AutoCAD or AutoCAD Mechanical 2004? A Productivity Study

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Productivity Study

Contents

Introduction

More than 20 years after the first release of AutoCAD® software, designers are still drawing lines and circles to represent mechanical parts. However, when discussing the contents of a mechanical design drawing, designers typically refer to drawn items as assemblies, parts, holes, and possibly even motion. They rarely refer to the contents as lines or circles. AutoCAD® Mechanical 2004 provides design tools that enhance the 2D design experience and offer a simpler, more natural 2D manufacturing design solution that more closely resembles the way designers approach their work. This document provides details on these design tools and demonstrates the productivity gains they provide over traditional AutoCAD.

The performance results in this paper were achieved by conducting automation testing over a controlled network. One engineer, with expert-level experience using both AutoCAD and AutoCAD Mechanical software programs, conducted the comparative tests on the same sample using an IBM® ThinkPad® A31 with a 2 GHz Intel® Pentium® 4 processor and 1 GB RAM. Results are approximate and subject to change. Product information and specifications are subject to change without notice. Autodesk provides this information "as is," without warranty of any kind, either express or implied.

Workflow Productivity Comparison

Based on AutoCAD technology and the DWG format, AutoCAD Mechanical takes advantage of the latest improvements to AutoCAD 2004 to help you

- Create with speed
- Share with ease
- Manage with efficiency

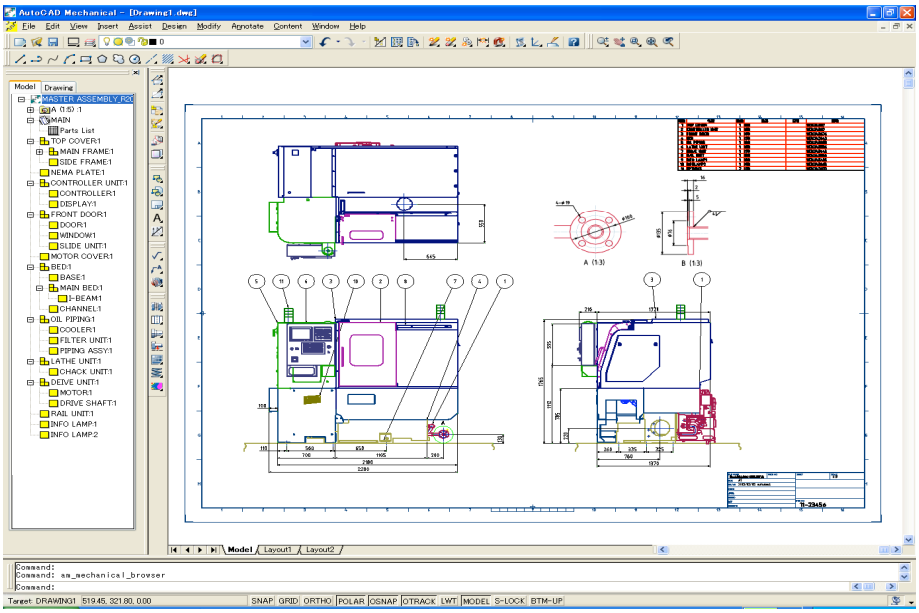
AutoCAD Mechanical is a purpose-built 2D mechanical design system that features

- Intelligent mechanical engineering and design
- Associative production drawing and detailing
- Standards-based 2D content

AutoCAD Mechanical Versus AutoCAD

This study explores 10 common design tasks, showing how the innovative, new 2D design tools in AutoCAD Mechanical 2004 offer significant productivity gains over standard AutoCAD software.

The following image shows the case study drawing. Ten common design tasks were used to create it from scratch, maintain it, and reuse it in other designs, using both AutoCAD and AutoCAD Mechanical software. The results clearly demonstrate that AutoCAD Mechanical is the more productive 2D mechanical design system.



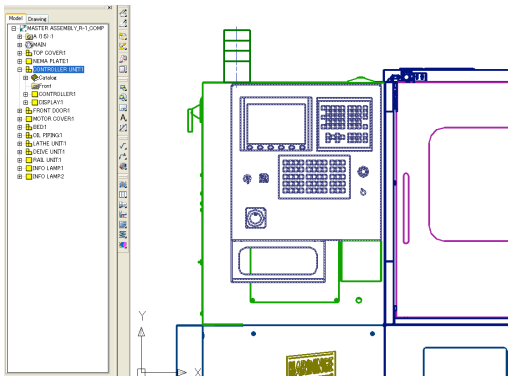
Before We Begin

AutoCAD Mechanical 2004 introduces a new concept called *2D mechanical structure*—or *mechanical structure* for short. Although out-of-the-box AutoCAD offers several tools to organize drawing data—such as groups, blocks, and layers—it falls short for mechanical design organization. The mechanical structure functionality in AutoCAD Mechanical, however, provides a comprehensive suite of tools for drawing organization and associative data reuse.

With AutoCAD Mechanical 2004, you can represent parts in a hierarchy structure. Therefore, you can now organize entities such as lines, arcs, and circles into parts and subassemblies. You can organize and manage these components quickly, avoiding "stale" or out-of-date data. Another benefit of working with structure is that you can generate an accurate bill of materials (BOM) based on the 2D mechanical structure. Not only does the BOM provide information like part numbers and materials, it can also manage cost, schedule, and other information required for the manufacturing phase.

AutoCAD Mechanical 2004 provides many tools that take advantage of mechanical structure. Many of these tools are available through the new browser, which provides an intuitive user interface for creating, viewing, and accessing the structured design data. Shortcut menus are available for the most common functions, such as highlighting, zoom to, properties, visibility, and creating, deleting, and inserting instances.

With this structure, parts and assemblies can have geometries assigned, so you don't need to set layers and layer groups. In addition, even if the component is a "mirrored" part or subassembly, it can be defined as an instance of the original component, which updates as changes are made to other instances, boosting productivity.



Mechanical structure creates a more intuitive mechanical design environment. Lines, arcs, and circles come together to form subassemblies and

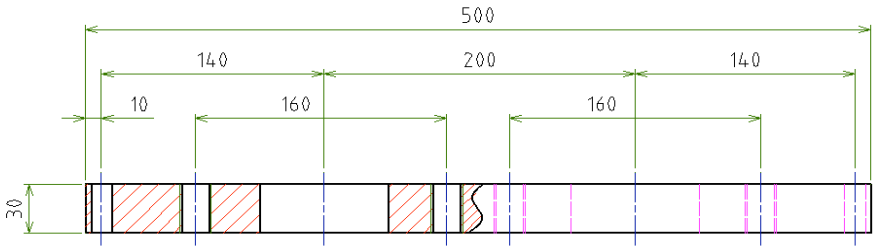
part views. Because the drawing structure is displayed in a browser, design intent is clear and more easily accessible.

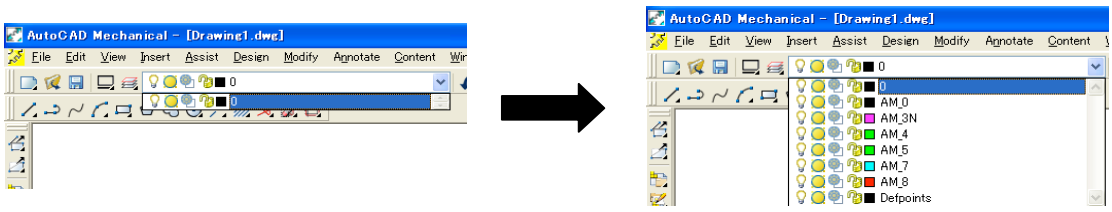
In addition, the innovative 2D design tools in AutoCAD Mechanical

- Eliminate the creation of stale data
- Enhance accurate BOM and parts lists
- Reduce detailing time
- Reduce editing
- Reduce design errors associated with stale data

Layer Management

AutoCAD Mechanical offers a flexible, customizable layer management system that puts objects on the appropriate layers automatically. This system reduces the amount of setup time required before starting a drawing as well as time spent creating, editing, and managing layers. The layer management system, which is integrated with the new innovative mechanical structure tools, alleviates the burden of manually managing and maintaining the specific elements that represent your products.





Study Results

As you can see in the following table, AutoCAD Mechanical completed the task of part design in this example in less than half the time required by AutoCAD. Where AutoCAD software requires you to maintain the layer properties of the individual elements (lines, arcs, circles, dimensions, text) that together represent a design, AutoCAD Mechanical software's layer management system does this automatically. This functionality enables you focus on the mechanical design itself rather than on how to represent it.

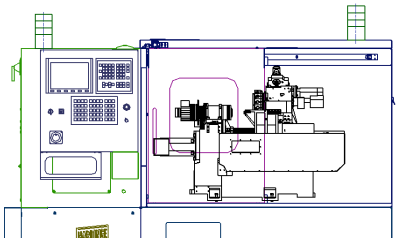
Productivity Gain*

	AutoCAD Mechanical	AutoCAD
No. of layers switching	1	4
Time to create view	2 min. 30 sec.	6 min.
Productivity up 240%		
Possibility of mistakes	Low	High

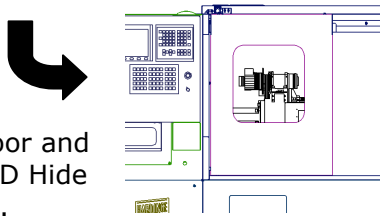
Hidden-Line Removal

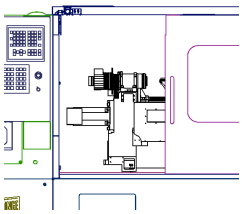
Traditional 2D CAD design, using products such as AutoCAD software, requires a lot of geometry manipulation to accurately represent parts and features that are partially or completely hidden in drawing views. Even in the simplest situation where one plate partially obstructs the view of another plate, several lines must be broken and then hidden in the drawing view. This design-capture process is labor intensive and tedious, reducing the time available for mechanical design.

AutoCAD Mechanical simplifies this process by combining the benefits of 2D mechanical structure with an advanced and associative 2D Hide tool. As a result, you spend less time on tedious, routine tasks have more time for design. In addition, the innovative 2D design tools in AutoCAD Mechanical make editing designs much easier and data reuse more intuitive and productive.



When the drawing is edited, the change is dynamically updated.





Place a door and execute 2D Hide command.

Study Results

As you can see in the following table, editing the hidden elements with the standard AutoCAD software product took four times longer than creating them. In fact, it may have been easier to re-create the hidden elements altogether. AutoCAD Mechanical, on the other hand, accomplished this task easily. Through its associative hide functionality, AutoCAD Mechanical was able to hide the geometry in a fraction of the time required by AutoCAD. Furthermore, as the design changed, AutoCAD Mechanical software automatically updated the drawing.

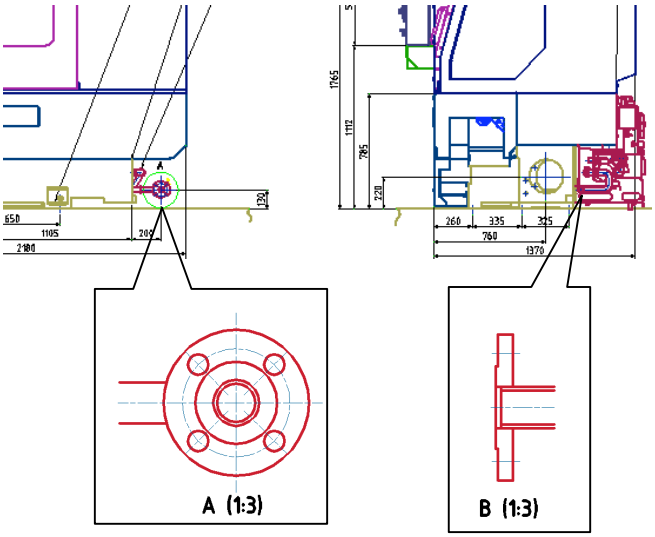
Productivity Gain*

	AutoCAD Mechanical	AutoCAD
No. of commands	1	3
Time to create hidden view	10 sec.	3 min.
Productivity up 1800%		
Time to update drawing	10 sec.	14 min.
Productivity up 8400%		

Detail View Creation

In production drawing it is often necessary to create a view with a different scale to show details. Creating a detail view in AutoCAD software is a disjointed process, requiring you to define and maintain a second set of dimension styles and view scales, or even create a not-to-scale view. These manual operations can lead to erroneous data and cause problems at the manufacturing stage.

AutoCAD Mechanical makes it easy to create detail views of a portion of a design. Simply outline the area to be detailed and then specify the scale, location, or detail view name, and AutoCAD Mechanical creates the appropriate detail view. The detail view is fully associative with the original geometry and always reflects the latest design changes.



Study Results

As you can see in the following table, AutoCAD Mechanical completed this task in about a quarter of the time required by AutoCAD. Creating a complete detail view in AutoCAD involves several commands, and editing is manual, time-consuming, and error prone. In contrast, AutoCAD Mechanical software's Detail View command automates the detail view process. Associativity ensures accuracy and automatic updating.

Productivity Gain*

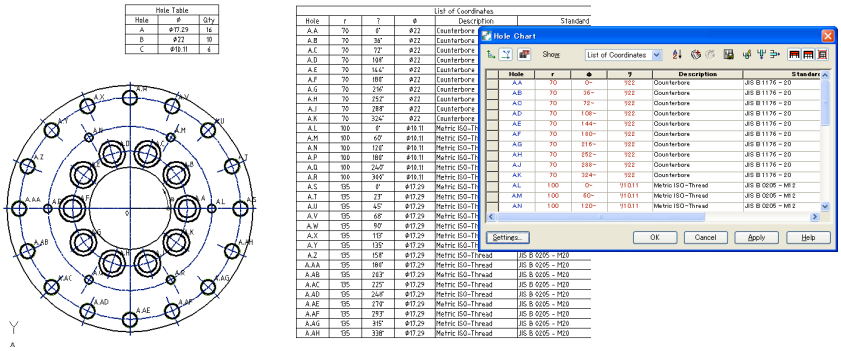
	AutoCAD Mechanical	AutoCAD
No. of commands	1	At least 7
Time to create view	45 sec.	3 min. 30 sec.
Productivity up 460%		
No. of commands for editing	0 (automatic)	At least 5
Time to update drawing	10 sec.	1 min. 30 sec.
Productivity up 900%		
Possibility of mistakes	None	High (like scale change)

Hole Chart

Hole charts are used to document hole type, size, and location for manufacturing. In AutoCAD software you must create these charts manually, an error-prone process that can increase manufacturing costs.

The AutoCAD Mechanical Hole Chart command creates two intelligent and associative lists to document the holes in a design drawing: a hole table showing a total count and description of each type of hole, and a list of coordinates for each of the holes selected. Any update to the holes is automatically reflected in the charts.

The design of large machines and complex machine parts involves the use of many holes of various types. Detailing and documenting these types of designs are much easier, faster, and more powerful with the hole charts feature. This functionality also provides clear and concise machining instructions.



Study Results

The preceding graphic shows a plate with holes aligned in a circular pattern. Creating the hole chart using AutoCAD software requires that each hole position with related information be checked and then added to the chart manually. In contrast, AutoCAD Mechanical automatically provides the positioning coordinates, positioning angle, and the types of holes, resulting in a tremendous time savings. Furthermore, associativity ensures that the chart is always up-to-date.

Productivity Gain*

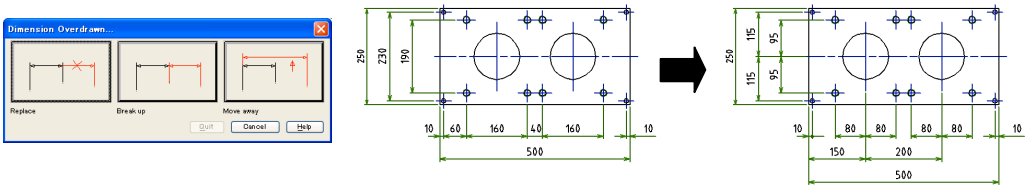
	AutoCAD Mechanical	AutoCAD
No. of commands used	1	8
Time to complete hole chart	30 sec.	14 min.
Productivity up 2800%		
No. of commands for edit	0 (1 double-click)	2
Time to update drawing	15 sec.	9 min.
Productivity up 3600%		
Possibility of mistakes	None	High

Dimension Editing

To stay competitive, you must be able to make design and engineering changes quickly and efficiently while maintaining company drafting standards. With AutoCAD software there is no

guarantee that design changes result in a standard, compliant drawing with proper dimensional arrangement.

Dimensions created with AutoCAD Mechanical, however, have intelligence about their spatial relationship with one another. For instance, if you delete the middle dimension in a group, the others automatically arrange themselves to fill the gap. The Smart Dimensions feature saves time by automatically making the appropriate changes to dimensions to ensure they are at proper offset distances from the part and from each other.



Study Results

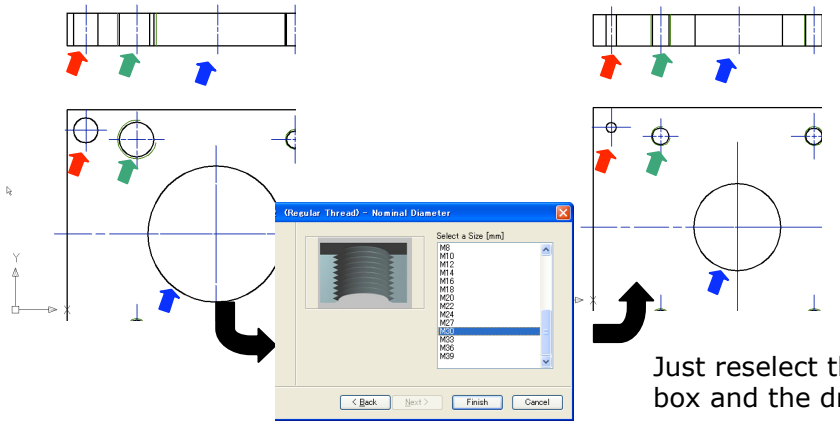
In the preceding graphic, the original dimensions (center) were edited to look like the drawing at right. With AutoCAD Mechanical, the dimension commands automatically maintain the placement gaps, simplifying drawing cleanup.

Productivity Gain*

	AutoCAD Mechanical	AutoCAD
No. of commands to align	Automatic	1 by 1
Time to add dimensions	40 sec.	1 min. 30 sec.
Productivity up 225%		
No. of commands to rearrange	Automatic and precise	1 by 1
Time to rearrange dimension	15 sec.	1 min.
Productivity up 400%		
Possibility of mistakes	None	High

Holes and Projected Views

AutoCAD Mechanical contains more than 8,000 predrawn standard holes that you can quickly incorporate into any design. These include through holes, blind holes, counterbored holes, countersunk holes, oblong holes, and others. When incorporated into a design, these holes clean up the area where they are inserted, so you don’t have to edit the area manually.



Just reselect the size from the dialog box and the drawing updates.

Study Results

In this example, a design change required three holes in a plate to have different diameters. To make this change in AutoCAD software, you must modify several circles and lines manually. In AutoCAD Mechanical, however, you make a simple change to the holes' properties and both the front and side views automatically update. In this example, the AutoCAD Mechanical update took 1/8 of the time required by the AutoCAD update.

Furthermore, the Power View functionality in AutoCAD Mechanical enables you to automatically generate a different view of a standard part or feature. For example, you can create the top view from the front. Quickly and accurately creating alternate views of standard parts and features can be invaluable, and this feature is integrated with the innovative mechanical structure tools in AutoCAD Mechanical 2004. The browser manages and tracks views, and edits to one view are automatically updated in associated views of the same part or feature.

Productivity Gain*

	AutoCAD Mechanical	AutoCAD
No. of commands to edit	0 (3 double-clicks)	3
Time for edit	15 sec.	2 min.
Productivity up 800%		

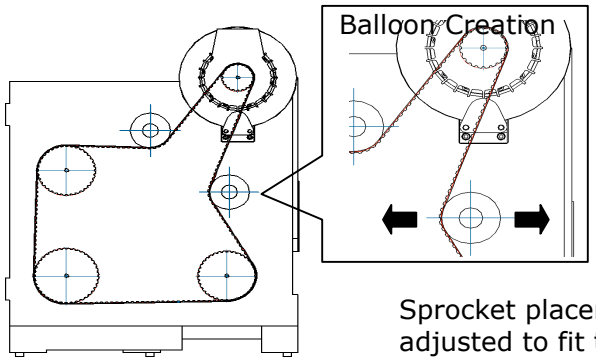
Sprocket and Chain System

Sprockets and pulleys are often used in the design of a drive system. Commonly, AutoCAD users draw each sprocket and pulley manually, a time-consuming task in its own right. To define the path lines, you have to create tangent arcs and lines to sprockets. These path lines are drawn with a specific length in mind, depending on which type of belt or chain you select. Typically, designing sprocket and chain systems becomes a series of trial-and-error workflows consisting of sprocket and path line repositioning. For an inexperienced designer this operation could take hours.

To alleviate this time-intensive task, AutoCAD Mechanical software's belt and chain generator function provides features to create chain-and-sprocket systems and belt-and-pulley systems, calculate optimal lengths for chains and belts, and insert these systems into your design. Belts and chains can be selected from standard libraries.

Study Results

The following results show that using AutoCAD Mechanical for this drive system design is 11 times faster than using AutoCAD software. When combined with research in a machinery handbook, the trial-and-error workflow in AutoCAD software makes the design time slow and prone to error. AutoCAD Mechanical software's sprocket and chain generator is a powerful and flexible tool that is purpose built for designing and optimizing drive systems. Automating this one task alone can save hours, or even days, of work and rework.



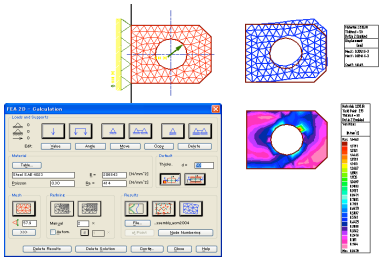
Sprocket placement needs to be adjusted to fit the right length.

Productivity Gain*

	AutoCAD Mechanical	AutoCAD
No. of commands used	1	8
Time to create the layout	4 min.	30 min.
Productivity up 750%		
Time to calculate path line	10 sec.	6 min.
Productivity up 3600%		
Time for chain optimization	10 sec.	19 min.
Productivity up 11400%		
Possibility for mistakes	None	High

FEA Calculations

To decrease field problems and recall, many companies must create prototypes to test the part in the environment in which it will be used. Performing basic 2D finite element analysis (FEA) helps you verify designs before they are built. This feature gives engineers the ability to quickly determine potential areas of failure in designs as well as analyze their integrity under various loads.



Study Results

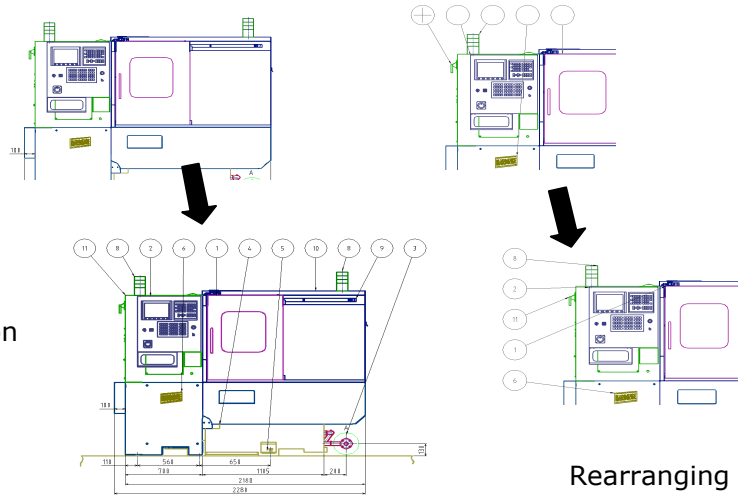
This example involves a hanging hook that required stress analysis. Since AutoCAD software does not provide 2D FEA functionality, designers must do calculations manually, referring to an engineering handbook. AutoCAD Mechanical, however, offers a simple 2D FEA feature. This powerful yet easy-to-use tool can determine the resistance capability of an object under a static load. This function enables you to add movable and fixed supports to the part to be analyzed as well as enter stress points, lines, and areas. As shown in the following table, AutoCAD Mechanical software's analysis tools provided tremendous time savings over the conventional mathematics required when using the basic AutoCAD program.

Productivity Gain*

	AutoCAD Mechanical	AutoCAD
No. of commands used	1	No command
Time for calculation	30 sec.	27 min.
Productivity up 5400%		
Possibility of mistakes	Very Low	Very High

Part Balloons

As a design nears completion, designers commonly annotate an assembly drawing with balloons that identify components for a parts list. These balloons are traditionally created manually. Often, designers attempt to speed up the process through customization.



Balloon Creation

Rearranging

Study Results

In AutoCAD software, each balloon must be created manually, using a circle and leader. The numbering also must be input manually, leaving room for error. AutoCAD Mechanical, however, provides a tool to automate the placement of balloons to identify parts in an assembly layout. New algorithms dynamically arrange balloons so that their leaders do not cross. In addition, the arrowheads on the balloon leaders track around the outer perimeter of the component, although an offset value can be set to place the arrowhead within the perimeter if you prefer. Balloons are tightly integrated into mechanical structure. AutoCAD Mechanical 2004 automatically manages part references to ensure accurate balloon labeling.

Although only 11 balloons were created and rearranged in this study, imagine how the time savings shown in the following table would increase as the assembly count increases.

Productivity Gain*

	AutoCAD Mechanical	AutoCAD
No. of commands	1	3 x each balloon
Time to create balloons	20 sec.	5 min.
Productivity up 1500%		
Time to rearrange balloon	20 sec.	4 min.
Productivity up 1200%		

Part Information and Parts List

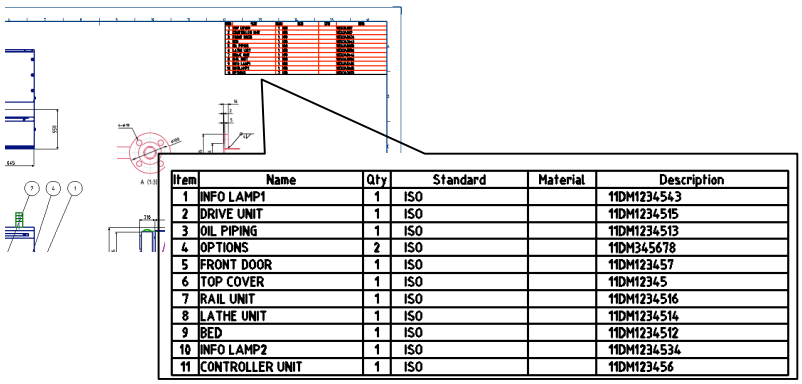
AutoCAD Mechanical contains several commands for creating balloons and BOMs. It supports multiple parts lists per drawing, as well as features such as summation, position lists, and report generators. The parts lists automatically recognize standard parts inserted from AutoCAD Mechanical. This functionality is tightly integrated with the new mechanical structure tools.

It is easy to create parts lists in drawings. In 2D design, BOM information is typically managed by hand and input manually into an MRP (Manufacturing Resource Planning) system. In AutoCAD Mechanical, BOM information is associative to mechanical structure and is dynamically updated throughout the design process. BOM data can even be exported to an MRP or ERP (Enterprise Resource Planning) system.

To combine similar items into a consolidated list, you can group a parts list. This enables you to quickly generate reports for ordering stock and combine selected items to calculate the total length required for an order. In this example, the parts list was created with just one command.

Study Results

With AutoCAD software, you must type all information and place it into a table manually. This cumbersome task requires significant time, and editing requires several operations. With AutoCAD Mechanical, the same parts list was created using a single command. In addition, the parts list created in AutoCAD Mechanical is intelligent, easy to manage, and always up-to-date.



Item	Name	Qty	Standard	Material	Description
1	INFO LAMP1	1	ISO		11DM1234543
2	DRIVE UNIT	1	ISO		11DM1234515
3	OIL PIPING	1	ISO		11DM1234513
4	OPTIONS	2	ISO		11DM345678
5	FRONT DOOR	1	ISO		11DM123457
6	TOP COVER	1	ISO		11DM12345
7	RAIL UNIT	1	ISO		11DM1234516
8	LATHE UNIT	1	ISO		11DM1234514
9	BED	1	ISO		11DM1234512
10	INFO LAMP2	1	ISO		11DM1234534
11	CONTROLLER UNIT	1	ISO		11DM123456

Productivity Gain*

	AutoCAD Mechanical	AutoCAD
No. of commands	1	3
Time to create parts list	10 sec.	13 min.
Productivity up 7800%		

Summary*

Based on these test examples, AutoCAD Mechanical offers the following advantages over AutoCAD software:

- Design and engineering tasks are 14 times faster.
- Design and engineering commands are reduced to 1/15.
- Over 90 percent savings of valuable work time.
- Risk of errors is greatly reduced.
- Changing designs is 25 times faster.

* The performance results in this paper were achieved by conducting automation testing over a controlled network. One engineer, with expert-level experience using both AutoCAD and AutoCAD Mechanical software programs, conducted the comparative tests on the same sample using an IBM ThinkPad A31 with a 2 GHz Intel Pentium 4 processor and 1 GB RAM. Results are approximate and subject to change. Product information and specifications are subject to change without notice. Autodesk provides this information "as is," without warranty of any kind, either express or implied.

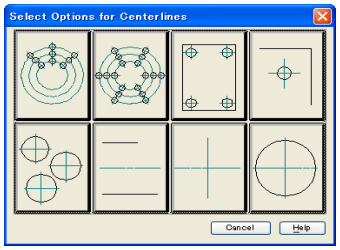
The following sections provide additional information on the features of AutoCAD Mechanical software.

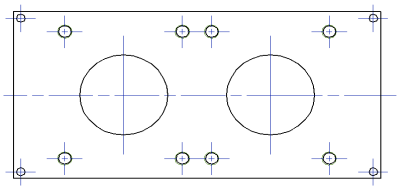
Commonly Used Functions for 2D Design

One of the long-standing strengths of AutoCAD Mechanical is the production-proven drafting and detailing capabilities it offers mechanical designers. AutoCAD Mechanical takes traditional 2D design to the next level, providing tools to automate drafting and design.

Centerline Creation

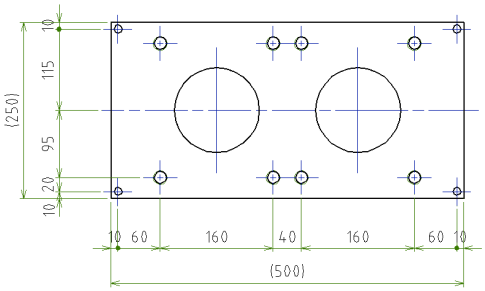
To properly detail parts and assemblies, centerline creation is essential. To reduce time spent on this task, AutoCAD Mechanical provides an intelligent centerline command, making easy work of centerline placement by creating centerline objects, rather than simple line geometry. Centerline objects are automatically placed on the correct layer, ensuring that the linetype and colors follow company standards. This keeps your focus on design, rather than on linework.

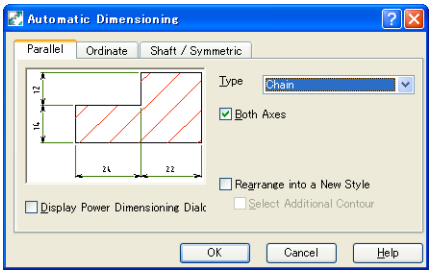




Automatic Dimensioning

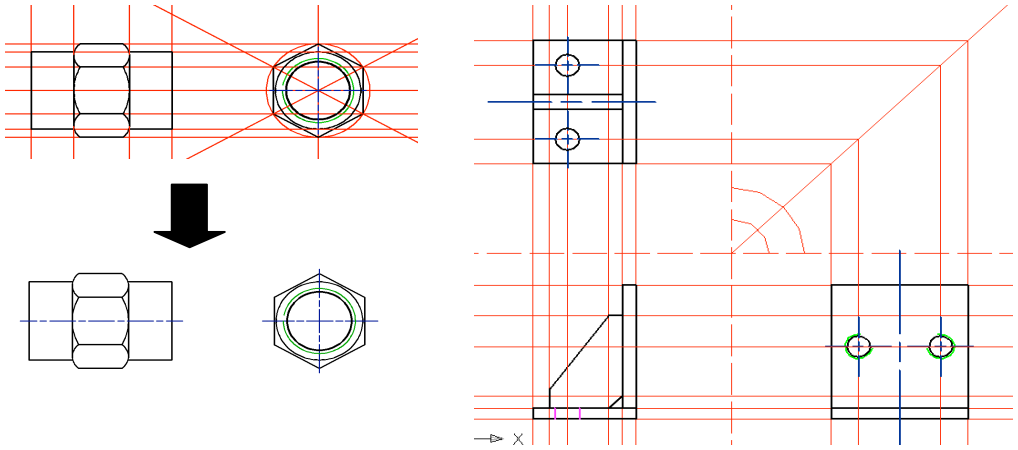
This feature automatically dimensions 2D geometry with ordinate, baseline, shaft, or symmetric dimensions, saving you time and effort. Dimension placement is done with predefined values, helping to reduce the amount of time required to finish a professional-looking drawing.





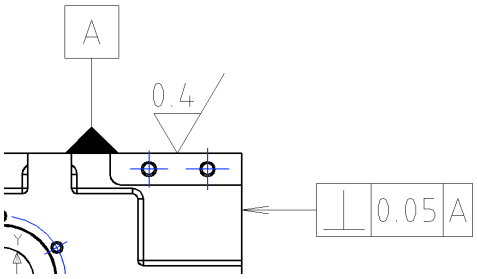
Construction Lines

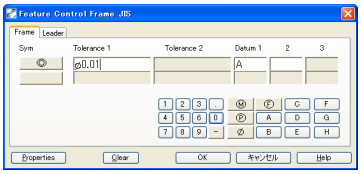
When creating drawings like layout and detail, many designers use construction lines. AutoCAD Mechanical provides a construction line tool that automatically creates construction lines on a designated layer, which does not print. This enables you to turn construction lines on or off or erase them in one command. The projection utility bends the construction lines about the correct angle of projection, making it easy to efficiently create three-view orthographic drawings. Construction lines are integrated with the automatic layer system in AutoCAD Mechanical, so you can focus on your designs rather than on a layering scheme.



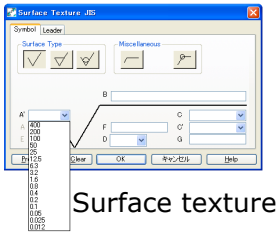
Mechanical Symbols

AutoCAD Mechanical includes commands to create standards-based surface texture symbols, geometric dimensioning and tolerances, targets, and weld symbols. Drawings often contain views of differing scales. Using settings in AutoCAD Mechanical, you can scale mechanical symbols automatically. Manual adjustments are not required to compensate for the scale difference. A single system setting controls the scale of drawing symbols. This capability eases the handling of scaled views and helps ensure that the drawing conforms to a company standard. Weld symbols, notes, and dimensions in detail views are scaled correctly and automatically, improving productivity.

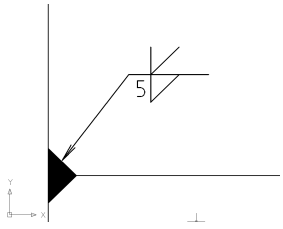


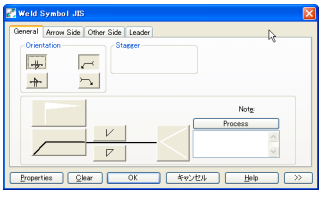


Feature control frame symbol



Surface texture symbol



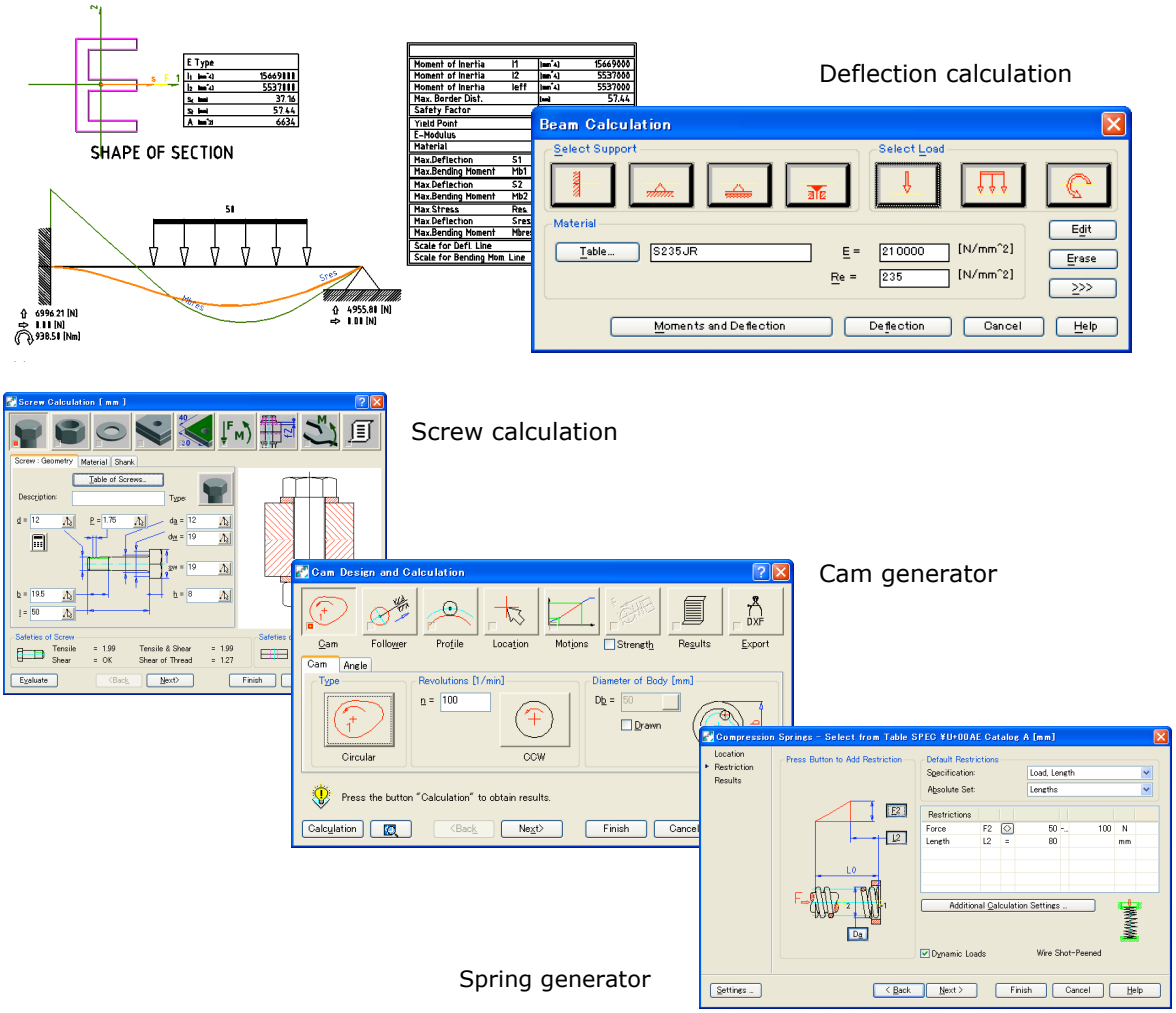


Weld symbol

Engineering Calculations

Companies are concerned about the liability of choosing the wrong component or material for a given application. AutoCAD Mechanical provides the tools to make engineering

calculations so you can easily validate screw connections, beam deflection, and bearing and shaft calculations. With quick access to these tools, it is easy to ensure that you have selected the correct material or part for a job. This reduces risk, minimizes concerns, and saves time for anyone who needs to conduct these types of calculations.



Deflection calculation

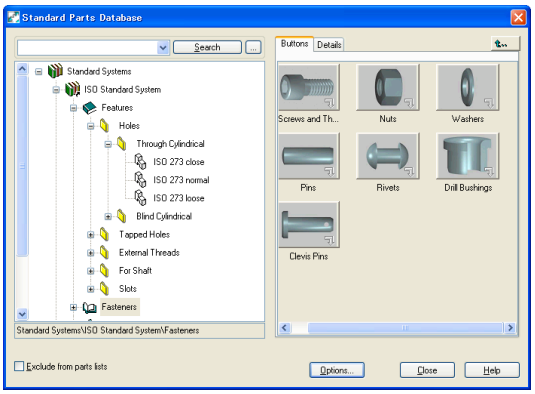
Screw calculation

Cam generator

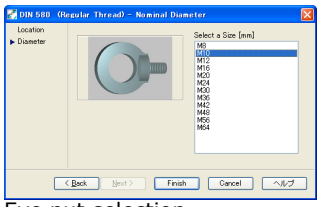
Spring generator

Standard Parts

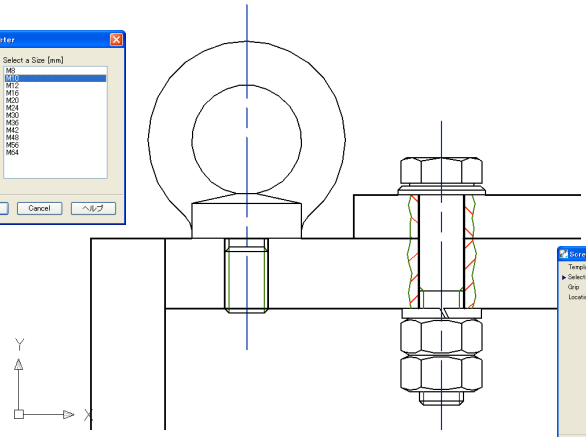
AutoCAD Mechanical contains about 600,000 standard parts that you can quickly incorporate into any design. These standard parts are readily available, ensuring quick and easy implementation. The standard part library includes predrawn screws, nuts, washers, pins, rivets, bushings, rings, seals, bearings, keys, and others and can be customized to conform to company standards. Standard parts functionality is tightly integrated into the mechanical structure functionality and provides consistency among various users. Parts placed into a design are automatically managed and tracked in the browser and the BOM database. Using predrawn, standards-based components can yield great productivity gains over drawing parts from scratch.



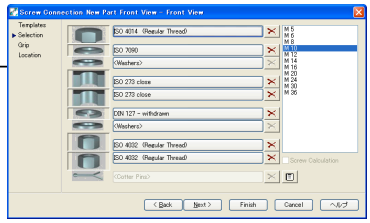
Standard part library



Eye nut selection



Screw connection



Functionality Comparison

The following table compares the functionality of AutoCAD Mechanical and AutoCAD software, and provides more details on how AutoCAD Mechanical can help increase your productivity.

	Functionality	AutoCAD Mechanical	AutoCAD
Basic Drawing	Drawing function	Drawing capabilities have been enhanced to make it easier to draw mechanical designs.	
	Adding dimensions	Easy to add tolerance. Easy to select dimension and arrow styles.	Cannot add standard tolerance. Dimension style must be set manually.
	Construction lines	Includes construction line function to assist complex drawing.	No special construction line functionality exists.
	Centerline creation	Centerline command has been enhanced for easier drawing. Scaling is automatically applied to meet correct pitch of long-dashed or short-dashed line.	Need to keep in mind the correct scale and change the property of line form solid line to dashed line.
	Annotation creation	Easy to create annotations that reference attributes.	All information in the annotation must be input and created manually.
Advanced Drawing	Standard part creation	Just select from content library to create standard parts based on 18 industry standards.	User needs to prepare standard parts.
	Detail view in model space	Easy to create a detail view with correct scale factor in model space. Changes made to the view update automatically.	Detail view is usually not to scale. Changes must be updated manually.
	Mechanical symbols	Select symbols from a dialog box to insert in drawing. Automatic scaling applies when exporting to detail drawing.	If the symbols were preset as a block, they can be inserted into the drawing. Scaling is not automatic and must be done manually.
	Scaling	Scale factor, which is set when inserting a drawing border, automatically applies to all dimensions and symbols.	Need to preset the scale factor and manually apply the multiplier to dimensions and symbols.
	Detail view in layout	Easy to set different scaled area in layout that applies correct scale factor to dimensions and text.	A viewport can be set to create a detail view, but the dimensions need to be applied in layout. If the dimensions are applied in model space, scale factor has to be applied.
Editing	Dimension edit or alignment	Modifications like align, join, insert, break, and arrow type change are easy.	Every modification has to be done manually.
	Smart dimension	Objects can be "stretched" according to dimension value.	Need to calculate the exact length to stretch.
	Standard part editing	Double-clicking standard parts brings up a dialog box to change types and sizes.	Need to reinsert standard parts. If the library does not exist, it needs to be re-created.

	Functionality	AutoCAD Mechanical	AutoCAD
	2D hide	Structure function helps to recognize the part positioning to do dynamic hide. Any changes are updated dynamically.	User has to define and edit each entity that needs to be trimmed or changed to a different linetype. All changes must be done manually, sometimes requiring redrawing.
Advanced Function	Balloon	Information attached to components defined by structure determines which components to apply to balloon.	Each balloon has to be created manually, one by one.
	Parts list information	Component information can be easily used for parts list.	No equivalent functionality.
	Customization	Same as AutoCAD software, which provides Visual LISP®, VBA (Microsoft® Visual Basic® for Applications), and C++. Also provides AutoCAD Mechanical API (application programming interface).	Provides Visual LISP, VBA, and C++ for API.
	Engineering calculations	Provides bearing lifetime calculation, screw calculation, spring/cam/shaft/drive system generator, moment of inertia, and FEA tools.	No equivalent functionality.
	Hole chart	Provides easy way of creating hole chart and hole list. Changes are updated automatically.	Everything has to be created manually. For any changes, chart has to be re-created.

Appendix

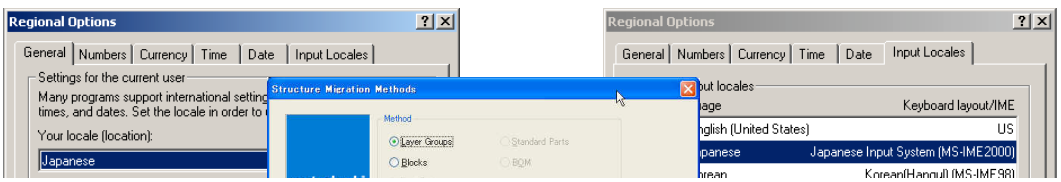
This appendix answers frequently asked questions about sharing data globally, moving to a new version of the software, and integrating new ideas into your current design environment.

Sharing Data in Different Languages

Because geographical boundaries are disappearing, a file created in one language is often brought into another language environment. The DWG file format used in AutoCAD Mechanical software is the world's most popular drawing format, so it can be easily read in different environments without conversion, shortening data sharing time. To write in a language different from the OS (operating system) language, you simply change the OS setting. For example, if a designer in Japan needs to write in Chinese to request a change, Chinese characters can be written in the Japanese OS. Team members can view the file in the Chinese OS and Chinese version of AutoCAD Mechanical without conversion. This is possible because AutoCAD Mechanical is used and supported worldwide.

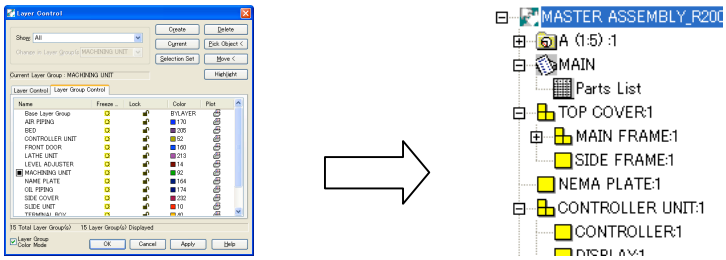
Moving to the Mechanical Structure Environment

For files created in previous versions of AutoCAD Mechanical (up to AutoCAD Mechanical 6), an ARX file (*am_migr.arx*) is provided to start the Structure Migration Methods tool. This tool provides two options for migrating data.



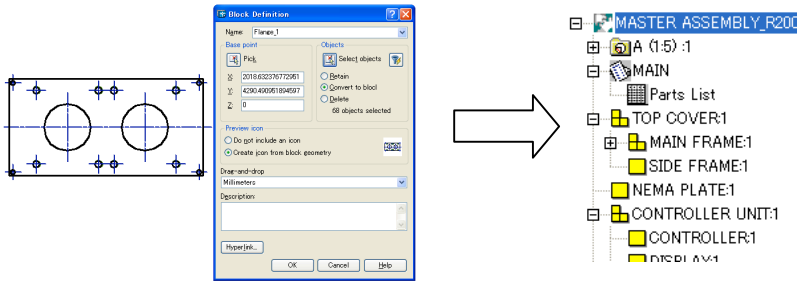
Option 1: Migrating Layer Groups

If the parts are defined using layer groups, use the option to migrate layer groups to structure.



Option 2: Migrating Blocks

If the parts are defined using blocks, use the option to migrate blocks to structure. Components defined by layer groups and blocks can be brought into the new environment provided by AutoCAD Mechanical 2004.

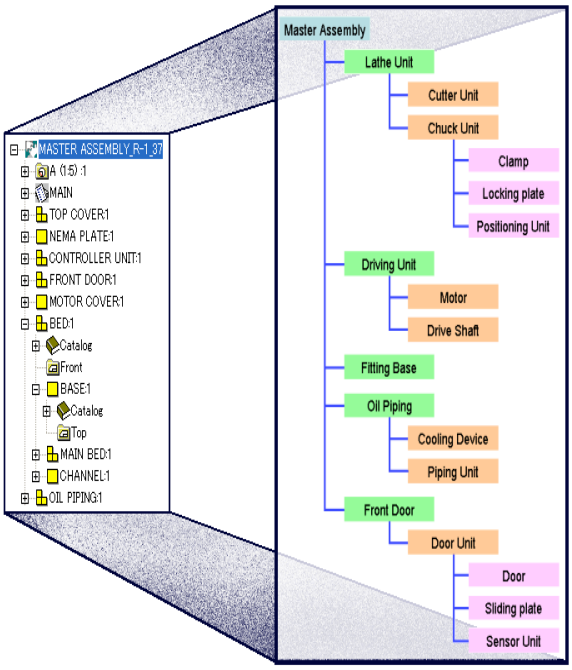


Using 2D Mechanical Structure

Because mechanical structure is a new methodology introduced in this version of the software, following are some hints that suggest more productive design methods.

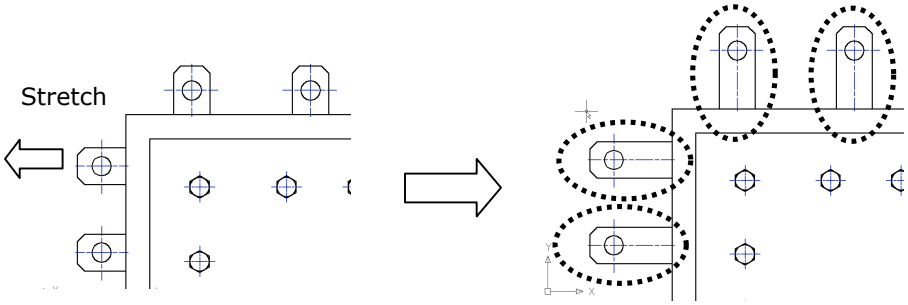
Situation 1: Creating Parts List Before Designing

Often, it is necessary to list all the components to set the specification and estimate cost. With mechanical structure, it is possible to create and analyze a list of components to be included and determine how many are needed before drawing a single line in AutoCAD Mechanical. The list helps you see how the components relate to each other, how many unique parts are required, and how many designs can be reused. At this point, cost calculation and completion schedule can also be determined. If you use the predefined structure as a guideline, it is easy to do detail designing within the specification and budget.



Situation 2: Having Multiple Instances in the Same Assembly

Structure can easily handle instances of components, even when the instance is mirrored. Multiple instances of the same components all update when a modification is applied to one instance, saving time and reducing errors.

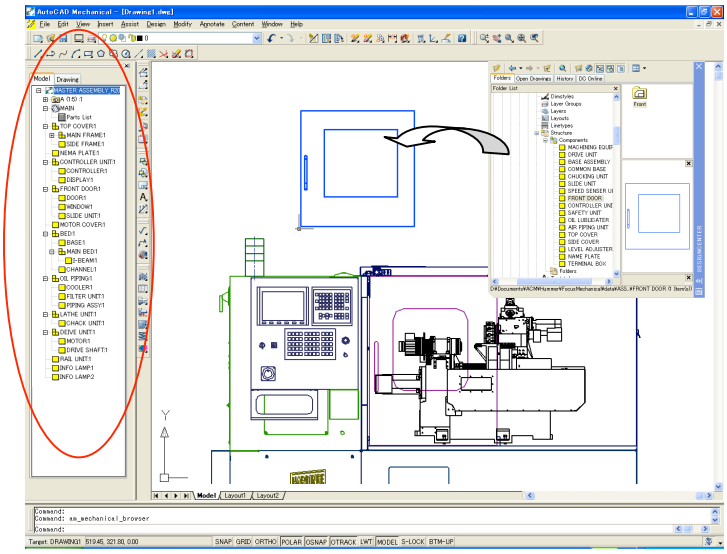


Every instance updates

Situation 3: Reusing Intelligent Components

There are many ways to place components in the AutoCAD Mechanical software program. One way is to use the AutoCAD DesignCenter™ feature. With DesignCenter, you can bring in not only the shape of the component but reusable component information as well. When the component is inserted into a new drawing, the BOM information updates accordingly to keep the information up-to-date and precise.

As you can see, mechanical structure provides design tools that help you realize ideas more effectively. The productivity gains in 2D hide, balloon, and parts list all result from this structure functionality.



DesignCenter functionality enables you to drag components from other drawings. The structure hierarchy updates accordingly.

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