



Autodesk® AutoCAD® Mechanical: Top 10 Productivity Tools

Rusty Belcher – IMAGINiT Technologies

MA 1923

AutoCAD Mechanical design software offers many drawing enhancements beyond traditional Autodesk® AutoCAD® software. Many of these productivity tools offer immediate benefits to manufacturing designers currently using AutoCAD. From standards management to documenting Autodesk® Inventor® 3D CAD software models, this class promotes 10 of the best productivity tools available in AutoCAD Mechanical.

Learning Objectives

At the end of this class, you will be able to:

- Describe the basics of AutoCAD Mechanical
- List and describe AutoCAD Mechanical productivity tools
- Use productivity tools for basic CAD practices
- Use productivity tools for documenting 3D designs

About the Speaker

Rusty Belcher is a Manufacturing Application Expert working with IMAGINiT Technologies. Rusty provides implementation, training, and support services at every level for all Autodesk Manufacturing products. His specialty involves the integration of 3D design practices into manufacturing production environments. As an instructor and mentor, IMAGINiT regularly receives outstanding reviews of his impact to their organization.

Rusty started his career as a structural steel fitter at Newport News Shipbuilding. He is a graduate of the Newport News Shipbuilding Apprentice School and worked in the shipyard's Mold Loft engineering division.

Over the past several years Rusty has worked directly with Autodesk to develop and author the current Factory Design Suite training courseware, has also developed, and recorded many of the tips and tutorial videos available on the Factory Design Suite YouTube Channel. He is currently working with Autodesk to develop the Factory Design Suite and Product Design Suite Test Drive for the 2014 release.

AutoCAD Mechanical – The Basics

From Autodesk

AutoCAD® Mechanical design and drafting software is AutoCAD dedicated to the manufacturing discipline. It includes all the functionality of AutoCAD, the world's leading 2D CAD mechanical design software application, plus libraries of standards-based parts and tools for automating common mechanical CAD tasks and accelerating the mechanical design process.

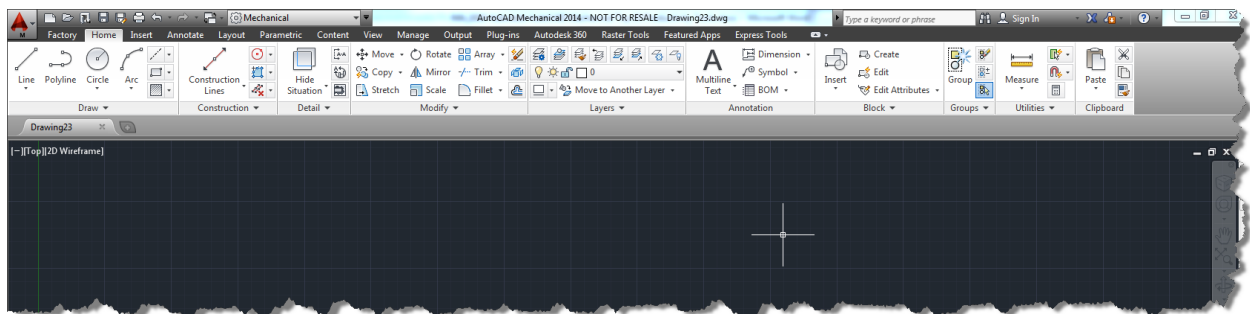
My Opinion – The Best-Kept Secret at Autodesk

With all the attention at Autodesk focused on 3D solutions like Inventor and Fusion, it is easy to understand how AutoCAD Mechanical does not get much attention or press. For quite some time, I have referred to AutoCAD Mechanical as the best-kept secret at Autodesk.

There is no doubt that 3D modeling has become the dominant method of mechanical design, but there are still mechanically specific tasks that are accomplished utilizing traditional 2D practices. 2D drawings are still the primary means of mechanical communication. The most complex 3D models still end up generating classic 2D drawings and prints. Many 3D designs start as intricate 2D layouts. Quite often, complex 2D designs are needed in order for the modeling process to begin.

“When I Draw In 2D, I use AutoCAD Mechanical”

When I am required to perform 2D AutoCAD work, AutoCAD Mechanical is my first choice. This course covers my Top 10 reasons for using AutoCAD Mechanical rather than traditional AutoCAD, but to put it simply, AutoCAD Mechanical is the “Gold Standard” of 2D manufacturing or mechanical design. AutoCAD Mechanical enhances almost every mechanically specific drawing task I need to create my designs. AutoCAD Mechanical enforces my drafting standards automatically eliminating the distraction traditional cad work like layers, linetypes, and dimension styles. It also provides mechanically specific tools to help me generate the most efficient engineering solution possible.



AutoCAD Mechanical – Productivity Tools – Top 10

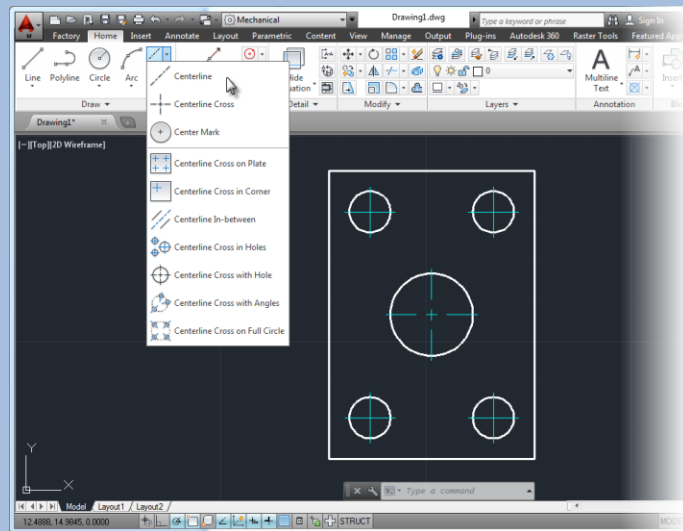
#1 - Mechanically Enhanced Commands

AutoCAD Mechanical offers users many mechanically oriented commands that are not available in the fundamental version of AutoCAD. Many core commands, that are available in Fundamental AutoCAD, are enhanced with extra options only available in AutoCAD Mechanical.

The mechanical specific and enhanced core commands available in AutoCAD Mechanical, are far superior to the fundamental drafting tools available in basic AutoCAD. These tools make “every day” drawing procedures much more efficient and productive.

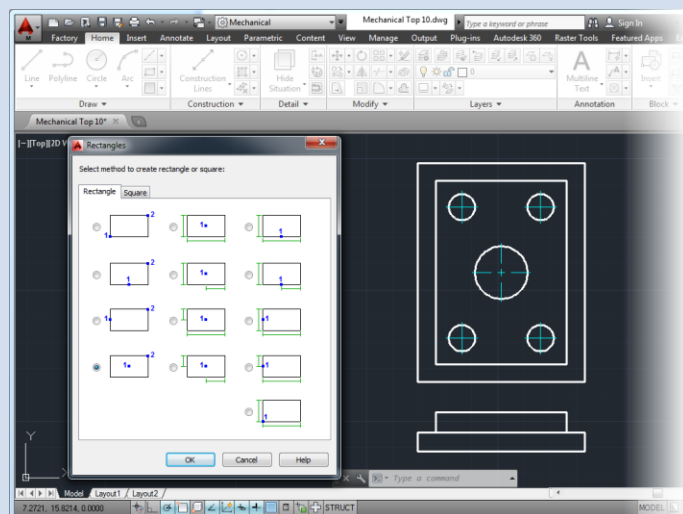
Centerlines

The Centerline option allows users to add centerline data to the design with a number of intelligent options. The centerlines are automatically placed on the centerline layer.



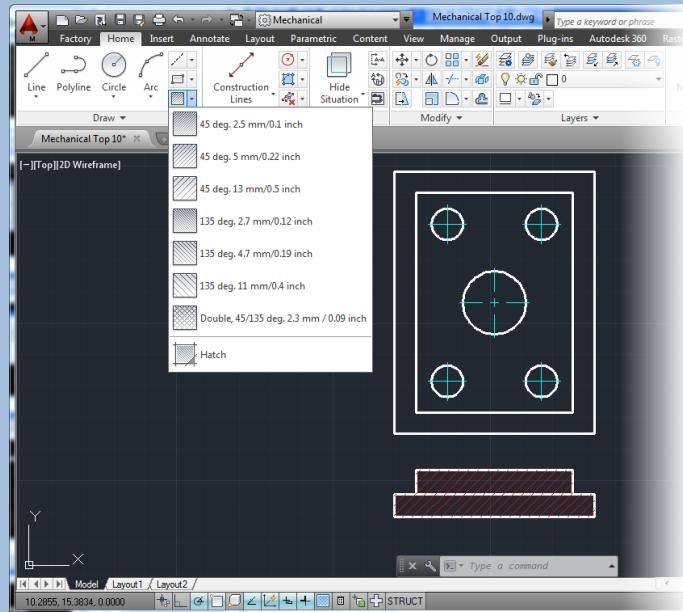
Enhanced Rectangles

There are 20 different options for creating a rectangle or square.



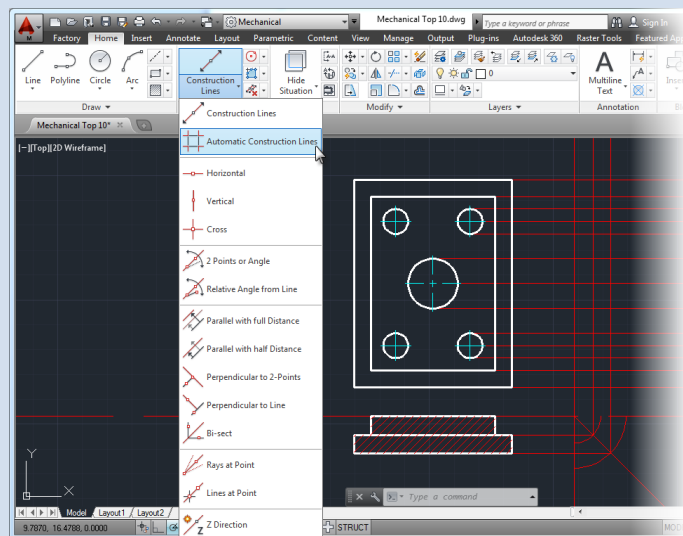
Mechanical Hatches

Predefined Hatches are available on the draw panel. Just pick the hatch you want and select the area you need hatched. AutoCAD Mechanical will do the rest. The hatches are automatically placed on the Hatch layer.



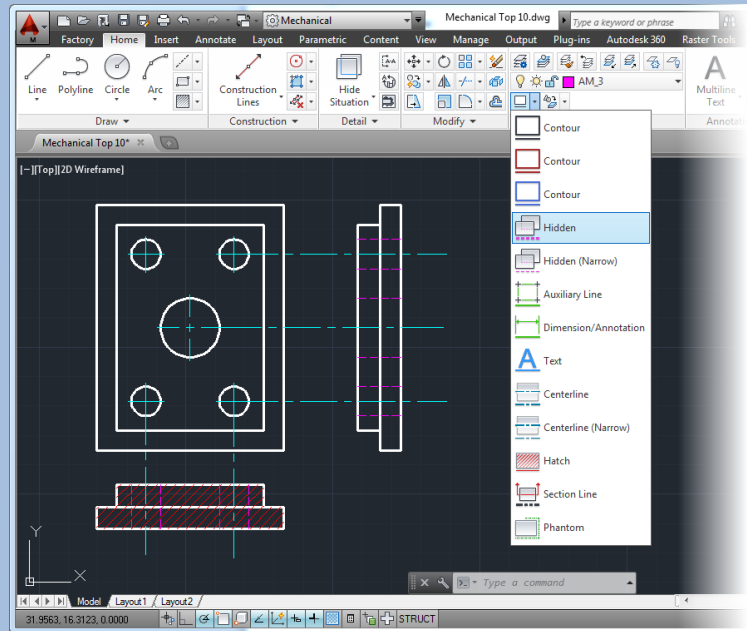
Construction Lines

Construction lines can be generated in any desired direction. There are several options for construction lines including automatic and projection. Construction lines are placed on a unique layer by default.



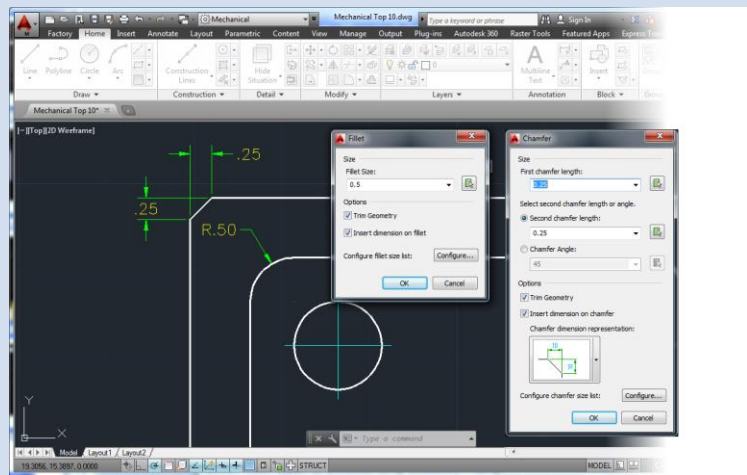
Predefined Linetypes

AutoCAD Mechanical offers a set of predefined linetypes for contour, hidden, centerline...



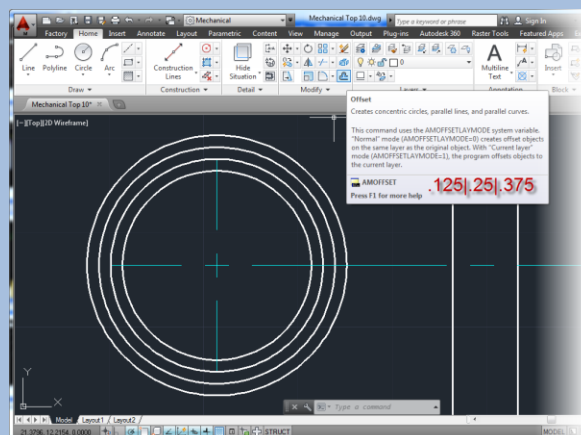
Enhanced Fillet and Chamfer

The Fillet and Chamfer commands have setup dialogs where common sizes can be established. There are also options to dimension the feature when it is placed.



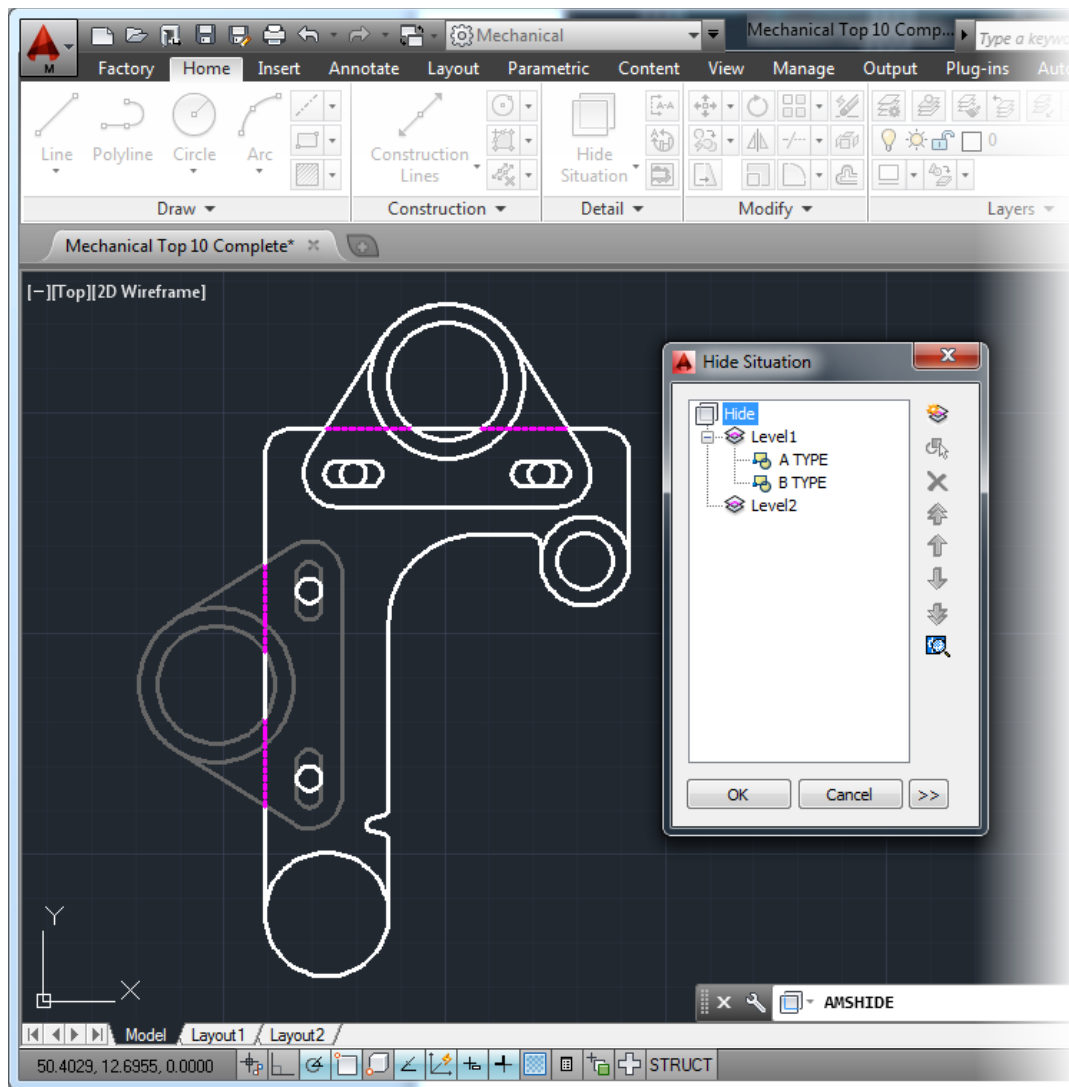
Multiple Offset

The Offset command is enhanced allowing multiple offset increments to be added in a single command.



#2 - Associative Hide

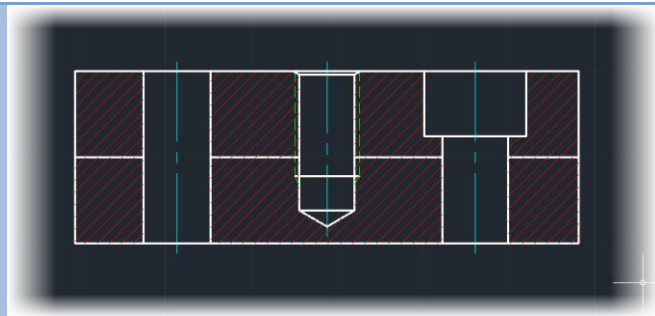
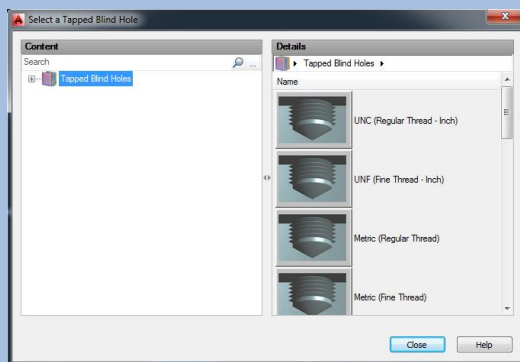
The Associative Hide command allows 2D designers the ability to generate hidden lines by selecting objects that are in front of one another. This workflow is far more sophisticated than the fundamental Trim command found in AutoCAD. To perform the same task in AutoCAD, users would have to edit each line one at a time. Designers can generate the Hidden Lines 15 times faster in AutoCAD Mechanical. The hidden relationship is associative. That means if the foreground objects ever move the hidden lines will update.



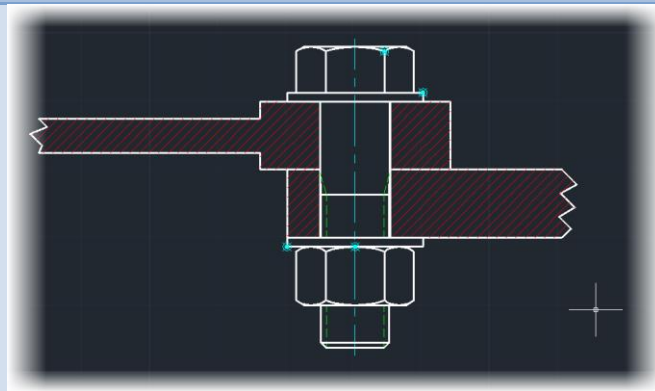
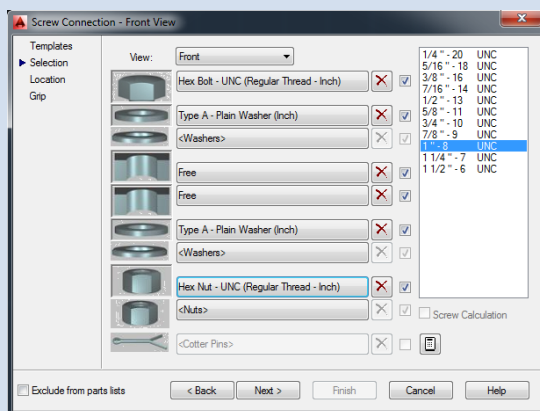
#3- Mechanical Content (2D)

The Autodesk Architecture solutions come equipped with a library of building design elements, and the Civil solutions are likewise equipped with discipline specific libraries. AutoCAD Mechanical is a manufacturing design solution with a large library of 2D mechanical content. The mechanical library content conforms to industry leading international standards. A small portion of the content is shown below.

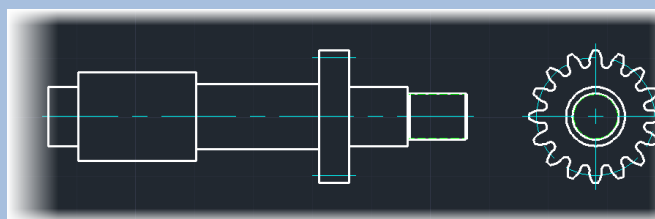
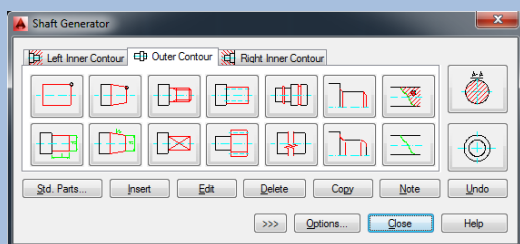
Drilled Holes



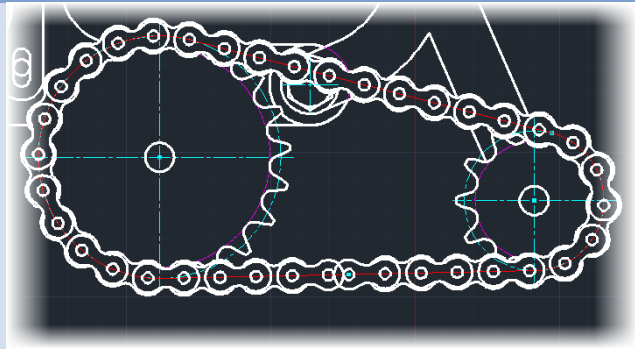
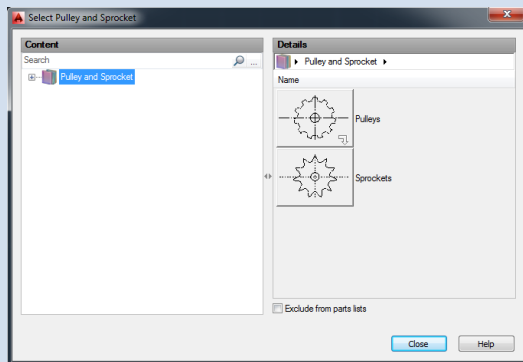
Fasteners



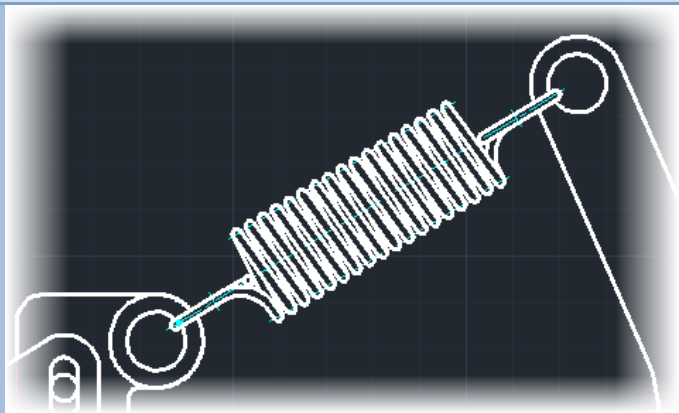
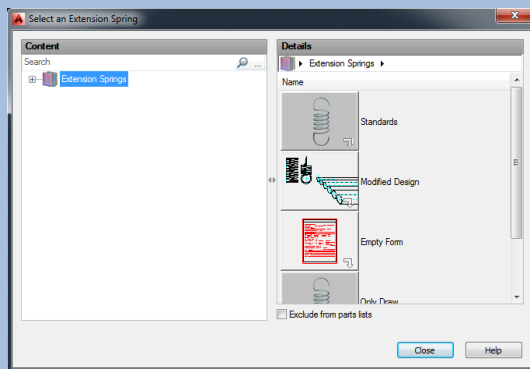
Shaft and Gears



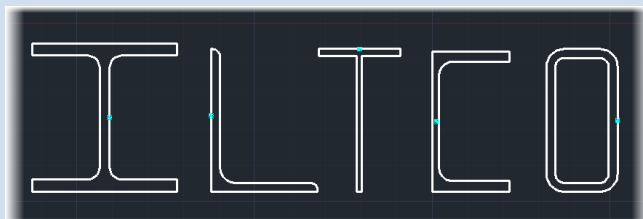
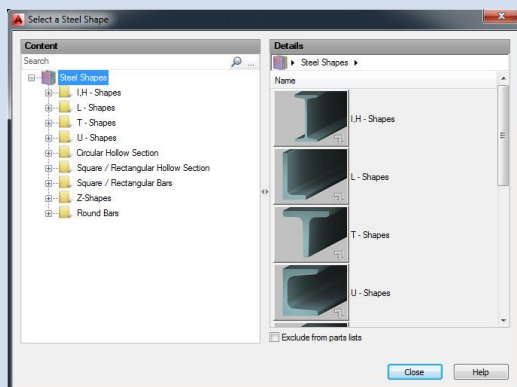
Sprockets and Chains



Springs



Steel Shapes

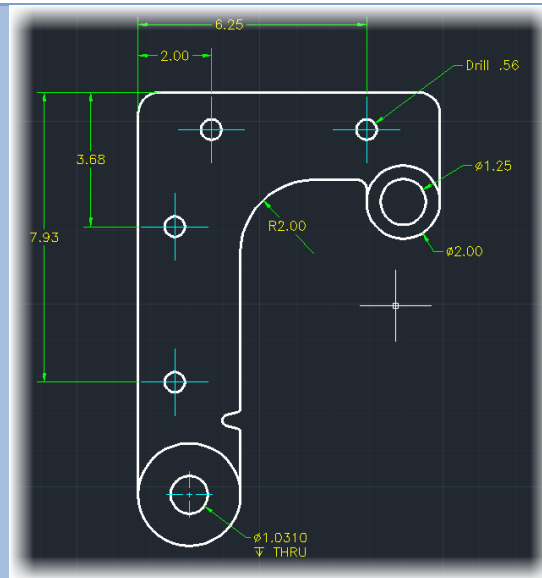


#4 - Power Dimensions

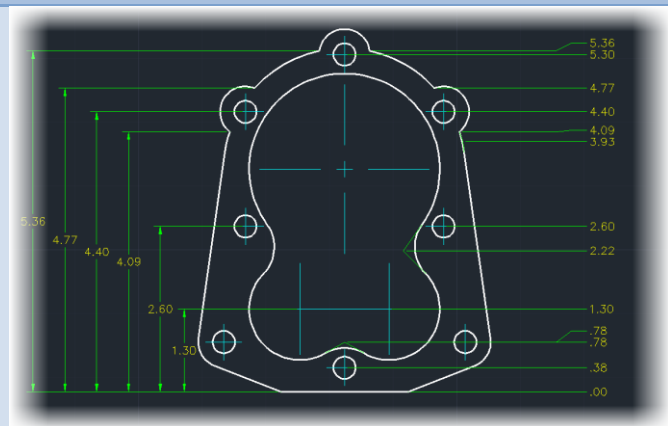
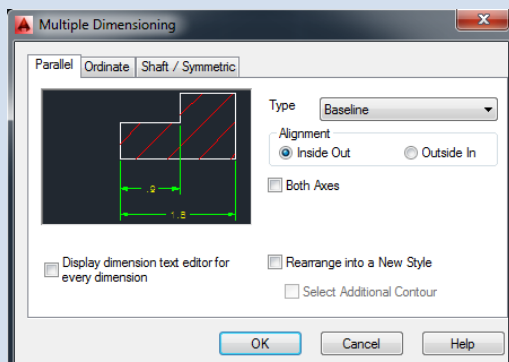
AutoCAD Mechanical allows designers to add numerous dimensions with a single command. The Power Dimensions are far more versatile than their fundamental AutoCAD counterparts.

Power Dimensions

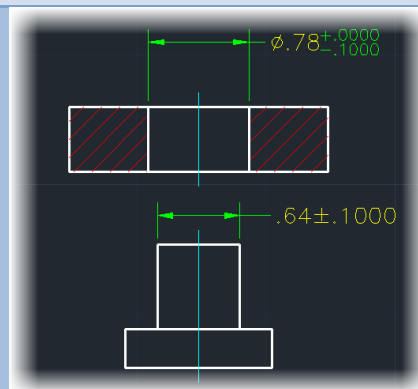
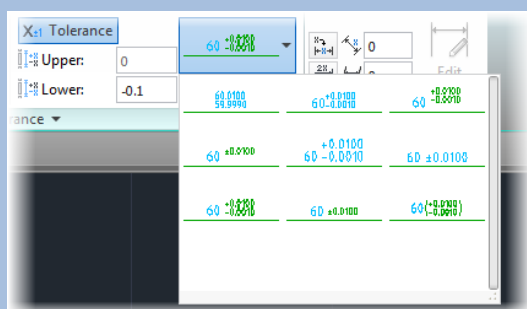
One command for all types of dimension types.



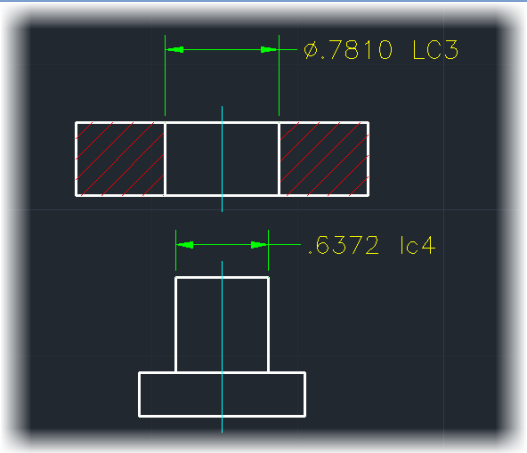
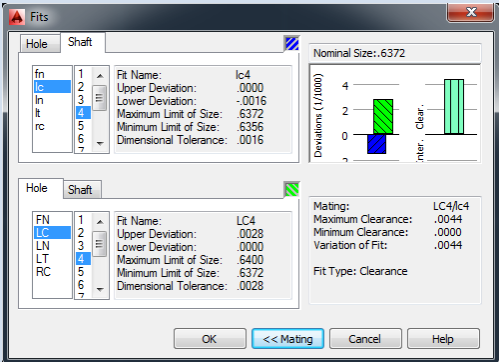
Multiple Dimensions



Dimension Tolerances



Adding Fits on Dimensions

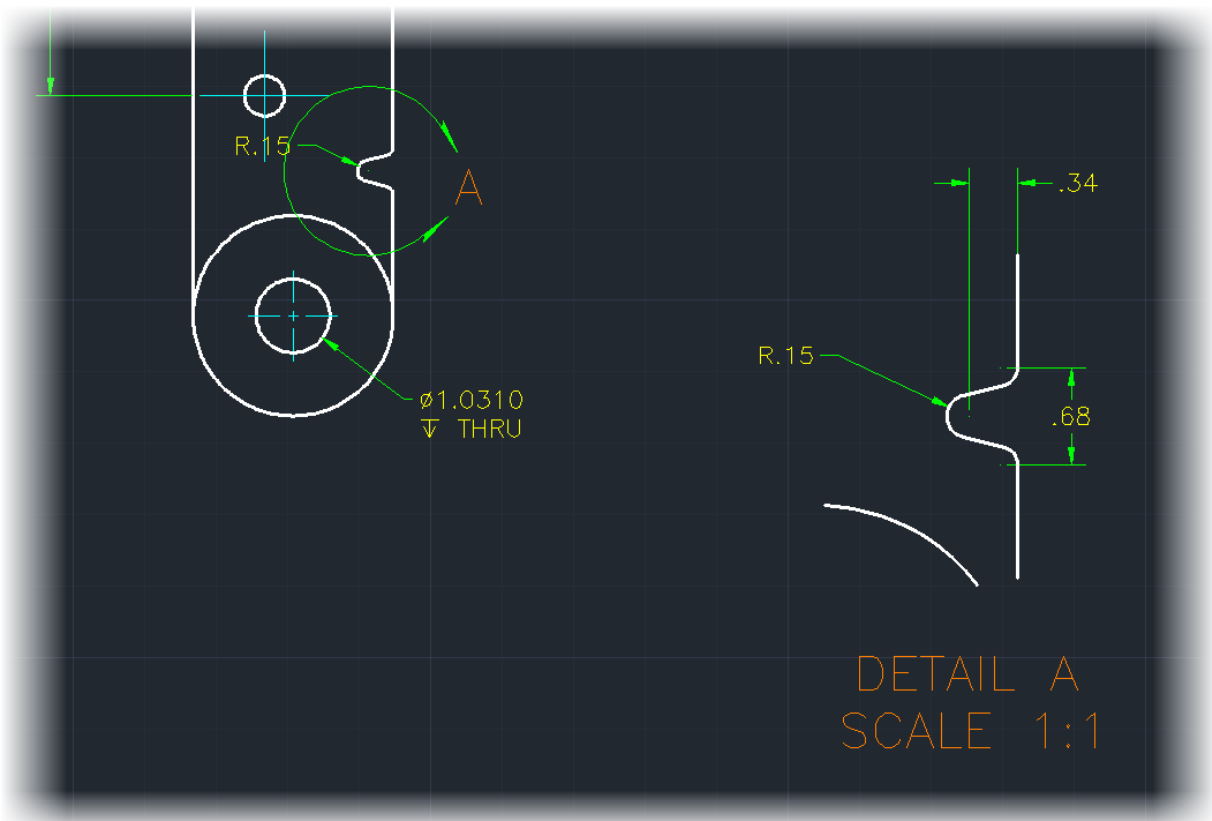


Fits List

| | | | |
|------------|-----|-----------|---------|
| $\phi .78$ | LC3 | + $.0012$ | $.7812$ |
| | | - $.0000$ | $.7800$ |
| .64 | lc4 | + $.0000$ | $.6400$ |
| | | - $.0016$ | $.6384$ |
| DIMEN. | FIT | | |

#5 - Detail Views

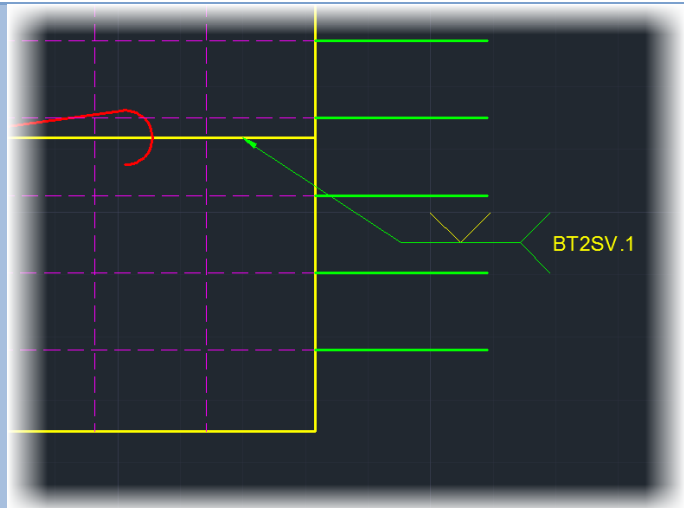
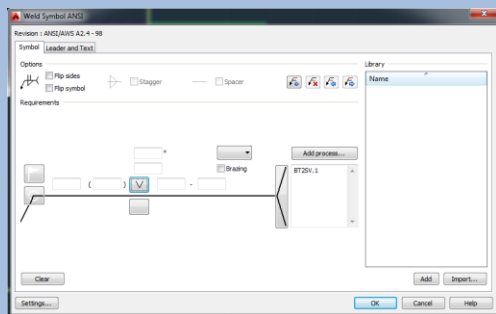
AutoCAD Mechanical makes it easy to generate Detail Views at any desired scale. The views are associative to the original and the power dimension tool accounts for the scale difference automatically. Detail Views can be generated in Model or Paper Space.



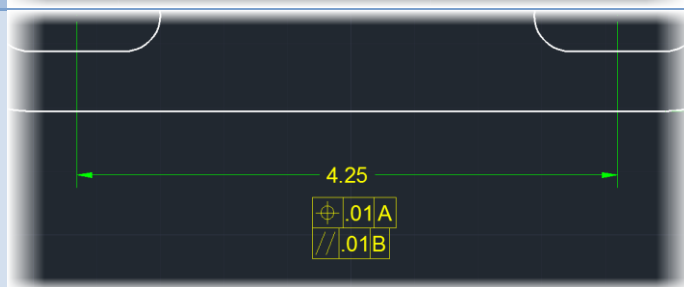
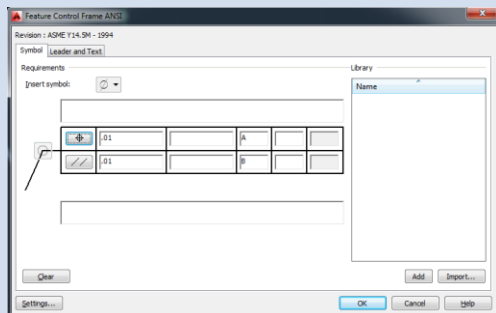
#6 - Mechanical Symbols

AutoCAD Mechanical offers designers many standard mechanical symbols to incorporate into the drawings. A simple weld symbol can cause Fundamental AutoCAD users a good deal of time and effort. Weld Symbols, Surface Texture, Geometric Tolerance and many other symbols are available thru intelligent dialog driven commands. Some of the available symbols are shown in the following table.

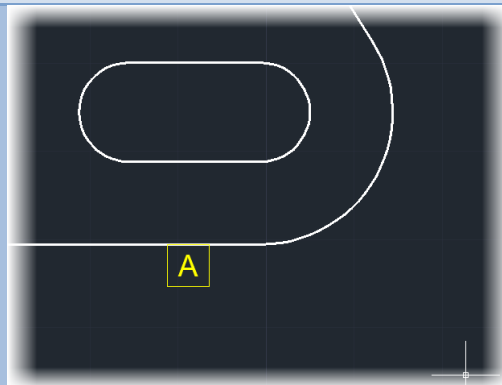
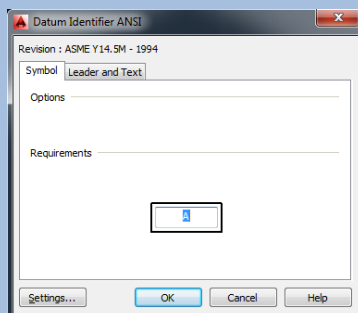
Weld Symbols



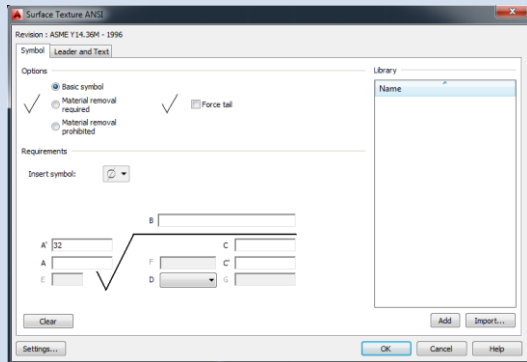
Feature Control Frame



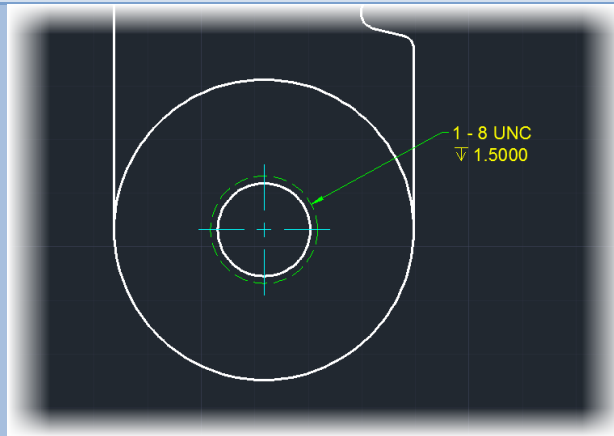
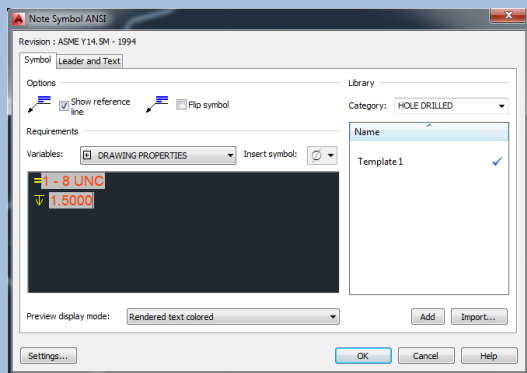
Datum Identifiers



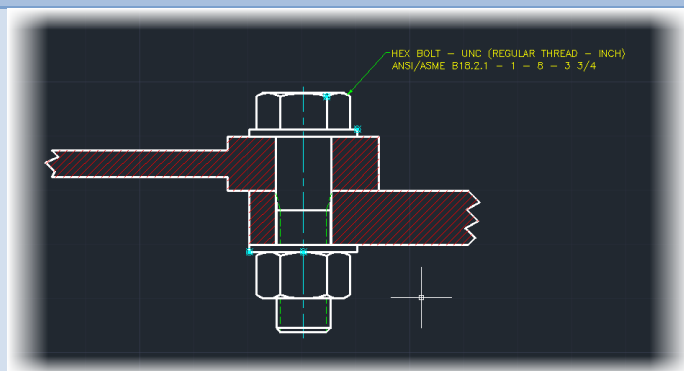
Surface Texture



Enhanced Leader – Hole Note



Enhanced Leader – Content Note

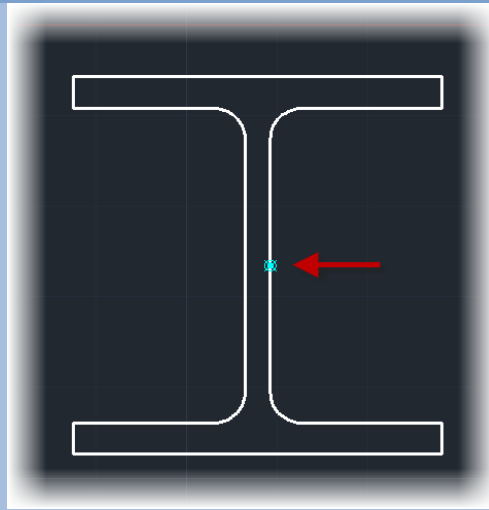


#7 - Bill of Material and Balloons

Establishing an accurate count and annotating the items in the design is a common part of every mechanical design. The Bill of Materials and Balloons commands in AutoCAD Mechanical make it very easy to develop accurate parts lists even if you have used traditional AutoCAD geometry or blocks.

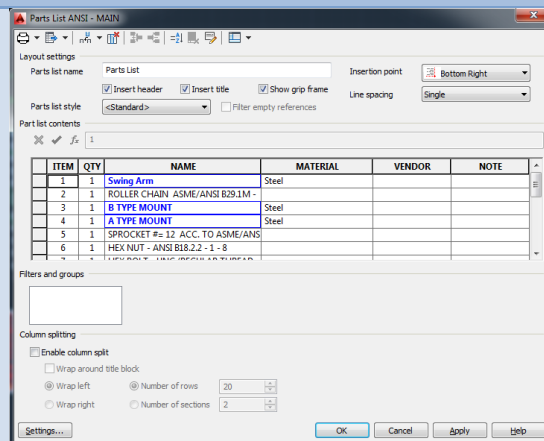
BOM Marker

Often called the “blue dot”, the BOM marker is a simple method of establishing and counting the items in your drawing.



Bill of Materials

Allows you to add information to your items and display the desired component properties. You can also export the **BOM** to various spreadsheet formats.

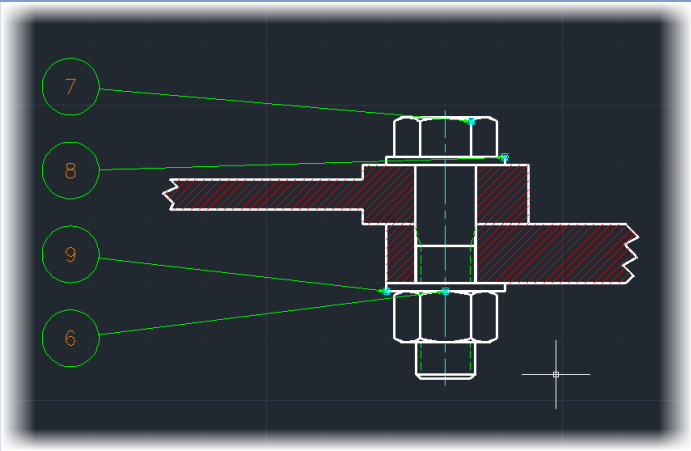


Parts List

| | | | | | |
|------|-----|--|---------------|--------|------|
| 17 | 1 | TUBE — AISC — 4X2X 1/4 — 72 | ASTM A500 | | |
| 16 | 1 | CHANNEL — DIN1026 — UPE 100 — S235JR — 72 | S235JR | | |
| 15 | 1 | T-SHAPE — AISC — MT 4X3.25 — 72 | ASTM A36 | | |
| 14 | 1 | ANGLE STEEL — AISC — L 4 X 3 X 1/4 — 72 | ASTM A36 | | |
| 13 | 1 | W SHAPE — AISC — W 4X13 — 72 | ASTM A36 | | |
| 12 | 1 | EXTENSION SPRING — SPEC — 5 X 55 X 157 | DIN 17223 — C | SPEC | |
| 11 | 1 | ROLLER CHAIN — ASME/ANSI B29.1M — NO. 100 X 37 | | | |
| 10 | 1 | SPROCKET #= 21 ACC. TO ASME/ANSI B29.1M — NO. 100 | | | |
| 9 | 1 | WASHER A — ANSI B18.22.1 — 1 — NARROW — TYPE A | | | |
| 8 | 1 | WASHER A — ANSI B18.22.1 — 1 — NARROW — TYPE A | | | |
| 7 | 1 | HEX BOLT — UNC (REGULAR THREAD — INCH) — ANSI/ASME B18.2.1 — 1 — 8 — 3 3/4 | | | |
| 6 | 1 | HEX NUT — ANSI B18.2.2 — 1 — 8 | | | |
| 5 | 1 | SPROCKET #= 12 ACC. TO ASME/ANSI B29.1M — NO. 100 | | | |
| 4 | 1 | A TYPE MOUNT | Steel | | |
| 3 | 1 | B TYPE MOUNT | Steel | | |
| 2 | 1 | ROLLER CHAIN — ASME/ANSI B29.1M — NO. 100 X 37 | | | |
| 1 | 1 | Swing Arm | Steel | | |
| ITEM | QTY | NAME | MATERIAL | VENDOR | NOTE |

Parts List

Balloons



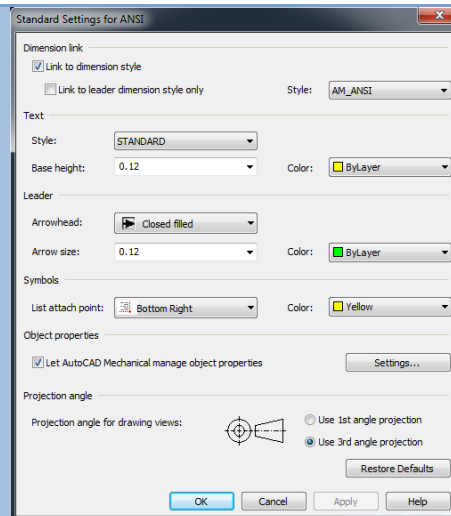
#8 - Drawing Standards

AutoCAD Mechanical creates drawings that are based upon standards. Layers, Geometry, Dimensions, Parts Lists and Symbols are all drawn based upon these standards. These standards ensure that all drawings look and function the same. Some of the major standards criteria are shown in the following table.

Drawing Standard

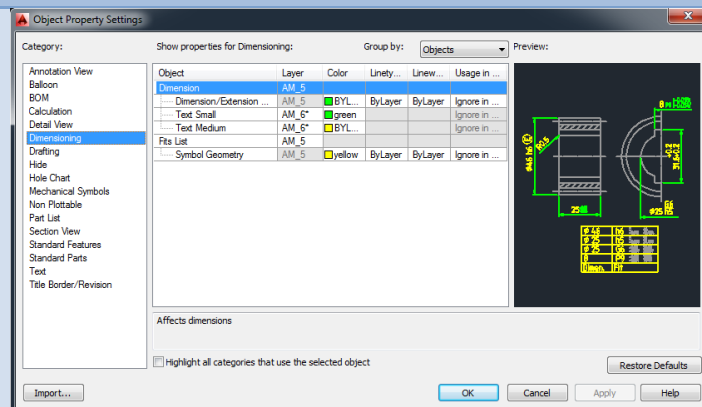
Preset templates are included for the following international standards.

- ANSI
- ISO
- DIN
- GB
- GOST
- JIS



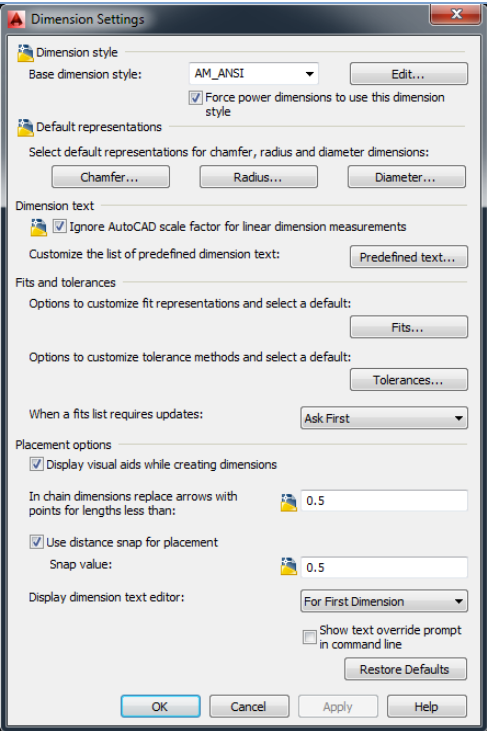
Object Properties – Automatic Layers

Offers the capability to configure the layers used for each mechanical object in the drawing.



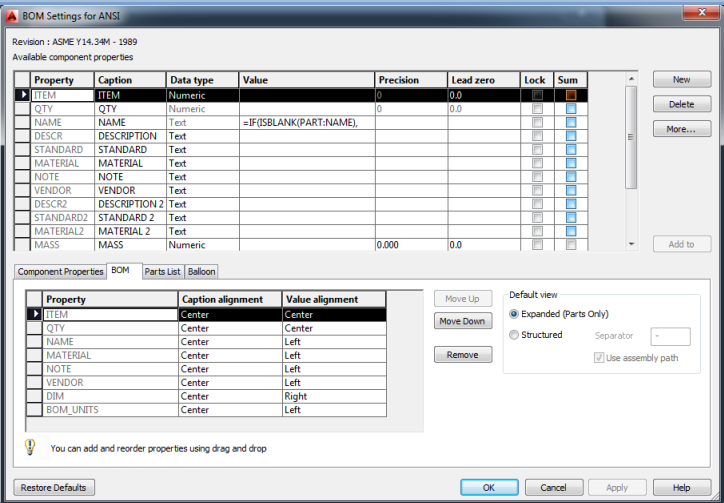
Dimensions

Provides configuration for the mechanical dimension enhancements.



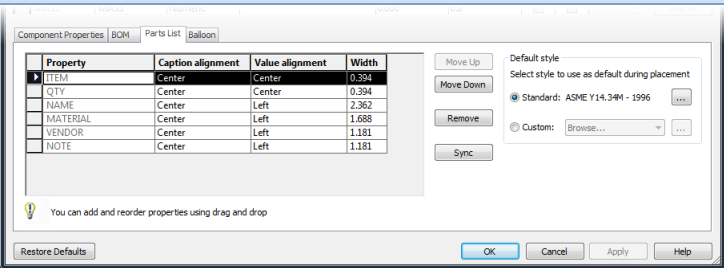
Bill of Material

Controls the types of data available for each mechanical component.



Parts List

Formats the columns of the Parts List.

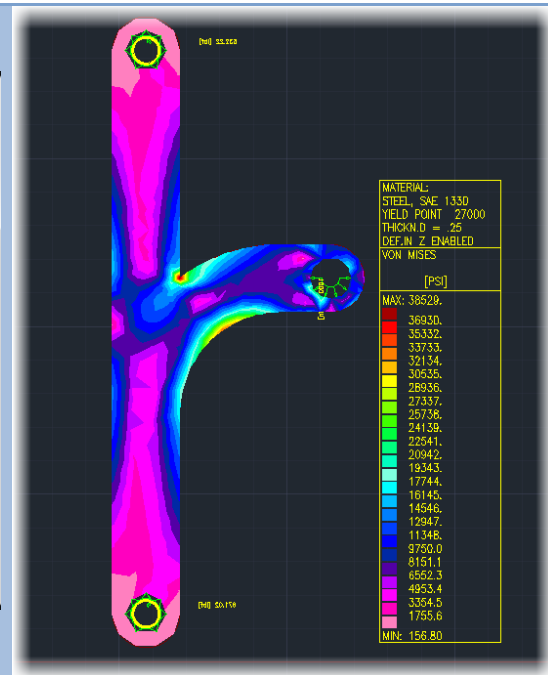
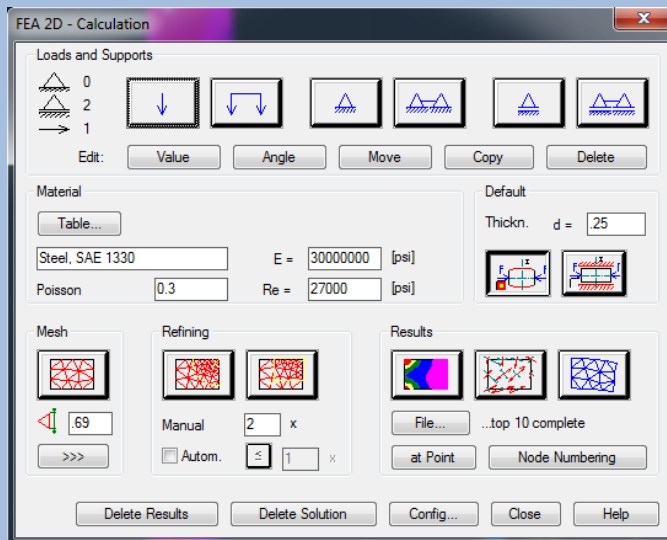


#9 - Mechanical Calculations (2D)

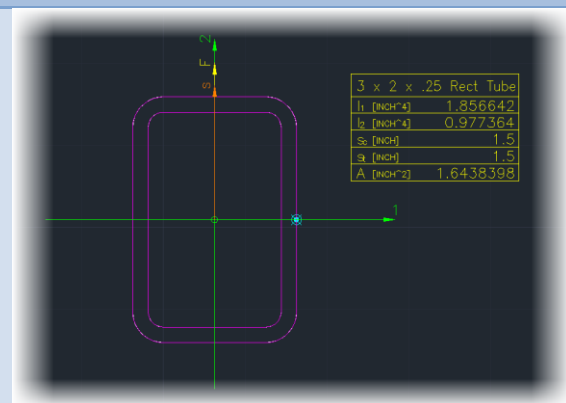
AutoCAD Mechanical offers designers the ability to run a number of engineering calculations on the design geometry.

Some of these calculations include...

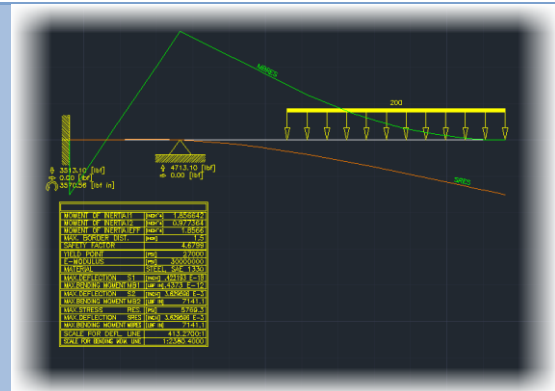
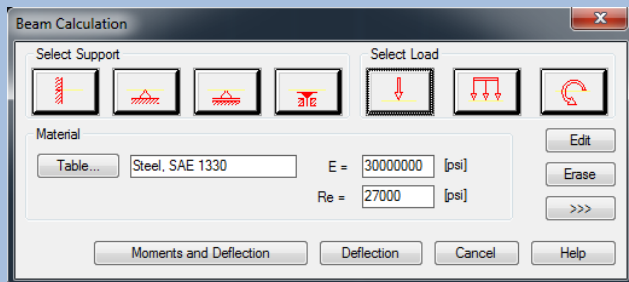
2D Finite Element Analysis



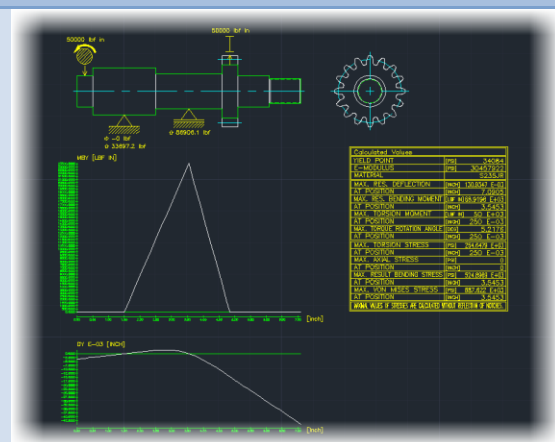
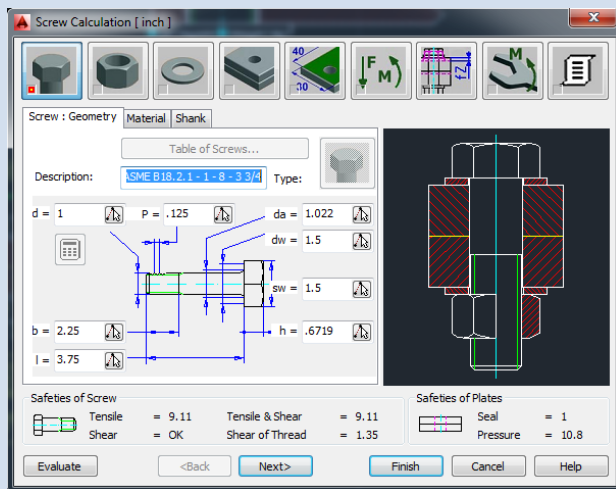
Moment of Inertia



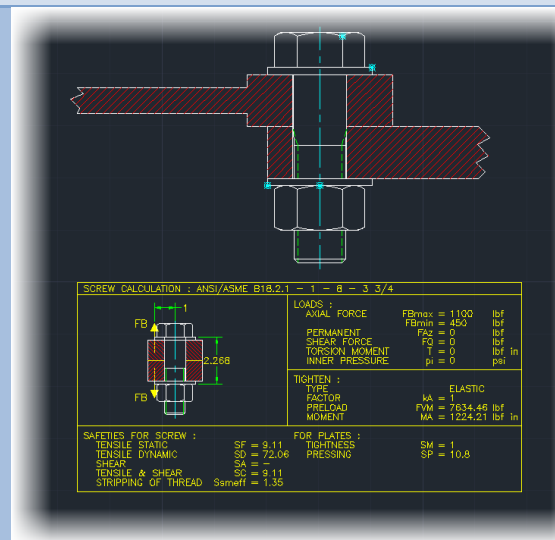
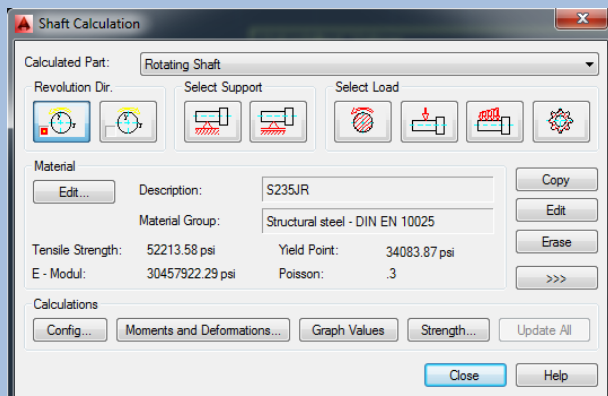
Beam Deflection



Shaft Calculations



Screw Calculations



#10 - Documenting Inventor Models

AutoCAD Mechanical allows users to create 3D models in Autodesk Inventor and associatively detail them in an AutoCAD environment. AutoCAD Mechanical can generate the orthographic and isometric views of the Inventor Model. If the model ever changes, these drawing views will update.

There are currently two methods of documenting Inventor models using AutoCAD Mechanical, the Inventor Link and the Create View commands. Each method has unique capabilities and drawbacks.

Create View Commands

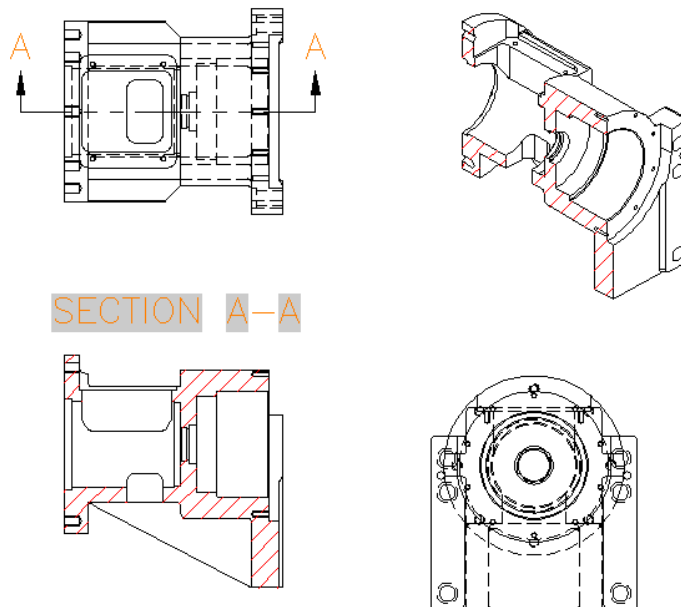
The ability to import Inventor files was added to the AutoCAD Viewbase command in the 2013 release. These commands allow the designer to generate drawing views from Inventor parts and assemblies.

Advantages

- Ease of Use
- Associative to Inventor

Disadvantages

- Access to base Geometry
- Restricted Workflow
- No BOM Support
- No Feature Recognition for Leader



Inventor Link

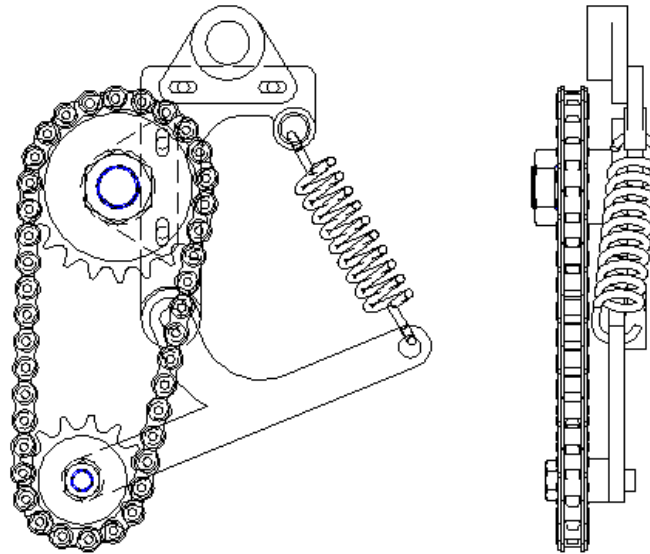
The ability to generate an AutoCAD Mechanical file directly linked to an Inventor part or assembly was added in the 2006 release.

Advantages

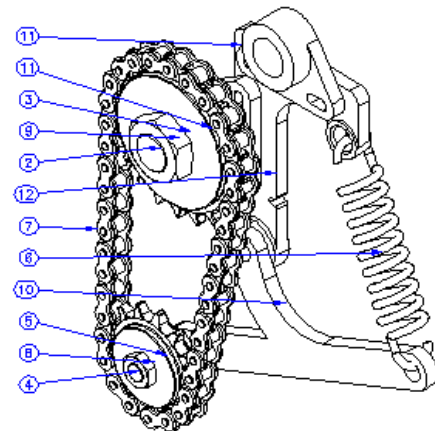
- Bill of Material Support
- Balloons
- Mechanical / Inventor Layers
- Feature Recognition for Leader (Part Only)
- Project Based

Disadvantages

- Workflow
- Project Based



| | | |
|------------|-----|-------------------|
| 12 | 1 | BASE PLATE |
| 11 | 2 | BRACKET |
| 10 | 1 | SWINGARM |
| 9 | 1 | N023311 002H4D2V |
| 8 | 1 | N023311 002HRO3V |
| 7 | 1 | PART4 |
| 6 | 1 | N026003T D08HBRRV |
| 5 | 1 | SHAFT3 OD610MPV |
| 4 | 1 | 1-UNC |
| 3 | 1 | SHAFT3 OD5GULEV |
| 2 | 1 | 2-UNC |
| ITEM | QTY | NAME |
| Parts List | | |



Summary

I hope this short class has demonstrated some of the mechanically specific tools available in AutoCAD Mechanical. If you use the Autodesk Product Design Suite, you have many choices when it comes to using AutoCAD. The next time you start an AutoCAD session I hope you remember these top 10 productivity tools.

Autodesk® AutoCAD® Mechanical: Top 10 Productivity Tools

Rusty Belcher – IMAGINiT Technologies

MA 1923