in `off`. Of course, if it does not bother you and you actually like it there, then ignore this whole tip.

Review Questions

Answer the following based on what you learned in this chapter:

1. What are the two types of text in AutoCAD? State some properties of each, and describe when you would likely use each type.
2. What is the easiest method to edit text in AutoCAD? What is another, typed method?
3. What feature allows you to add extensive symbols to your mtext?
4. What are the three essential features to input when using Style?
5. What is the width factor?
6. What is an oblique angle?
7. How do you initiate spell check?
8. What new OSNAP is introduced in this chapter?
9. How do you get rid of the UCS icon?
10. What can you do if you cannot see the dashes in a Hidden linetype?

Exercises

1. Creating tables of data, such as a Bill of Materials (BOM), is an important part of many designs. AutoCAD has a table creation tool (similar to MS Word), which we cover in Level 2, but for this exercise, you need to create one from scratch with basic linework and the offset command, populating it with text data, as shown. Open a blank file and create a new style called RomanS.2; choose font: RomanS, height: .2, and width factor: 0.95. Then, create the table shown, using the suggested sizing. Finally, fill in the data, using your choice of text or mtext commands. Position and size the text/mtext as needed. (Difficulty level: Easy; Time to completion: 20 minutes.)

LIST OF MAIN PARTS				
ITEM	QTY	DESCRIPTION	SIZE DWG	DWG. #
1	1	SKID ASSEMBLY	A1	83006
2	1	STRAINER ASSEMBLY	A1	83008
3	1	GENERATOR ASSEMBLY	A1	59470-001
4	1	GENERATOR ASSEMBLY	D1	59470-002
5	2	POWER SUPPLY (OIL IMMERSED)	B1	58717-001
6	1	POWER SUPPLY (OIL IMMERSED)	B1	58717-002
7	1	LOCAL CONTROL PANEL ASSEMBLY	D1	83017-001
8	2	LOCAL CONTROL PANEL ASSEMBLY	A1	88017-002
9	1	INSTRUMENT AIR ASSEMBLY	A1	83022
10	1	AIR PUMP	A1	86584

2. This next exercise is similar to the previous one. Using a combination of text and mtext, create the following table of tooling part numbers based on the starter dimensions given, including the text height. Exact text positioning is not specified and can be approximated. Use text styles similar to the previous example, but leave the width factor as 1.0 and adjust the height to the value shown. Create the fractions via mtext or by hand. (Difficulty level: Easy; Time to completion: 20 minutes.)

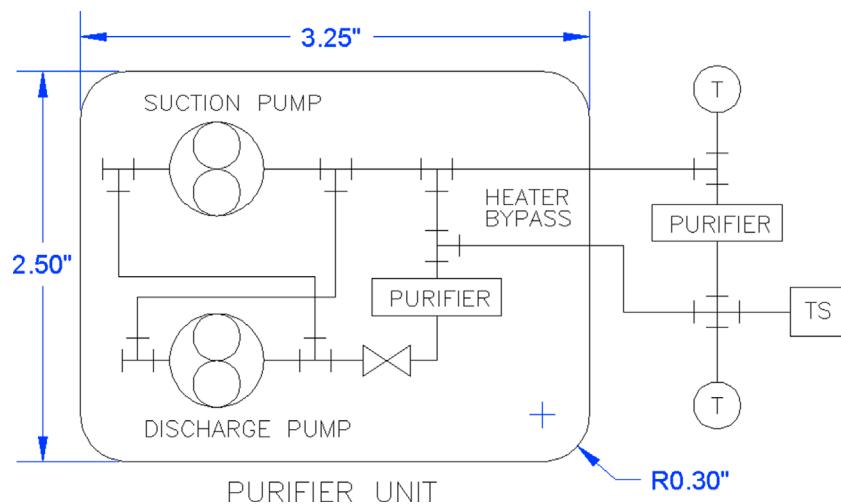
CONTENTS					
PART NUMBER	NAME	QTY	PART NUMBER	NAME	QTY
3402454-9	BACKUP BAR	1	110G050-101A	TAPER LOK DEPTH GAUGE	1
NO. 23	DRILL	5	110G050-201A		1
¹¹ / ₆₄	DRILL	5	110G050-103A		1
A	DRILL	5	110G050-203A		1
¹¹ / ₆₄	DRILL	5	110G050-303A		1
110C202-040C	TAPER LOCK REAMER	3	110G050-403A		1
110C202-050C		3	110G050-104A		1
110C213-070C		3	110G050-204A		1
110C213-080C		3	110G050-304A		1
110C213-085C		3	110G050-404A		1
110C213-091C		3			
110C213-100C		3			
110C213-110C		3			
110C213-120C		3			
110C213-125C		3			
110C214-070C		3			
110C214-080C		3			
110C214-085C		3			
110C214-091C		3			
110C214-100C		3			
110C214-110C		3			
110C214-120C		3			
110C214-125C		3			
110C214-130C		3			
110C214-140C		3			

3. As seen with Exercise 7 of [Chapter 3](#), Layers, Colors, Linetypes, and Properties (electrical pieces), you may be asked to draft something based on a picture and use arbitrary, not strict, design dimensions. You need to be fast and efficient while maintaining strict accuracy. A good grasp of the basics is essential, and you must know exactly how you will draft something in your mind, just moments before your fingers do it via mouse and keyboard. Such is the nature of this next exercise—to build up this accuracy and speed. Draw the following set of P&ID (piping and instrumentation diagram) symbols. They are not to scale and are approximated, but you have all of the necessary tools at your disposal. Before drafting each shape, recite to yourself the approach you will use, then execute it. Finally, add the text next to the respective symbols. Use the Arial font of appropriate size. (Difficulty level: Intermediate; Time to completion: 35–45 minutes.)

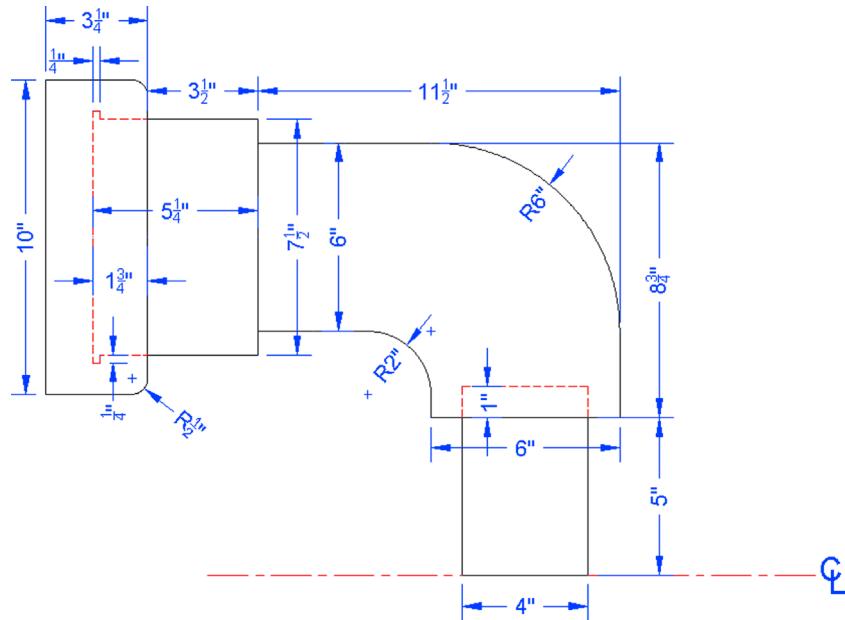
SYMBOL LEGEND

	VENT		FLOOR DRAIN
	BALL VALVE		INTERLOCK LOGIC
	3-WAY SOLENOID VALVE		TURBINE ELEMENT
	SOLENOID ACTUATOR		TANK CLOSED TOP FLAT BOTTOM
	DIAPHRAGM ACTUATOR		REDUCER
	PNEUMATIC ACTUATOR,		INSTRUMENTS SHARING COMMON HOUSING
	NEEDLE VALVE NORMALLY OPEN		SCREEN
	REGULATOR VALVE, SELF CONTAINED, INTERNAL		INSTRUMENT AIR 20 PSI
			FILLED CAPILLARY

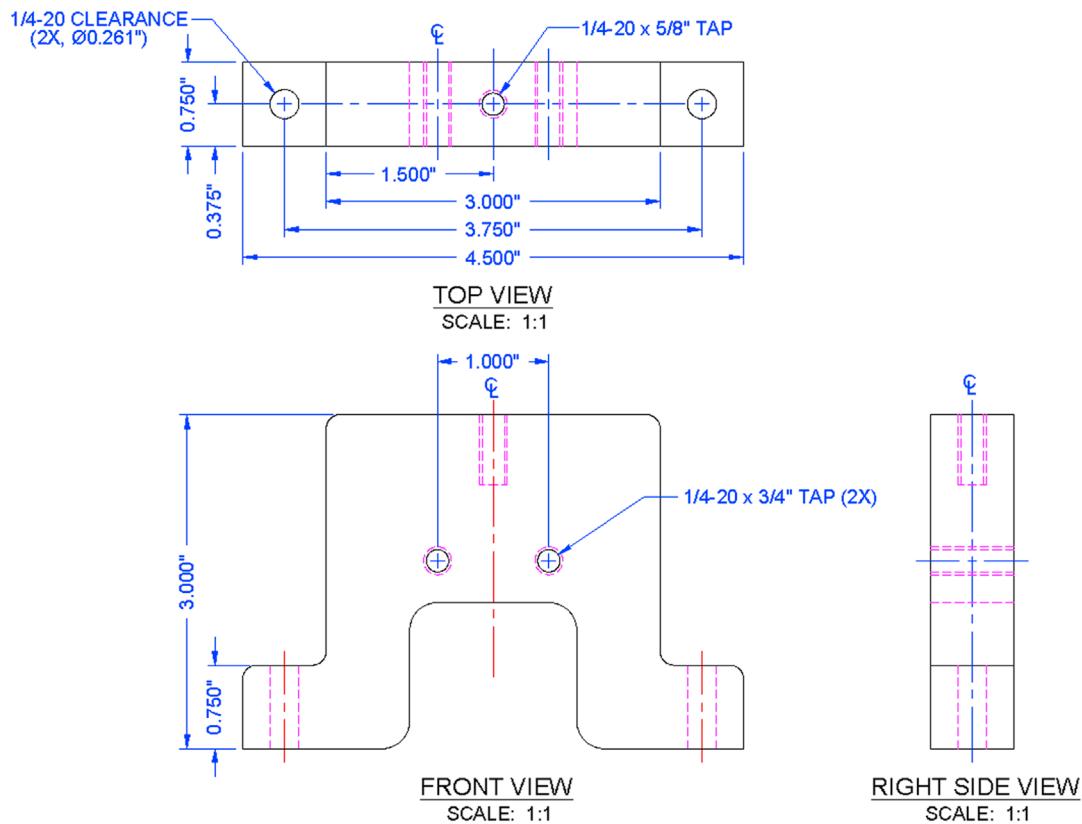
4. This exercise shows a simple P&ID schematic using some additional industry symbols. Draft it based on the reference dimensions given, with all internal pieces and text sizing estimated in relation to those. Use accuracy, connecting all lines with OSNAPS. (Difficulty level: Easy/Intermediate; Time to completion: 20–30 minutes.)



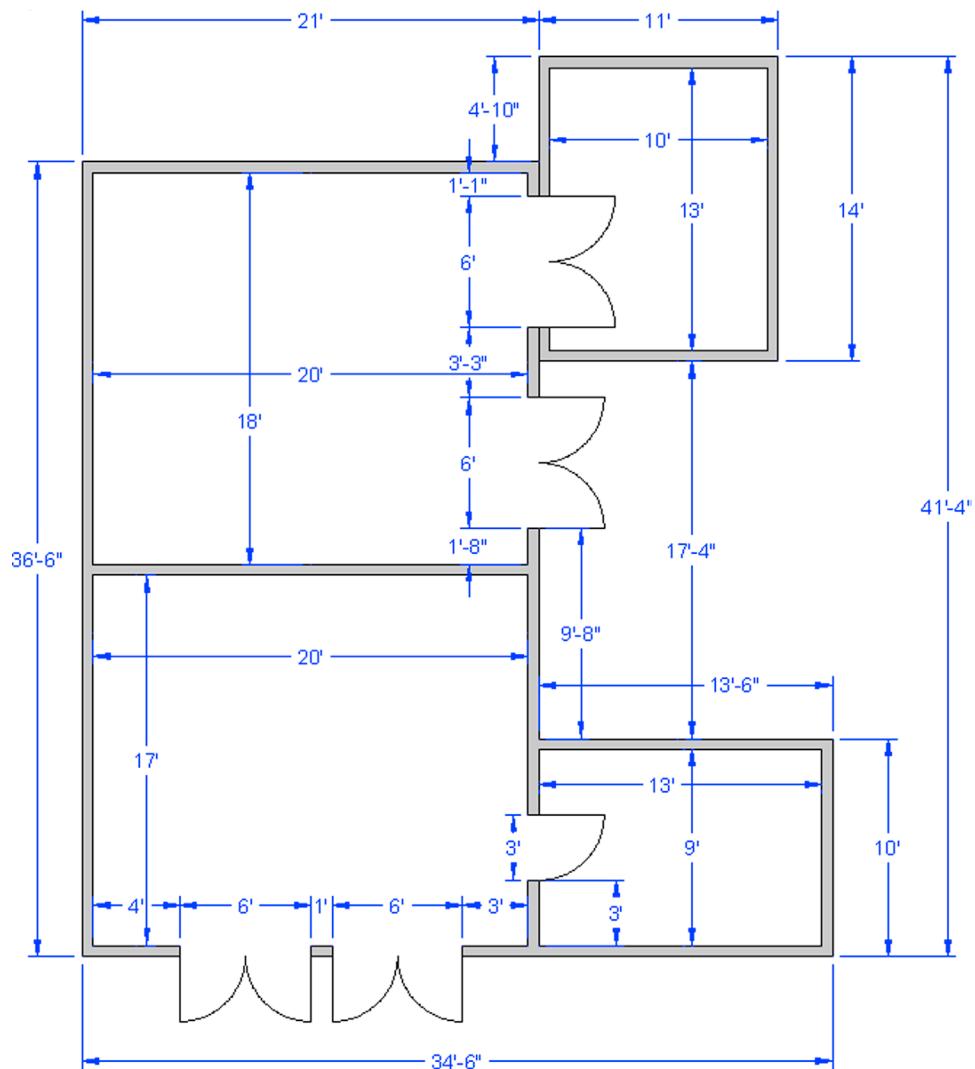
5. While we are on the subject of P&IDs, let us create a simplified design of a pipe. Open a new file and set up Architectural units, creating proper layers, colors, and linetypes (Hidden and Center), as shown. Then, draw the following pipe design. Be careful in how you approach the hidden lines, noting that they are on the same plane as the solid lines. This is commonly seen on mechanical drawings. (Difficulty level: Intermediate; Time to completion: 20–30 minutes.)



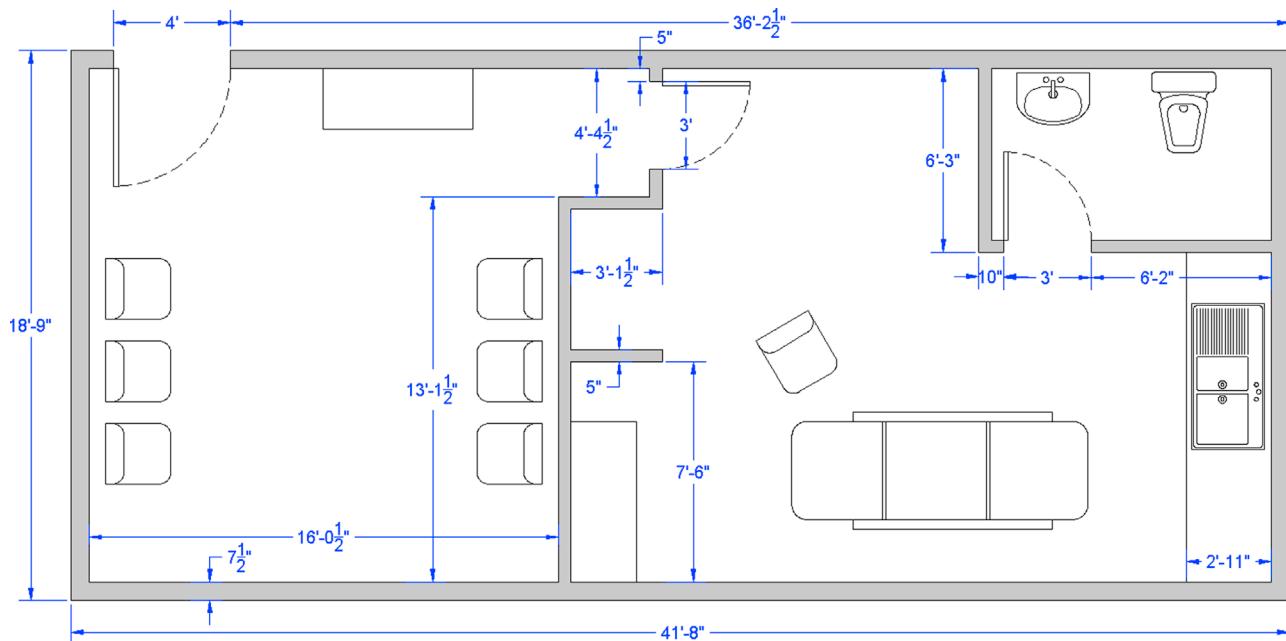
6. For this drawing, we return to basic bracket design, although this one is a bit more intricate. Set up the appropriate layers and linetypes and create the following mechanical part. (Difficulty level: Intermediate; Time to completion: 20–30 minutes.)



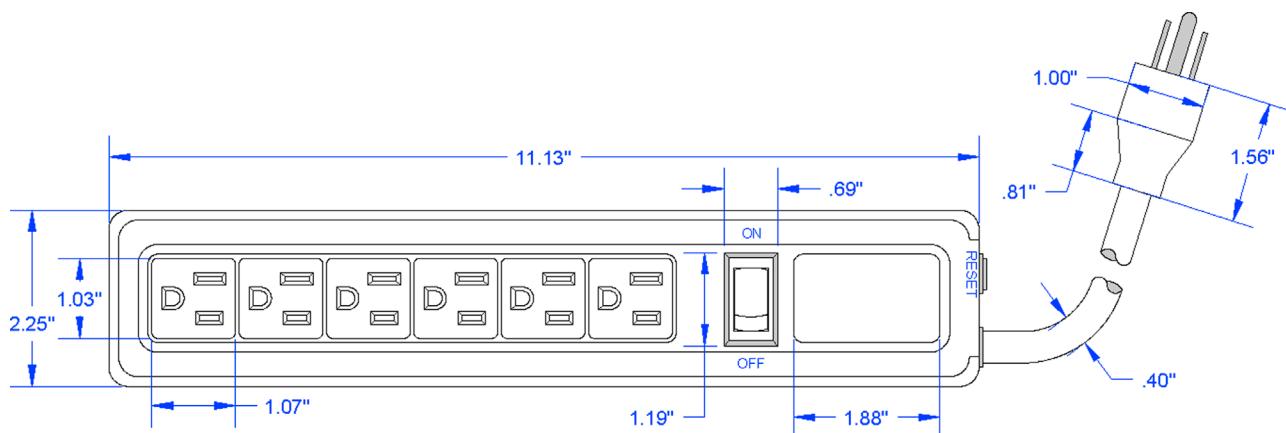
7. This exercise involves a floor plan. Similar to previous activities, open a new file, set up A-Walls and A-Doors layers and colors, and leave your units as Architectural. Then, complete the following basic floor plan. All walls are 6" thick. All the doors are 3' wide and have no thickness; you may give them thickness if you like. (Difficulty level: Intermediate; Time to completion: 45–60 minutes.)



8. This exercise is a similar, if slightly more involved, floor plan. As before, open a new file; set up A-Walls, A-Doors, and A-Furniture layers and colors; and leave your units as Architectural. Then, complete the following floor plan layout. All walls are either 7.5" or 5" thick. All the doors are either 3' or 4' wide and have a 2" thickness. The furniture sizing can be approximated. Dimensions and shading are for clarity only. (Difficulty level: Intermediate; Time to completion: 45–60 minutes.)



9. Open a new file and set up layers of your choosing. Then, create the following electrical power strip according to the critical dimensions shown. Where no dimensions are given, assume an appropriate value. Add text where shown. Dimensions and some hatching are shown just for clarity and for construction purposes. (Difficulty level: Easy; Time to completion: 20–30 minutes.)



10. This exercise is another mechanical bracket. In a fashion similar to Exercise 6, it is projected in top, front, and side views, which is very typical for mechanical design drawings. Open a new file, set up your units as Decimal, and draw the shapes as shown. The dimensions and shading are for your use and clarity; we cover both shortly. (Difficulty level: Intermediate/Advanced; Time to completion: 60 minutes.)

