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Page Setup for Plotting to Scale: Model Versus Paper Space—Which Way Is Best for You?

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Learning Objectives

- Discover 3 different methods of plotting drawings to scale
- Understand the necessary settings and workflow to plot to scale from both model and paper space
- Compare and contrast the pros and cons of plotting from model space versus paper space
- Determine which plotting method is best for you

Description

Plotting to scale is something that seems to be omitted from a lot of the textbooks. And for most of us, template files have already been established and we gladly go about our business using them. But what happens when you need to set up your own pages to plot correctly? This course will demonstrate 3 distinctly different methods to plot to scale. The “old school” method of setting drawing limits, changing text sizes, and dimension scale factor and plotting from Model Space might still be used in some cases. The “confusing way,” which establishes a plot scale in the page setup—which conflicts with the annotation scale—does work in the end. The “best way,” wherein the page-setup scale is 1:1 and the scaling is done with the viewport, works fantastically with annotative objects and their scale setting. Attendees will gain setup requirements and pitfalls for each method. Regardless of the means you decide to use, always design your projects at full scale. This session features AutoCAD.

Your AU Expert(s)

Kendall Casey is a Master Instructor and Director of the Career Education Division at Arkansas State University-Beebe. He has been educating students in CAD since 2004, with graduates scattered across the nation. His education includes a Master of Science in Geographic Information Systems, Bachelor of Science in Mechanical Engineering Technology, and Associate of Applied Science in Computer-Aided Drafting and Design. He began using AutoCAD in 1991 with release 11. After spending roughly ten years using AutoCAD and Mechanical Desktop in product design for a commercial refrigerator manufacture a chance to impart his nerdy CAD skills became a reality. Kendall is very passionate about AutoCAD and loves to help others grow their knowledge.

Additional Resources

AU Online

[GEN10807: Plotting Survival Guide: Tips for Headache-free AutoCAD Plotting](#)

[AC6563: Plan to Plot: From Page Setup to Output](#)

Background

Plotting to Scale, so what's the fuss?

There are several reasons someone might need to plot drawings to scale whether it is to follow industry drafting standards or simply to transfer designs to work pieces. Regardless of the reason, you should have the skills to plot your drawings to scale. When I say to scale, I mean that the drawing or printout is of a known and predictable representation of the design or project. One very important note that I will repeat several times throughout this course is that you should **ALWAYS** do your AutoCAD design work at full scale. The “scaling” happens when you decide to plot/print the design onto paper. Designs can be scaled down to fit larger objects on to a drawing sheet or scaled up to enlarge smaller objects. Scale is often indicated as a representative fraction like: 1:1. The first digit represents 1 inch or 1 foot or 1 mile of the drawing on paper represents 1 inch or 1 foot or 1 mile of the design in AutoCAD. The scale 1:1 is a common drawing scale often called full size, where the print is exactly the same size as the design. Other common scales might include half size (1:2), where the print is one half the size of the design. Larger projects might require scales such as one quarter of an inch of the print equals one foot of the design (1/4"=1'). Even larger projects could be one inch of the print represents five hundred feet of the project (1"=500'). These are only a few of an unlimited amount of scales you can use.

Fundamental Knowledge

Paper Sizes

To successfully Plot your drawings to scale there are a couple of things that you must understand or know. The first is you must know what size of paper you intend to use. The sheet size might be dependent on your printer. Perhaps you have a laser printer that can only print on letter (ANSI A) size paper. If this is the case, you will always scale your drawings to fit on that letter (ANSI A) size paper. Most of us who are using AutoCAD have access to large format plotters capable of printing letter size up to ANSI E or larger sheets. Knowing the sizes of the sheets you have access to is very important. At my university, we only use ANSI A, ANSI B, ANSI C, ARCH D size sheets. Therefore, I have dedicated a little permanent storage space in my brain to the physical sizes of these sheets. You might use these or other sizes, get to know them!

Sheet	Physical Size	Estimated “Usable” Size
ANSI A	8.5" x 11"	6.5" x 9"
ANSI B	11" x 17"	9" x 15"
ANSI C	17" x 22"	15" x 20"
ARCH D	24" x 36"	22" x 34"

Now that you have memorized the sizes of the sheets you use; you need to realize that you can't expect to use the entire sheet of paper. Printer margins and your sheet border and title blocks will occupy some of the sheet. I recommend that you plan to lose about two inches in both the X and Y directions. This means when using a letter (ANSI A) size sheet, you can expect to be able to use about 9 inches x 6.5 inches for your project.

Project Size

The other thing you must know before you even begin to consider scale is the overall size of your project. Your project could be a simple part, complex machine, or detailed map of an interstate roadway. Regardless of the item drawn you need to have an idea about its size. In the first example listed below my project is roughly 16.25 inches by 12.5 inches and I want to scale it to fit on a letter (ANSI A) size sheet. If I don't know my project size, I will place a horizontal and vertical linear dimension to quickly collect the rough X and Y measurement values. Be sure to include your project dimensions and notes in this measurement, because they need to fit on the sheet too.

Do The Math

At this point you should know the size of paper you want to use and the general size of your project. The next step is to determine what scale you need in order to fit your project onto your sheet. Consider the example mentioned below, where my project is 16.25 inches by 12.5 inches and I want to print it on a letter (ANSI A) sheet in landscape orientation. Remember I should expect to be able to use roughly 6.5 inches by 9 inches of the sheet. The math is simple division. You want to divide your project size by your sheet size in both the X and Y directions.

$$X \text{ Direction} \rightarrow \frac{16.25}{9} = 1.81$$

$$Y \text{ Direction} \rightarrow \frac{12.5}{6.5} = 1.92$$

Since both the X and Y direction results were less than 2.0, you know that half scale (1:2) will work. Using this scale means your drawing will physically measure on paper exactly half the actual size of your design.

Had one of the X or Y direction results exceeded 2.0 than half size project would not fit on this sheet. At this point your options are to either use a larger scale or a larger sheet of paper. The idea is to select a common scale factor that is near to but larger than the calculated need. This selected number will be referred to as scale factor throughout the remainder of this document.

Annotative Elements

There have been many enhancements built into AutoCAD over my twenty-five years of experience, but few have been as significant as adding Annotative elements. AutoCAD allows several items to be Annotative such as text, dimensions, and leaders. What does Annotative mean? My simple way of explaining Annotative elements is that these items can and will resize themselves based on a drawing scale. We should see this in action a little later. This advancement helps us avoid a common mistake I see on drawings. The

mistake is easy to notice when looking at the drawing because the text and dimensions are either way too large or too small.

Knowing these fundamentals will be a great start to plotting all your projects to scale. No matter how much you want to resist dedicating precious brain storage, I think standard sheet sizes is one thing that you should know and know well. It is easy enough to measure your project using AutoCAD linear dimensions. Do the math to determine an appropriate scale that will accommodate your project on the sheet size you want to use. When considering scales follow your company's standards or use common scales such as one quarter (1:4) or one eighth (1:8) scale for your drawings. For larger projects scales like $\frac{1}{4}"=1'$ or $1"=100'$ are common. Some projects may require enlarging at scales like 2:1, 4:1 or 10:1 could be used.

Mechanical Drawings

Description	Effect	Scale Factor	Paper Units	Project Units
1:2	Reduce	2	1	2
1:4	Reduce	4	1	4
1:8	Reduce	8	1	8
2:1	Enlarge	.5	1	.5
4:1	Enlarge	.25	1	.25

Architectural Drawings

Description	Effect	Scale Factor	Paper Units	Project Units
$\frac{1}{4}" = 1'$	Reduce	48	.25	12
$\frac{1}{2}" = 1'$	Reduce	24	.5	12
$1" = 1'$	Reduce	12	1	12

Civil Drawings

Description	Effect	Scale Factor	Drawing Units	Paper Units
$1" = 10'$	Reduce	120	1	120
$1" = 50'$	Reduce	600	1	600
$1" = 100'$	Reduce	1200	1	1200

If you are only interested in learning the single best way to plot drawings to scale, skip right to the "The Best Way" method. In my opinion, this method is by far the most user friendly and the only method I teach my students. However, to fully appreciate "The Best Way" I think it is important to understand where we began and that is the reason for explaining the "Old School" method first.

Plotting from Model Space "Old School"

This was the first and only method I learned will studying AutoCAD in 1991. Paper space existed in Release 11, but it wasn't as warm and fuzzy as it is today. We should all be comfortable with the Model Space environment of AutoCAD, but to get your drawings plotted to the right size you need to follow some basic steps. As mentioned above, you need to know your

paper sizes, you must know your project size, and you must do the math. The math gives you a scale factor. In the old days (hence the heading “old school”), we had to use this scale factor to set the drawing limits, determine the proper text size, and to set a system variable DIMSCALE, and set the proper plot/page setup options. In the example, above where I plan to use 1:2 (half scale). It would be necessary to multiply your desired text size by these scale factor. For example, I want the text of my notes to be 1/8” high. I need to multiply 1/8” by 2 and set the text height to 1/4”. Now when I print the drawing to half size the text will actually be 1/8” high when printed. I also need to set

Drawing Limits

After determining the necessary scale factor. The next step is to establish your drawing limits. This is an easy command, simply type LIMITS and press enter. You will be prompted for the lower left corner. Leave this as 0,0, which is likely the default. Next AutoCAD will ask you for the upper right corner. Here we must use the calculated scale factor along with our desired paper dimensions. In this example, we are using ANSI A size Landscape paper and our scale factor is 2.0, which will result in a 1:2 or half size drawing. To determine the LIMITS upper right corner X, Y values you multiple the paper size by the scale factor. In this example the upper corner will be $2 \times 11 = 22$ and $2 \times 8.5 = 17$ or 22, 17 given as X/Y pair.

Hint: I like to display the grid on my drawings, but I don’t like for it to display beyond my limits. This helps me know my drawing limit boundaries. See the drafting standards dialog box below.

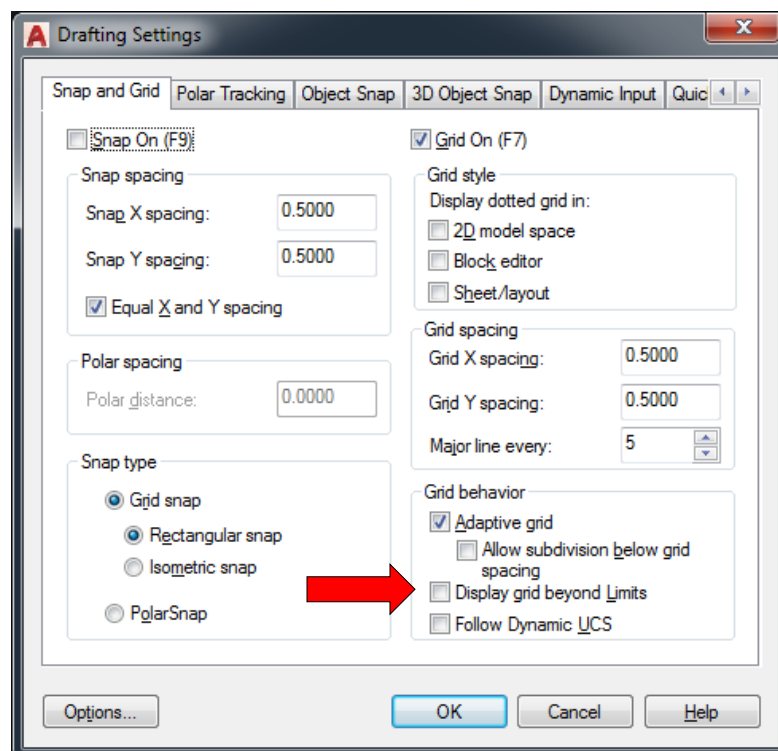


FIGURE 1 DRAFTING SETTINGS, TURN OFF DISPLAY GRID BEYOND LIMITS

Text Size

At this point we have determined our paper size (ANSI A landscape), scale factor (2), and your drawing limits (0,0 / 22,17) have been properly set. The next step is to adjust the text height specification in ALL your Text Styles. The new text height specifications are the existing height times the scale factor. In this example 1/8" is the desired text size. We know the scale factor is 2, which means I need to set my text height to 1/4" ($2 \times .125 = .25$).

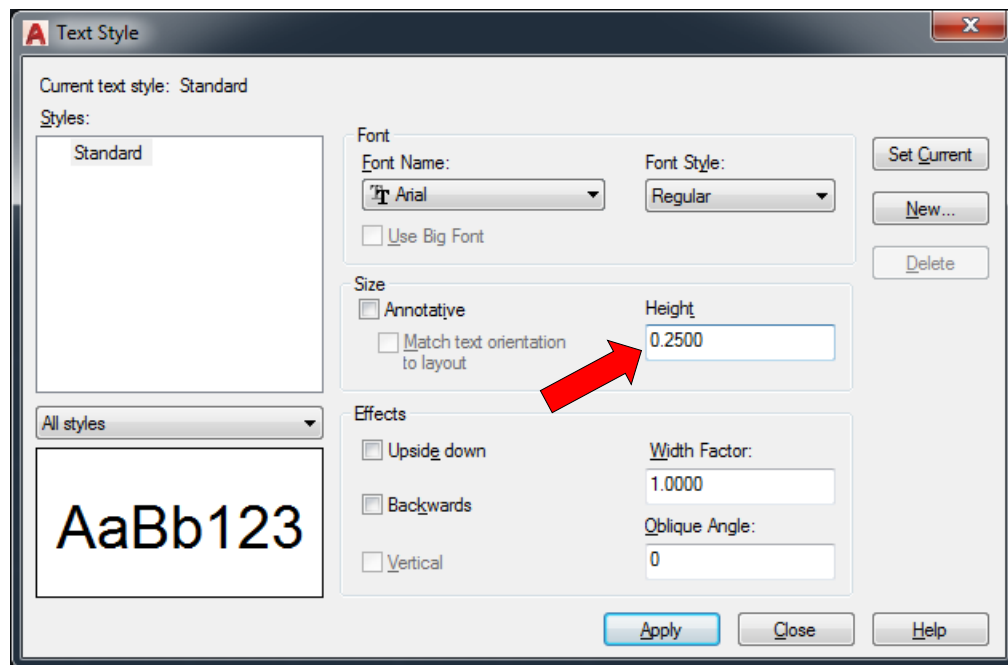


FIGURE 2 TEST STYLE - SET HEIGHT TO "DESIRED SIZE" TIMES SCALE FACTOR

Dimension Style

Dimensions are complicated elements constructed of extension lines, dimension lines, arrow heads, texts, and specific spaces. I often see dimensions that have been overlooked when scaling drawings. Keep in mind the example we are working with which has a scale factor of 2. If no adjustments are made all the elements of each dimension will print out half of the desired size. This is easily noticed due to extremely small dimension text that we expect to print at 1/8" high but ended up being only 1/16" high. Fortunately for us, the DIMSCALE system variable has been in play for the whole time I have known AutoCAD. The DIMSCALE system variable should be set to be the same as the scale factor we calculated earlier. The DIMSCALE system variable will multiply the specified sizes for all the dimension elements, which makes everything the proper size by making a single adjustment. You can set the DIMSCALE variable on the Fit tab of the Modify Dimension Style dialog box or simply type DIMSCALE at the command line.

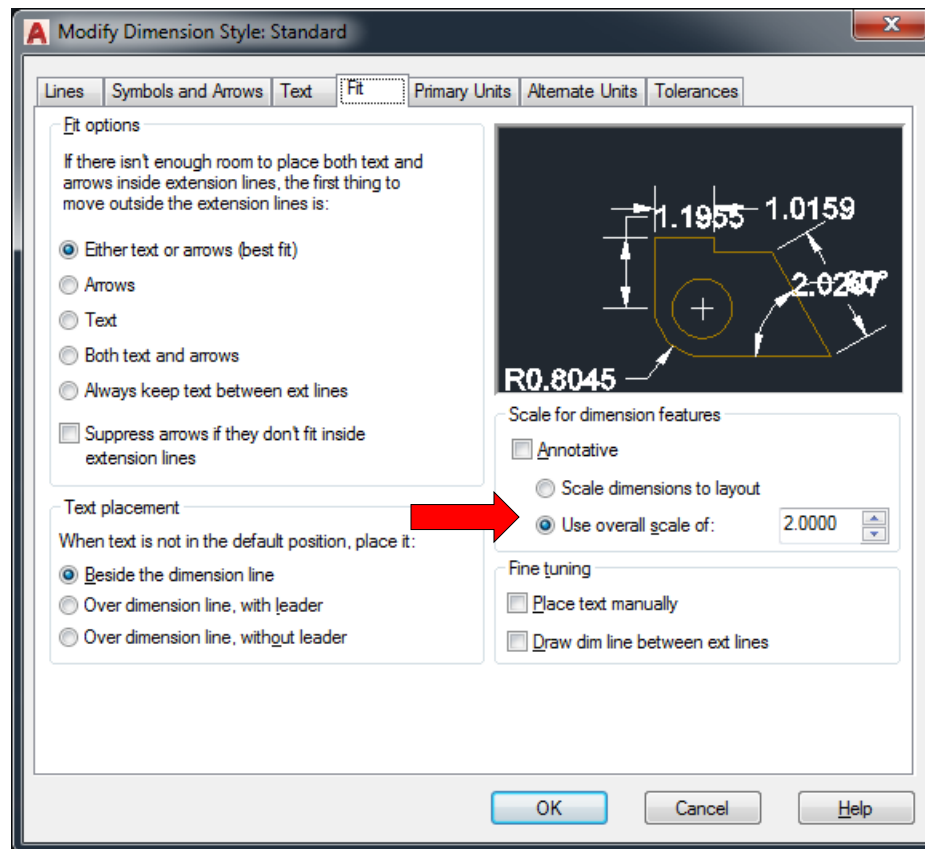


FIGURE 1 MODIFY DIMENSION STYLE - FIT TAB SET OVERALL SCALE

Hint: Instead you could use an Annotative Text Style and Dimension Style, which is more efficient and better explained in the next section.

Page Setup – Plot Settings

The final step is to set the Page Setup or Plot options. I always like starting at the top of dialog boxes and work my way down, read all the text and think about it. Set the printer you want to use, in this case I want to create a PDF file instead of a paper copy. Set the Paper size to the sheet size you want to use (ANSI A). The Plot Area must be set to LIMITS, remember we went through a lot of trouble to set those LIMITS to the right values here is where we use them. The Plot Scale MUST be set to your desired scale.

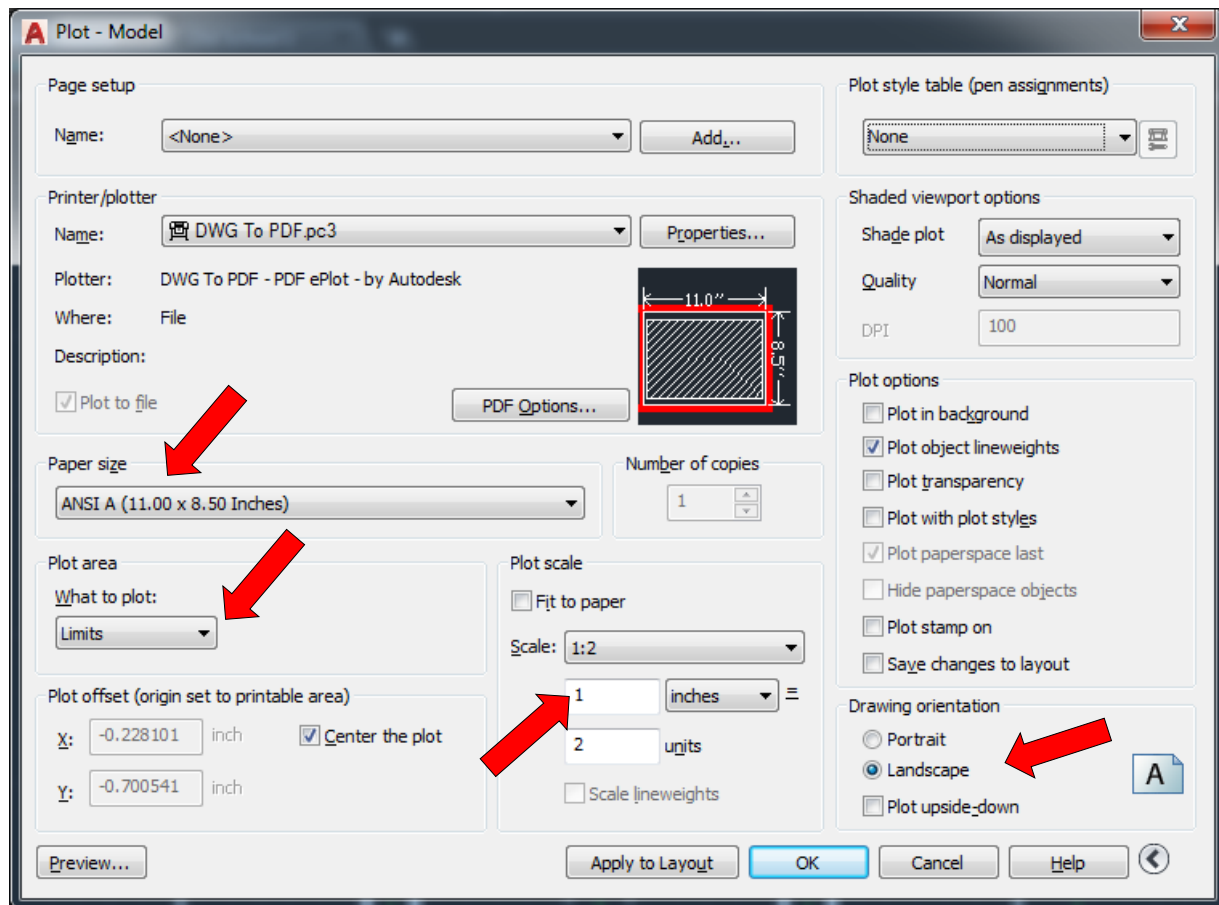


FIGURE 4 PLOT DIALOG BOX SHOWING CRITICAL SETTINGS

Hint: Use the ADD button at the top of the dialog box to save your Page setup settings. NEVER pick Fit to paper, if you want your projected plotted to a particular scale.

Old School Pitfalls

Some commonly seen problems with the “Old School” method are:

1. Existing text and dimensions are overlooked and not properly adjusted leaving them either too small or too large. This is easily caught, if you just look at your drawings.
2. The dimension spacing is NOT automatically updated. You need to account for the scale when placing your dimensions. I want my first dimension to measure 1/2" away from the part. So if the scale factor is 2, I have to place that dimension 1" away. This is a pitfall for all three methods explained in this handout.

Example 1

We should work through a couple of these projects, just make sure we got it all down. So go ahead and launch AutoCAD and open the Old School 1 drawing.

This drawing included a dimensioned top and front view of a very simple part with the material noted. Since this drawing already includes dimensions and text we will have to

modify them to plot to the correct size. If you prefer to follow along with a video use this link: [Old School 1](#). (From AU 2016)

1. Launch AutoCAD
2. Download and OPEN the Old School 1.dwg file – this is the project we have been talking about in the above sections. We want to plot it on an ANSI A landscape sheet and we have calculated the scale factor to be 2, so our drawing will be plotted 1:2 (half size).
3. I recommend setting up the drawing limits right away. Type LIMITS and press enter.
4. Press ENTER to accept the <0,0> Lower Left Corner default value
5. Type 22, 17 for the Upper Right Corner (I like to have the GRID on with the settings as shown in Figure 1 above, forcing the grid to only show up inside the drawing limits.)
6. Edit the Standard text style. Click the tiny slanted arrow as shown in Figure 5 below, set the text height to .25" so that it will print out .125" inches on the paper. (Unfortunately, I'm not aware of a way to automatically update the height of any text that is already on the drawing. However, Annotative features takes care of this problem, well talk about that a little later.)

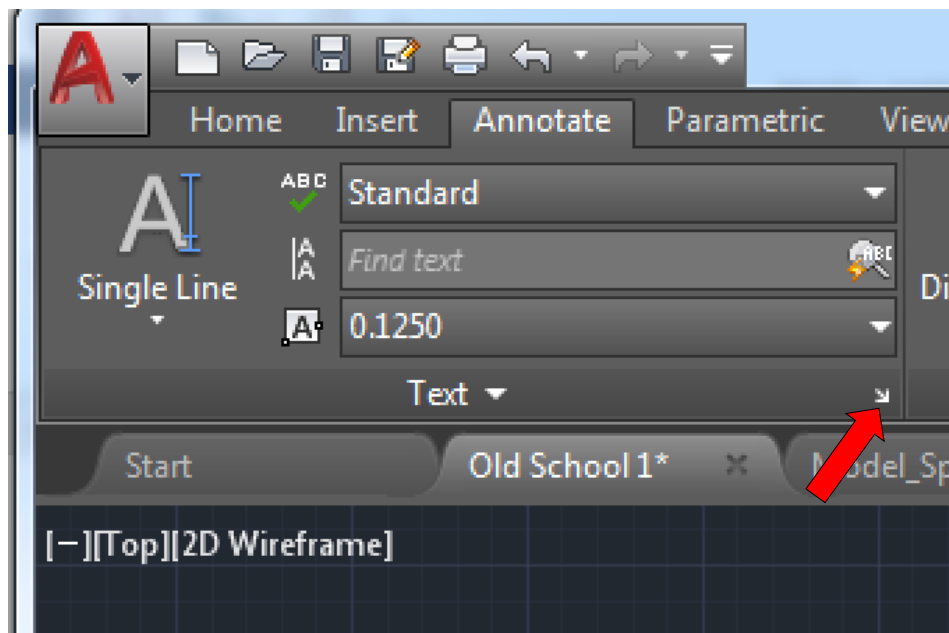


FIGURE 2 LAUNCH THE TEXT STYLE EDITOR

7. To update all the text you can use the Quick select tool on the Properties Pallet. Set the options as shown below in Figure 6. This will select all the text in the Standard text style. After all the text is selected you can change the text height to .25" in the properties pallet. (Believe me, very much of this will make you really appreciate the Annotative elements!)

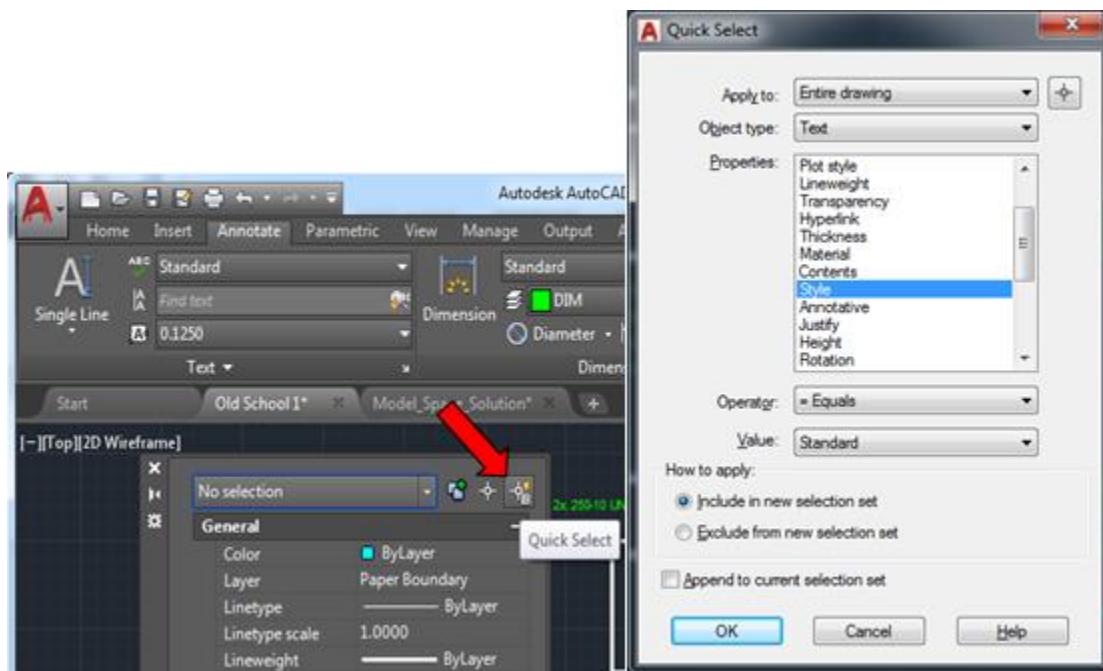


FIGURE 3 QUICK SELECT TOOL FROM THE PROPERTIES PALETTE

8. Now we need to take care of our dimensions. Launch the Dimension Style Manager. From the Annotate Ribbon, Dimensions Panel, pick the tiny slanted arrow, see Figure 7.

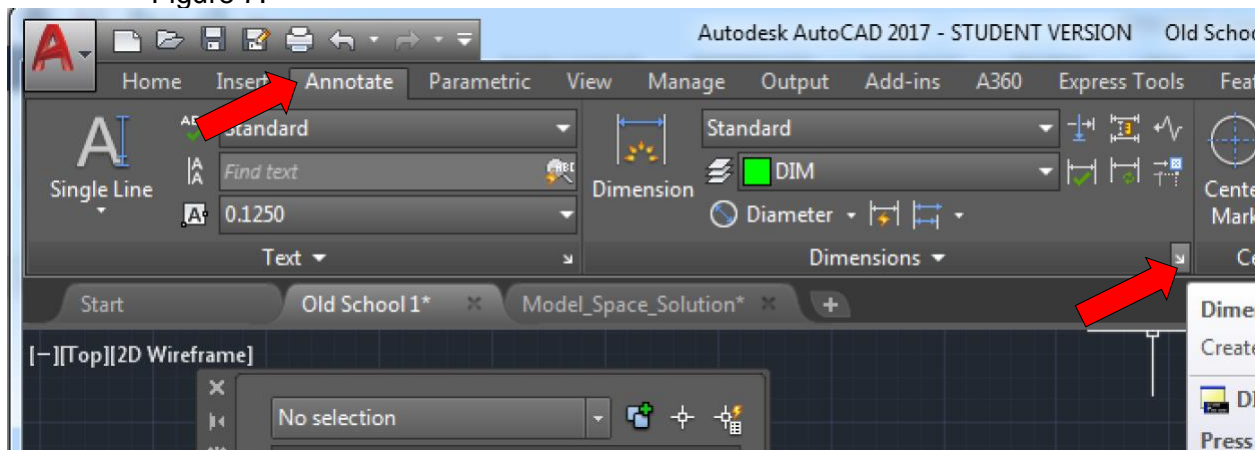


FIGURE 7 LAUNCH DIMENSION STYLE EDITOR

9. Pick the Modify button, to change the Standard Dimension Style.

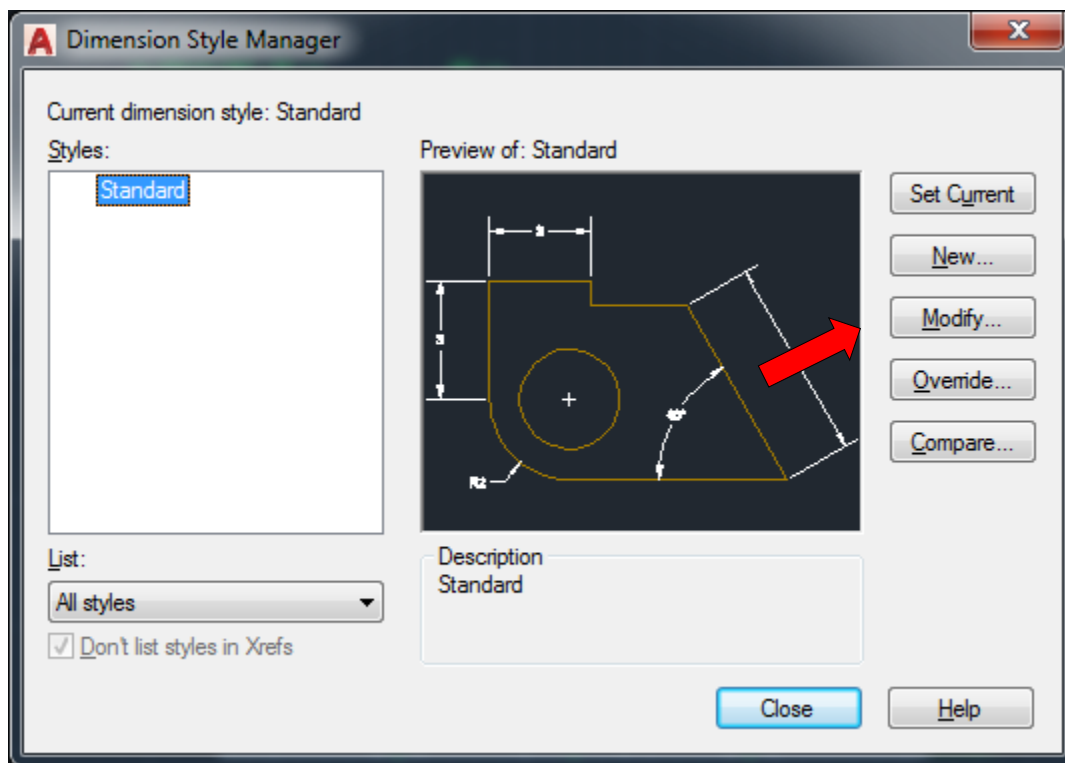


FIGURE 8 PICK MODIFY TO CHANGE STANDARD DIMENSION STYLE

10. Switch to the FIT tab and set the Use Overall Scale of to 2.0. See Figure 3 above, if necessary.
11. Pick OK then Close, you should be back to the drawing now. Notice the dimension have increased in size.
12. Our project is ready to plot. Pick the Plot tool, confirm the plotter you wish to use, Select the proper paper size, Set the Plot Area to Limits, set the Scale to 1:2, and Drawing Orientation to Landscape, Pick OK.

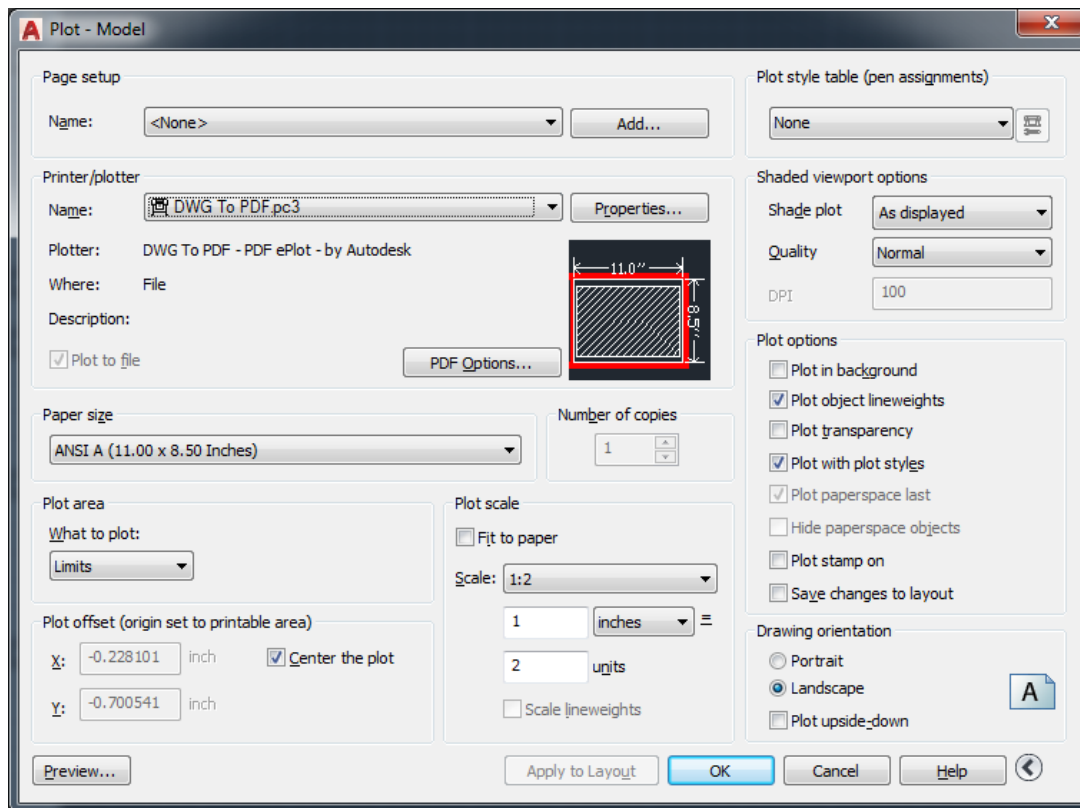


FIGURE 9 PLOT SETTINGS FOR 1:2 SCALE OF THIS PROJECT

Congratulations! You just plotted this project to scale. Get this drawing in your hands and measure the overall length of the part. It should be exactly 7 inches.

Example 2

We should work through another one, just make sure we got it all down. If you prefer to follow along with a video use this link: [Old School 2](#).

The next drawing includes a dimensioned floor plan with some text notes. Since this drawing already includes dimensions and text we must modify them to plot to the correct size. The shop is 30ft x 30ft and I want to plot it on an ANSI B size landscape sheet. Common scales for these type of “architectural” drawings are 1/8” = 1’, 1/4”=1’, 1/2”= 1...So we are trying to squeeze 30 ft into 11 inches (Y direction). Remember I suspect we can only use 9 of our 11 inches on the sheet. So DO THE MATH.

$30ft = 360 inches$ $\frac{360}{9} = 40$ A scale of 1:40 equates to 1/4” = 10” which is not common at all. So consider the nearest common scale 1/4” = 1’, scale factor 48. (There are 48, 1/4 inches in a foot.)

1. If necessary, Launch AutoCAD
2. Download and OPEN the Old School 2.dwg file
3. Establish the drawing limits. The lower left corner will be 0,0. The upper right corner will be 816,528 (multiply the sheet size by the scale factor, 48*17=816, 48*11=528, The 17 and 11 are from the ANSI B sheet size, the 48 is our scale factor.)

Drawing Limits

With this method Model Space drawing limits are not a factor at all. Prior to my developing this handout, it has been years since I have set or used the LIMITS command....” Forget About It”.

Text Size and Dimension Styles

I have mentioned Annotative elements several times throughout this handout. This is certainly a very significant upgrade for AutoCAD way back in 2008 (I think). AutoCAD allows users to set the following elements to be Annotative: text, mtext, dimensions, hatches, tolerances, multileaders, leaders, blocks, and attributes. We could easily spend this hour talking exclusively about Annotative elements, but we are here to discuss plotting to scale.

What does this mean? Text and dimensions that are Annotative can maintain a specific size regardless of the drawing scale being used. Which is fantastic, I no longer must multiply my text size by the scale factor or set my dimension style to Use an Overall Scale Value. It just happens, sort of... I still must know a few tricks to make it work out.

The best advice I can give, is that you should start looking for the Annotative symbols on the elements you use. Create template files (. dwt) that have these elements set to annotative with the sizes you want. The styles shown in the Figure below, are default styles found in the acad.dwt file. It is important that you understand that the style name “Annotative” is not what makes the style Annotative, but you can recognize Annotative elements by the Annotative symbol, which is the tiny scale symbol to the left of the style names.

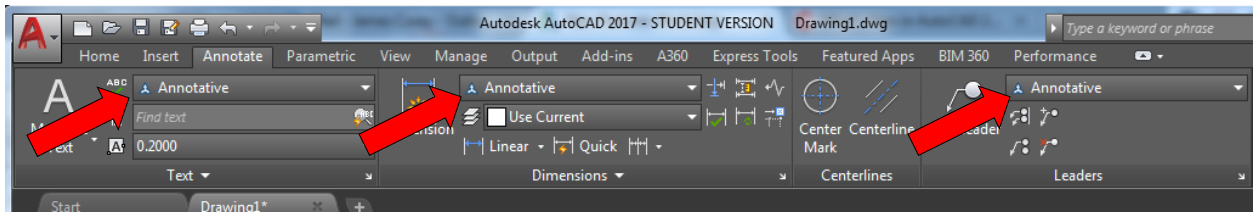


FIGURE 11 ANNOTATIVE ELEMENTS

To switch a Text Style to Annotative, simply Modify the Text Style and turn Annotative on with the check box then set the Paper Text Height.

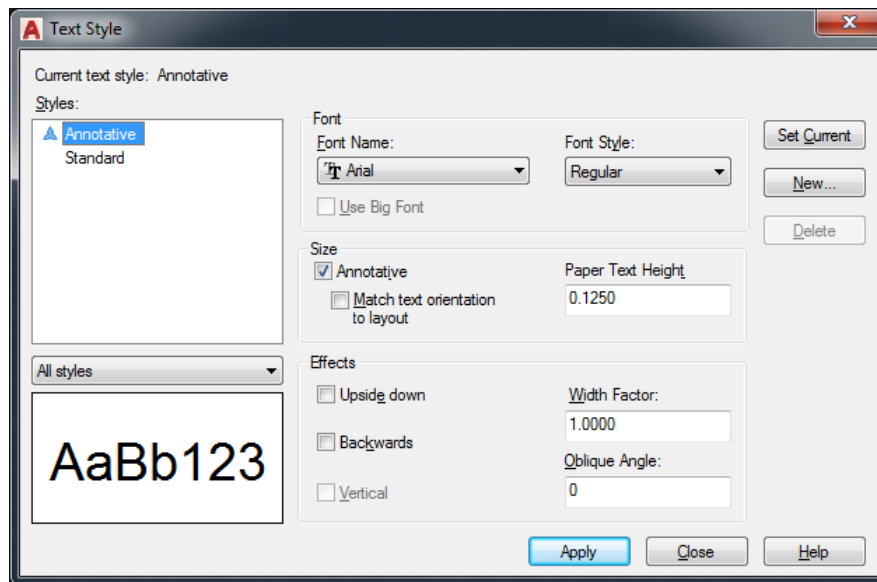


FIGURE 12 MAKING TEXT STYLES ANNOTATIVE

To switch your Dimension Style to Annotative, Modify the Dimension Style and look on the FIT tab in the Scale for dimension features area and turn on Annotative.

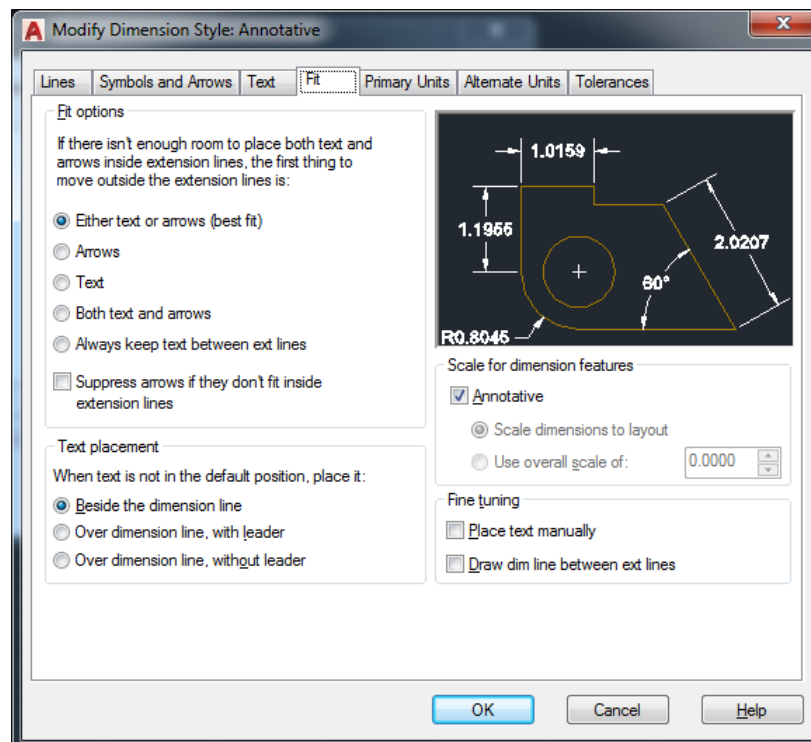


FIGURE 13 MAKING DIMENSION STYLES ANNOTATIVE

You also need to confirm you are using an Annotative Text style in your Dimension Style. Switch to the Text tab and confirm the test style is indeed an Annotative style.

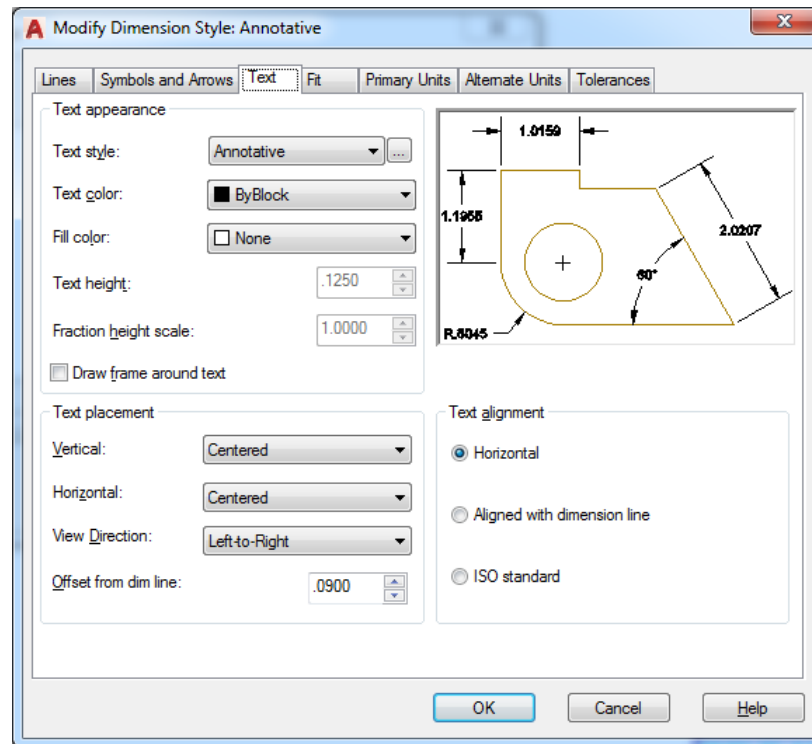


FIGURE 14 CONFIRM YOU ARE USING AN ANNOTATIVE TEXT STYLE

That should take care of your text and dimension styles. If your project uses leaders, go ahead and make sure you have an Annotative leader style, that is using an Annotative text style as well.

Assigning Annotative Scales

It is best to establish your Annotative Scale prior to placing any Annotative objects in your project. To set the scale use the Annotative Scale of Current View tool on the Status Bar. When you create Annotative text or dimensions, they inherit the Annotative Scale setting of the current view. Therefore it is a good idea to have the Annotative Scale set before placing Annotative elements. There are several Annotative Scales listed in the acad.dwt template, see the Figure below. You can also add other scales, by defining the paper units to drawing units. After you set the Annotative Scale of the Current view, you are ready to place your dimensions and other Annotative elements.

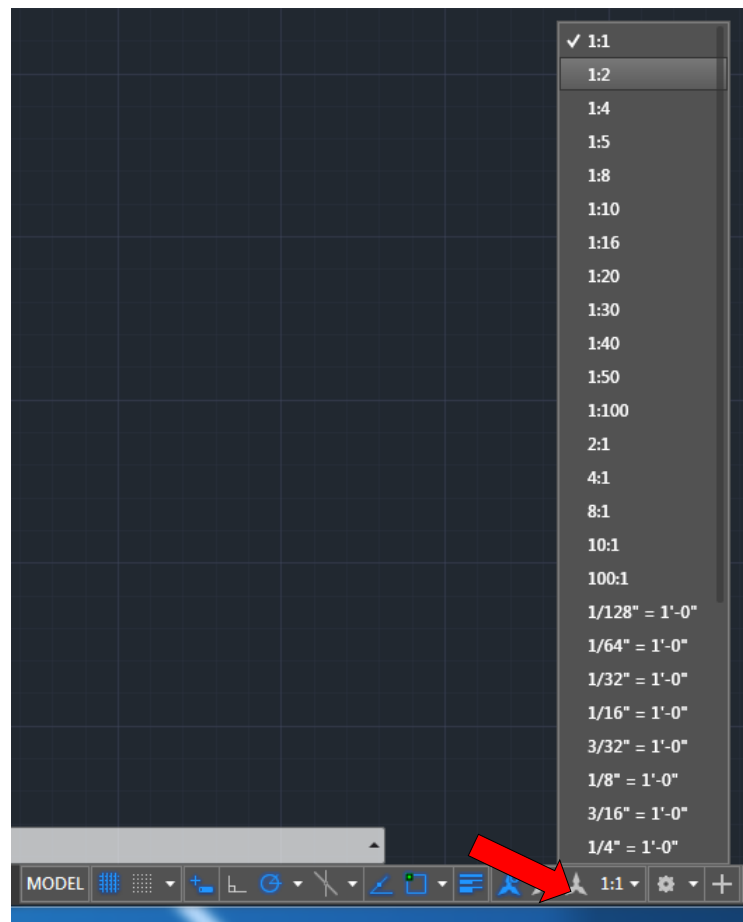


FIGURE 15 SETTING ANNOTATION SCALE

Once your Annotative elements are placed and for some reason you need to change the scale, no problem. You will need to simply add the desired scale to the properties of all the Annotative elements. Elements can be set to have multiple Annotative Scales. This allows them to display at the specified size when any listed scale is applied. To Add another Annotative Scale, pick the dimensions or text that you want to change and Add the desired Annotative Scale using the Properties Pallet.

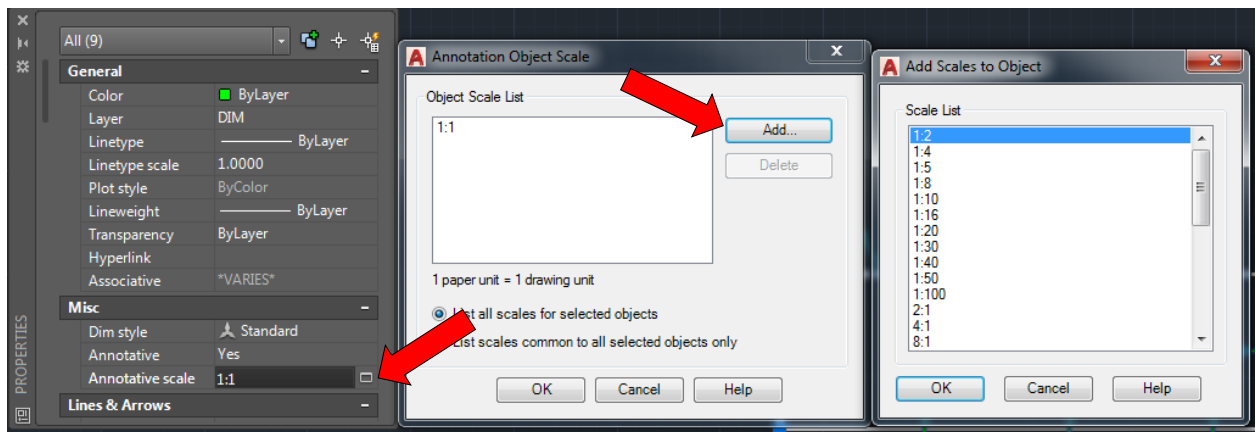


FIGURE 16 ADDING ANNOTATIVE SCALE TO EXISTING ELEMENTS

Page Setup – Layout tab

Once you have dimensioned your project and you are ready to plot, the next step is to set up the Page. You should see tabs beneath your Drawing Area. Right click on a Layout tab and select Page Setup Manager.

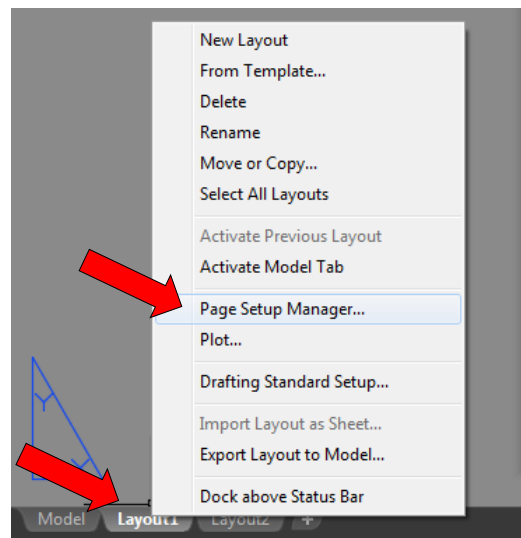


FIGURE 17 LAYOUT TAB – LAUNCHING PAGE SETUP MANAGER

If you don't see the Tabs below your drawing area as shown above, you will want to check the Display settings in the Options. Launch the Options and pick the Display tab. In the Layout element sections, turn on the Display Layout and Model tables. I also recommend turning on both the Display Printable Area and Display Paper Background switches.

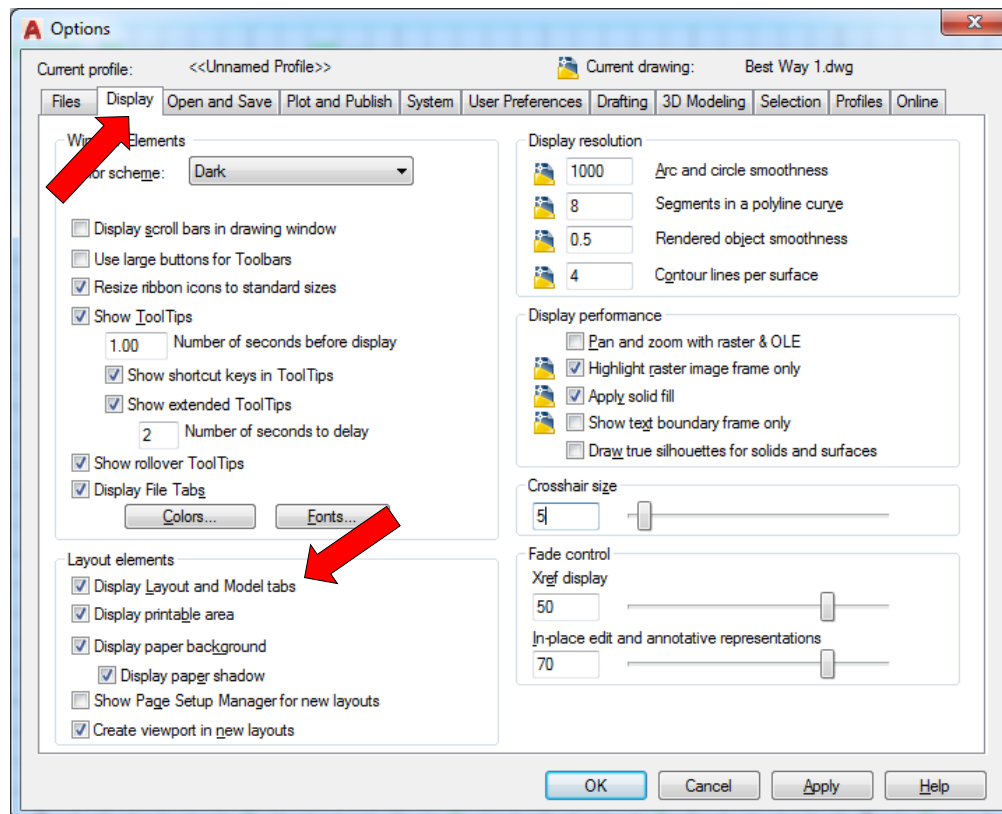


FIGURE 18 AUTOCAD OPTIONS – DISPLAY AND LAYOUT ELEMENTS SETTINGS

Now that you can access the Page Setup dialog box confirm these settings. Make sure you have selected your printer/plotter/pdf creator and set your paper size. In the Plot Area set What to plot to Layout. This next setting is IMPORTANT, regardless of what scale you intend to use set the Plot scale to 1:1. Let me repeat that, the Plot scale will be 1:1 regardless of what scale you are using for your project. What this does is make the Paper the actual measured size of the sheet. Scaling your project will happen later by zooming in or out inside of your viewport window. Fortunately, this is easy to accomplish by setting the viewport scale.

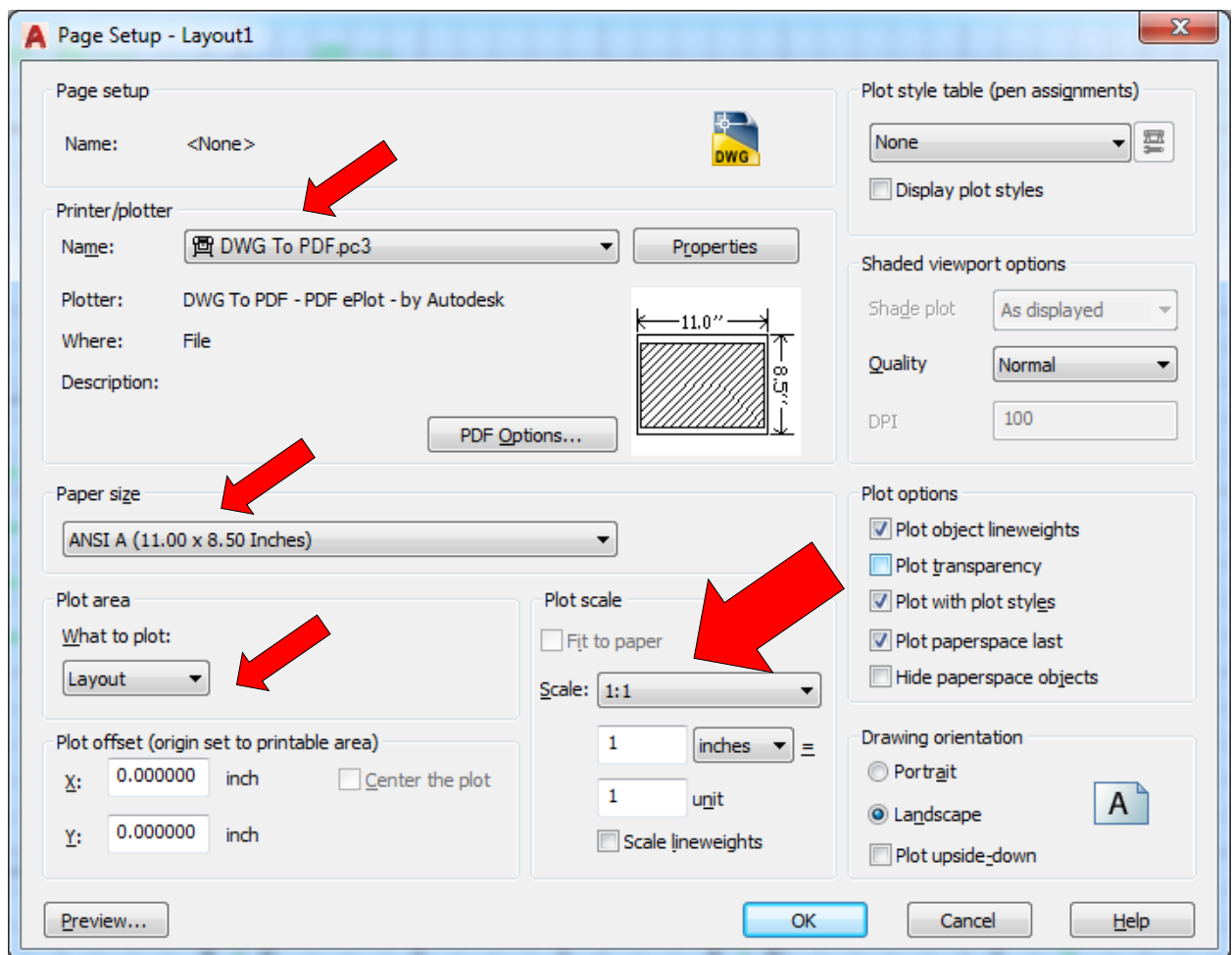


FIGURE 19 PAGE SETUP

Setting the Viewport Scale

The final step to getting your drawing printed to scale is to set the viewport scale. This is where the “scaling” actually takes place. How it works is really just zooming out or moving the project further away to scale down, or zooming in or moving the project closer for enlarged views. Just select the viewport window and change the scale in the status bar.

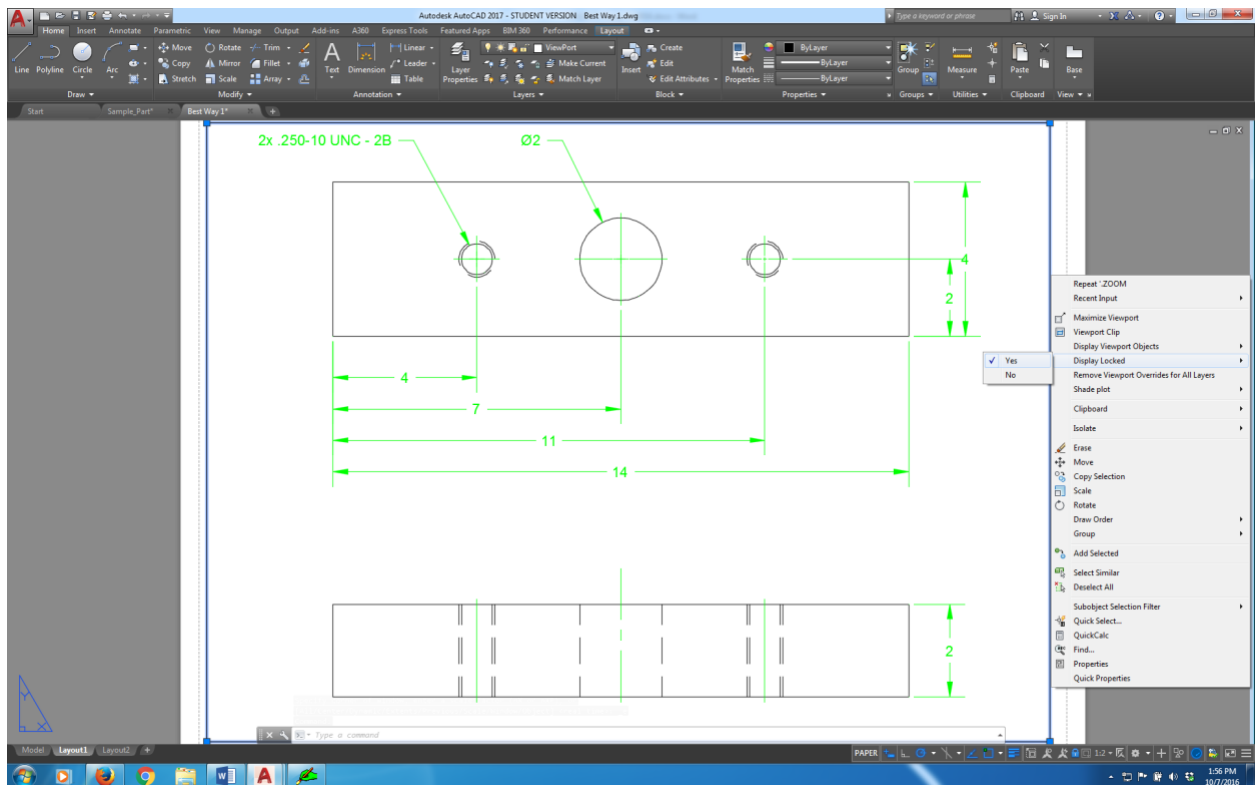


FIGURE 20 LOCKING THE DISPLAY AFTER YOUR VIEWPORT SCALE IS SET

If needed you PAN your project around to fit it into the viewport. Be careful not to roll the mouse wheel and zoom the drawing because that will change the scale. Once I have the project centered in my viewport, I like to lock the display to prevent any accidental zooming.

At this point your project is ready to print to scale, when you print using the settings explained above the length of this part will measure exactly 7 inches.

Hint: All of these settings can be set in a template file. I recommend creating a separate Layout for each paper size your organization uses. Place your company's title block and border in Paper Space on each Layout. Rename the layouts to be paper sizes like ANSI A or ANSI B. I also like to leave the viewport window just inside the border so that I can easily select it to modify the scale. I doubt you want the viewport window to print in your drawings, so use a special layer for your viewport that is set not to print.

Best Way Pitfalls

Like the "Old School" method, the dimension spacing is NOT automatically updated. You need to account for the scale when placing your dimensions. I want my first dimension to measure 1/2" away from the part. So if the scale factor is 2, I have to place that dimension 1" away.

Example 3

We should work through a couple of these projects, just make sure we got it all down. So go ahead and launch AutoCAD and open the Best Way 1 drawing. If you prefer to follow along with a video use this link: [Best Way 1](#).

We should work through another one, just make sure we got it all down.

The next drawing includes a very small gear. We will add Annotative dimensions, leaders, and text. The gear project is roughly 1in x 3/4in and I want to plot it on an ANSI A size landscape sheet. Because this part is tiny, we want to enlarge the drawing of this project. So DO THE MATH.

$$\frac{1}{9} = .111 \text{ and } \frac{.75}{6.5} = .115$$

Because both values are below 0.125, we should be able to enlarge the part 8 times the normal size (8:1). That is 8 paper units to 1 drawing unit.

1. Launch AutoCAD
2. Download and Open the Best Way 1.dwg.
3. Activate the Annotation Ribbon and set the Dimension style, text style, and multi-leader style to the existing Annotative style.
4. On the status bar set the Annotation Scale to 8:1.
5. Add the dimensions shown. (I recommend using the SNAP tool to place the first dimension, in this case it should .0625 inches (.125 *.5 = .0625) away from the part)
6. Add the 12 TEETH EQ SP note with a leader.
7. Add the MATL: BRASS note with the mtext command. The drawing project is complete.

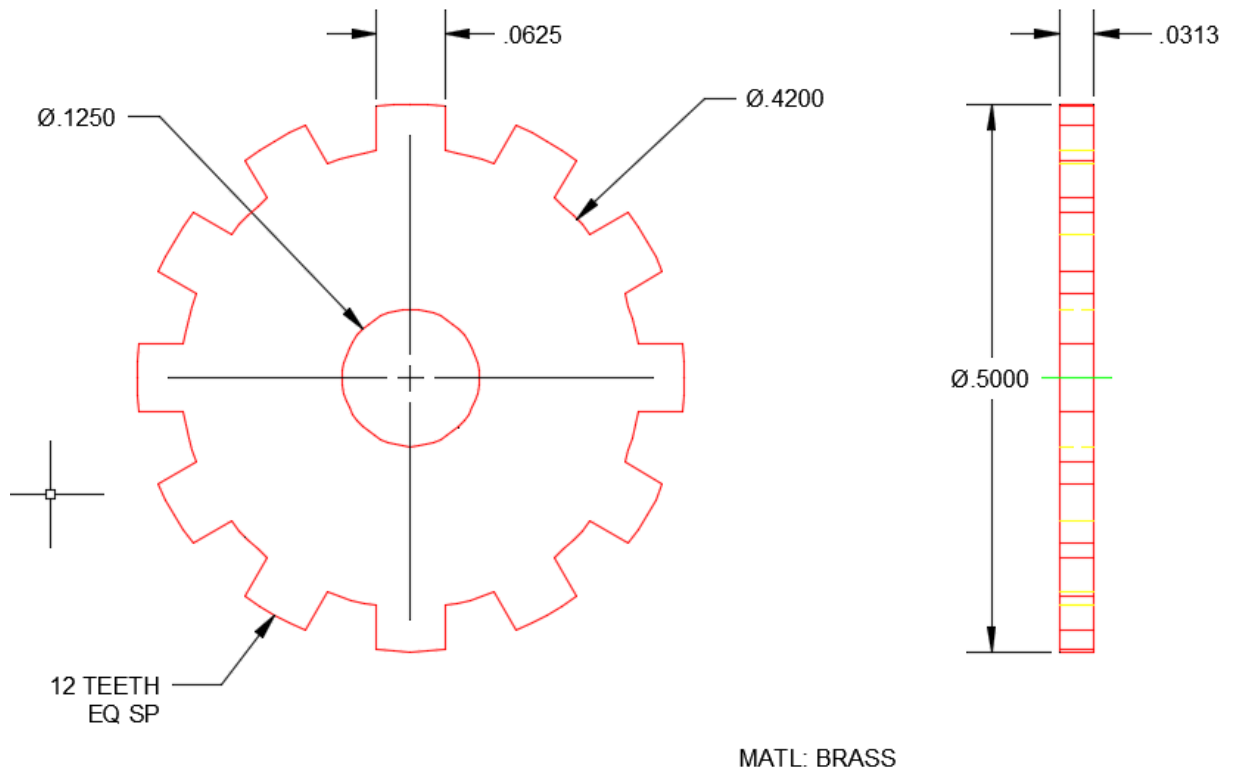


FIGURE 21 PROJECT DIMENSIONS AND NOTES

8. Select the Layout1 tab, you should see the sheet of paper, a viewport window, and your project inside the viewport window.
9. Right Click on the Layout tab and select Page Setup Manager.
10. Pick the Modify button.
11. Select your printer/plotter or pdf file writer.
12. Select ANSI A (landscape) paper size.
13. Set the What to Print to Layout.
14. Set the Plot Scale to 1:1. Remember the scaling will take place within the viewport.

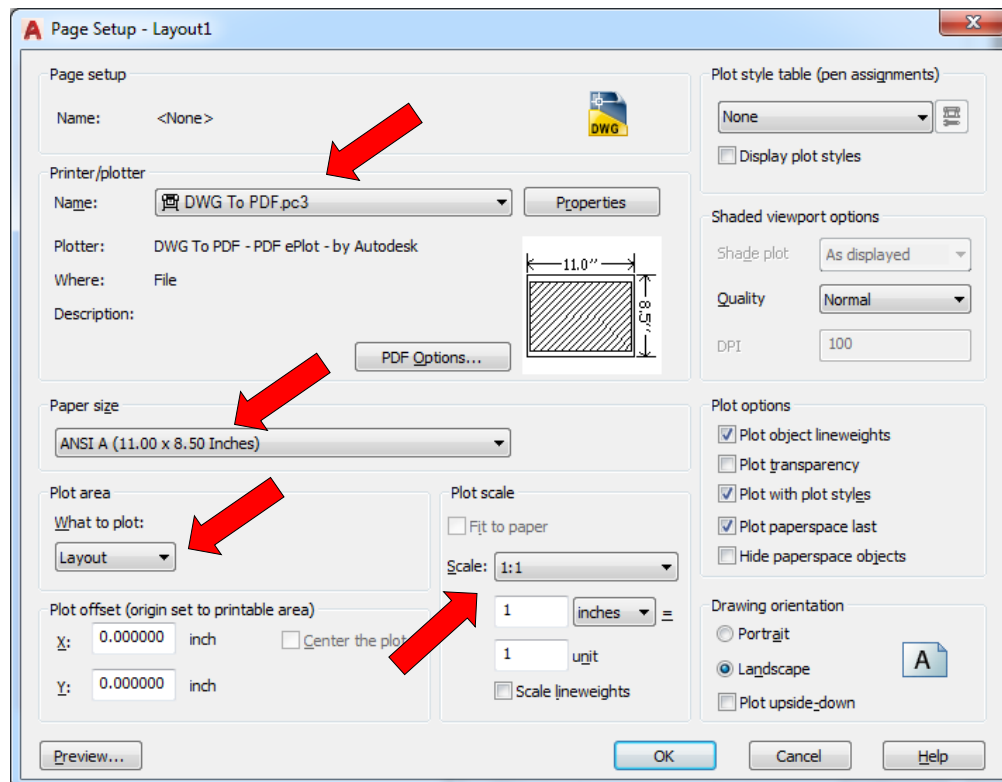


FIGURE 22 PAGE SETUP – PAPER SIZE, PLOT AREA, AND SCALE

15. Pick OK to complete the Page Setup Manager.
16. The final step is to set the viewport scale to 8:1. To do this select the viewport window.
17. On the status bar set the scale to 8:1. (You may have to use the PAN tool to position your project in the viewport window.)
18. I strongly recommend locking the viewport display once you have it like you want it. Select the viewport, Right Click and Select Display Locked and **Yes**. This will prevent any accidental zooming that will change the viewport scale.

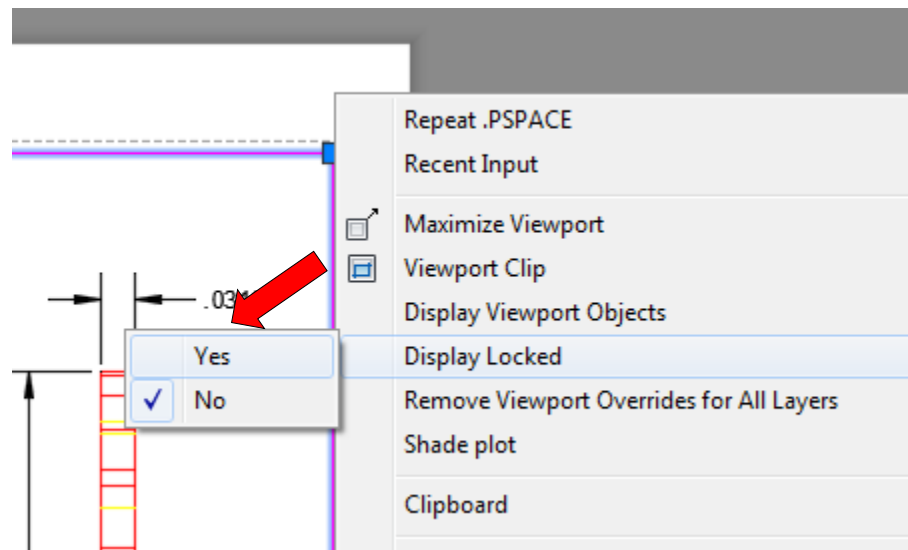


FIGURE 23 LOCK THE VIEWPORT DISPLAY TO PREVENT ACCIDENTAL CHANGING OF THE SCALE

That is it! This project is ready to plot to scale. Go ahead and plot this project and measure the length of the .5 diameter dimension. It should physically measure 4 inches ($8 \times .5 = 4$).

Example 4

We should work through another one of these projects, just to make sure we got it all down. So go ahead and launch AutoCAD and open the Best Way 2 drawing. If you prefer to follow along with a video use this link: [Best Way 2](#).

This arm drawing includes a top and front view with dimensions and text. In this case I want to plot this drawing full size (1:1) and I want to plot it on an ANSI C size landscape sheet. Because this part fits on a C size sheet without scaling, there is no need to do the math in this case.

1. Launch AutoCAD
2. Download and Open the Best Way 2.dwg.
3. Select the Layout1 tab, you should see the sheet of paper, a viewport window, and your project inside the viewport window.
4. Right Click on the Layout tab and select Page Setup Manager.
5. Pick the Modify button.
6. Select your printer/plotter or pdf file writer.
7. Select ANSI C (landscape) paper size.
8. Set the What to Print to Layout.
9. Set the Plot Scale to 1:1.

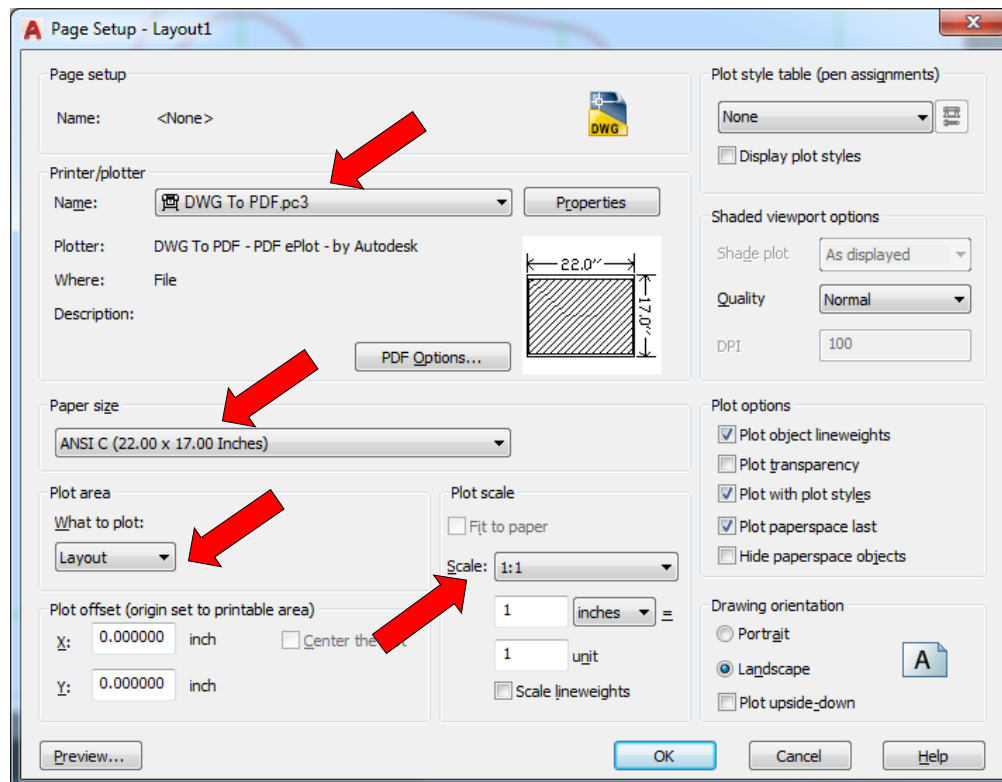


FIGURE 24 PAGE SETUP – PAPER SIZE, PLOT AREA, AND SCALE

10. Pick OK to complete the Page Setup Manager.
11. Adjust the size of the viewport window using the corner Grips.
12. Set the viewport scale to 1:1.
13. If needed PAN the project to center the arm in the viewport window.
14. Plot the project, confirm the dimension measurements. They should measure exactly as shown in the dimension value.

Bonus Example 5

Perhaps you decide you would like to plot this arm part on an ANSI A sheet. You need to do the math to confirm the part views and dimensions will fit on an A size sheet at half size (1:2).

$$\frac{11}{9} = 1.2 \text{ and } \frac{10}{6.5} = 1.53$$

Since both values are less than 2, you should determine that it will fit. Picking up where you left off above.

1. Click the + sign to add a new Layout tab.

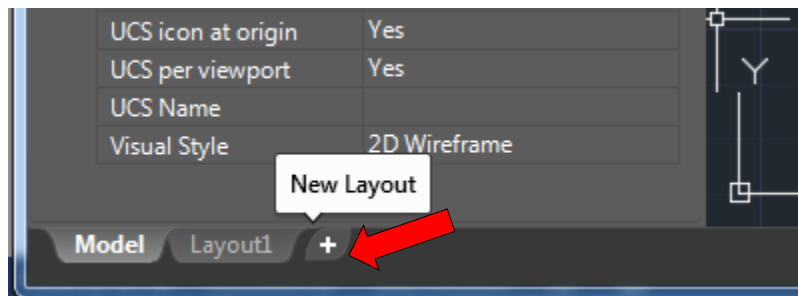


FIGURE 25 CREATE A NEW LAYOUT

2. Right Click your new tab and select Page Setup Manger
3. Adjust the Paper size to ANSI A size.
4. Keep the What to Plot set to Layout.
5. Keep the Plot Scale set at 1:1. Remember the scaling happens within the viewport window, not the page.

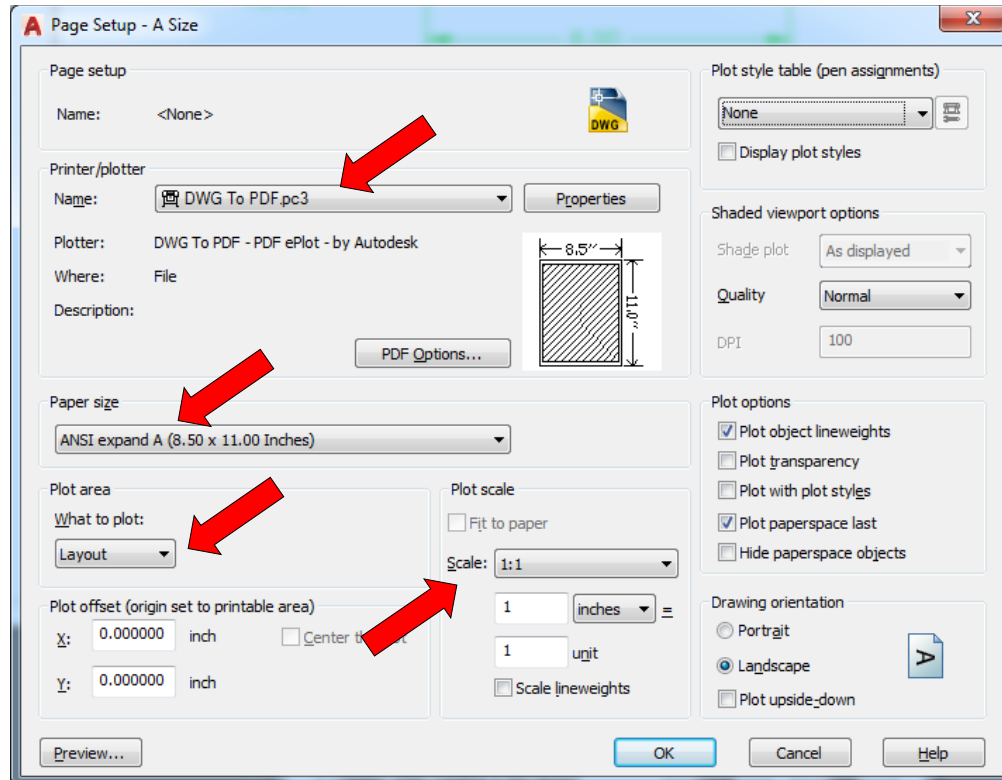


FIGURE 26 PAGE SETUP – PAPER SIZE, PLOT AREA, AND SCALE

6. Pick OK to complete the Page Setup Manager
7. Adjust the viewport window on the page.
8. Set the viewport scale to 1:2 on the status bar.
9. If needed PAN your project to be centered in your viewport.
10. Select the Viewport and Right Click.
11. Select Display Locked and Yes, to prevent accidentally changing the viewport scale.

12. If you look closely, you should notice that your dimensions and text are too small.
They are exactly half the size you want them to be.
13. Select all of the dimensions and Right Click and select properties to open the Properties Pallet.
14. With all of the dimensions select change the Annotative property to YES.
15. Next you will need to add the 1:2 Annotative Scale property to the dimensions.
16. Convert the MATL: AISI 1020 text string to be Annotative and ADD the 1:2 Annotative Scale property to it as well.

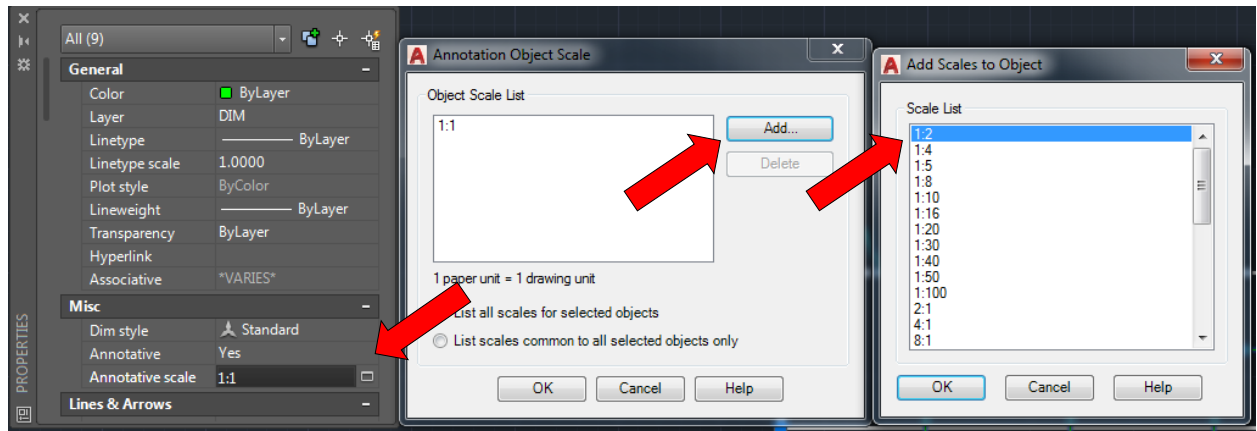


FIGURE 27 ADD NECESSARY ANNOTATION SCALES TO ANNOTATIVE ELEMENTS

17. Take another close look at your drawing you can see, the dimensions are too close to the part.
18. I like to use the STRETCH command to add another half inch between the first-dimension line and the part.
19. Now you can plot this part on A size sheet at half scale (1:2) or on C size sheet at full scale (1:1) by selecting one tab or the other.

Plotting from Paper Space “The Worst Way”

So far you have mastered two methods of plotting drawings to specific scales. If you are sick of it at this point, just walk away. This next method is the worst way and I don't recommend using it, but I promised three methods so here goes. I call it the Worst Way because to me it confusing and difficult to keep everything set to work properly. What makes this method different, is that the scaling happens with the Page Setup instead of within the viewport. You are just making a larger or smaller sheet of paper.

As with the previous method, you need to know your paper sizes, you should know your project size, and you must do the math to determine an appropriate scale.

For this demonstration, I'll use the same part from Example 1 above. We have already done the math and we know that part and dimensions will fit on an ANSI A landscape sheet at half scale (1:2). Making the scale factor 2.

Drawing Limits

Like the previous plotting from Paper Space method the Model Space drawing limits are not a factor at all.

Text Size and Dimension Styles

You can use either method described above to set your text and dimension sizes. I would recommend the “Best Way” method which uses annotative object. So I’ll describe that method first, then follow it with the “Old School” method. Both of which should be a review at this point.

“Best Way”

Set your text, dimension, and leader styles to be Annotative. Make sure you have set the text size to the desired paper size, .125 inches, in this case. Also make sure your dimension style is using an Annotative text style.

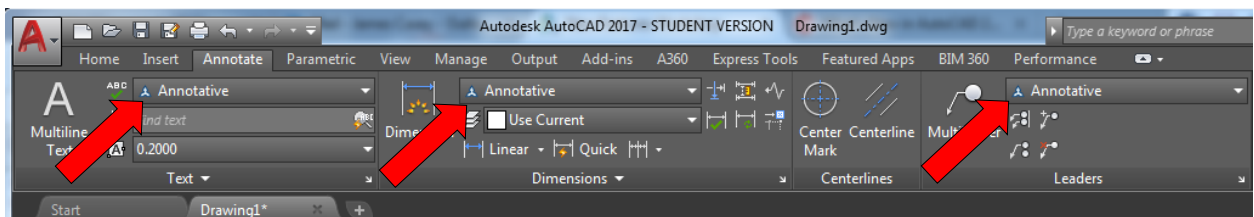


FIGURE 28 CONFIRM YOUR TEXT, DIMENSION, AND LEADER STYLES ARE ANNOTATIVE

“Old School”

You will have to use the Model Space methods of setting text sizes and dimension sizes. That is multiplying the desired text height by the determined scale factor and setting that height in the Text Style. In this case I want my text to print out as .125 inches, so I set the size to .25 ($2 * .125 = .25$).

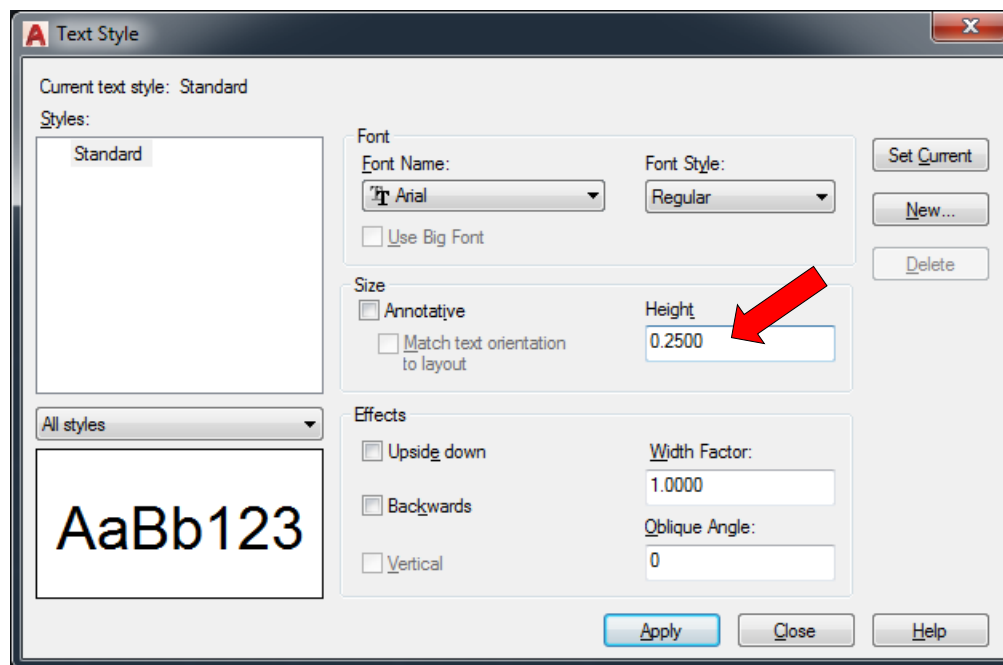


FIGURE 29 MULTIPLY DESIRED TEXT SIZE BY SCALE FACTOR

We also need to apply the scale factor to our Dimension Style. The DIMSCALE system variable should be set to be the same as the scale factor we calculated. The DIMSCALE system variable will multiply the specified sizes for all of the dimension elements, which makes everything the proper size by making a single adjustment. You can set the DIMSCALE variable on the Fit tab of the Modify Dimension Style dialog box or simply type DIMSCALE at the command line.

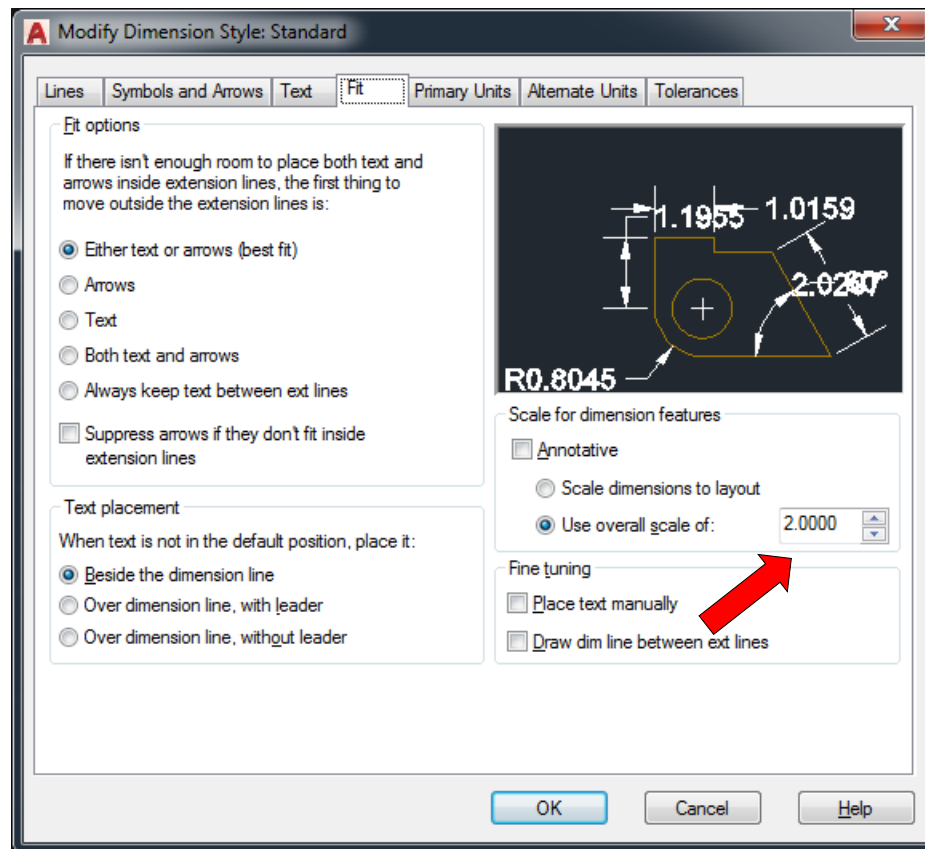


FIGURE 30 USE OVERALL SCALE OF EQUAL TO SCALE FACTOR

Page Setup – Layout tab

Right click on a Layout tab and select Page Setup Manager. With this method, we set the scale here. In this case, the scale is set to half size (1:2). This is doubling the size of the paper.

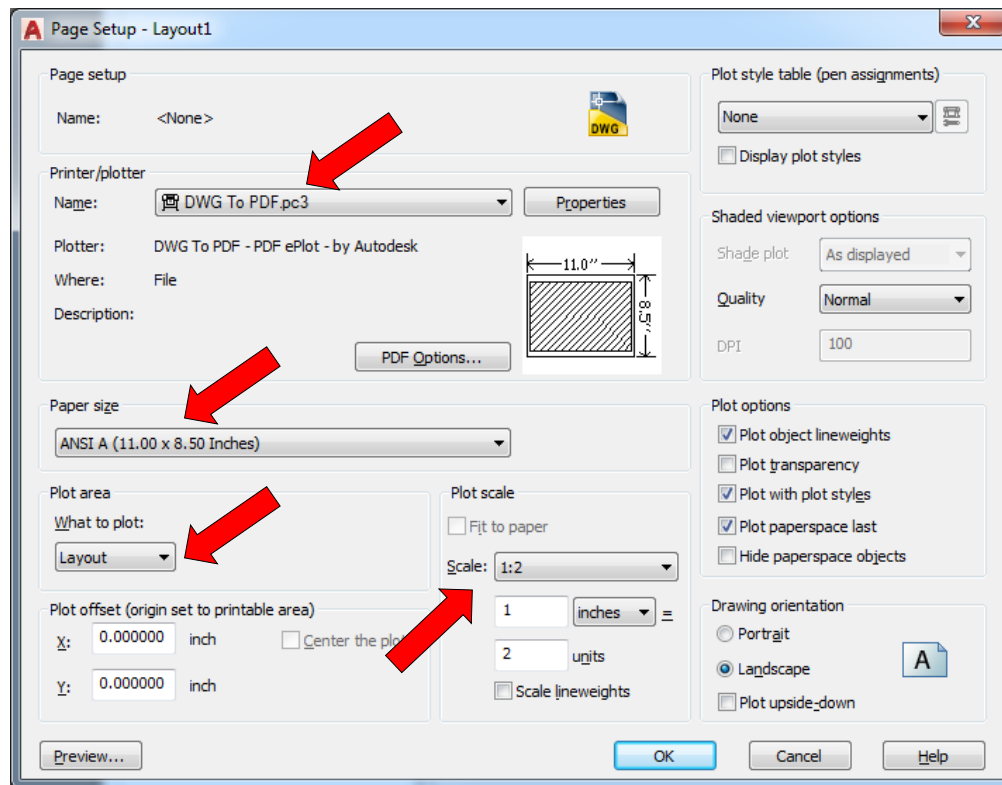


FIGURE 31 PAGE SETUP – PAPER SIZE, PLOT AREA, AND SCALE

When you click OK to complete the Page Setup Manager, you will notice the sheet has gotten a lot bigger. Use the Grips to adjust your viewport window to fit the entire page.

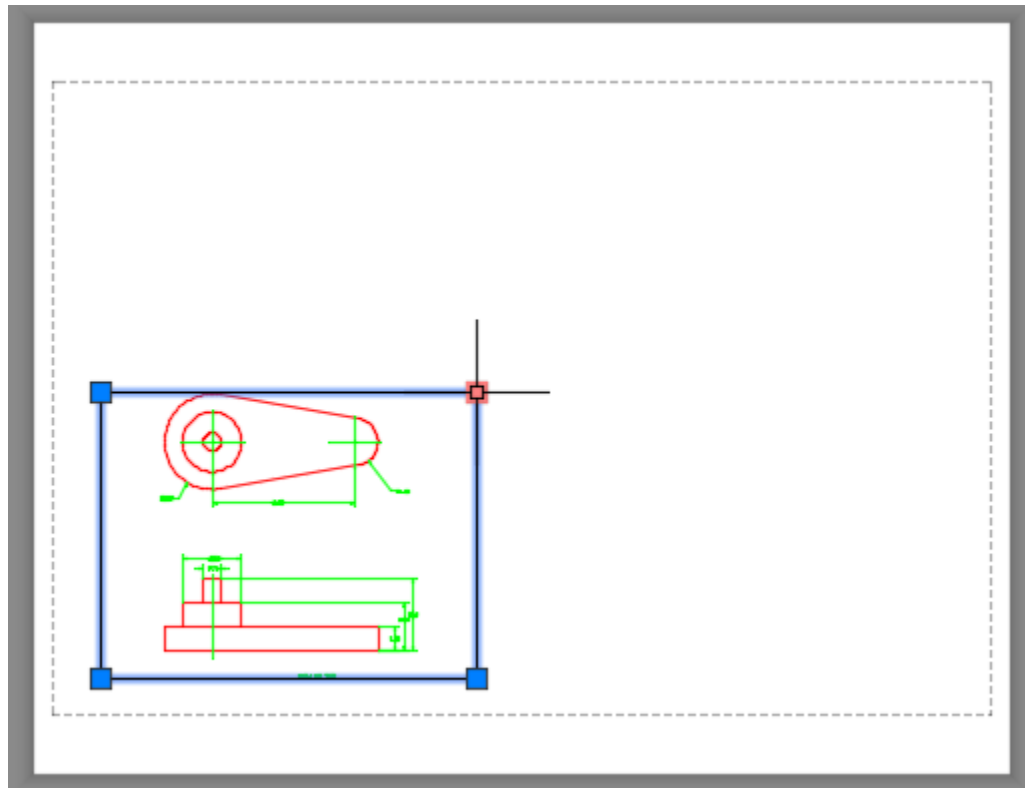


FIGURE 32 RESIZE VIEWPORT TO FIT THE PAGE

The final step is to set the viewport scale in the status bar. **IMPORTANT!** The viewport scale is 1:1, regardless of the scale you are wanting. Remember we set the scale using the Page Setup Manager.

Depending on which method you used to set your text and dimension sizes depends on what to do next. If you used the “Old School” method, your project is ready to plot. If you used the “Best Way” method your Annotative dimensions and text likely is not showing up at. This is because your Annotative scale is 1:2 and your viewport scale is set to 1:1. Fortunately, there is a tool that will allow the Annotative elements to show up even when they conflict with the viewport scale. That tool is on the status bar, show annotation objects at current scale.

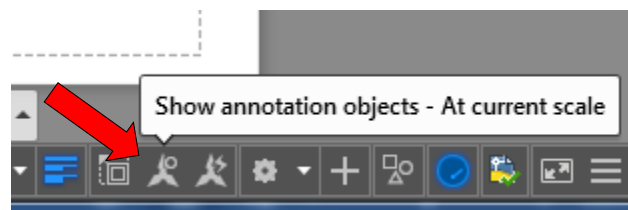


FIGURE 33 SHOW ANNOTATION OBJECTS AT CURRENT SCALE

Hint: Your annotative elements can have only one Annotative scale set and it must match the scale you set in the Page Setup Manager.

Worst Way Pitfalls

1. Like the other methods, the dimension spacing is NOT automatically updated. You need to account for the scale when placing your dimensions. I want my first dimension to measure 1/2" away from the part. So if the scale factor is 2, I have to place that dimension 1" away.
2. You can only have one Annotative Scale assigned to your Annotative elements and must match your Page Setup Scale.
3. It is easy to get confused about what your scale is because you can't readily see it on the status bar.

Example 6

We will do one of these and let's use the familiar part from example 1 above. Like before we want to fit this on an ANSI A landscape sheet at half scale (1:2). We have already done the math and we know it will fit. If you prefer to follow along with a video use this link: [Worst Way](#).

1. Launch AutoCAD.
2. Download and Open the Worst Way.dwg.
3. Confirm you are in Model Space by selecting the Model Space tab.
4. Modify the Standard Text Style to be Annotative with a paper size of .125 inches.

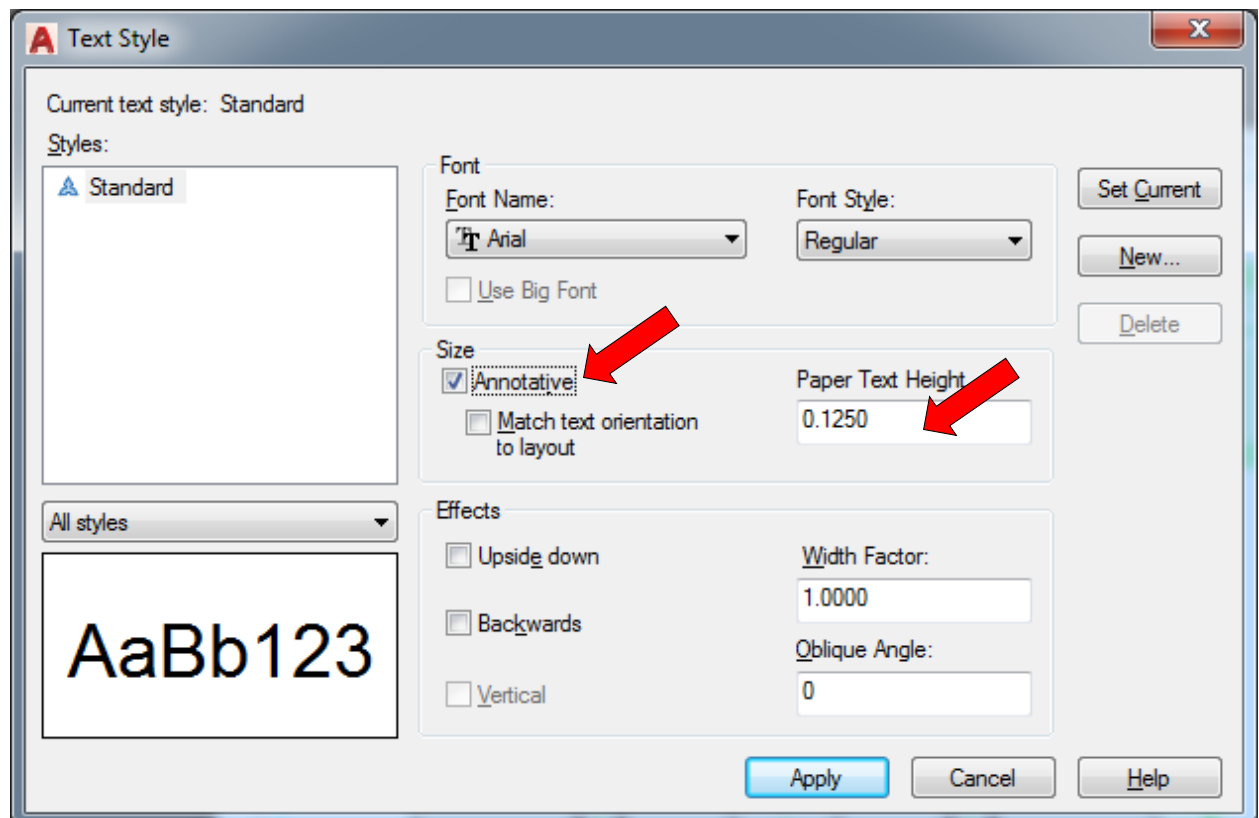


FIGURE 34 SET TEXT STYLE TO BE ANNOTATIVE

5. Confirm the Annotation Scale is set to 1:2 on the status bar.
6. Add the MATL: AISI 1020 note.
7. Modify the Standard Dimension Style to be Annotative and add the Linear and hole diameter dimensions. Remember you should place the first dimension 1 inch away from the part.

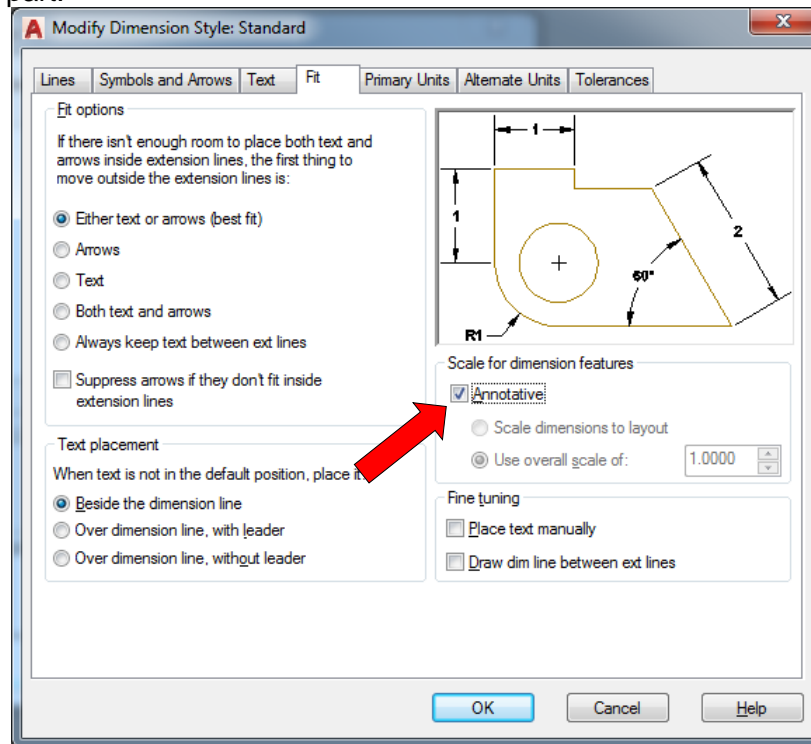


FIGURE 35 SET DIMENSION STYLE TO BE ANNOTATIVE

8. Set the Leader Style to be Annotative.

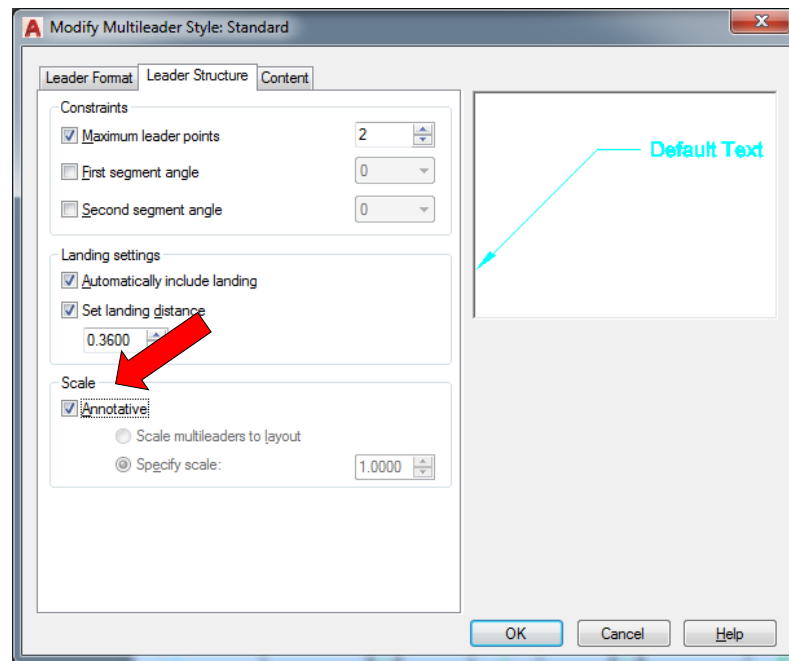


FIGURE 36 SET LEADER STYLE TO BE ANNOTATIVE

9. Add the threaded hole note (2x .250-20 UNC – 2B) using a leader.
10. Select the Layout1 tab, you should see the sheet of paper, a viewport window, and your project inside the viewport window.
11. Right Click on the Layout tab and select Page Setup Manager.
12. Pick the Modify button.
13. Select your printer/plotter or pdf file writer.
14. Select ANSI A (11 x 8.5) paper size.
15. Set the What to Print to Layout.
16. Set the Plot Scale to 1:2. This is the difference maker.
17. Pick OK to close the Page Setup Manager.
18. You will need to resize the viewport window to better fit the page. Edit using the Grips.
19. Set the viewport scale 1:1, yep Really (That is where it gets confusing!).
20. Your Annotative Elements probably will not show up.
21. Pick the show annotation objects at current scale and your set.

This project is ready to plot to scale.

Conclusion

You should be able to use one of these methods to plot all your projects to any scale you need to fit any size sheet you desire. You just need to: 1) know the sheet sizes you plan to use. 2) Measure or know the actual size of your project. 3) Follow one of the methods described above to setup your Text, Dimension, and Leader Styles, Drawing Limits, and Page Setup.

My last bit of advice, is to repeat that you should **ALWAYS** create your projects full size and let the viewport handling the scaling. You should follow your industry or company drawing scale standards.

Revised: 10/30/2019