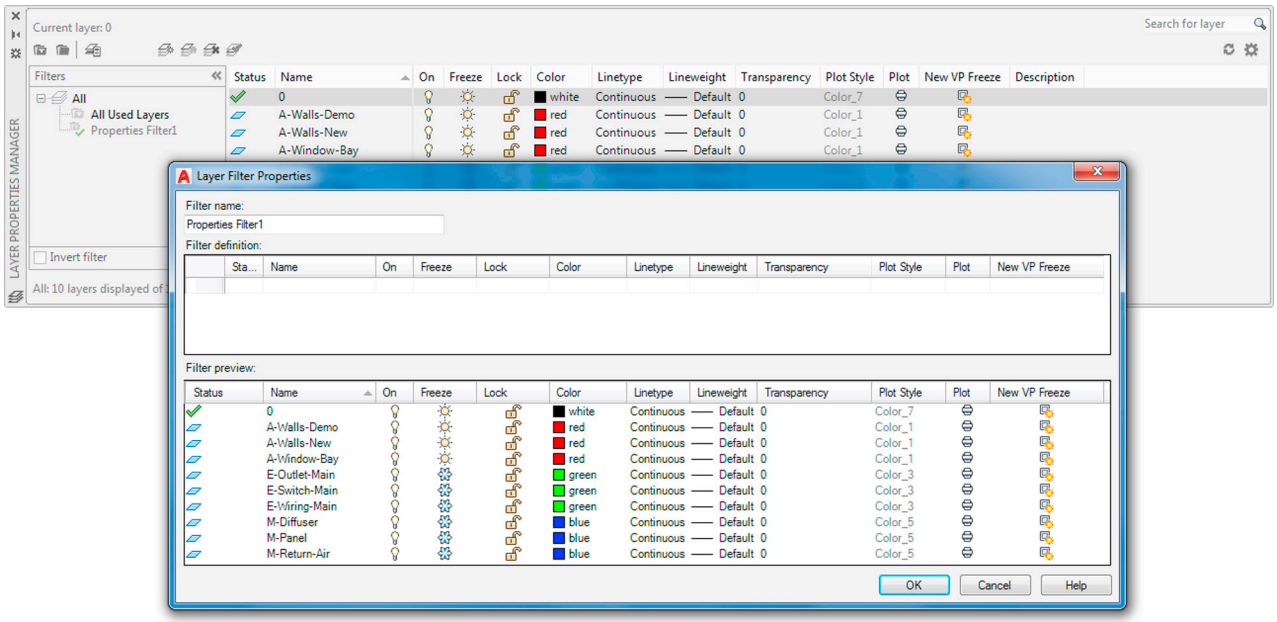
Chapter 12

Advanced Layers



Learning Objectives

In this chapter, we introduce advanced layers and discuss the following:

- The need for automation
- Script files
- Layer State Manager
- Layer filters

By the end of this chapter, you will learn how to use and apply these new types of layer tools and be able to incorporate them into future design work where a large number of layers are present in the file.

Estimated time for completion of this chapter: 1–2 hours.

12.1 INTRODUCTION TO ADVANCED LAYERS

After the basic commands in Level 1, we introduced the layer concept. This was just a basic primer, showing you how to create them and set a variety of items, such as color and linetype. Also, several methods of control were covered, such as freezing and locking. Here, we look at additional powerful features that allow for unprecedented control over your layers. They are script files, the Layer State Manager, and layer filtering.

Up and Running with AutoCAD 2017: 2D and 3D Drawing and Modeling. DOI: http://dx.doi.org/10.1016/B978-0-12-811058-4.00012-8

So, why do you need advanced layer control tools? Well, imagine the following scenario. You work at a large architecture or engineering consulting firm that specializes in complete commercial building and site design. Among your staff are a number of

- Architects and interior designers to lay out the overall exterior and interior of the building.
- Civil engineers to assist in structural design and site plans.
- Mechanical engineers to design the HVAC and mechanical systems.
- Fire protection and security engineers to design the electrical, sprinkler, and security systems.
- Landscape designers to integrate landscape design into the site plan.
- Additional design professionals as needed for specialized subsystems.

All these people contribute to the complete design in their own way. Generally, all their work is based on (or ends up in) one main building design file. This common file contains not only the architectural layout of the building but also the data from all these other disciplines. Each discipline has its own set of layers, usually following the AIA convention or another in-house layer naming method. Therefore, architects have their own set of layers starting with an A- (e.g., A-Demo-Wall, A-Bay-Window). Civil engineers have their own (C-Struct-Column, etc.), electrical engineers their own (E-Light-Switch), and so on.

You may already see where this is going as far as layers are concerned. As the project progresses, the layers grow in number. Toward the end, when everyone has added his or her respective design, the file may contain as many as 500 layers (not common, but not entirely unusual either!). There needs to be a way to impose some order and control over them, so only the needed layers are visible to each discipline. This can certainly be done by manually freezing and thawing layers but is very time consuming. If you guessed that some sort of simple automation is available to you for this purpose, then you are correct.

This, in essence, is advanced layer management, a process where the layers, once set, are saved under a descriptive name, such as `Arch_Layout` or `Elect_Layout`, and recalled when necessary by simply clicking on the name. AutoCAD then freezes and thaws the layers automatically, exactly the way you initially told it to. This is what script files, the Layer State Manager, and layer filtering do. These tools allow sorting, classifying, and filtering of layers according to a variety of properties and are indispensable when working on a large project.

12.2 SCRIPT FILES

A script, in most general terms, is simply a text file with one command on each line. Its purpose is to automate a sequence of commands when executed. It is perhaps the simplest type of programming you can do. All you need is a text editor (such as Notepad). You next list the commands you want the script to go through, one per line. Then you save it under a name and an .scr extension (e.g., `MyScript.scr`), close the file, and run it from AutoCAD's command line by typing in `script` and pressing Enter (alternatively via the Ribbon's Manage tab→Run Script). The Script dialog box appears, the script is double-clicked on (executed), it does its →thing; and if you got the command sequence correct, a short task is automatically performed.

Scripts are generally not used as much now for purposes of layer control as they once were, but we briefly cover them because knowing how they perform gives you insight into the other remaining tools. It is also a good skill to have overall. You can automate a variety of AutoCAD routines. It may be worth your time to read up on further script file details in the Help files, as we do not go too much in depth here.

We present a very simple example of a script file. It freezes all layers after first thawing them and setting 0 as the current layer. As scripts do not work with dialog boxes, everything has to be command-line driven, such as this version of the layer command (generally any commands that are preceded by a hyphen [`-`] go to the command line, bypassing any dialog boxes). After the -layer is a set of answers to prompts: `t` means thaw, `*` means all, `s` means set, and `f` means freeze. This exactly answers everything AutoCAD asks for if you were to do this by hand at the command line. The last two keystrokes (→→) are Enter and Enter.

```
-layer
t
*
s
0
f
*
→→
```

This reads as Layer, Thaw, All, Set, 0, Freeze, All, Enter, Enter. Try this out with an AutoCAD file that has a bunch of layers. In a real application, you of course have to manually type in the layers deemed not relevant to the particular state (which therefore need to be frozen) in place of the last * and before the two Enters. The steps prior to that (t, *, s, 0) are necessary in case a layer that needs to be frozen is set to current (you cannot freeze the current layer), so the 0 layer is set as current.

This was a lengthy process and is the main reason why script files gradually fell out of favor, replaced by the Layer State Manager for layer control, as shown next. Keep in mind, however, that the Layer State Manager (LSM) works in pretty much the same way, except you select layers and do everything graphically through the Layers dialog box. Now that you have read through the underlying theory, we can rapidly go through the functions of the LSM.

12.3 LAYER STATE MANAGER

As described previously, the LSM is essentially a graphical version of script files. Since you should now have a basic understanding of what you need to do, let us just set up a collection of layers and go through the mechanics of how to set up several layer states. While our example is simple—we set up only three layer states, an Arch_Layout, Mech_Layout, and Elect_Layout—the theory can be easily extended to a large number of layers and states. Open up a new AutoCAD file and set up the following layers:

A-Walls-Demo
A-Walls-New
A-Window-Bay
E-Outlet-Main
E-Switch-Main
E-Wiring-Main
M-Diffuser
M-Panel
M-Return_Air

Assign color to these layers as shown in Fig. 12.1. What we want to do now is create a layer state called Arch_Layout. This means only the A- layers are needed, with the electrical and mechanical layers frozen. So go ahead and freeze the six layers beginning with E- and M-, as shown in Fig. 12.1. For those of you who notice every detail, the Transparency category has been moved out of the way to the end of the layer palette.

Now that the layers have been frozen, we need to save this "state" under the appropriate name. Click on the Layer State Manager button in the upper left of the Layers dialog box, as seen in Fig. 12.2. The LSM then appears (Fig. 12.3). It can be expanded (if it is not already) by pressing the arrow in the lower right corner.

We now create a new layer state by clicking on New… and filling in the name and description (if desired), as shown in Fig. 12.4, then clicking on OK. Once the layer state is entered, it appears in the LSM, as shown in Fig. 12.5, and you can press Close to exit out of the LSM dialog box.

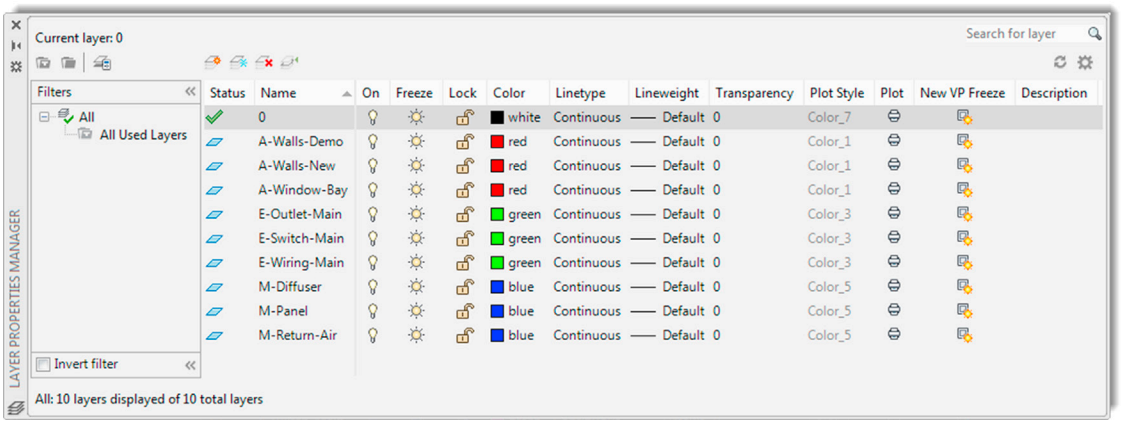


FIGURE 12.1 Layer setup for Layer State Manager exercise.

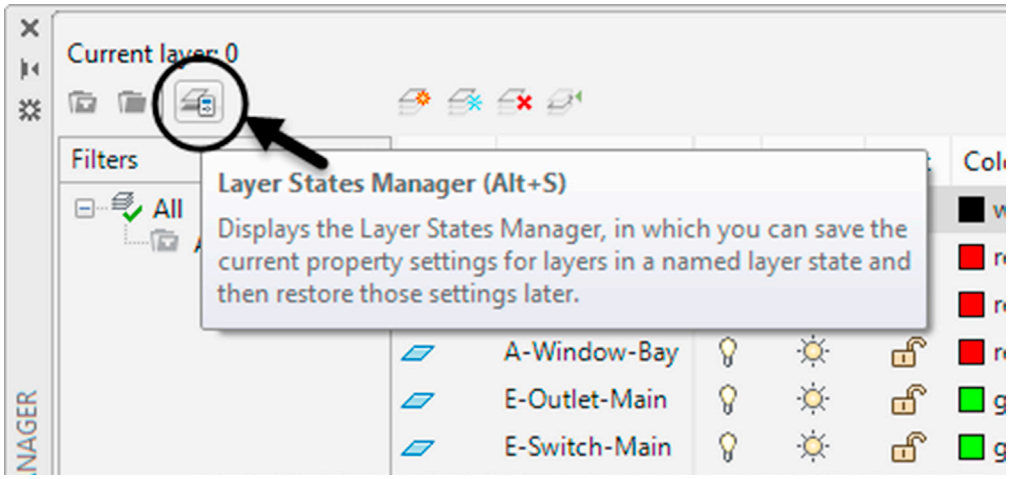


FIGURE 12.2 Layer State Manager icon.

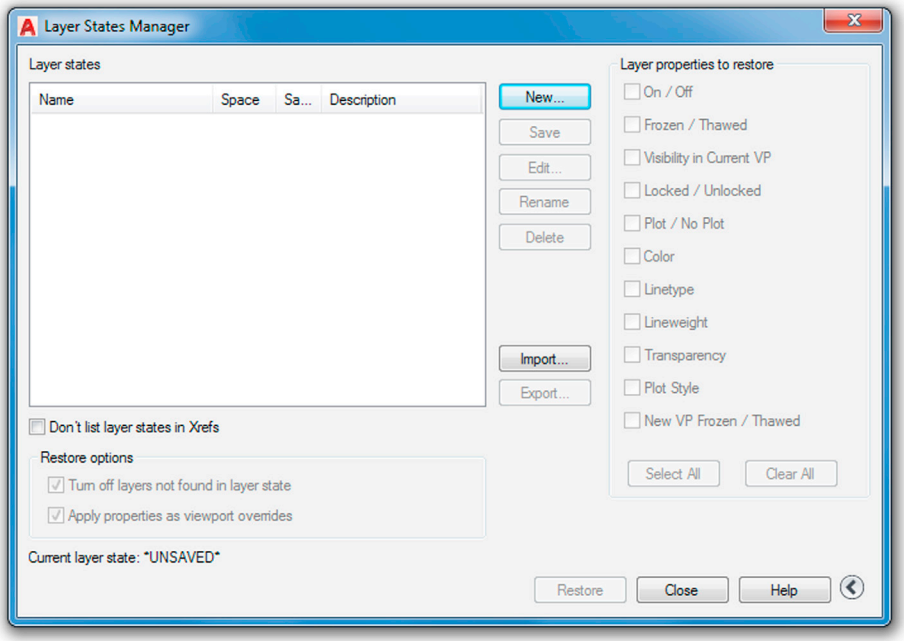


FIGURE 12.3 Layer State Manager (LSM).

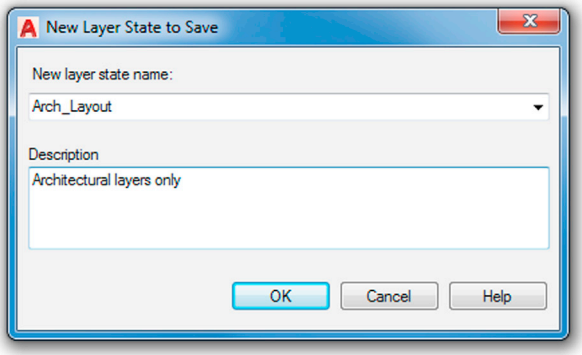


FIGURE 12.4 New Layer State to Save.

In the same manner, go back to the Layers dialog box and create the other two states: `Elect_Layout` (only E- layers visible) by turning off the unneeded layers and activating the LSM and `Mech_Layout` (M- layers visible). The result is shown in Fig. 12.6.

To activate these states when needed, you simply go to the Layers dialog box, click on the LSM icon, and when it appears, double-click on the state name or highlight it with one click and press Restore. Instantly, the correct layers are frozen or thawed (you can see this happen in real time in the Layers dialog box as you click on one state or another).

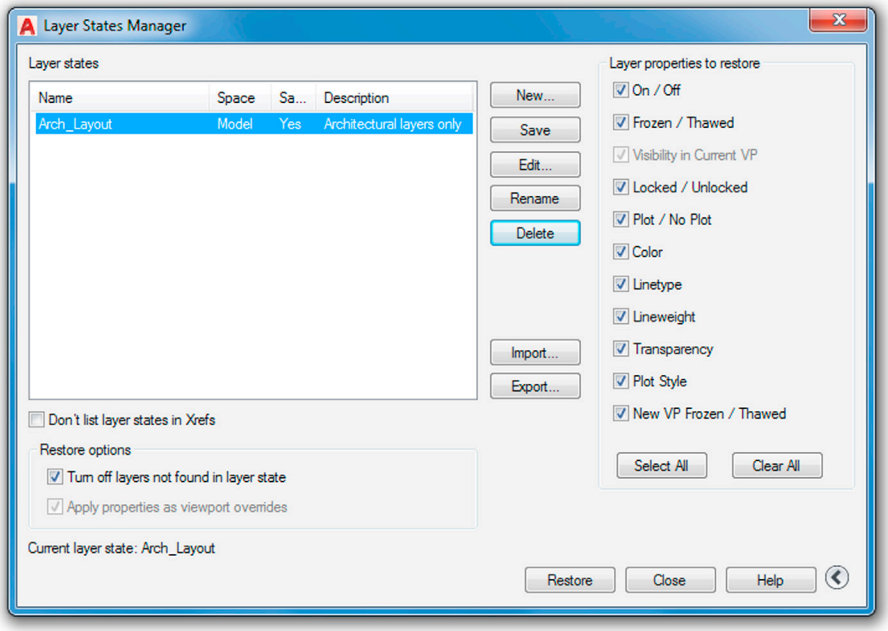


FIGURE 12.5 LSM with new layer state.

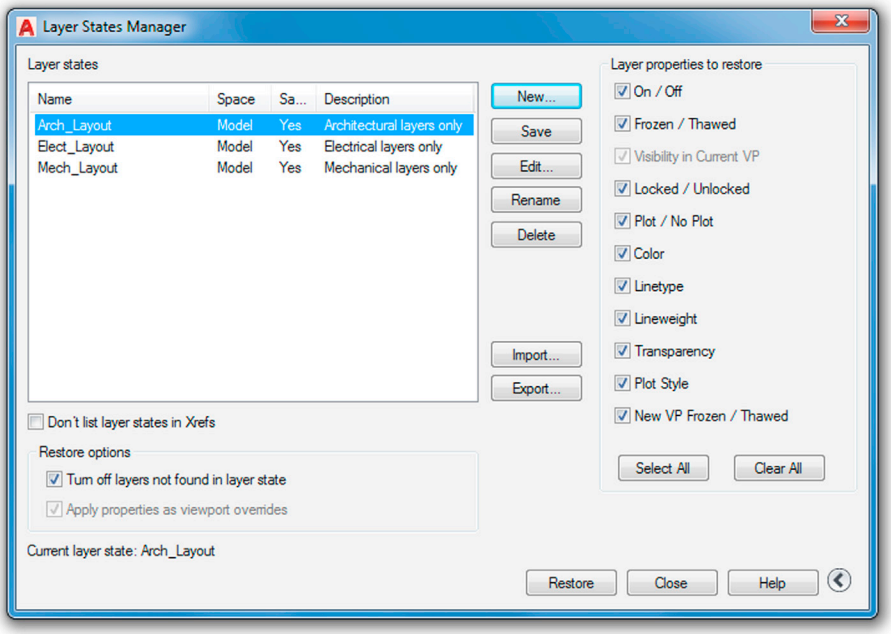


FIGURE 12.6 LSM with remaining layer states.

The purposes of the buttons found to the right of the main LSM window are as follows:

- *New*: Displays the New Layer State to Save dialog box, which we already used.
- *Save*: Saves the selected named layer state.
- *Edit*: Displays the Edit Layer State dialog box, where you can modify the layer state.
- *Rename*: Allows editing of the layer state name.
- *Delete*: Removes the selected layer state.
- *Import*: Layer states (`*.las` extension) can be imported from another file by means of this option, although this is not done often in practice.
- *Export*: Layer states (`*.las` extension) can be exported to another file by means of this option, although this is also rarely done in practice.

Some additional options are available in the LSM dialog box, if you click on the small arrow in the extreme bottom right, as previously mentioned (Fig. 12.7).

Layer properties to restore is simply a listing of every property a layer typically has, and you can check off different properties if you want them restored. If all are checked, as is more typical in practice, all the layer's properties are affected.

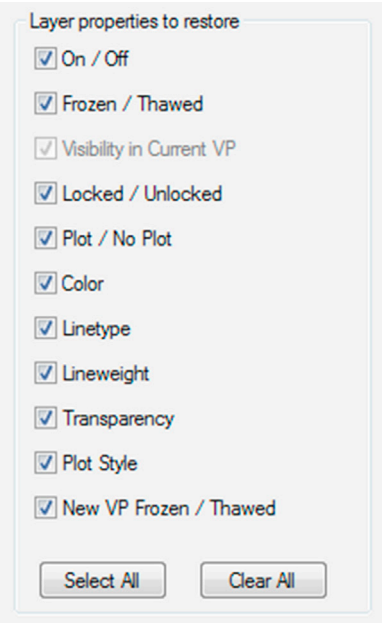


FIGURE 12.7 Additional LSM options.

12.4 LAYER FILTERING

Layer filtering is a tool that allows you to filter out (or selectively choose) layers that fall under a certain description. You can create filters of your own choosing and assign them names. For example, if for some reason you want only the red layers to show or ones assigned a hidden linetype, this can be done. Layer names can also be filtered. If you want only those layers that start with an A- to show, this can be arranged, although in this case you are essentially doing what was described previously with the LSM.

The key to layer filtering is to set up filter definitions. These can include full names or partial names (using the wildcard * character) and property definitions (color, linetype, etc.). The entire left side of the Layers dialog box, since AutoCAD 2005, is dedicated to filters. When used properly, these are very effective tools. We highlight some of the more important features essential to using them in this chapter. You are encouraged to explore them further on your own as well.

Two types of filters are available as icons on the top left of the Layers dialog box, as shown in Fig. 12.8.

The New Property Filter is what you use to set up the definitions. If you press that icon, the box in Fig. 12.9 appears, with the previously entered layers visible.

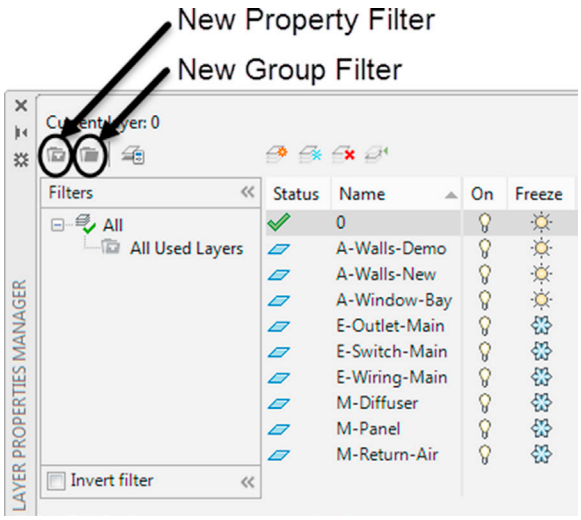


FIGURE 12.8 Layer filters.

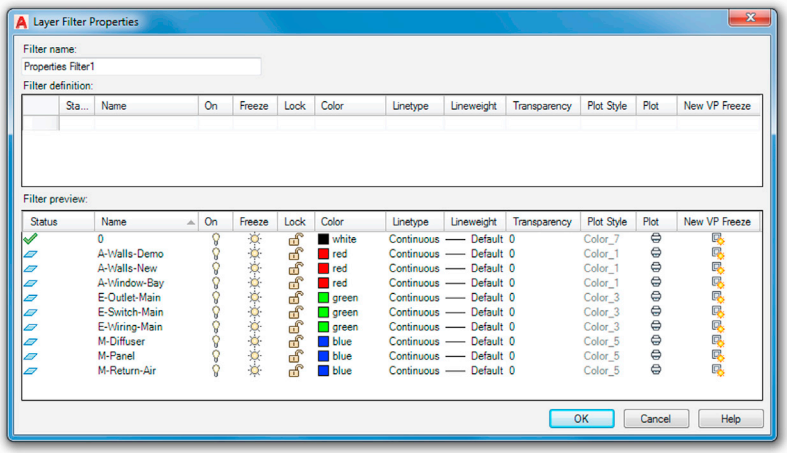


FIGURE 12.9 Layer Filter Properties.

The Layer Group Filter is a general filter that includes all the layers put into the property filter when you define it, regardless of their names or properties. Selected layers can then be added from the layer list by dragging them into the filter. This type of filtering is generally not used but can be employed to make a new filter based on the layers of another filter. To begin, click on the icon, create a name, and click and drag layer names from the right side of the Layers box into the group filter.

Remember an important point with filters: By themselves, they do little except sort the layers. It is up to you to then do something useful with this, such as freeze or lock them as needed. Therefore, think of filtering as simply a way to get the layers in some sort of order for further action on them.

Here, you first enter the name of your filter in the text field in the upper left. Then, it is just a matter of careful selection of the properties or names (or both) of the layers you want to see. You may use the wild character * in conjunction with typed parts of the layer name to indicate to the filter to include anything before or after the specific letters. Any property can also be used as a filter; color and linetype are common ones.

Go through the filter at your own pace and experiment with the settings. Shown in Fig. 12.10, as a simple example, are the layers that are green and the letter W somewhere in the name.

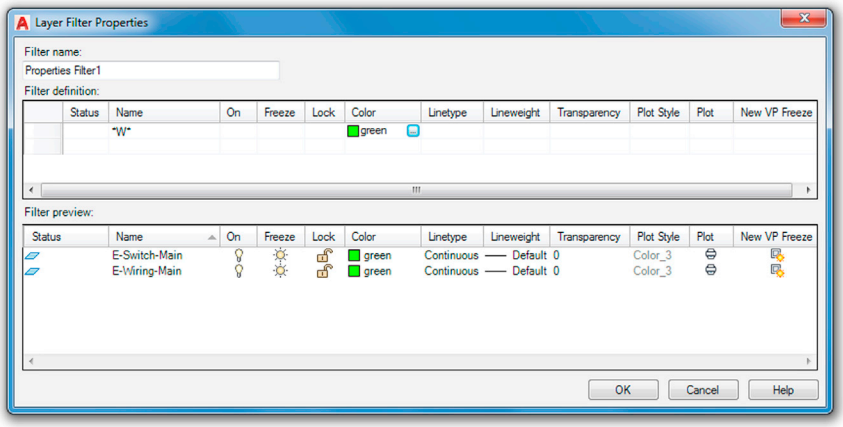


FIGURE 12.10 Example of layer filtering.

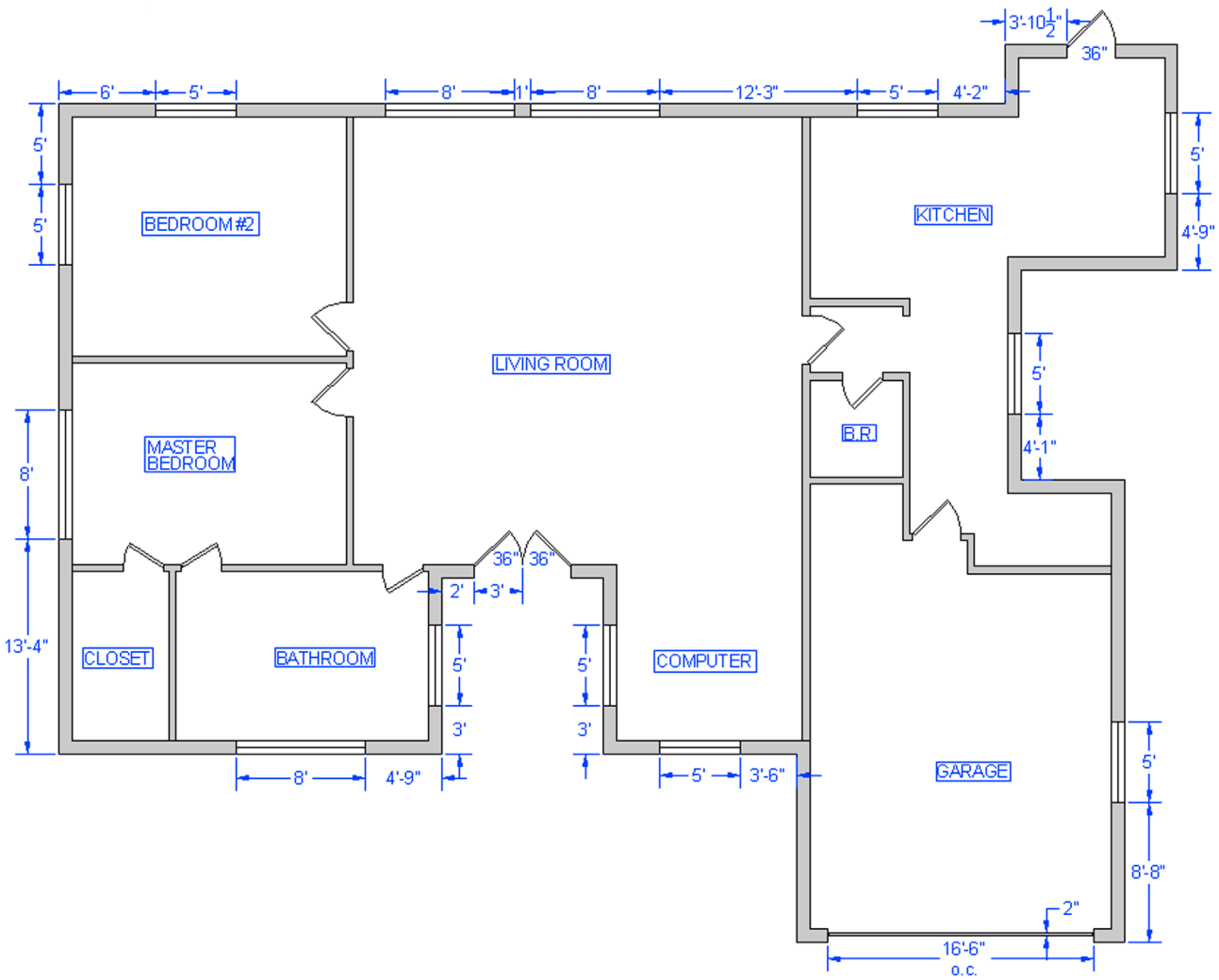


FIGURE 12.11 Exterior windows and doors.

12.5 LEVEL 2 DRAWING PROJECT (2 OF 10): ARCHITECTURAL FLOOR PLAN

For Part 2 of the drawing project, you continue to add to the walls of the floor plan, with a lot of new work on the interior, as well as adding doors, windows dimensions, and text. We can now also hatch the exterior and interior walls.

Step 1. As always, before starting to draft something new, create the appropriate layers, as follows:

- A-Doors (Yellow).
- A-Text (Cyan).
- A-Walls-Hatch (Gray_9).
- A-Walls-Interior (Green).
- A-Windows (Red).

Step 2. Add in the exterior windows and all doors. Be sure to follow the layering guidelines carefully. Make all windows and doors blocks for convenience. The exterior dimensions are shown in Fig. 12.11. Note that the deck and deck hatching is frozen, as it is not relevant to the new material you are adding.

Step 3. Add in the interior walls and doors as shown in Fig. 12.12. All interior walls are 5″ thick. Also add in the actual dimensions themselves. As mentioned before, they are very useful as a check of your drafting accuracy.

Step 4. Finally, add in the hatch (using the light gray color 9). This should be the very last step, because you need to erase the hatch if you find a mistake in the layout.

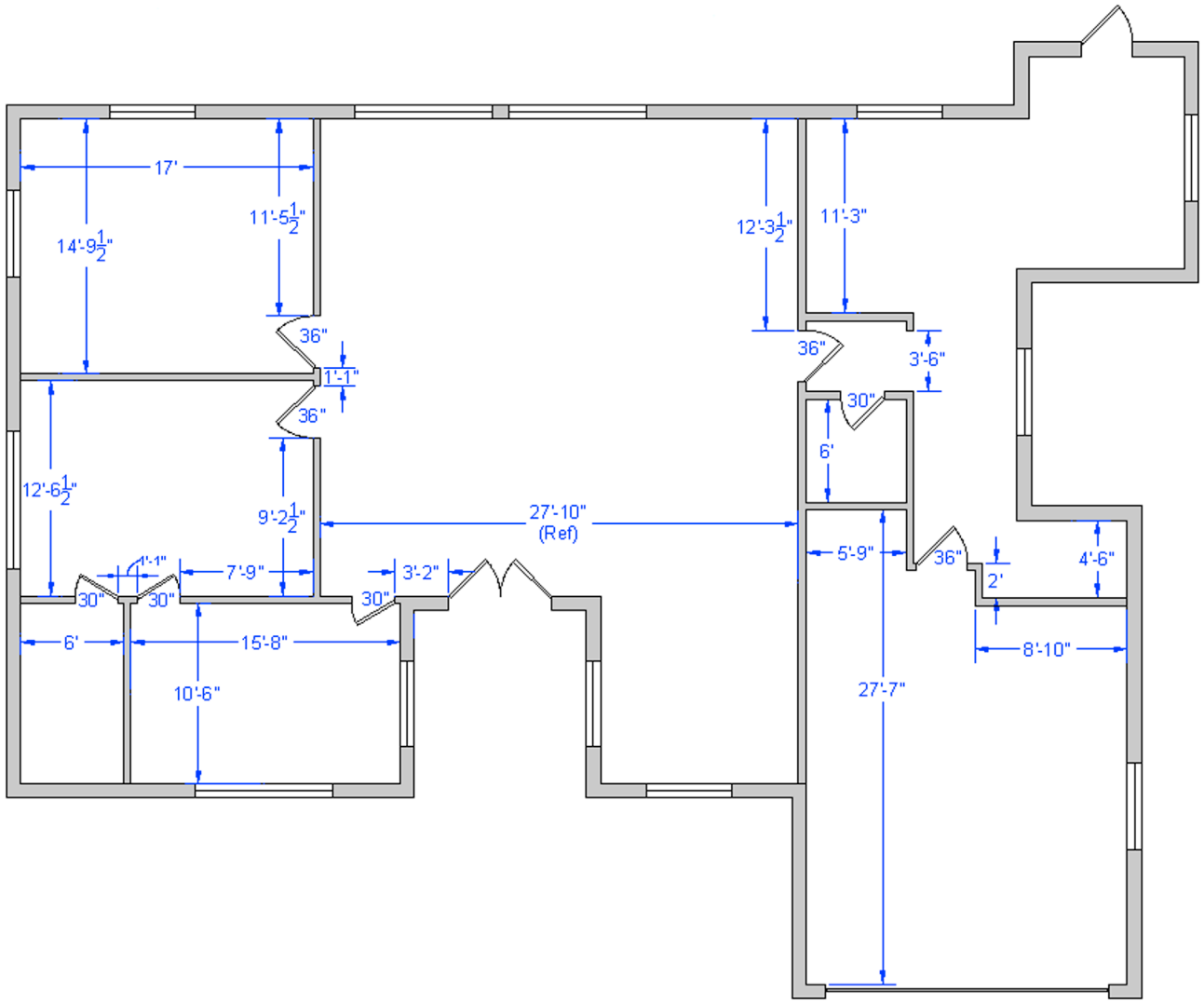


FIGURE 12.12 Interior walls and doors.

12.6 SUMMARY

You should understand and know how to use the following concepts and commands before moving on to Chapter 13, Advanced Dimensions:

- Script files
  - Basic concept
  - Writing a simple script file
- Layer State Manager (LSM)
  - New
  - Save
  - Edit
  - Rename
  - Delete
  - Import
  - Export
  - Restore
  - Layer properties
- Layer filters
  - New Property filter
  - Layer Group filter

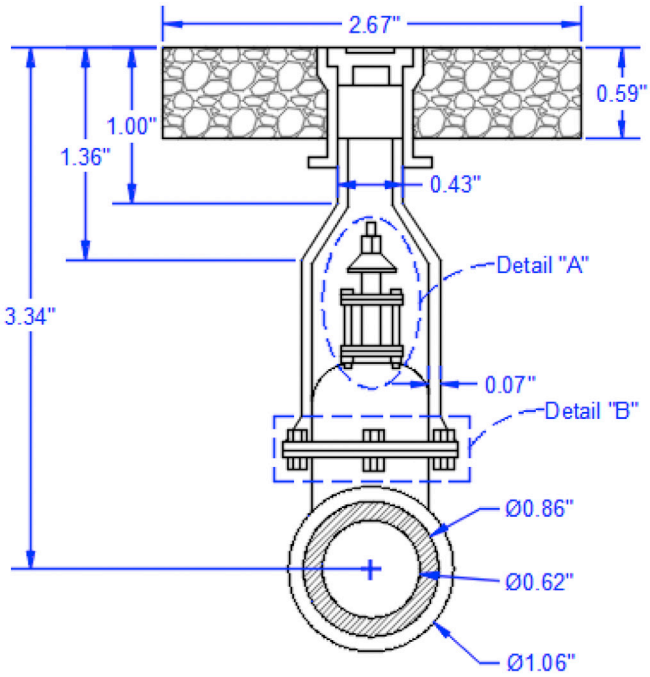
Review Questions

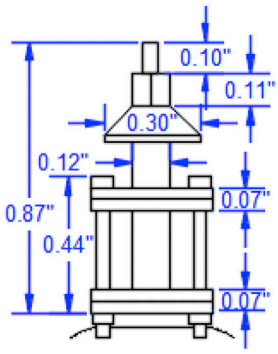
Answer the following based on what you learned in this chapter:

1. Describe what is meant by *layer management*. Why is it needed?
2. Describe the basic premise of a script.
3. What can a script file do for layer management?
4. Describe what the Layer State Manager does.
5. What are the fundamental steps in using the Layer State Manager?
6. What is layer filtering? What are the two types?

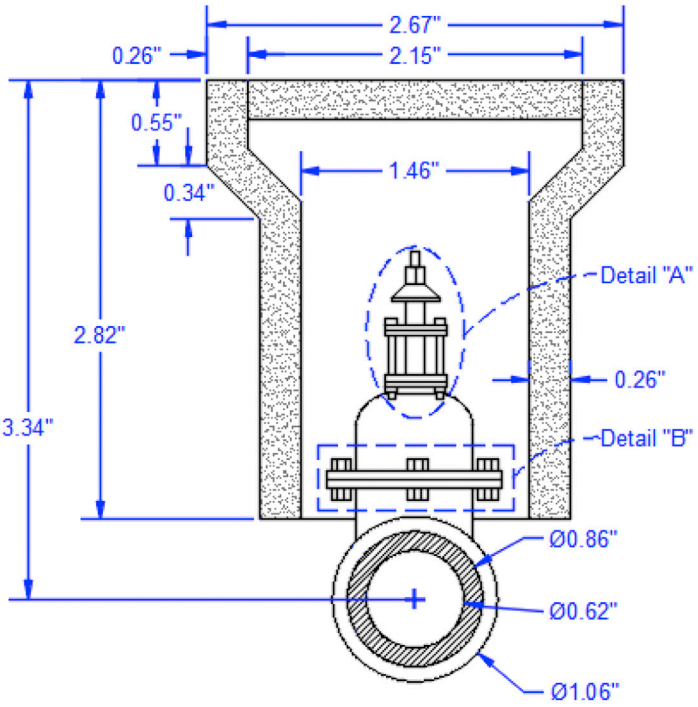
Exercises

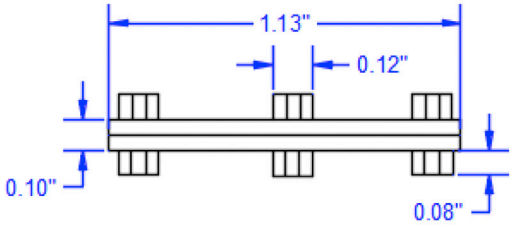
1. Create six layers (and colors) as shown next. Then, write a script file to thaw all the layers; set layer 0 as current. Finally, freeze all and thaw just the even numbered layers. (Difficulty level: Easy; Time to completion: 10 minutes.)
   - A-Walls_1 (Green)
   - A-Walls_2 (Red)
   - A-Walls_3 (Green)
   - A-Walls_4 (Red)
   - A-Walls_5 (Green)
   - A-Walls_6 (Red)
2. Using the same six layers, set up layer states `Odd_Layers` and `Even_Layers` and run them. (Difficulty level: Easy; Time to completion: <5 minutes.)
3. Using the same six layers, create filters to sort and capture only the green layers. (Difficulty level: Easy; Time to completion: <5 minutes.)
4. To maintain your drafting skills, draw the following two sets of mechanical valves. Not all dimensions are shown, so improvise when needed. The upper and lower valve assemblies have many features in common. Use the detail images to assist in drafting, but there is no need to draw them separately. (Difficulty level: Intermediate; Time to completion: 40–50 minutes.)





Detail "A"





Detail "B"

Spotlight On: Interior Design

Interior design is a major branch of architecture that concerns itself with interior living spaces. The goal is to create a personal, work, or public space that is both functional and aesthetically attractive by the creative use of colors, lighting, and materials (Fig. 1). Interior design is not to be confused with interior decorating. Interior designers are often well versed in the principles of architecture, engineering, and materials and must generally hold at least a four-year degree. They can be called upon to create challenging spaces that are tailored to certain ecological or handicapped-accessible needs. It is a creative profession, but one that still requires analytical skills.

FIGURE 1

Education for interior designers (in the United States) involves a four-year baccalaureate degree in interior design. Masters degrees (MS, MA, MFA, and recently the MID) in interior design are also available, although this advanced degree is not as common. Many professionals pursue advanced degrees in related subjects, such as industrial design, fine art, or education. Doctoral programs in interior design are increasing in number at various institutions of higher education. It is worth noting that some of the more notable interior designers held no formal education, though this is the exception not the rule.

Following formal training, graduates usually enter a one- to three-year apprenticeship to gain experience before taking a national licensing exam or joining a professional association. The National Council for Interior Design Qualification (NCIDQ) administers the licensing exam. To be eligible to take the exam, applicants must have at least six years of combined education and experience in interior design, of which at least two years constitute postsecondary education in design. Once candidates have passed the qualifying exam, they are granted the title of Certified, Registered, or Licensed Interior Designer, depending on the state. Some states require continuing education units to maintain the license.

Interior designer earnings vary, based on employer, number of years of experience, and the reputation of the individual. For residential projects, self-employed interior designers usually earn a per-hour fee plus a percentage of the total cost of furniture, lighting, artwork, and other design elements. For commercial projects, they may charge per-hour fees or a flat fee for the whole project. The median annual pay for interior designers in 2014 was approximately $48,400, with the top 10% earning over $78,760.

So, how do interior designers use AutoCAD and what can you expect? Very often, as far as AutoCAD goes, interior design is tied in with the general architecture design of a building. Therefore, interior designers work side by side with architects on their CAD files. The layering convention often follows AIA standards. You find layers such as A-Furniture, A-Carpeting, and the like. Designers also work with blocks and attributes, and make extensive use of custom hatch patterns and a wide array of colors (such as Pantones).

Interior designers often work in 3D, as the whole idea is often to present and sell the design concept, such as the rendering shown in Fig. 2. In these cases, they have to master 3D AutoCAD as well as additional rendering software. With 3D work, AutoCAD is not the only choice, and one can find Rhino, Form Z, and other applications running side by side with AutoCAD or even bypassing AutoCAD completely.

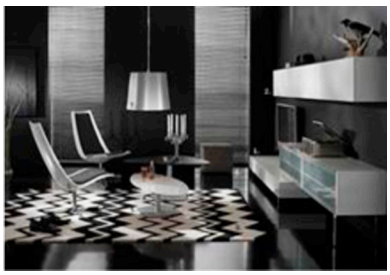


FIGURE 2

Shown in Fig. 3 is a 2D plan view of a residential interior. It makes use of solid shading and custom hatch patterns to give the client a good idea of the final outcome of the design effort.

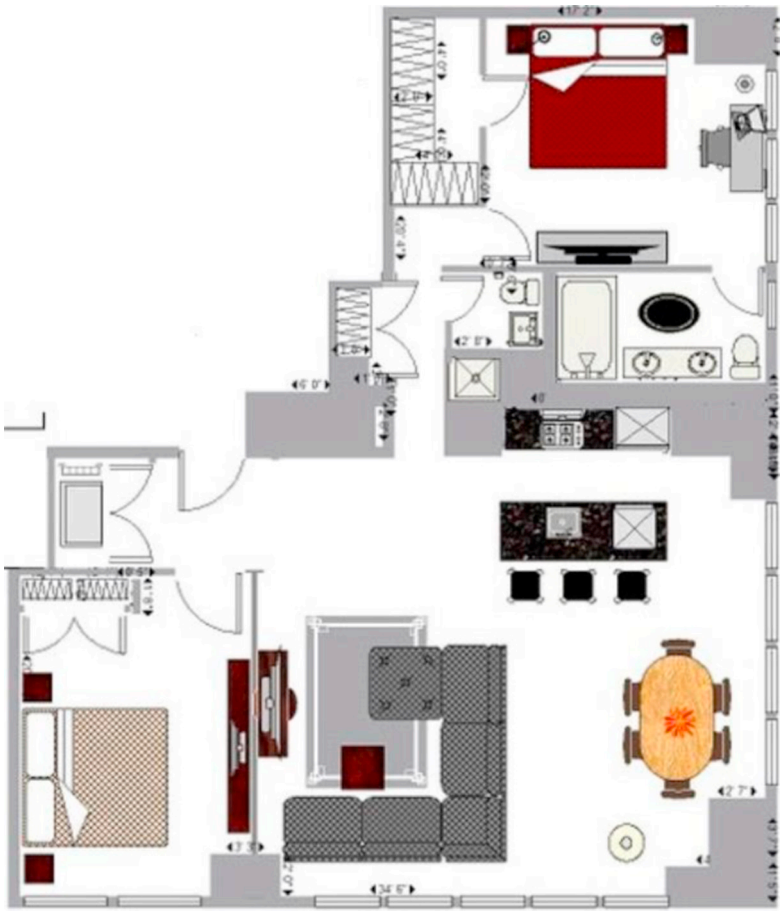


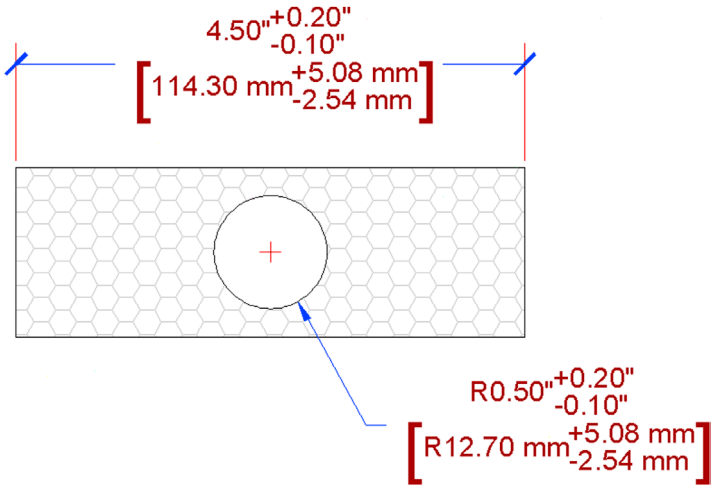
FIGURE 3 2D plan view of a residential interior.

Shown in Fig. 4 is a 3D photorealistic rendering of another design. Although AutoCAD can be used to easily create the underlying architecture, additional rendering tools are usually used for this level of sophistication and realism.

FIGURE 4 3D photorealistic rendering of a design.

Chapter 13

Advanced Dimensions



Learning Objectives

In this chapter, we introduce advanced dimensions and discuss the following:

- Lines tab
- Symbols and Arrows tab
- Text tab
- Fit tab
- Primary Units tab
- Alternate Units tab
- Tolerances tab
- Geometric constraints
- Dimensional constraints

By the end of this chapter, you will learn additional, advanced features of the Dimension Style Manager and be capable of setting up complex dimensions. We also discuss two advanced dimensioning features called *geometric* and *dimensional constraints*.

Estimated time for completion of this chapter: 2–3 hours.

13.1 INTRODUCTION TO ADVANCED DIMENSIONS

This chapter is meant to complete your knowledge of AutoCAD's dimensioning features. Specifically, we look at the New Dimension Style (NDS) dialog box and Parametrics. In Level 1, we focused primarily on defining the types of available dimensions and how to properly dimension geometry. Little was mentioned of this dialog box except for the four essential features deemed most important: Arrowheads, Units, Fit, and Text Style (not needed as much anymore, as the better-looking Arial is the default font). In this chapter, we go through the entire NDS dialog box and discuss other options and features, some more than others, according to their usefulness.

Up and Running with AutoCAD 2017: 2D and 3D Drawing and Modeling. DOI: http://dx.doi.org/10.1016/B978-0-12-811058-4.00013-X