

GearTrax

COMPONENTS FOR YOUR DRIVE



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Introduction

The first seat of GearTrax was sold in 1998. The original GearTrax was programmed using Visual Basic and is limited to 32bit compiling. The new GearTrax is programmed using Visual Studio 2015 Update 3. We have tried to retain the user friendly interface of the original GearTrax but incorporate the technologies that were developed for our GearTeq product. While many features of GearTeq are now available with the new GearTrax, some of the advanced features will be available in the PRO version, such as profile modification and crowning. Planetary gear sets are not available, please see our GearTeq product.

GearTrax is an object oriented/property driven gear design program. It is not the intent of GearTrax to replace your CAD system but to augment the CAD system with a user interface that will allow the gear designer to accurately visualize the components before they are modeled in the CAD system.

GearTrax has a predetermined number of components. For example, the spur tab always has 2 gears, a pinion and a gear. For bevel gears this is important because bevels are normally defined as a set. The number of teeth in both gears defines such properties as the pitch angles. When GearTrax creates in CAD, the user can select between creating only the individual models or the models and the assembly.

GearTrax is programmed in the USA using 100% renewable energy.



Definitions:

CAD

CAD (Computer Aided Design) is the system this program was compiled to run with, either as an add-in or add-on.

Assembly

An assembly is a number of parts placed in a CAD assembly document. For gears that can be created as a set, GearTrax can create the assembly in CAD.

Component

Component is a single GearTrax gear, sprocket, pulley, etc.

Part

Part is a single CAD part document file that contains one GearTrax component.

Model

Model is a CAD part document.

Annotation

Annotation is a text or Excel note placed on the CAD part or drawing document.

Starting GearTrax

GearTrax is compiled and published as a Click-once application. To have GearTrax available on a computer, each user of that computer must install GearTrax. Use the Windows Start menu to start GearTrax by clicking on Start>All Programs>Camnetics, Inc>GearTrax*. Communication with the CAD program is done through the controls in the CAD group box on each of the tabs.

GearTrax Menus

File

Save GearTrax File

Save GearTrax File saves to the .gtx extension.

Open GearTrax File

Open a previously saved GearTrax document. GearTrax documents have .gtx as the file extension.

Capture GearTrax screen and open in viewer

Capture GearTrax screen as a jpeg and opens in the default picture viewer or editor.

Capture GearTrax screen to the clipboard

Capture GearTrax screen to the clipboard captures the GearTrax screen, including borders, to the clipboard.

Convert Legacy GearTrax file

Convert Legacy GearTrax file opens a GearTrax file that was saved in the original version of GearTrax. The legacy file extension is .gtx.

Open GearTrax by Active CAD Part

GearTrax will read the custom properties of the active CAD document. If the CAD document is a part model created by GearTrax the data will be read into the active component of GearTrax.

Recent files

A list of recent files is provided for easy access to opening files.

Exit

Exit closes GearTrax. The user is prompted to save any unsaved data.

View

Redraw - fit all

Redraw – fit all redraws the assembly to fit on the screen with the front view and resets the drive position to zero.

Tools

Reverse Animation Direction

Clicking 'Reverse Animation Direction' reverses the direction of the simulation.

Create a Data Sheet for active component

Excel file

Clicking 'Excel file' creates a data sheet of the active component in Microsoft Excel, if available.

Text file

Clicking 'Text file' creates a data sheet of the active component in Microsoft Notepad, if available.

Comma Separated Values (CSV) file

Clicking 'Comma Separated Values file' creates a data sheet in Microsoft Notepad, if available, that can be imported into most spread sheet programs.

SYMBOL	VALUE	UNIT	TERM
	Coarse_Pitch_Involute_25deg		Standard
Pd	8.000000		Normal Diametral Pitch
Fd	8.000000		Diametral Pitch
m	3.175000		Normal Modular Pitch
mn	3.175000		Modular Pitch
da	25.0000	deg	Normal Pressure Angle
mq	25.0000	deg	Pressure Angle
C	0.0000	deg	Helix Angle
MA	0.3929		Ratio, i:x
MR	2.4516	in	Center Distance
mp	0.2368	in	Approach Length
Np	0.2436	in	Recess Length
Dp	1.3577		Contact Ratio
Dpn	11		Number of Teeth
do	1.3750	in	Pitch Diameter
dr	1.3750	in	Pitch Diameter, Normal
a	1.6536	in	Major Diameter
b	1.0911	in	Minor Diameter
db	0.1393	in	Addendum
dbn	0.1420	in	Dedendum
ht	0.11428		Addendum Modification Coefficient
p	0.0143	in	Addendum Modification
pn	1.2462	in	Base Diameter
B	1.2462	in	Base Diameter, Normal
t	0.2813	in	Whole Depth
tn	0.3927	in	Circular Pitch
F	0.3927	in	Circular Pitch, Normal
dw	0.0375	in	Fillet Radius
M	0.0000	in	Backlash
	0.20967	in	Tooth Thickness
	0.20967	in	Tooth Thickness, Normal
	0.7500	in	Face Width
	0.2160	in	Size Between Pins
	1.6794	in	Pin Diameter
	1.6710	in	Measurement over Pins
	0		Measurement over Pins-Minimum
	0.0000	in	Chordal over Teeth
	7		Number of Teeth to Gage over
	0.0032	in	Chordal Measurement
	0.00099	in	AGMA Quality Class
	0.0013	in	Max Runout
	0	in	Pitch Variation
	0.0026	in	Profile Tolerance
	0.0062	in	Tooth Alignment Tolerance
	0.00500	in	Total Index Tolerance
			Total Composite Tolerance
			Tooth Thickness Tolerance

Sample of a data sheet created as text file

Create an Involute X-Y File

Excel file

Clicking 'Excel file' creates an involute data sheet of the active component in Microsoft Excel, if available.

Text file

Clicking 'Text file' creates an involute data sheet of the active component in Microsoft Notepad, if available.

Comma Separated Values (CSV) file

Clicking 'Comma Separated Values file' creates an involute data sheet in Microsoft Notepad, if available, that can be imported into most spread sheet programs.

Create an Involute XYZ Surface File

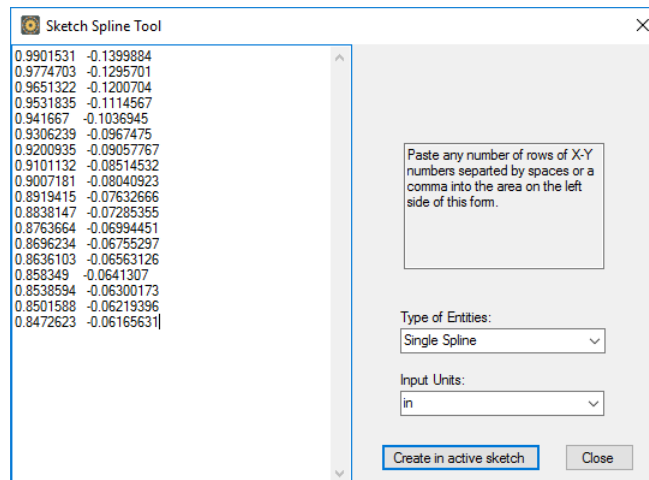
Text file

Clicking 'Text file' creates a XYZ surface data sheet of the active component in Microsoft Notepad, if available.

CAD Tools

Draw a Spline

Use this tool to create a spline in the active sketch using a number of XY points separated by either a space or a comma. The origin of the part is used as the 0, 0 for the data.



Open install folder using Explorer

GearTrax is compiled and published as a "Click-once" application. Therefore, the installation folder is not in the program folder as it is for most programs. The installation folder can be opened with this command.

General Options

The menu item activates the General Options.

PRO Tools

For GearTraxPRO users only.

Additional CAD Tools

Edit CAD Models...

Edit Cad Models menu item opens a dialog box editing CAD models.

Show Alerts On-screen

Show Alerts On-screen menu item is a check box. If checked, any alerts will be displayed in the upper left hand corner of the graphic window.

Create a DXF File

A simple DXF can be created. It is recommended you use the CAD system, if available, to create the DXF rather than this option.

Help

GearTrax Help Topics

Clicking 'GearTrax Help Topics' opens the GearTrax help topics.

GearTrax Manual (PDF)

Clicking 'GearTrax Manual' opens a PDF of the manual. Adobe Acrobat must be installed on the computer.

Camnetics Media Page (video demos)

Opens our web page www.camnetics.com/media.htm Internet access required.

License

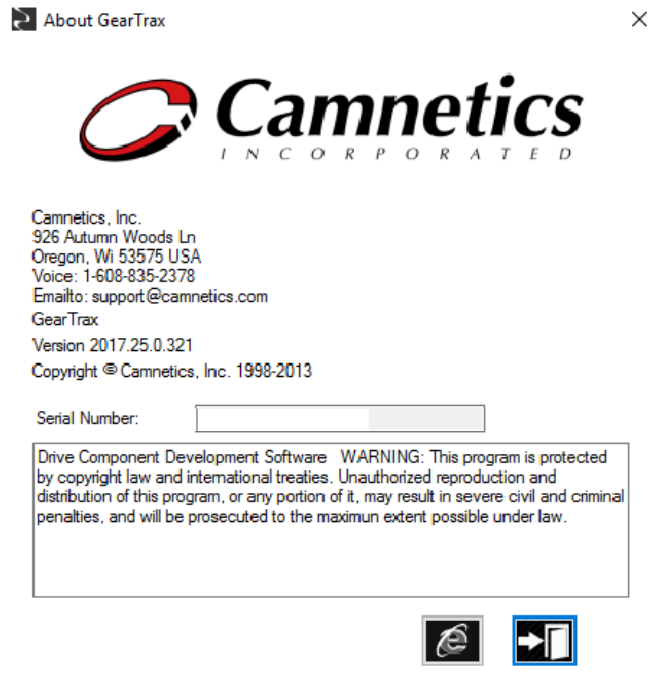
Opens the license text file.

Registration...

Clicking 'Registration...' opens the Registration window.

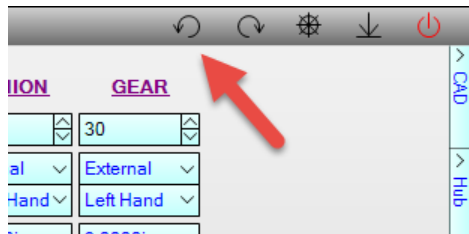
About GearTrax...

Clicking 'About GearTrax...' opens the About window.
Camnetics addresses are listed along with a link to the web site.
The version of GearTrax that is installed is displayed.



Undo

The Undo button will restore the last change in the active component :



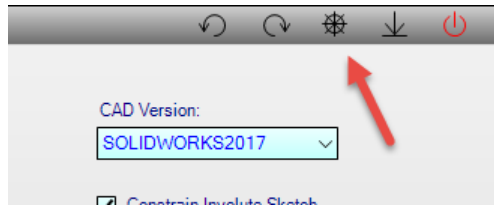
Redo

The Redo button will restore the last Undo change in the active component:

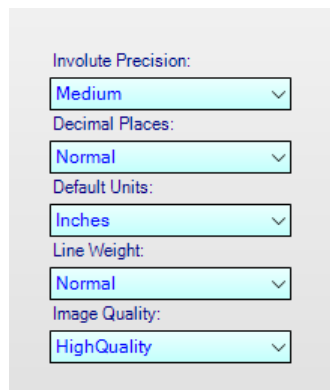


General Options

The General Options are available on the GearTrax Options tab.
Menu>Tools>General Options or the General Options button.



GearTrax Settings



Involute Precision

Involute Precision allows the user to have some control over the number of points used to create the spline that defines the involute portion of the tooth. The number of spline points will be affected by the number of teeth in the gear and any addendum modification. The maximum number of points used to create the involute per side is:

- Low: 10
- Medium: 20
- High: 40
- Very High: 80

Decimal Places

Decimal Places determines the number of decimal places from normal. The normal setting is x.xxxx for inches and x.xxx for millimeters. This option will not change the standard or add one or two decimal places to most of the values displayed or presented in any data sheets. This may not affect some settings.

Default Units

Default Units defines the units (inches or millimeters) to be used when creating a new GearTrax component. This value is saved as a default for the next time GearTrax is started.

Line Weight

Line Weight sets the thickness of the line in the graphics display. Choose between Normal, Heavy and Very Heavy.

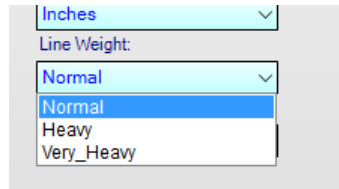
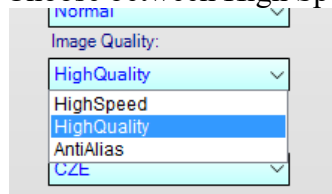


Image Quality

Image Quality sets the quality of the image in the graphics display. Choose between High Speed, High Quality and AntiAlias.



Language Selector

The Language Selector sets the language to be used in GearTrax labels. The 3 character code is used for the different languages. The first releases of this will only be in English. We are counting on feedback from users to enhance this feature in the future.

Enable Label Edit (Ctrl key)

If the Enable Label Edit is checked then the user can edit label, check box and button text on the GearTrax form. To edit a label, hold down the control key and use the mouse to select a label. The label will be displayed in a text box with a yellow back ground color. Make any changes to the label and press enter. The label change will be active for this session of GearTrax. For this change to be permanent the user must go back to the General Options and click the Save Current Language button.

Save Current Language

The Save Current Language button saves any changes made to the active language.

Export Language

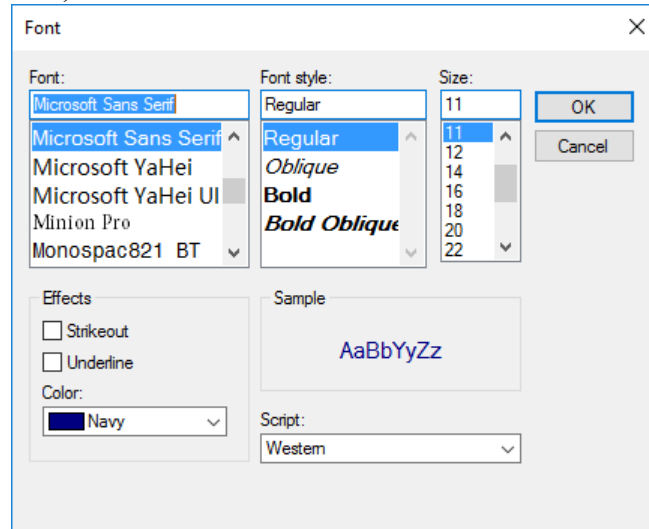
The Export Language button allows the user to share the current language changes with other users. If you have made a significant change to the language please email that language to support@camnetics.com so that we may incorporate those changes into the software for future releases.

Import Language

The Import Language button allows the user to import a language saved by other others.

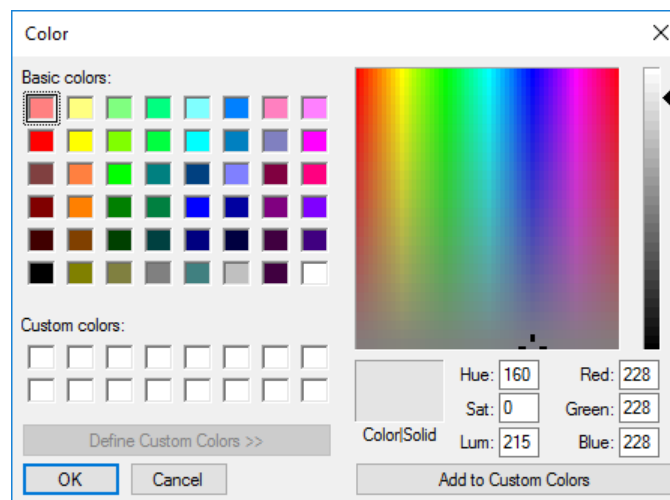
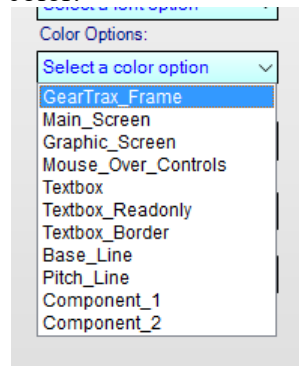
Font Options

Select a type of display component to change the Font, Font style, Size, Effects and Color.



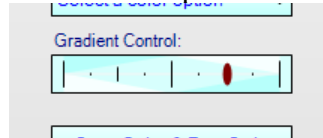
Color Options

Select a type of display component or display action to change its color.



Gradient Control

The Gradient Control slider control allows the user to change the gradient amount or set it in the center for no gradient. Move the knob to right of center for lighter on the top or left of center for dark on the top.



Save Color & Font Style

The Save Color & Font Style button allows the user to save the current style so it can be used later or shared with other users.



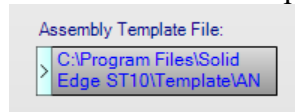
Load Color & Font Style

The Load Color & Font Style button allows the user to open a previously saved style.



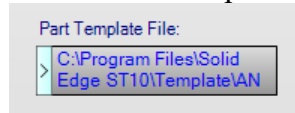
Assembly Template File

A CAD template for assemblies can be specified by clicking on the side button that will open a dialog box.



Part Template File

A CAD template for parts can be specified by clicking on the side button that will open a dialog box.



CAD Version

CAD Version defines which version of CAD to use with GearTrax when it is running as an Add-On. This option is not available when GearTrax is running as an Add-In. This value is saved as a default for the next time GearTrax is started.

Constrain Involute Sketch

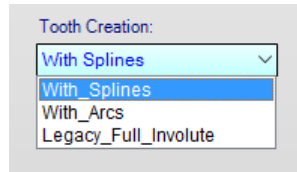
The Constrain Involute Sketch check box determines if the involute sketch will be created with an anchor (or fixed) constraint. Setting this to checked will prevent unintended dragging of the

sketch entities with the mouse. This value is saved as a default for the next time GearTrax is started.

☒ Constrain Involute Sketch

Tooth Creation

The Tooth Creation option allows the user to select between splines and arcs when creating the tooth sketch geometry. This value is saved as a default for the next time GearTrax is started.



With Splines

The involute tooth profiles are created with a single spline.

With Arcs

The involute tooth profiles are created with a series of arcs. The same points that would be used to create a spline are used. Every 3 points are used to create the arc. This option may not be available for all CAD systems.

Legacy Full Involute

The gear tooth root of this option does not conform to any known standard. It is advised not to use this option.

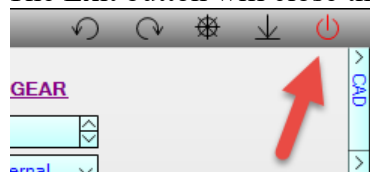
Minimize

The Minimize button will hide the application. GearTrax can be restored to the screen by clicking in the GearTrax icon in the tool tray.



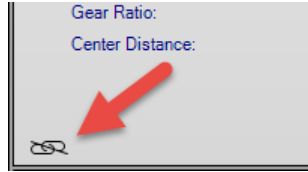
Exit

The Exit button will close the program.



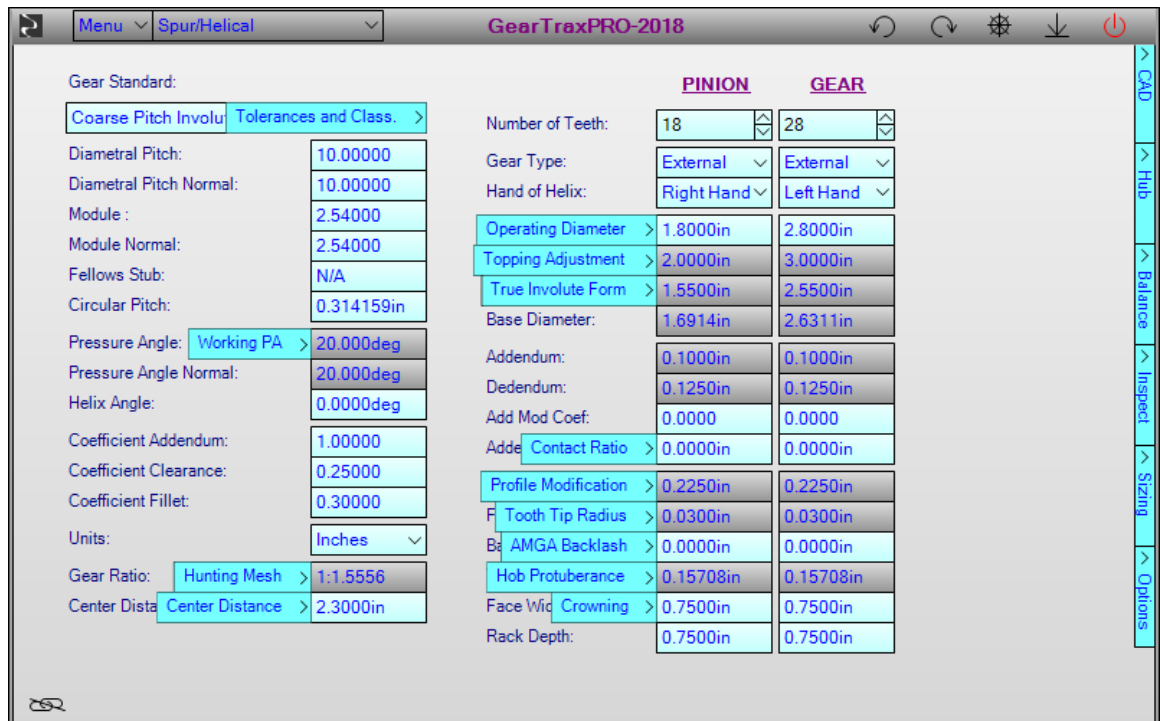
Tether and Tether

For PRO licensed users only. The Tether toggle button is in lower left corner of the data window. If it is un-tethered, the graphics window is not tethered to the data window. The graphics window is then free to be relocated and resized.



Side Buttons

Side Buttons allow access to sub windows. The following screen shot shows the side buttons expanded displaying the name of the sub window. Not all component types have Side Buttons.



Menu ▾ **Bevel Gears** ▾ **GearTraxPRO-2018**

Bevel Type: **Straight** ▾

Full Fillet Radius (hobbed): **Gleason** ▾

AGMA Class: **none** ▾

Diametral Pitch: **10.0000**

Module: **2.54000**

Circular Pitch: **0.3142in**

Spiral Angle: **0.0000deg**

Hand of Spiral Pinion: **Right Hand** ▾

Pressure Angle: **20.0000deg**

Generating Diameter: **n/a**

Coefficient Addendum: **1.00000**

Coefficient Clearance: **0.18800**

Coefficient Fillet: **0.28200**

Whole Depth: **0.2208in**

Fillet Radius: **0.0282in**

K Factor: **0.0000**

Units: **Inches** ▾

Gear Ratio: **Hunting Mesh** ▾ **1:1.0000**

	PINION	GEAR
Number of Teeth:	20	20
Pitch Diameter:	2.0000in	2.0000in
Outside Diameter:	2.1414in	2.1414in
Addendum:	0.1000in	0.1000in
Dedendum:	0.1188in	0.1188in
Add Mod Coef:	0.00000	0.00000
Addendum Mod:	0.0000in	0.0000in
Backlash:	0.0000in	0.0000in
Tooth Thickness:	0.1570in	0.1570in
Pitch Angle:	45.0000deg	45.0000deg
Pitch Angles Sum:	90.000deg	
Face Angle:	45.0000deg	45.0000deg
Root Angle:	40.1982deg	40.1982deg
Face Wic Crowning ▾:	0.5000in	0.5000in
Web Thickness:	0.0000in	0.2500in
Mounting Distance:	1.1793in	1.1793in
Crown to Back:	0.2500in	0.2500in
Face to Back:	0.5739in	0.5739in
Crown to Apex:	0.9293in	0.9293in

CAD Hub Inspect

Menu ▾ **Splines** ▾ **GearTraxPRO-2018**

Spline Standard: **ANSI Diametral B92 1 1996** ▾

Root and Fit: **Fillet Root Side Fit** ▾

Manufacturing Method DIN only: **Broaching** ▾

Units: **Inches** ▾

Diametral Pitch: **16.000000**

Diametral Pitch Stub: **32.000000**

Module: **1.587500**

Circular Pitch: **0.1963in**

Number of Teeth: **16**

Pitch Diameter: **1.0000in**

Diameter Nominal SAE: **n/a**

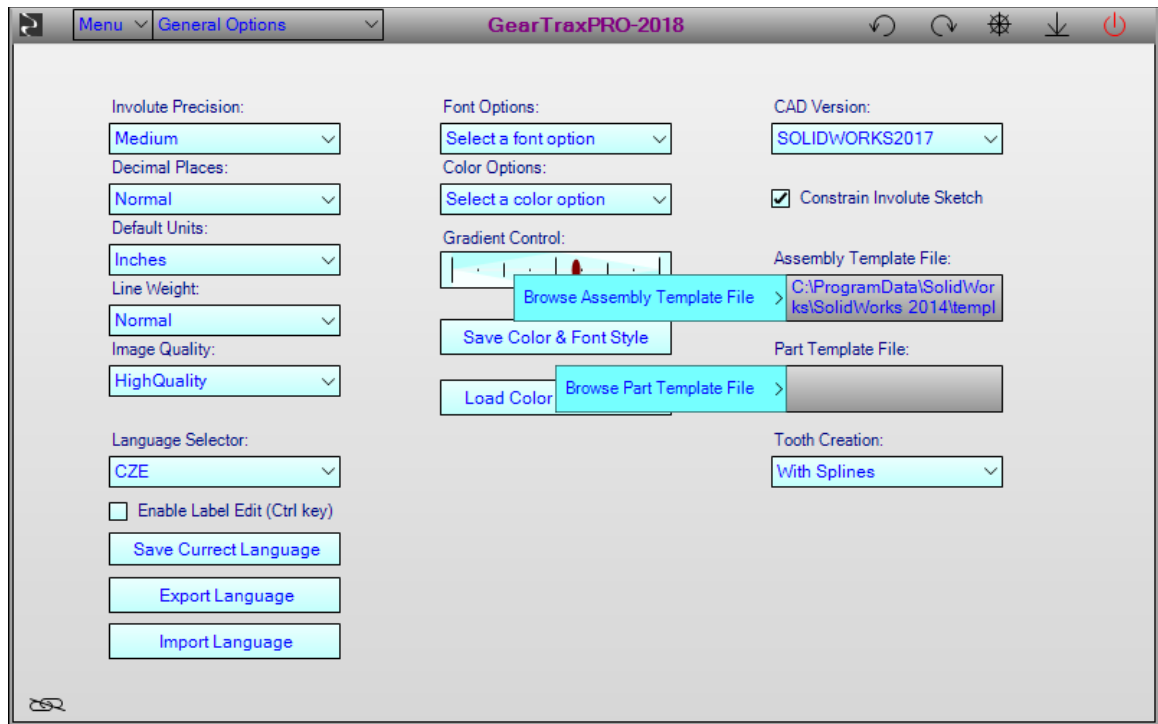
Pressure Angle: **30.0000deg**

Internal Designation: **INT 16Z x 16/32 x 30R x 5H ANSI B92.1-**

External Designation: **EXT 16Z x 16/32 x 30R x 5h ANSI B92.1-**

	INTERNAL	EXTERNAL
Length:	1.0000in	3.0000in
Major D Diameters ▾:	1.1125in	1.0625in
Minor D Diameters ▾:	0.9375in	0.8750in
Diameter Ref DIN:	N/A	N/A
Base Diameter:	0.8660in	0.8660in
Diameter TIF:	1.0670in	0.9330in
Addendum:	0.0313in	0.0313in
Dedendum:	0.0563in	0.0625in
Add Mod Coef:	n/a	n/a
Addendum Mod:	n/a	n/a
Fillet Radius:	0.0213in	0.0213in
Spac Space Widths ▾:	0.0982in	
Tooth Thickness Tooth Thickness ▾:	0.0982in	
Tolerance Class:	Class 5 ▾	Class 5 ▾
Fit Class:	 ▾	H h ▾
Blank OD:	1.5000in	
Coefficient Addendum:	0.50000	0.50000
Coefficient Dedendum:	0.9000	1.00000
Coefficient Fillet:	0.34000	0.34000

CAD Hub Inspect Chart Options



Spur/Helical Gears

Addendum

Addendum is the length of the tooth from the pitch diameter to the major diameter. This value cannot be changed directly unless GearTrax is in the “Free Form” mode.

Addendum Modification

Addendum Modification is the amount of addendum change of a modified tooth. This value can be positive or negative. If the sum of change to a pair of gears equals zero then there is no change to the center distance.

A positive value will increase the addendum length and a negative value will decrease the addendum length.

If GearTrax is in the “Free Form” mode, the value will be unused.

Clicking on the side button next to the Addendum Mod. text boxes will open a dialog box for displaying contact ratio values.

Contact Ratio

Approach Length:	0.2418in	51.71%
Recess Length:	0.2258in	48.29%
Contact Ratio:	1.5839	
Contact Ratio Face:	0.0000	
Active Length of Line of Action:	0.4676in	

Sidebar tabs: CAD, Hub, Balance, Inspect, Sizing, Options

Addendum Modification Coefficient

Addendum Modification Coefficient is the ratio of change of a modified tooth. This value can be positive or negative. If the sum of change to a pair of gears equals zero then there is no change to the center distance of the gear set.

A positive value will increase the addendum length and a negative value will decrease the addendum length.

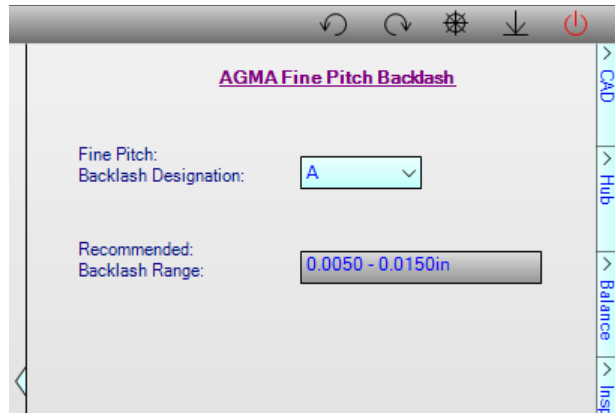
If GearTrax is in the “Free Form” mode, the value will be unused.

AGMA Class

AGMA Class sets the AGMA Class for this component.

Backlash

Backlash is the thinning (or thickening, if a negative value) of the tooth profile after any modification to the tooth form. This backlash is achieved by rack shift and does not affect the diameters. See Addendum Modification for tooth thinning or thickening that also affects the diameters. Clicking on the side button next to the backlash text boxes to open the dialog box for AGMA Backlash recommendations for fine pitch gears.



Blank O.D.

Blank O.D. is the diameter of the blank used to create the internal gear. The diameter must be large enough for the tooth cut in CAD.

Chordal Tooth Height

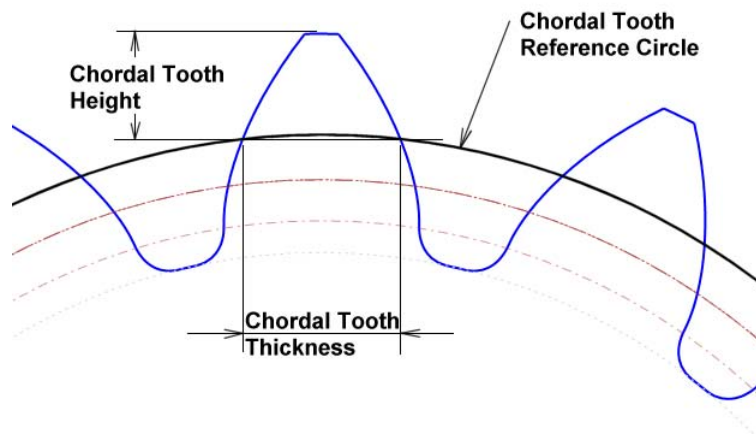
Chordal Tooth Height is the length of the tooth portion to be measured at which the chordal tooth thickness is calculated. Twice the chordal tooth height plus the chordal tooth reference circle should equal the outside diameter of the gear.

Chordal Tooth Reference Circle

Chordal Tooth Reference Circle is the diameter of the datum circle at which the chordal tooth thickness is measured. The chordal tooth reference circle should be equal to the outside diameter of the gear minus twice the chordal tooth height.

Chordal Tooth Thickness

Chordal Tooth Thickness is a straight-line measurement across a single tooth at the chordal tooth reference circle.



Chordal Tooth Thickness Minimum

Chordal Tooth Thickness is a straight-line measurement across a single tooth (maximum actual tooth thickness minus tooth thickness tolerance) at the chordal tooth reference circle.

Circular Pitch

Circular Pitch is the arc length of a single pitch at the pitch diameter.

Coefficient, Addendum

Addendum Coefficient is a constant that is divided by the diametral pitch to determine the length of the addendum before any modification. The addendum length of a 10 diametral-pitch gear with an addendum coefficient of 0.8 is 0.080in.

The whole depth is equal to the sum of twice the addendum coefficient and the clearance coefficient divided by the diametral pitch.

Coefficient, Clearance

Clearance Coefficient is a constant that is divided by the diametral pitch to determine the clearance in the root of the gear tooth.

The whole depth is equal to the sum of the clearance coefficient and twice the addendum coefficient divided by the diametral pitch.

Coefficient, Fillet

Fillet Coefficient is a constant that is divided by the diametral pitch to determine the radius of the hob tip that creates gear tooth root.

Contact Length, Approach

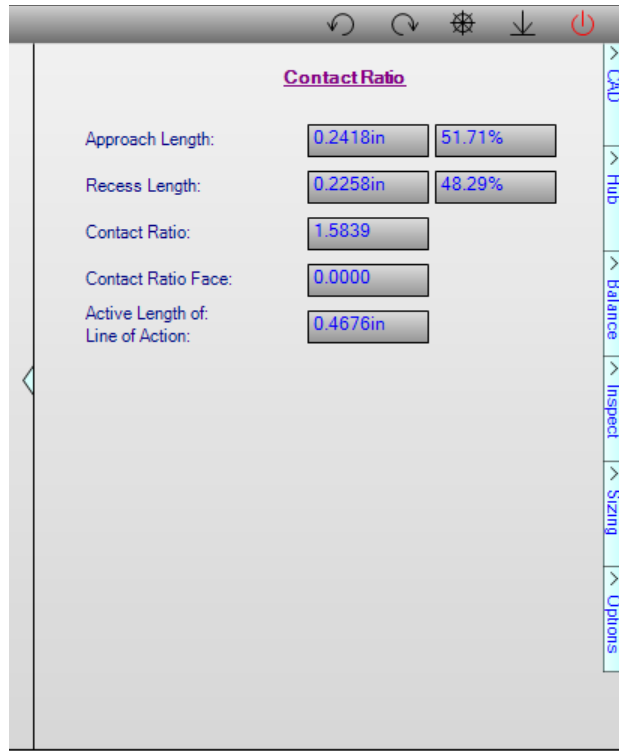
Contact Length, Approach and the recess length equal the total contact for a pair of gear teeth. To view these read-only values, click on the small button next to the Addendum Mod text boxes.

Contact Length, Recess

Contact Length, Recess and the approach length equal the total contact for a pair of gear teeth. To view these read-only values, click on the side button next to the Addendum Mod text boxes.

Contact Ratio

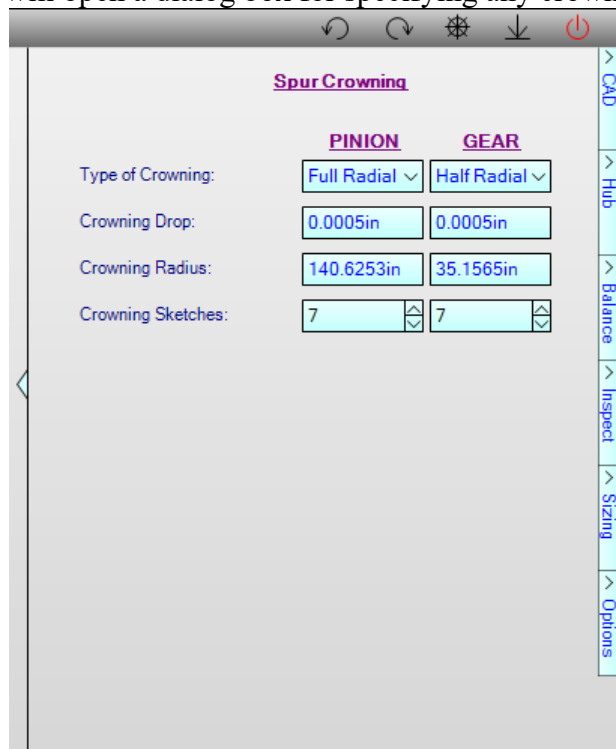
Contact Ratio is the ratio of the arc of action to the circular pitch. This value should be over 1.4 to assure a smooth transfer of load from one pair of teeth to the next pair of teeth. To view these read-only values, click on the side button next to the Addendum Mod text boxes.



Contact Ratio		
Approach Length:	0.2418in	51.71%
Recess Length:	0.2258in	48.29%
Contact Ratio:	1.5839	
Contact Ratio Face:	0.0000	
Active Length of Line of Action:	0.4676in	

Crowning

Crowning is available in GearTraxPRO. Crowning is the alteration to the tooth thickness along the length of the face width. This can also be referred to as lead or longitudinal crowning. Clicking on the small button will open a dialog box for specifying any crowning.



	PINION	GEAR
Type of Crowning:	Full Radial	Half Radial
Crowning Drop:	0.0005in	0.0005in
Crowning Radius:	140.6253in	35.1565in
Crowning Sketches:	7	7

Crowning Drop

Crowning Drop is the amount of change to the tooth thickness on one side of the tooth at the faces. Changing this value will change the crowning radius value. Changing the face width will not affect this value.

Crowning Radius

Crowning Radius is the radius used to create the drop to achieve the specified drop. Changing this value will change the drop value. Changing the face width will affect this value.

Crowning Sketches

Crowning Sketches is the number of sketches used in CAD to create the tooth loft cut. The number of sketches is limited to at least 5 and no more than 21. The sketches are evenly distributed along the face width. An odd number of sketches is recommended so a sketch is placed at the center of the gear. If half radial or half tapered crowning type is used it is recommended to have 9 or 17 sketches so a sketch is at the start of the crowning transition.

Crowning Type

Crowning Type defines the type of crowning.

- None, no crowning is used.
- Full Radial, the full length of the tooth is modified. If an odd number of sketches is used, the center sketch will have no modification.
- Half Radial, the center 1/2 of the tooth has no modification. Using at least 9 sketches is recommended with the half radial type. Using 9 or 17 sketches places one sketch at the transition at the start of the half radial crowning.
- Half Tapered, the center 1/2 of the tooth has no modification. Using at least 9 sketches is recommended with the half tapered type. Using 9 or 17 sketches places one sketch at the transition at the start of the half tapered crowning.

Dedendum

Dedendum is the radial length of the tooth between the pitch diameter and the minor diameter.

Base Diameter

Base Diameter is a diameter that is tangent to the pressure angle. The involute curve cannot be within this diameter.

Major Diameter

Major Diameter is the outside diameter of a gear. Clicking on the small button will open a dialog box for changing the values of the topping adjustment and displaying the values of the top land.

The screenshot shows the 'Topping Adjustment' dialog box. It has a title bar with standard window controls (undo, redo, zoom, pan, close). The main area is titled 'Topping Adjustment' in purple. Below the title, there are two columns labeled 'PINION' and 'GEAR' in purple. Under 'PINION', there are two input fields: 'Topping Adjustment' with a value of '0.0000in' and 'Topping Land' with a value of '0.06817in'. Under 'GEAR', there are two input fields: 'Topping Adjustment' with a value of '0.0000in' and 'Topping Land' with a value of '0.07310in'. On the right side, there is a vertical toolbar with buttons for 'CAD', 'Hub', 'Balance', 'Inspect', 'Sizing', and 'Options', each with a small icon and a dropdown arrow.

	PINION	GEAR
Topping Adjustment:	0.0000in	0.0000in
Topping Land:	0.06817in	0.07310in

Minor Diameter

Minor Diameter is the root diameter of a gear. Clicking on the small button will open a dialog box for displaying the TIF values.

The screenshot shows the 'True Involute Form Diameter' dialog box. It has a title bar with standard window controls (undo, redo, zoom, pan, close). The main area is titled 'True Involute Form Diameter' in purple. Below the title, there are two columns labeled 'PINION' and 'GEAR' in purple. Under 'PINION', there is one input field: 'True Involute Form Diameter' with a value of '1.691in'. Under 'GEAR', there is one input field: 'True Involute Form Diameter' with a value of '2.653in'. On the right side, there is a vertical toolbar with buttons for 'CAD', 'Hub', 'Balance', 'Inspect', 'Sizing', and 'Options', each with a small icon and a dropdown arrow.

	PINION	GEAR
True Involute Form Diameter:	1.691in	2.653in

Pitch Diameter

Pitch Diameter is the theoretical diameter of the gear. On a face gear, this value defines the inner diameter. The outside diameter of a face gear is the pitch diameter plus twice the face width. Clicking on the small button will open a dialog box for displaying values of the operating (working) diameters, start of active profile and HPSTC & LPSTC (single tooth contact) for both gears as they relate to each other in the assembly.

The screenshot shows a software window titled "Operating Diameter". It contains two columns of input fields, labeled "PINION" and "GEAR". The fields are for "Operating Diameter", "Start of Active Profile", "HPSTC", and "LPSTC". The values entered are: Pinion Operating Diameter: 1.8000in, Gear Operating Diameter: 2.8000in; Pinion Start of Active Profile: 1.6966in, Gear Start of Active Profile: 2.6794in; Pinion HPSTC: 1.8393in, Gear HPSTC: 2.8505in; Pinion LPSTC: 1.7574in, Gear LPSTC: 2.7653in. On the right side of the window is a vertical toolbar with buttons for CAD, Hub, Balance, Inspect, Sizing, and Options.

	PINION	GEAR
Operating Diameter:	1.8000in	2.8000in
Start of Active Profile:	1.6966in	2.6794in
HPSTC:	1.8393in	2.8505in
LPSTC:	1.7574in	2.7653in

Pitch Diameter, Operating

Pitch Diameter, Operating is a theoretical diameter at which a set of gears meshes. It normally equals the pitch diameter except when either of the gears is modified or the center distance has been modified. To view these read-only values, click on the small button next to the Pitch Diameter text boxes.

True Involute Form Diameter

The true involute form (TIF) diameter is the smallest diameter of the involute curve. To view these read-only values, click on the small button next to the Minor Diameter text boxes.

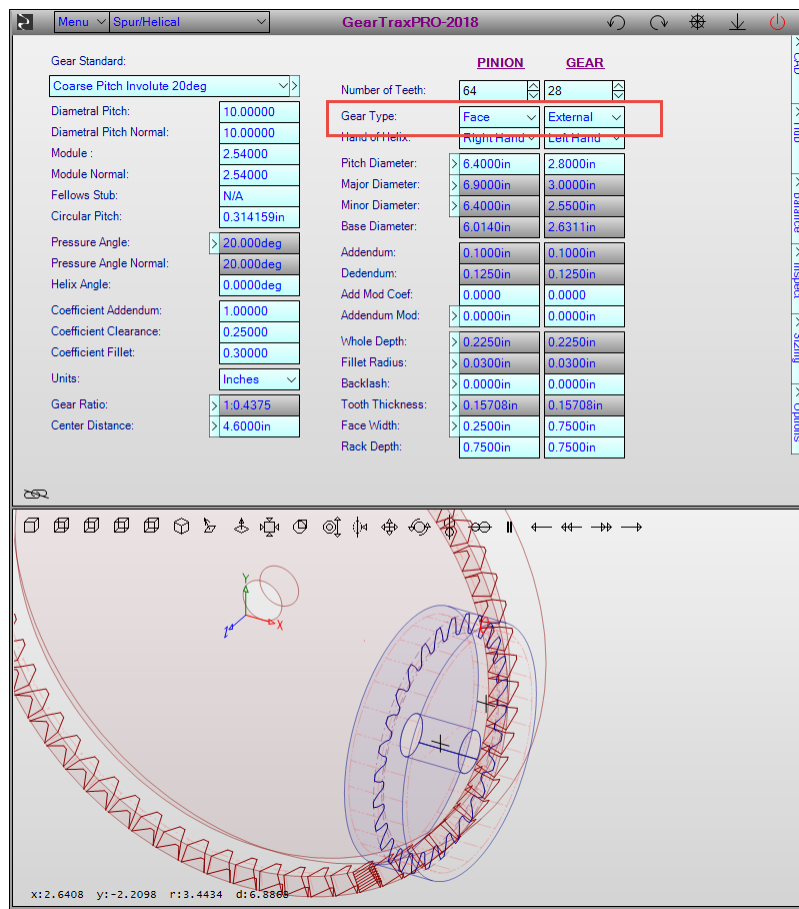
Gear Type

Gear Type defines the component as an external gear, internal gear or rack. A face gear option is available in GearTraxPRO.

Face Gears

Face gears are available in GearTraxPRO. Face gears are more like a circular rack than an internal or external spur gear.

- The shaft angle is always at 90 degrees.
- The pinion and the face gear axis are always coincident.
- The pitch diameter of a face gear is at the internal diameter of the teeth.
- The outside diameter of a face gear is equal to the pitch diameter plus twice the face width.
- Backlash is always 0.000 and cannot be changed.
- The addendum modification is always 0.000 and cannot be changed.
- The Pitch Depth of Rack property controls the distance from the pitch line to the back of the face gear.
- Lead or longitude crowning is not available for face gears. Add any crowning to the mating gear.
- Face gears are sometimes call crown gears because they look like a king's crown. But this should not be confused with gears that have their teeth "crowned".



Face Width

Face Width is the length of the tooth parallel to the shaft.

	PINION	GEAR
Type of Crowning:	None	None
Crowning Drop:	n/a	n/a
Crowning Radius:	n/a	n/a
Crowning Sketches:	7	7

Fellows Stub Denominator

Module :	2.54000
Module Normal:	2.54000
Fellows Stub:	N/A
Circular Pitch:	0.314159in

The Fellows Stub Denominator sets the denominator for the Fellows Stub standard. The Fellows Stub standard must be selected to change this value. This value must be equal to or less than the diametral pitch

The user may specify any combination of nominator/denominator for the Fellows Stub standard as long as the denominator is a value greater than the nominator. The standard ratios established by the Fellows Gear Shaper Co. are 4/5, 5/7, 6/8, 7/9, 8/10, 9/11, 10/12 and 12/14.

Fillet Radius

Fillet Radius defines the radius on the tip of the cutter, which forms a trochoidal curve tangent to the tooth root. Clicking on the small button will open a dialog box for specifying the values for a tooth tip radius.



Full Fillet Radius

Full Fillet Radius is a check box. This is enabled for AGMA Course and Fine pitch standards only. If checked, the clearance and fillet coefficients change according to the standard. This effects the dedendum and fillet radius values.

Gear Standard

Gear Standard sets the AGMA, DIN, JIS, PGT or other standards for the component. Click the Side Button to the right of the drop down box to change tolerance specifications.

Cycloidal Standard (tooth profile)

The Cycloidal standard offers a tooth profile other than involute. This standard is typically used in the manufacturing of gears for clocks. If this standard is selected the addendum and clearance coefficients are available for manual editing. The defaults are 1.4 and 0.4 respectively. The fillet radius is drawn integral with the tooth form and is tangent to the straight sides of the tooth and the minor diameter. The tooth thickness for both gears at the pitch

diameter is 1/2 of the circular pitch. The tooth thickness can be changed by adjusting the backlash values. A negative backlash will result in a thicker tooth. Addendum modification should not be used with cycloidal gears.

The cycloid generating diameter for both gears is equal to 1/2 of the pinion pitch diameter.

Helix Angle

Helix Angle is the angle of the tooth from the shaft. A zero angle would be parallel to the shaft and would define a spur gear. An angle other than zero would define a helical gear.

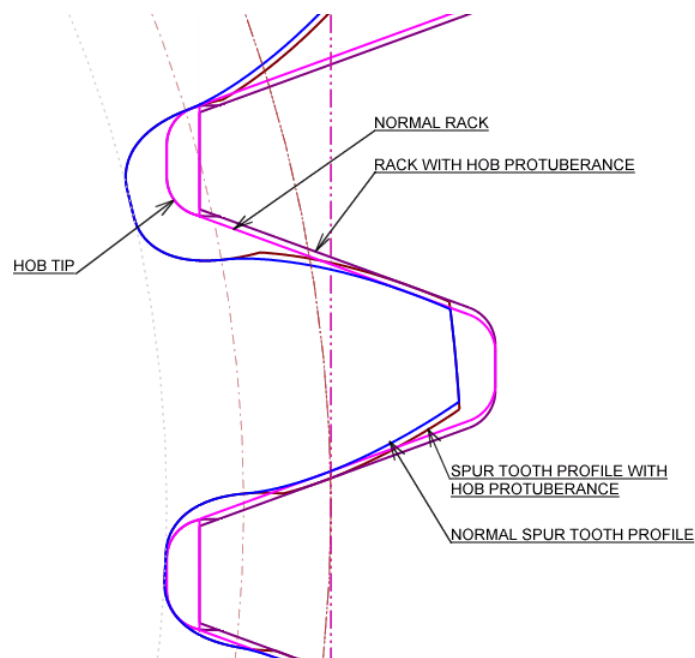
Helix Direction

Helix Direction defines the direction of the angle. The teeth of a left hand helical gear on a horizontal surface lean to the left.

Hob Protuberance

Hob Protuberance is available in GearTraxPRO.

Hob Protuberance is the amount of undercutting of the involute surface created by the hob. The fillet remains unchanged except for a slight increase in length.



To access the Hob Protuberance adjustment click on the side button next to the Tooth Thickness text boxes.

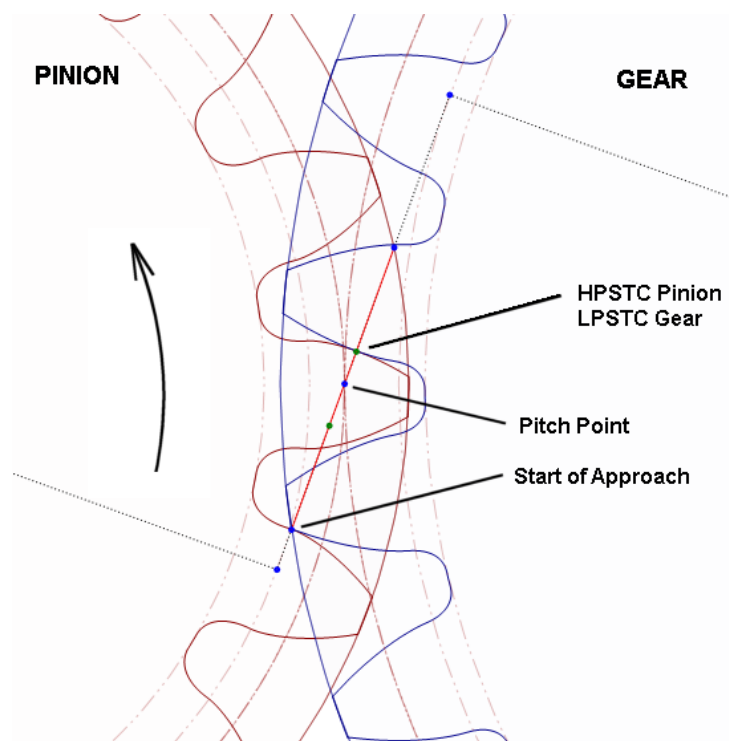
HPSTC (Highest Point of Single Tooth Contact)

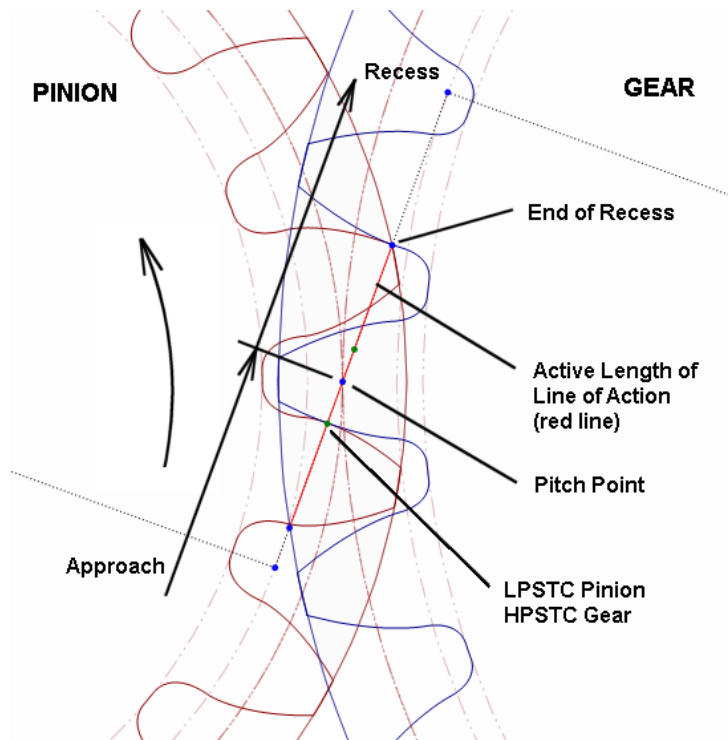
Highest Point of Single Tooth Contact is the largest diameter on a spur gear at which a single tooth is in contact with the mating gear. To view

these read-only values, click on the side button next to the Pitch Diameter text boxes.

Line of Action

The Line of Action is a line that is tangent to the base diameters of the mating gears. Within the Line of Action is the Active Length. The Active Length is the sum of the Approach Length and the Recess Length. The Approach Length starts at the beginning of the Active Length and continues to the Pitch Point. The Recess Length starts at the Pitch Point and terminates at the end of the Active Length.





LPSTC (Lowest Point of Single Tooth Contact)

Lowest Point of Single Tooth Contact is the smallest diameter on a spur gear at which a single tooth is in contact with the mating gear. To view these read-only values, click on the side button next to the Pitch Diameter text boxes.

Modification, Profile

Profile Modification is available in GearTraxPRO.

Module

Module (transverse) is used in metric system gears. Module equals the normal module divided by the cosine of the helical angle.

Module Normal

Module Normal is used in metric system gears and is normal to the cutter.

$$\text{Module} = 25.4 / \text{diametral pitch}$$

Number of Teeth

Number of Teeth defines the number of teeth for each component.

Pin Diameter

Pin Diameter defines the diameter of the pins or wires used with Measurement of Pins. A user defined pin diameter may be entered. To reset the value to the standard value click the Reset button in the Spur Inspection window.

Pitch Depth of Rack

Pitch Depth of Rack is the distance from the pitch line to the back of the rack. This value is also used to define the depth of a face gear from the pitch line to the back of the gear.

Diametral Pitch

Diametral Pitch is used in imperial system gears. This defines the diametral pitch in the transverse plane.

Diametral Pitch, Normal

Diametral Pitch, Normal is used in imperial system gears and is normal to the cutter.

Pressure Angle

Pressure Angle is the angle of the tooth at the pitch diameter. This is sometimes referred to as the transverse pressure angle.

Pressure Angle, Normal

Pressure Angle, Normal is the angle of the tooth at the pitch diameter normal to the cutter.

Single Tooth Contact

To view these read-only values, click on the small button next to the Pitch Diameter text boxes.

Start of Active Profile

Start of Active Profile is the diameter at which a gear comes in to contact with its mating gear. To view these read-only values, click on the small button next to the Pitch Diameter text boxes.

Shrinkage Rate

Shrinkage Rate is not available in GearTrax but is available in our GearTeq product.

Shrinkage Rate defines the shrinkage rate for plastic gears. This is only used when inserting a tooth cut profile. The value entered must be less than 0.0100 (1%), $0.0025 = 0.25\%$.

Tooth Pattern in CAD

Tooth Pattern in CAD selects the number of teeth to pattern when creating the model in CAD. The options are All, None, or First 10. If this is set to All, GearTrax will create a pattern that contains all the teeth. This might be very time consuming if there are a large number of teeth and/or the component is a helical gear. If this is set to none, then a pattern will not be created. Set this to 'First 10' to create a pattern with 10 teeth that can easily be expanded in the CAD system.

Test Master Gear Pitch Diameter

Enter the pitch diameter of the master test gear, if available. By itself, this value has no effect on the actual geometry of the gear. To enter or view this value click on the inspection button (picture of a caliper).

Test Radius

The test radius of the master gear plus the test radius of this gear equals the setup center distance for a composite action test. If a test radius for the master gear has been entered, GearTrax will calculate the test radius of this gear.

The test radius can also be used to calculate the tooth thickness of a gear. If a test diameter for the master has been entered and a test radius for this gear is then entered, GearTrax will calculate the addendum modification coefficient for this gear to achieve the proper tooth thickness in conjunction with the perfect master gear. The user will be prompted to use this calculated value or not. To enter or view this value click on the inspection button (picture of a caliper).

Tooth Thickness (Normal)

Tooth Thickness is the arc thickness of the tooth at the pitch diameter normal to the cutter. Clicking on the Side Button next to the Tooth Thickness text box will display the transverse, normal, normal-minimum and tolerance of the tooth thickness and for specifying the values for any hob protuberance.

Tooth Thickness and Hob Protuberance											
Tooth Thickness:											
	<table border="1"> <thead> <tr> <th>PINION</th> <th>GEAR</th> </tr> </thead> <tbody> <tr> <td>Transverse: 0.15708in</td> <td>0.15708in</td> </tr> <tr> <td>Normal: 0.15708in</td> <td>0.15708in</td> </tr> <tr> <td>Normal Minimum: 0.15288in</td> <td>0.15288in</td> </tr> <tr> <td>Tolerance: 0.00420in</td> <td>0.00420in</td> </tr> </tbody> </table>	PINION	GEAR	Transverse: 0.15708in	0.15708in	Normal: 0.15708in	0.15708in	Normal Minimum: 0.15288in	0.15288in	Tolerance: 0.00420in	0.00420in
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Hob Protuberance:	<table border="1"> <thead> <tr> <th>PINION</th> <th>GEAR</th> </tr> </thead> <tbody> <tr> <td>0.0000in</td> <td>0.0000in</td> </tr> </tbody> </table>	PINION	GEAR	0.0000in	0.0000in						
PINION	GEAR										
0.0000in	0.0000in										

Topping Adjustment

Topping Adjustment will shorten the length of the addendum by this value and the major diameter by twice this value. This value must be equal to or greater than zero and less than the unadjusted addendum. To view and edit these values, click on the small button next to the Major Diameter text boxes.

Units

Units sets the measurement units for the component; select Inches or Metric.

Whole Depth

Whole Depth is the depth of the tooth (from the major diameter to the minor diameter).

The whole depth is equal to the sum of the clearance coefficient and twice the addendum coefficient divided by the diametral pitch. Clicking on the small button will open a dialog box for specifying any profile modification.

Spur Tolerances

ANSI/AGMA 2000-A88

Open the Tolerances window by clicking on the side button to the right of the Gear Standards drop down selection box.

Tolerances ANSI/AGMA			
	PINION	GEAR	
Tolerances ANSI/AGMA:	AGMA Q7	AGMA Q7	
Tolerance Code:	A	A	
Radial Runout:	0.00310in	0.00340in	
Pitch Variation:	0.00099in	0.00110in	
Profile:	0.00120in	0.00130in	
Tooth Alignment:	0.00000in	0.00000in	
Total Composite:	0.00540in	0.00550in	
Tooth to Tooth Composite:	0.00220in	0.00210in	
Tolerance Tooth Thickness:	0.00420in	0.00420in	

Define Company Standards			
	Number 1	Number 2	Number 3
Coefficient Addendum:	0.10000	0.10000	0.10000
Coefficient Clearance:	0.10000	0.10000	0.10000
Coefficient Fillet:	0.10000	0.10000	0.10000
Pressure Angle Normal:	20.0000deg	20.0000deg	20.0000deg

Export Import

Code Tooth Thickness

The tooth thickness code is user selectable between A, B, C and D.

Radial Runout

Please refer to ANSI/AGMA 2000-A88 standard for a detailed description.

Pitch Variation

Please refer to ANSI/AGMA 2000-A88 standard for a detailed description.

Profile

Profile Tolerance is the permissible amount of profile variation in the functional profile, designated by a specified “K” chart envelope. Plus material at the tip, which increases the amount of variation outside the functional profile, is not acceptable. Minus material beyond the start of tip break can be disregarded.

Tooth Alignment

Tooth Alignment Tolerance is the permissible amount of tooth alignment variation, designated by the specified “K” chart envelope. Tolerance values in this standard are normal to the tooth surface.

Total Composite

Total Composite Tolerance is the permissible amount of total composite variation, which is the total change in center distance while the gear being tested is rotated one complete revolution during double flank composite action test.

Tooth to Tooth Composite

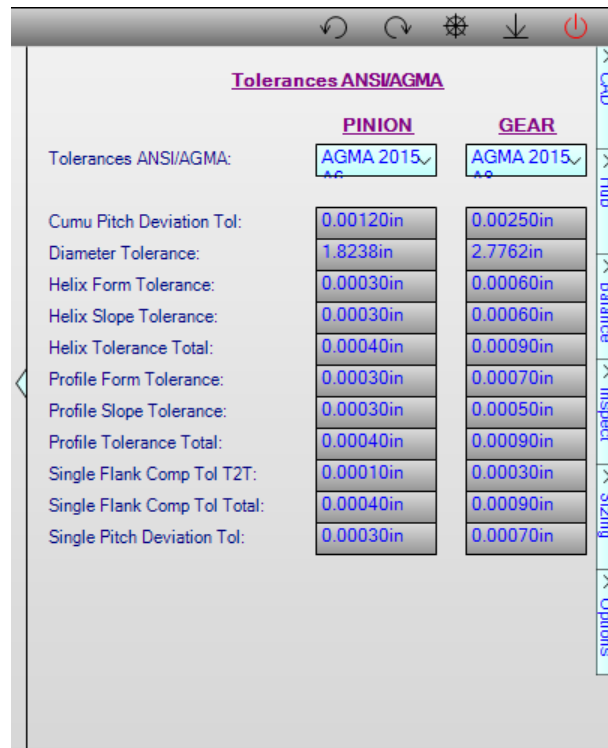
Please refer to ANSI/AGMA 2000-A88 standard for a detailed description.

Tooth Thickness

Tooth Thickness Tolerance is the permissible amount of tooth thickness variation.

ANSI/AGMA 2015-1-A01

Open the Tolerances window by clicking on the small button to the right of the Gear Standards drop down selection box.



The screenshot shows a software window titled "Tolerances ANSI/AGMA". It contains a table with two columns: "PINION" and "GEAR". The table lists various tolerance types and their values in inches. The "Tolerances ANSI/AGMA:" row has dropdown menus for "AGMA 2015" and "AGMA 2015". The table is organized into sections: Cumu Pitch Deviation Tol, Diameter Tolerance, Helix Form Tolerance, Helix Slope Tolerance, Helix Tolerance Total, Profile Form Tolerance, Profile Slope Tolerance, Profile Tolerance Total, Single Flank Comp Tol T2T, Single Flank Comp Tol Total, and Single Pitch Deviation Tol. A vertical sidebar on the right contains buttons for CAD, Hub, Balance, Inspect, Sizing, and Options.

	PINION	GEAR
Tolerances ANSI/AGMA:	AGMA 2015	AGMA 2015
Cumu Pitch Deviation Tol:	0.00120in	0.00250in
Diameter Tolerance:	1.8238in	2.7762in
Helix Form Tolerance:	0.00030in	0.00060in
Helix Slope Tolerance:	0.00030in	0.00060in
Helix Tolerance Total:	0.00040in	0.00090in
Profile Form Tolerance:	0.00030in	0.00070in
Profile Slope Tolerance:	0.00030in	0.00050in
Profile Tolerance Total:	0.00040in	0.00090in
Single Flank Comp Tol T2T:	0.00010in	0.00030in
Single Flank Comp Tol Total:	0.00040in	0.00090in
Single Pitch Deviation Tol:	0.00030in	0.00070in

Cumulative Pitch Deviation Tolerance

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

Diameter Tolerance

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

Helix Form Tolerance

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

Helix Slope Tolerance

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

Helix Tolerance Total

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

Profile Form Tolerance

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

Profile Slope Tolerance

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

Profile Tolerance Total

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

Single Flank Composite Tolerance Tooth to Tooth

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

Single Flank Composite Tolerance Total

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

Single Flank Deviation Tolerance

Please refer to ANSI/AGMA 2015-1-A01 standard for a detailed description.

DIN 867

Open the Tolerances window by clicking on the side button to the right of the Gear Standards drop down selection box.

Gear Tooth Quality

User selectable between DIN 1 and DIN 12. Please refer to DIN 867 standard for a detailed description.

Series Allowance

User selectable a, ab, b, bc, c, cd, d, e, f, g and h series allowance. Please refer to DIN 867 standard for a detailed description

Series Tolerance

User selectable between 21 and 30. Please refer to DIN 867 standard for a detailed description.

Tooth Thickness Tolerance

Please refer to DIN 867 standard for a detailed description.

Upper Tooth Thickness Allowance

Please refer to DIN 867 standard for a detailed description.

Company Standards

Company Standards allows the user to configure up to three different company standards. To access the Company Standards click on the side button to the right of the Gear Standard selection box.

Tolerances ANSI/AGMA			
	PINION	GEAR	
Tolerances ANSI/AGMA:	AGMA Q7	AGMA Q7	
Tolerance Code:	A	A	
Radial Runout:	0.00310in	0.00340in	
Pitch Variation:	0.00099in	0.00110in	
Profile:	0.00120in	0.00130in	
Tooth Alignment:	0.00000in	0.00000in	
Total Composite:	0.00540in	0.00550in	
Tooth to Tooth Composite:	0.00220in	0.00210in	
Tolerance Tooth Thickness:	0.00420in	0.00420in	

Define Company Standards			
	Number 1	Number 2	Number 3
Coefficient Addendum:	0.10000	0.10000	0.10000
Coefficient Clearance:	0.10000	0.10000	0.10000
Coefficient Fillet:	0.10000	0.10000	0.10000
Pressure Angle Normal:	20.0000deg	20.0000deg	20.0000deg

Export Import

Define Company Standards

Coefficient Addendum

Coefficient Addendum defines the constant that is used to calculate the length of the addendum.

$\text{addendum} = \text{coefficient addendum} / \text{diametral pitch (inches)}$

$\text{addendum} = \text{coefficient addendum} * \text{module (millimeters)}$

Valid values are greater than 0 and less than 2.

Coefficient Clearance

Coefficient Clearance defines the constant that is used to calculate the length of the addendum.

$\text{dedendum} = (\text{coefficient addendum} + \text{coefficient clearance}) / \text{diametral pitch (inches)}$

$\text{dedendum} = (\text{coefficient addendum} + \text{coefficient clearance}) * \text{module (millimeters)}$

Valid values are greater than or equal to 0 and less than or equal to 1.

Coefficient Clearance Additional

Coefficient Clearance Additional is a linear dimension that defines the amount of additional length to be added to the dedendum. This value does not take into consideration the units (inches or millimeters) of the component.

Coefficient Fillet

Coefficient Fillet defines the constant that is used to calculate the length of the addendum.

The hob tip fillet radius = coefficient fillet / diametral pitch (inches)

The hob tip fillet radius = coefficient fillet * module (millimeters)

Valid values are greater than 0 and less than or equal to 1.

Pressure Angle Normal

Pressure Angle Normal defines the pressure angle for the standard.

Export

Export allows the user to backup the company standards in a location that will not be destroyed when removing or installing a new version of GearTrax. This can also be used to store the standards so that other users can have access to them.

Import

Import Company Standards allows the user to restore company standards after a new installation of GearTrax or to import the company standards from another location.

Working Pressure Angle and Roll Angles

Working Pressure Angle and Roll Angles is available by clicking on the Side Button next to the Pressure Angle text box.

Pressure Angle, Working

Pressure Angle, Working is the angle of the tooth at the pitch diameter. Normally the same as pressure angle unless either gear in the set has been modified or the center distance has been changed.

Roll Angles

Roll Angles are available in the Working Pressure Angle window.

	PINION	GEAR
Working Pressure Angle:	20.000deg	
Roll Angles at:		
Custom Diameter:	20.85deg @ 1.8000in	20.85deg @ 2.8000in
Operating Diameter:	20.85deg	
True Involute Form Dia:	0.00deg	7.45deg
Major Diameter:	36.15deg	31.38deg
HPSTC:	24.47deg	23.88deg
LPSTC:	16.15deg	18.53deg
Profile Modification APL:	N/A	N/A
Profile Modification BPL:	N/A	N/A

Roll Angle at Custom Diameter

Roll Angle at Custom Diameter provides the user with a method to calculate a roll angle at any valid diameter. Entering a new diameter in this property will calculate the roll angle for the entered value. The value must be greater than the base diameter.

Roll Angle at Operating Diameter

Roll Angle at the Operating Diameter is displayed.

Roll Angle at HPSTC

Roll Angle at the HPSTC (Highest Point of Single Tooth Contact) is displayed.

Roll Angle at LPSTC

Roll Angle at the LPSTC (Lowest Point of Single Tooth Contact) is displayed.

Roll Angle at Major Diameter

Roll Angle at the Major Diameter is displayed.

Roll Angle at Profile Modification Above Pitch Line

Roll Angle at the start of the profile modification above the pitch line is displayed if a modification is specified.

Roll Angle at Profile Modification Below Pitch Line

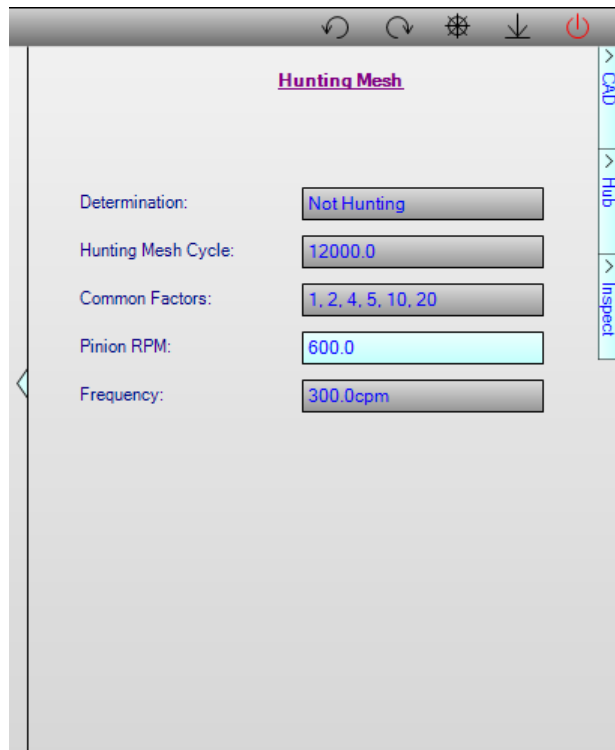
Roll Angle at the start of the profile modification below the pitch line is displayed if a modification is specified.

Roll Angle at TIF Diameter

Roll Angle at the TIF (True Involute Form) Diameter is displayed.

Hunting Mesh

The Hunting Mesh can be accessed by clicking on the side button next to the Gear Ratio text box.



The screenshot shows a software window titled "Hunting Mesh". On the right side, there is a vertical toolbar with three buttons: "CAD", "Hub", and "Inspect". The "Inspect" button is currently selected. The main area of the window contains five input fields, each with a label and a value:

Label	Value
Determination:	Not Hunting
Hunting Mesh Cycle:	12000.0
Common Factors:	1, 2, 4, 5, 10, 20
Pinion RPM:	600.0
Frequency:	300.0cpm

Determination

Determination indicates whether the gear set is hunting or not hunting.

Hunting Mesh Cycle

Hunting mesh Cycle equals the number of teeth in the pinion multiplied by the pinion RPM.

Common Factors

Common Factors displays the common factors between the pinion and the gear. It is recommended that the cutting tool selected should not share any of these common factors.

Pinion RPM

Pinion RPM (revolutions per minute) is a user input.

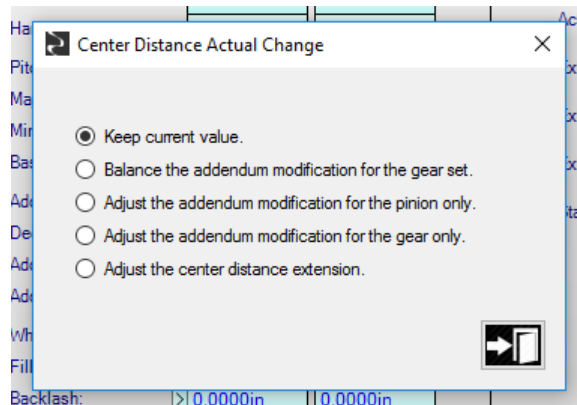
Frequency

Frequency is displayed in cycles per minute. $\text{Frequency} = (\text{pinion RPM} * \text{pinion teeth}) * \text{largest common factor} / (\text{pinion teeth} * \text{gear teeth})$

Center Distance

Center Distance is the distance between the centers of the pinion and the gear.

Changing the center distance will allow the user to balance the addendum modification of the set, change the addendum modification of either the pinion or the gear and adjust the center distance extension to provide backlash for the gear set.



Select "Keep current value" to prevent any changes to the gear set.

Select the "Balance the addendum modification for the gear set" option to modify by the following formula:

$$x1 = 1 / 3 * (1 - 1 / u) + (x1 + x2) / 1 + u$$

where u is the gear ratio

x1 and x2 are the addendum modification coefficients of the pinion and gear, respectively. The pinion in this case is the gear with fewer number of teeth.

Select "Adjust the addendum modification for the pinion only" option to modify the addendum of the pinion without making any changes to the gear.

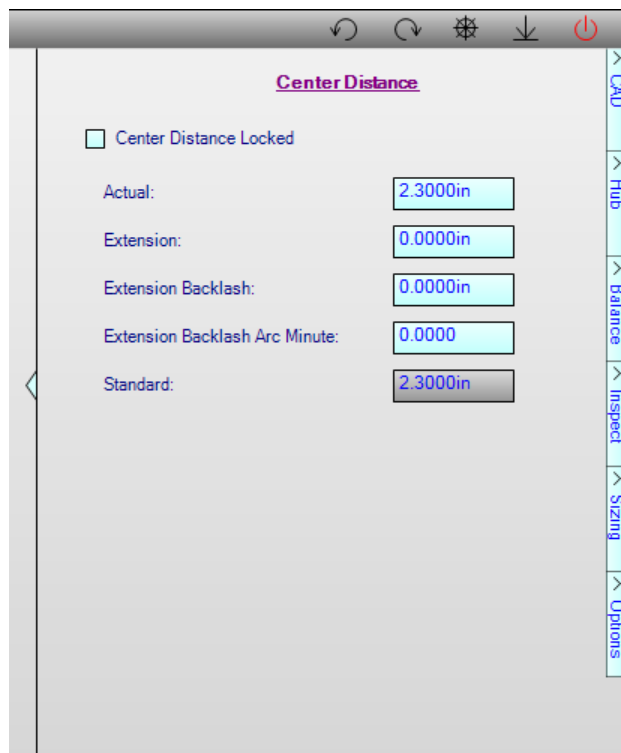
Select "Adjust the addendum modification for the gear only" option to modify the addendum of the gear without making any changes to the pinion.

Select "Adjust the center distance extension" option to modify the center distance of the gear set. No changes will be made to the addendum modifications of the pinion or the gear.

Clicking on the side button to the left of the Center Distance text box will open the Spur Center Distance dialog window.

If the Center Distance Locked check box is selected, the user can input a specific center distance. Any changes to this value will affect the backlash of the gear assembly, not of the individual gears.

More center distance functions can be accessed by clicking on the side button next to the Center Distance text box.



Center Distance Locked

The Center Distance Locked check box allows the user to specify a fixed center distance between the pinion and the gear. If it is not checked, GearTrax will adjust the center distance per the other parameters.

Center Distance Actual

The Center Distance Actual displays the current center distance between the pinion and the gear. The user can change this value. See the above section for more information.

Center Distance Extension

The Center Distance Extension allows the user to add any additional distance between the pinion and the gear, primarily for backlash purposes.

Center Distance Extension Backlash

The Center Distance Extension Backlash allows the user to add a specific amount of backlash that is the result of the change in center distance.

Center Distance Extension Backlash Arc Minute

The Center Distance Extension Backlash Arc Minute allows the user to add a specific amount of backlash that is the result of the change in center distance.

Center Distance Standard

The Center Distance Standard displays the for a tight running set of gears. The standard backlash (rack shift) does not effect this value.

Operating Diameter

	PINION	GEAR
Operating Diameter:	1.0058in	2.7157in
Start of Active Profile:	0.9505in	2.5732in
HPSTC:	1.1919in	2.7343in
LPSTC:	0.9888in	2.6058in

Topping Adjustment

The screenshot shows the 'Topping Adjustment' dialog box. It has a title bar with standard window controls (undo, redo, zoom, pan, close). The title 'Topping Adjustment' is in red. Below the title, there are two columns: 'PINION' and 'GEAR'. Under 'PINION', 'Topping Adjustment' is set to 0.0000in and 'Topping Land' is set to 0.01989in. Under 'GEAR', 'Topping Adjustment' is set to 0.0000in and 'Topping Land' is set to 0.08270in. On the right side, there is a vertical toolbar with icons for CAD, Hub, Balance, Inspect, Sizing, and Options.

	PINION	GEAR
Topping Adjustment:	0.0000in	0.0000in
Topping Land:	0.01989in	0.08270in

True Involute Form Diameter

The screenshot shows the 'True Involute Form Diameter' dialog box. It has a title bar with standard window controls (undo, redo, zoom, pan, close). The title 'True Involute Form Diameter' is in red. Below the title, there are two columns: 'PINION' and 'GEAR'. Under 'PINION', 'True Involute Form Diameter' is set to 0.940in. Under 'GEAR', 'True Involute Form Diameter' is set to 2.537in. On the right side, there is a vertical toolbar with icons for CAD, Hub, Balance, Inspect, Sizing, and Options.

	PINION	GEAR
True Involute Form Diameter:	0.940in	2.537in

Contact Ratio

The screenshot shows the 'Contact Ratio' dialog box. It has a title bar with standard window controls and a toolbar with icons for undo, redo, zoom, and power. The main area is titled 'Contact Ratio' in purple. On the right is a vertical sidebar with tabs: CAD, Hub, Balance, Inspect, Sizing, and Options. The main area contains five input fields with labels and values:

Parameter	Value
Approach Length:	0.0996in 26.36%
Recess Length:	0.2781in 73.64%
Contact Ratio:	1.2795
Contact Ratio Face:	0.0000
Active Length of Line of Action:	0.3777in

Profile Modification

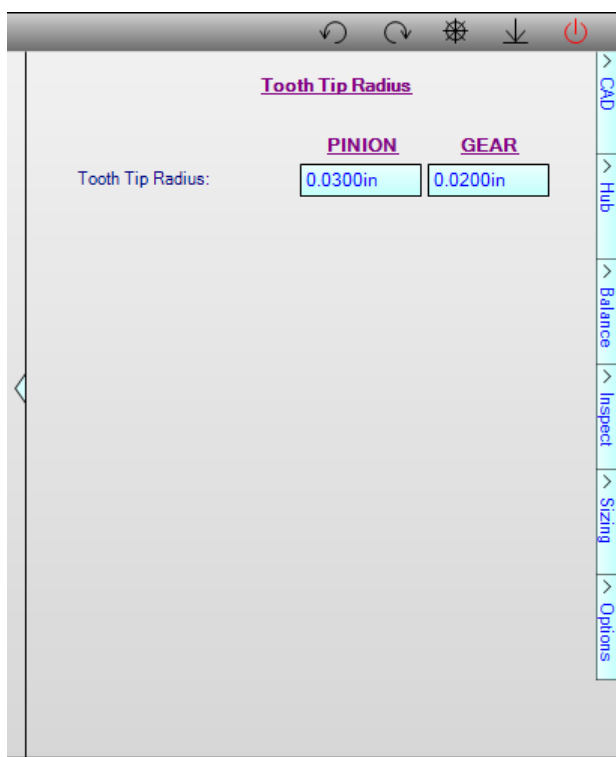
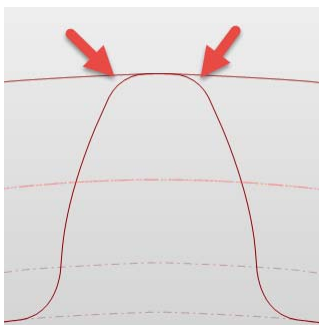
The screenshot shows the 'Profile Modification' dialog box. It has a title bar with standard window controls and a toolbar with icons for undo, redo, zoom, and power. The main area is titled 'Profile Modification' in purple. On the right is a vertical sidebar with tabs: CAD, Hub, Balance, Inspect, Sizing, and Options. The main area is divided into two sections: 'Modification Above Pitch Line' and 'Modification Below Pitch Line'. Each section has two columns for 'PINION' and 'GEAR'.

	PINION	GEAR
Type of Modification:	Linear	Parabolic
Amount of Modification:	0.0010in	0.0010in
Length of Modification:	0.0300in	0.0500in
Diameter of Modification:	1.2400in	2.7000in

	PINION	GEAR
Type of Modification:	None	None
Amount of Modification:	n/a	n/a
Length of Modification:	n/a	n/a
Diameter of Modification:	n/a	n/a

Tooth Tip Radius

Tooth Tip Radius is available by clicking the Side Button next to the Fillet Radius text box.



AGMA Fine Pitch Backlash

AGMA Fine Pitch Backlash is available by clicking the Side Button next to the Backlash text box.

AGMA Fine Pitch Backlash

Fine Pitch:
Backlash Designation:

Recommended:
Backlash Range:

CAD
Hub
Balance
Inspect
Sizing
Options

Tooth Thickness and Hob Protuberance

Tooth Thickness and Hob Protuberance is available by clicking the Side Button next to the Tooth Thickness text box.

Tooth Thickness and Hob Protuberance

Tooth Thickness:

	PINION	GEAR
Transverse:	<input type="text" value="0.19348in"/>	<input type="text" value="Ground: 0.12068in"/>
Normal:	<input type="text" value="0.19348in"/>	<input type="text" value="0.11648in"/>
Normal Minimum:	<input type="text" value="0.18928in"/>	<input type="text" value="0.11648in"/>
Tolerance:	<input type="text" value="0.00420in"/>	<input type="text" value="0.00420in"/>

Hob Protuberance PRO Version Only:

	PINION	GEAR
Hob Protuberance:	<input type="text" value="0.0000in"/>	<input type="text" value="0.0200in"/>

CAD
Hub
Balance
Inspect
Sizing
Options

Spur Crowning

Spur Crowning is available by clicking the Side Button next to the Face Width text box.

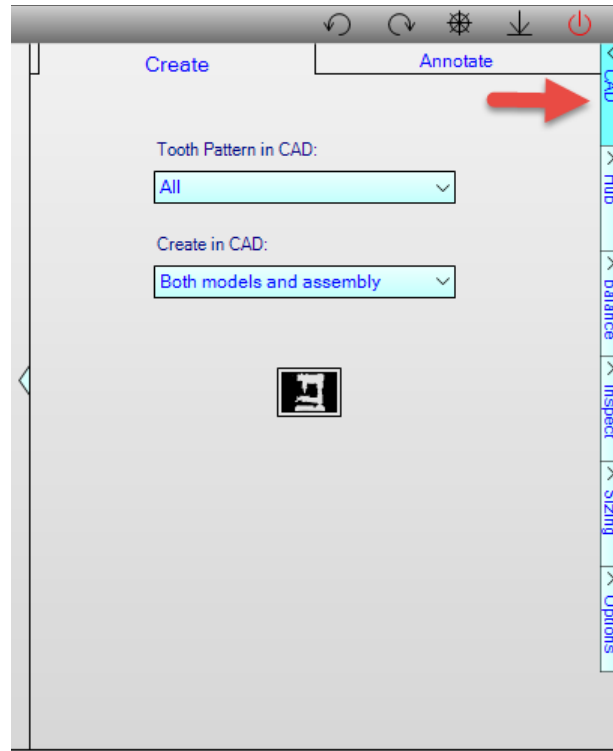
The image shows a software dialog box titled "Spur Crowning". At the top, there are icons for undo, redo, fit, zoom, and power. The dialog is organized into two columns: "PINION" and "GEAR".

	PINION	GEAR
Type of Crowning:	Full Radial	None
Crowning Drop:	0.0015in	n/a
Crowning Radius:	46.8758in	n/a
Crowning Sketches:	15	7

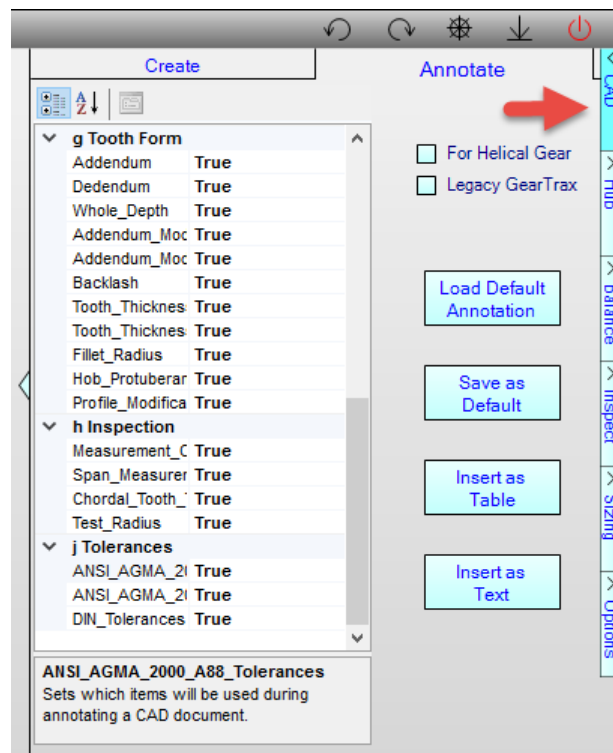
On the right side of the dialog, there is a vertical sidebar with buttons: CAD, Hub, Balance, Inspect, Sizing, and Options. The "CAD" button is currently selected.

CAD

Create



Annotate



HUB

See the Hub Mounting (general) section for more detailed information.

	PINION	GEAR
Bore Diameter:	0.5000in	0.5000in
Bore Chamfer:	0.0000in	0.0000in
Hub Diameter 1st:	1.5000in	0.0000in
Hub Projection 1st:	0.7500in	0.0000in
Hub Chamfer 1st:	0.0300in	0.0000in
Hub Diameter 2nd:	0.0000in	0.0000in
Hub Projection 2nd:	0.0000in	0.0000in
Hub Chamfer 2nd:	0.0000in	0.0000in
Keyway:	ANSI Square	Bore only
Keyway Depth:	0.0625in	0.0000in
Keyway Width:	0.1250in	0.0000in
Keyway Position:	On Space Center	On Space Center
Bushing Side:	Bushing on 1st Side	Bushing on 1st Side
Taper Bushing Pinion:	None	
Taper Bushing Gear:	None	

Balance

The Balance Addendum Modification menu option opens a dialog window that can adjust the addendum modification for the active gear and its mate. The mate must be a spur gear with a gear mate.

The change in addendum modification coefficient can be automatically estimated. The addendum modification coefficients for the current component and its mating component can be balanced by the following formulas:

General Applications:

$$x_1 = 1/3 * (1 - 1/u) + (x_1 + x_2) / 1 + u$$

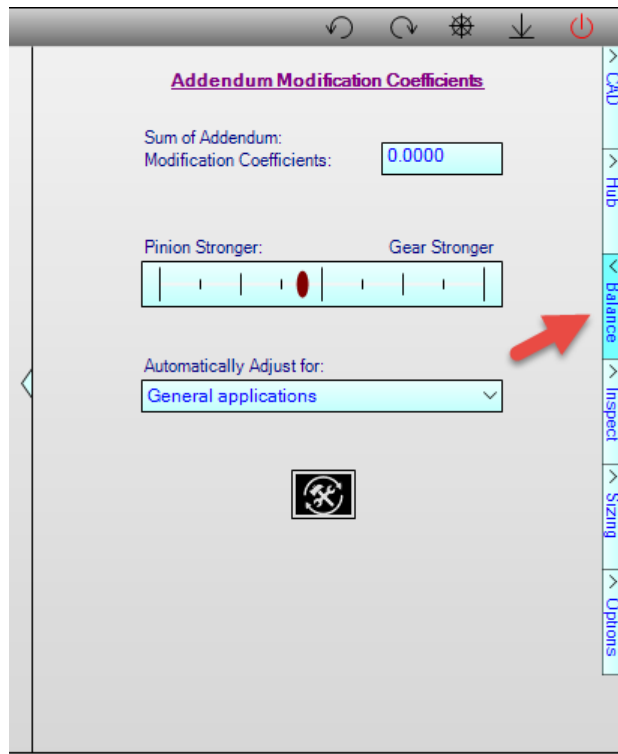
Approximate equality of bending strength factors:

$$x_1 = 1/2 * (1 - (1/u)) + ((x_1 + x_2) / (1 + u))$$

Approximate equality of ratios of specific sliding or slide roll ratio:

$$x_1 = (2.0 / (z_v1)^{-2}) * (1 - (1/u)) + ((x_1 + x_2) / (1 + u))$$

In this formula, u is the gear ratio while x_1 and x_2 are the addendum modification coefficients of the pinion and the gear, respectively. The pinion is the gear with the lesser number of teeth.



The user may manually enter values for the sum and individual addendum modification coefficients. The screen will be updated to reflect these changes.

The slider bar may also be used to change the distribution of the modification.



Click the button to calculate the modifications based on the "Automatically Adjust for:" (drop down box) selection.

Inspect

Spur Inspection

	PINION	GEAR
Measurement Over or Under Pins:		
Pin Diameter:	0.17280in	0.17280in
Over or Under Pins:	1.26752in	2.91189in
Over or Under Pins Min:	1.25974in	2.90142in
Span Measurement:		
Teeth to Gage Over:	2	3
Measurement:	0.4730in	0.7665in
Measurement Minimum:	0.4691in	0.7625in
Chordal Measurement:		
Reference Circle:	1.0000in	2.5558in
Tooth Height:	0.1313in	0.1605in
Thickness:	0.17344in	0.17570in
Thickness Minimum:	0.16931in	0.17173in
Master Test Gear:		
Master Pitch Diameter:	0.00000in	0.00000in
Test Radius Max Actual:	0.00000in	0.00000in
Test Radius Min Actual:	0.00000in	0.00000in

Navigation pane (right): CAD, Hub, Balance, **Inspect**, Sizing, Options

Measurement Over or Between Pins

	PINION	GEAR
Measurement Over or Under Pins:		
Pin Diameter:	0.17280in	0.17280in
Over or Under Pins:	1.26752in	2.93586in
Over or Under Pins Min:	1.25974in	2.92590in

Pin Diameter

Pin Diameter defines the diameter of the pin or ball (helical gears).

Over Pins

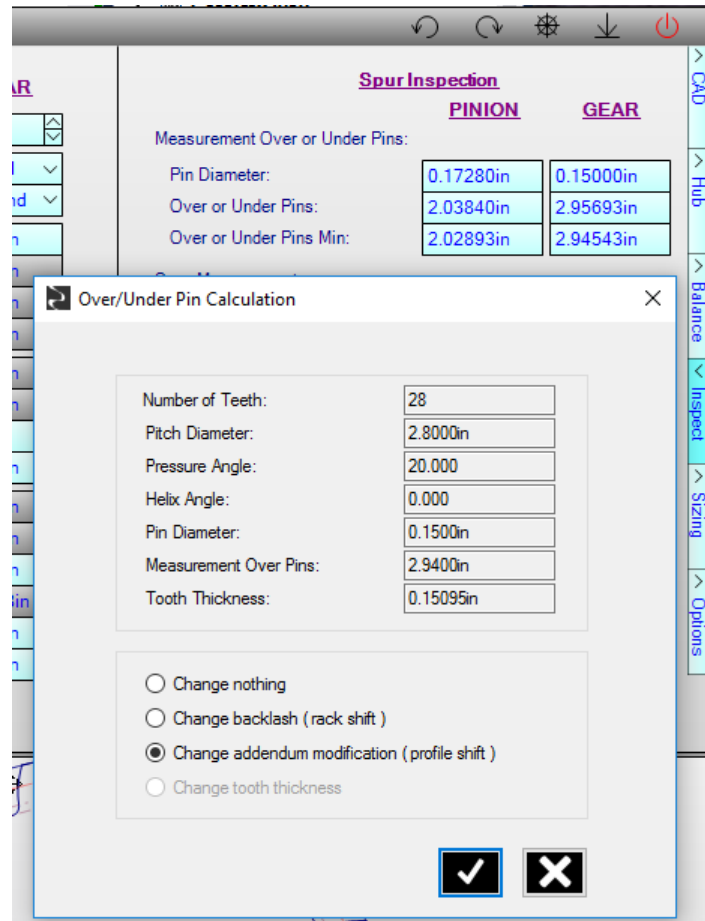
Measurement Over/Under Pins is the measurement over two pins diametrically opposed in a gear and is normally used for inspection. The measurement is over pins for external gears and under pins for internal gears. GearTrax will calculate the tooth thickness for an external gear and the space width for internal gears if a value is entered for the over/under pin measurement.

Over Pins Minimum

Over Pins Minimum is the measurement over two pins diametrically opposed in a gear and is normally used for inspection. This value measures the tooth thickness minus the total tooth thickness tolerance.

Driving the model by Measurements Over or Under Pins

The Backlash and Addendum Modification values can be set by first entering a value for the pin diameter then entering the Over or Under Pins value. A dialog box will be displayed with valid options.



Span Measurement

Span Measurement:	
Teeth to Gage Over:	2
Measurement:	0.4730in
Measurement Minimum:	0.4691in

Teeth to Gage Over

Span Measurement, Teeth to Gage Over define the number of teeth that are used in conjunction with Span Measurement.

Measurement

Span Measurement is a straight-line measurement across the Number of Teeth to Gage Over. The measurement line is normally tangent to the base line. This value is read-only.

Measurement Minimum

Span Measurement Minimum is the minimum straight-line measurement across the Number of Teeth to Gage Over using the tooth thickness minimum value. This value is read-only.

Chordal Measurements

Chordal Measurement:		
Reference Circle:	1.0000in	2.5558in
Tooth Height:	0.1313in	0.1745in
Thickness:	0.17344in	0.18511in
Thickness Minimum:	0.16931in	0.18114in

Chordal Tooth Height

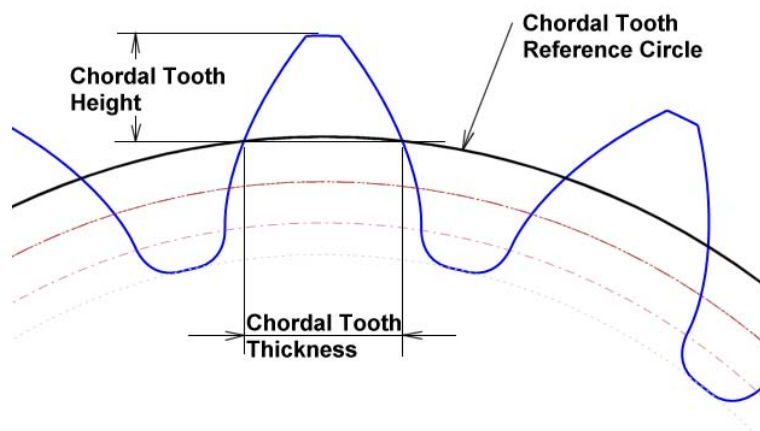
Chordal Tooth Height is the length of the tooth portion to be measured at which the chordal tooth thickness is calculated. Twice the chordal tooth height plus the chordal tooth reference circle should equal the outside diameter of the gear.

Chordal Tooth Reference Circle

Chordal Tooth Reference Circle is the diameter of the datum circle at which the chordal tooth thickness is measured. The chordal tooth reference circle should be equal to the outside diameter of the gear minus twice the chordal tooth height.

Chordal Tooth Thickness

Chordal Tooth Thickness is a straight-line measurement across a single tooth at the chordal tooth reference circle.



Chordal Tooth Thickness Minimum

Chordal Tooth Thickness is a straight-line measurement across a single tooth (maximum actual tooth thickness minus tooth thickness tolerance) at the chordal tooth reference circle.

Master Gear Test

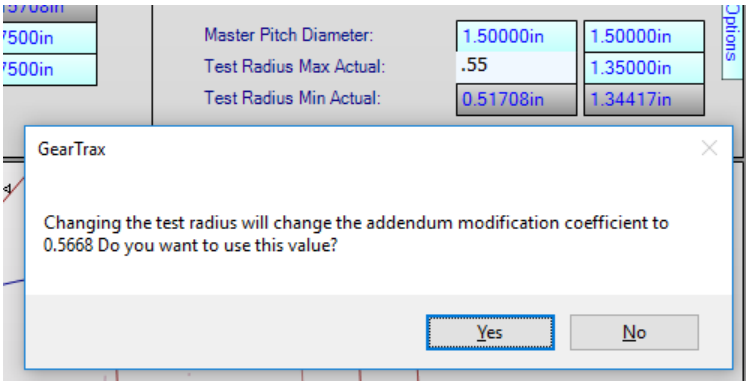
Master Test Gear:		
Master Pitch Diameter:	1.50000in	1.50000in
Test Radius Max Actual:	0.52228in	1.35000in
Test Radius Min Actual:	0.51708in	1.34417in

Master Pitch Diameter

After entering the master pitch diameter, the test radius will be calculated for the pinion or gear. For example, if the gears are 10 Diametral Pitch (2.54 Module) and 50.0mm is entered, GearTrax will calculate the nearest master gear size with a whole number of teeth.

Test Radius

Enter a value for the test radius. If the master pitch diameter does not equal 0, GearTrax will calculate the change to the addendum modification and display a message box with that change and allow the user to make that change to the gear.



Master Gear Test

Sizing

Units

Units are in the Imperial system unless noted.

Loading

	PINION	GEAR
T = Torque IN LBS:	299.0	807.3
HP - Input Horsepower:	2.3721	
REQ W = Tooth Load, LBS (along PL):	591.4	
RPM:	500.0	185.2
S = Safe Material Stress (Static) PSI:	20,000.0	20,000.0
V = Pitch Line Velocity, Feet/Minute:	131.0000	
Tooth Thickness Area:	0.1321in ²	0.1370in ²
W = Tooth Safe Load, LBS:	439.7	448.4
Tooth Thickness PSI Capacity:	3327.5	3273.8
Tooth Thickness PSI Actual:	4475.9	1599.3

☒ Show Parabola

T = Torque IN LBS

User input.

Input HP (Horse Power)

User input.

REQ W = Tooth Load, LBS (along pitch line)

User input.

RPM

User input.

S = Safe Material Stress (Static) PSI

User input.

V = Pitch Line Velocity Feet/Minute

Calculated value.

Number of Teeth

Retrieved from the current gear set.

DP = Diametral Pitch, Normal

Retrieved from the current gear set.

PSI(s) = Helix Angle

Retrieved from the current gear set.

G = Face Width

Retrieved from the current gear set.

Tooth Thickness Area

Calculated value.

W = Tooth Load Safe

Calculated value.

Tooth Thickness PSI Capacity

Calculated value.

Tooth Thickness PSI Actual

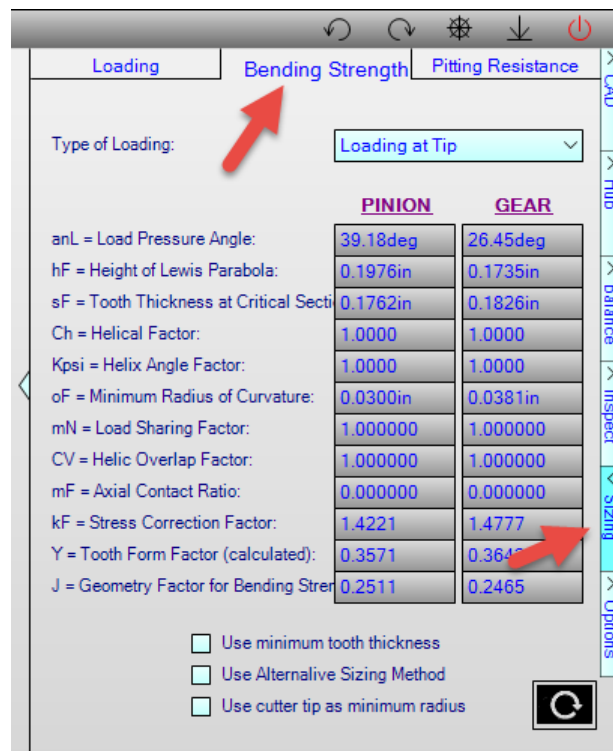
Calculated value.

Show Parabola check box

If this box is checked, the parabolas for both gears will be displayed in the graphics window. Also displayed are lines representing the height of Lewis Parabola and the tooth thickness at the critical section.



Bending Strength



Loading Bending Strength Pitting Resistance

Type of Loading: Loading at Tip

	PINION	GEAR
anL = Load Pressure Angle:	39.18deg	26.45deg
hF = Height of Lewis Parabola:	0.1976in	0.1735in
sF = Tooth Thickness at Critical Section:	0.1762in	0.1826in
Ch = Helical Factor:	1.0000	1.0000
Kpsi = Helix Angle Factor:	1.0000	1.0000
oF = Minimum Radius of Curvature:	0.0300in	0.0381in
mN = Load Sharing Factor:	1.000000	1.000000
CV = Helic Overlap Factor:	1.000000	1.000000
mF = Axial Contact Ratio:	0.000000	0.000000
kF = Stress Correction Factor:	1.4221	1.4777
Y = Tooth Form Factor (calculated):	0.3571	0.3645
J = Geometry Factor for Bending Stress:	0.2511	0.2465

☐ Use minimum tooth thickness
☐ Use Alternative Sizing Method
☐ Use cutter tip as minimum radius

Type of Loading

User selectable drop down box. Select between Loading at Tip and Loading at HPSTC (highest point of single tooth contact).

anL = Load Pressure Angle

Calculated value.

hF = Height of Lewis Parabola

Calculated value.

sF = Tooth Thickness as Critical Section

Calculated value.

Ch = Helical Factor

Calculated value.

Kpis = Helix Angle Factor

Calculated value.

oF = Minimum Radius of Curvature

Calculated value.

mN = Load Sharing Factor

Calculated value.

CV = Helical Overlap Factor

Calculated value.

mF = Axial Contact Factor

Calculated value.

KF = Stress Correction Factor

Calculated value.

Y = Tooth Form Factor (calculated)

Calculated value.

J = Geometry Factor for bending Strength

Calculated value.

Bending Strength Options

Use minimum tooth thickness

Using the minimum tooth thickness will result in a decrease in the calculated bending strength of the gears.

Use alternative sizing method

If this is checked, it only considers the trochoid rather than the whole tooth cut. In a few circumstances this could be advantageous. In most circumstances it will have no effect on the calculations.

User cutter tip as minimum radius

A hobbed tooth cut is a serial of scallops made by the cutter tip. If another method is used to create the fillet from the model, the minimum fillet radius would be defined by the geometry. This will result in an equal to or larger minimum fillet radius. A larger fillet radius will increase the calculated bending strength of the gear.

Pitting Resistance

	PINION	GEAR
u = Poisson's Ratio:	0.30	0.30
Web Thickness:	20,000,000	20,000,000
Cp = Elastic Coefficient:	1870.27	
Wt = Transmitted Tangential Load, LB:	589.3	
Ko = Overload Factor:	1.00	
Kv = Dynamic Factor:	1.50	
Ks = Size Factor:	1.00	
Km = Load Distribution Factor:	1.00	
Cf = Surface Condition Factor:	1.00	
ZN = Stress Cycle Factor:	1.00	
CH = Hardness Ratio Factor:	1.00	
SH = Safety Factor:	1.00	
KT = Temperature Factor:	1.00	
KR = Reliability Factor:	0.99	
K = Contact Load Factor PSI:	1057.68	
CG = Gear Ratio Factor:	0.73	
Lmin = Face Width of Narrowest Member:	0.75	
I = Geometry Factor for Pitting Resistance:	NaN	
Kac = Allowable Contact Load Factor PSI:	NaN	
sc = Contact Stress PSI Actual:	NaN	
sac = Contact Stress PSI Allowable:	195,000.0	

u = Poisson's Ratio

User input.

E = Modulus of Elasticity PSI

User input.

Cp = Elastic Coefficient

Calculated value.

Wt = Transmitted Tangential Load, LB

Calculated value.

Ko = Overload Factor

User input.

Kv = Dynamic Factor

User input.

Ks = Size Factor

User input.

Km = Load Distribution Factor

User input.

Cf = Surface Condition Factor

User input.

ZN = Stress Cycle Factor

User input.

CH = Hardness Ratio Factor

User input.

SH = Safety Factor

User input.

KT = Temperature Factor

User input.

KR = Reliability Factor

User input.

K = Contact Load Factor PSI

User input.

CG = Gear Ratio Factor

User input.

Lmin, Face Width of Narrowest Member

User input.

I = Geometry Factor for Pitting Resistance

User input.

Kac = Allowable Contact Load Factor PSI

User input.

cs = Contact Stress PSI Actual

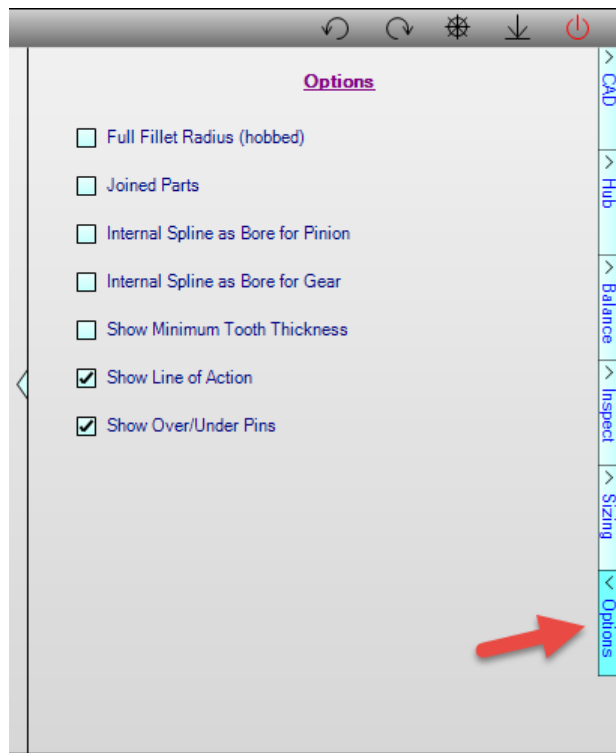
User input.

sac = Allowable Contact Stress, PSI

User input.

Spur Gear Options

Access the Spur/Helical Options by clicking on the Options button on the right side of the GearTrax window.



Full Fillet Radius (hobbed)

For ANSI Coarse and Fine Pitches only. This option changes the clearance and fillet coefficients to full fillet radius on the hob tool. If Full Fillet Radius is unchecked then the standard hobbing manufacturing method will be used to generate the tooth form. Standards that do not allow this option will ignore this check box.

Joined Parts

Available for GearTraxPRO users.

If checked, the pinion and the gear surfaces are coincident and if created in CAD the model will be a single CAD part.

Internal Spline as bore for pinion

Available for GearTraxPRO users.

Internal Spline as bore for pinion is a check box. If checked, the internal spline in the Splines tab will be used to create the bore of the pinion. The bore diameter of the pinion is automatically changed to match the minor diameter of the spline. The spline teeth are not shown on the GearTrax screen. The spline will need to be saved separately in order to reopen the part in GearTrax part in the future.

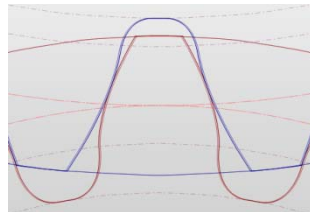
Internal Spline as bore for gear

Available for GearTraxPRO users.

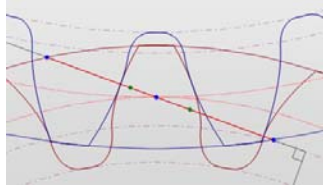
Internal Spline as bore for gear is a check box. If checked, the internal spline in the Splines tab will be used to create the bore of the gear. The bore diameter of the gear is automatically changed to match the minor diameter of the spline. The spline teeth are not shown on the GearTrax screen. The spline will need to be saved separately in order to reopen the part in GearTrax part in the future.

Show Minimum Tooth Thickness

Select this option to display the minimum tooth thickness on the graphics screen. Graphic speed performance will be reduced with this option.

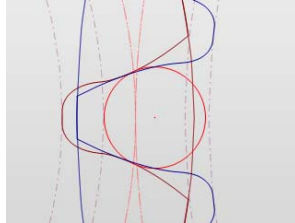
**Show Line of Action**

Select this option to display the line of action on the graphic screen.

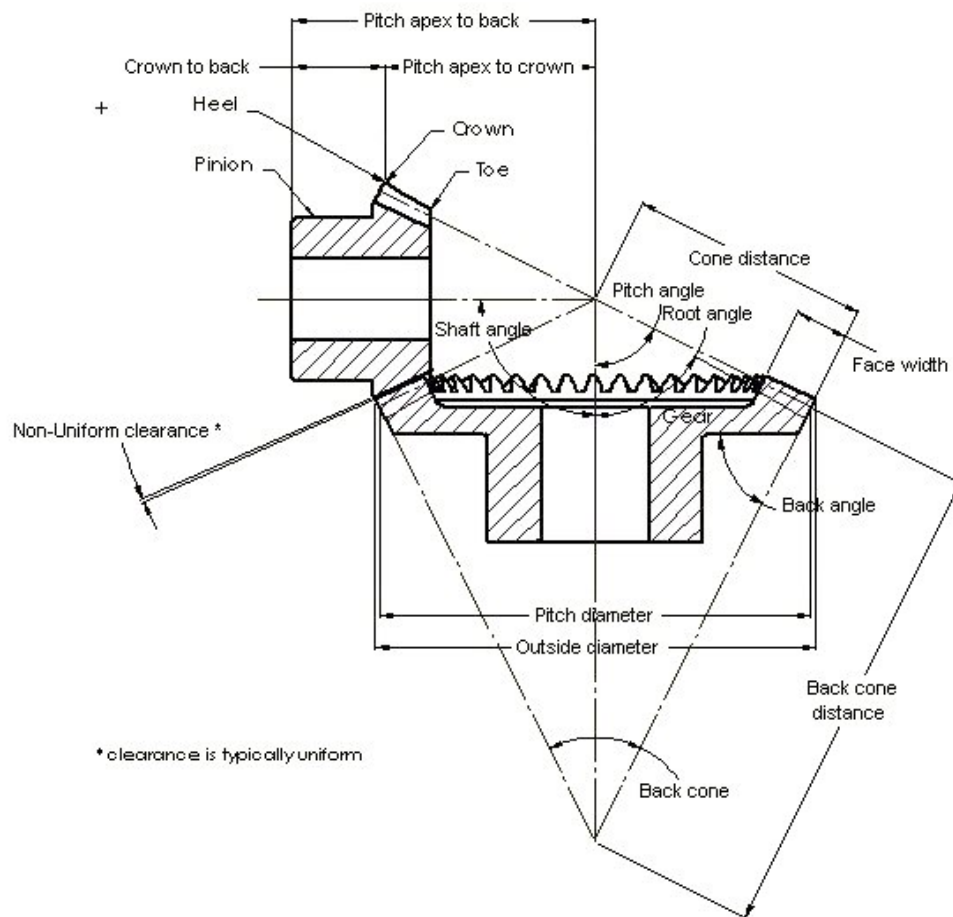


Show Over/Under Pins

Select this option to display the inspection pin on the graphic screen.



Bevel Gears



Addendum

Addendum is the length of the tooth from the pitch diameter to the major diameter.

Addendum Mod. (Addendum Modification)

Addendum Modification is the amount of addendum change of a modified tooth. This value can be positive or negative. The user value can only adjust this value in the Non standard mode. In the Gleason and DIN mode it is automatically calculated. In the Free Form mode it is not used.

Add. Mod. Coef. (Addendum Modification Coefficient)

Addendum Modification Coefficient is the ratio of change of a modified tooth. This value can be positive or negative. The user can only adjust this value in the Non standard mode. In the Gleason and DIN mode it is automatically calculated. In the Free Form mode it is not used.

AGMA Class

AGMA Class sets the AGMA Class for this component.

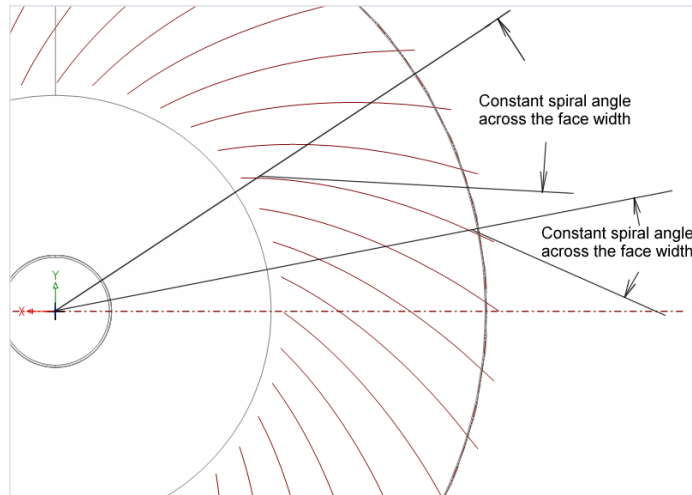
Backlash

Backlash is the thinning (or thickening, if a negative value) of the tooth profile after any modification to the tooth form.

Bevel Type

Camnetics TruSpiral

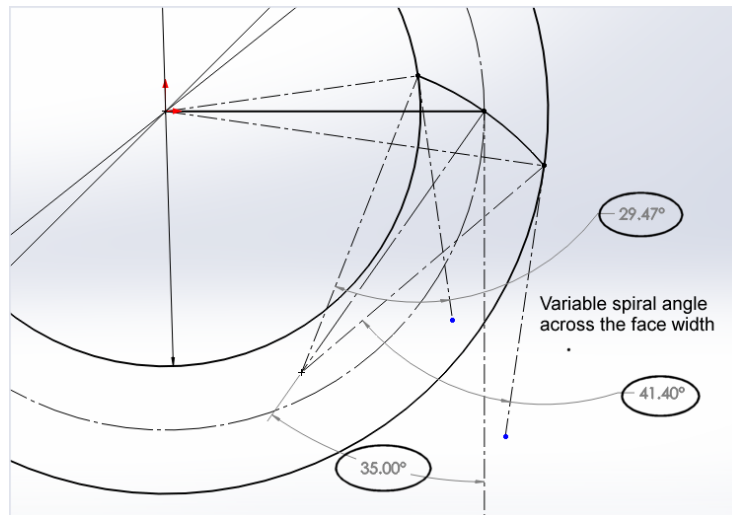
The Camnetics TruSpiral is an equiangular spiral on the pitch cone through the length of the tooth. As a set, the models are very accurate. Always inspect the models very carefully before using them for rapid prototyping or fabrication.



Straight

The straight tooth has no curvature over the length of its tooth.

Spiral



The spiral tooth is defined by the cutter diameter whose center is at the specified spiral angle from the tooth midpoint. This is the

standard method that gear machines use. Use extreme caution using a gear created with this program and one created on a gear machine. It is unknown at this time how close the geometry matches.

Zerol

The Zerol tooth is similar to the spiral except the spiral angle is always zero.

Circular Pitch

Circular Pitch is the arc length of a single pitch at the pitch diameter.

Coefficient, Addendum

Addendum Coefficient is a constant that is divided by the diametral pitch to determine the length of the addendum before any modification. The addendum length of a 10 diametral-pitch gear with an addendum coefficient of 0.8 is 0.080in.

The whole depth is equal to the sum of twice the addendum coefficient and the clearance coefficient divided by the diametral pitch.

Coefficient, Clearance

Clearance Coefficient is a constant that is divided by the diametral pitch to determine the clearance in the root of the gear tooth.

The whole depth is equal to the sum of the clearance coefficient and twice the addendum coefficient divided by the diametral pitch.

Coefficient, Fillet

Fillet Coefficient is a constant that is divided by the diametral pitch to determine the radius of the hob tip that creates the gear tooth root.

Crown to Back

Crown to Back defines the distance from the crown to the back of the gear including any hub projection.

Crown to Apex

Crown to Apex defines the distance from the crown to the gear apex. This is a read-only value.

Dedendum

Dedendum is the radial length of the tooth between the pitch diameter and the minor diameter.

Diametral Pitch

Diametral Pitch is used in imperial system gears

Face Angle

The Face Angle of a blank is made parallel to the root cone of the mating gear.

Face to Back

Face to Back is a read only value that defines the overall length of the gear along the axis.

Face Width

Face Width defines the length of the tooth along the pitch cone.

Fillet Radius

Fillet Radius defines the radius on the tip of the cutter, which forms a trochoidal curve tangent to the tooth root.

K Factor

Circular Thickness Factors K for Gleason system spiral bevel gears. This value is automatically generated for Gleason straight bevel gear sets. The user must specify this value for spiral bevel gears, see the chart below:

Equations for Chordal Thickness of Gleason Spiral Bevel Gears

No.	Item	Symbol	Formula	Example
1	Circular Tooth Thickness Factor	K	Obtain from chart	$\Sigma = 90^\circ$ $m = 3$ $\alpha_n = 20^\circ$ $z_1 = 20$ $z_2 = 40$ $\beta_m = 35^\circ$ $h_{a1} = 3.4275$ $K = 0.060$ $p = 9.4248$ $s_1 = 5.6722$
2	Circular Tooth Thickness	s_1	$p - s_2$	
		s_2	$\frac{p}{2} - (h_{a1} - h_{a2}) \frac{\tan \alpha_n}{\cos \beta_m} - Km$	$h_{a2} = 1.6725$ $s_2 = 3.7526$

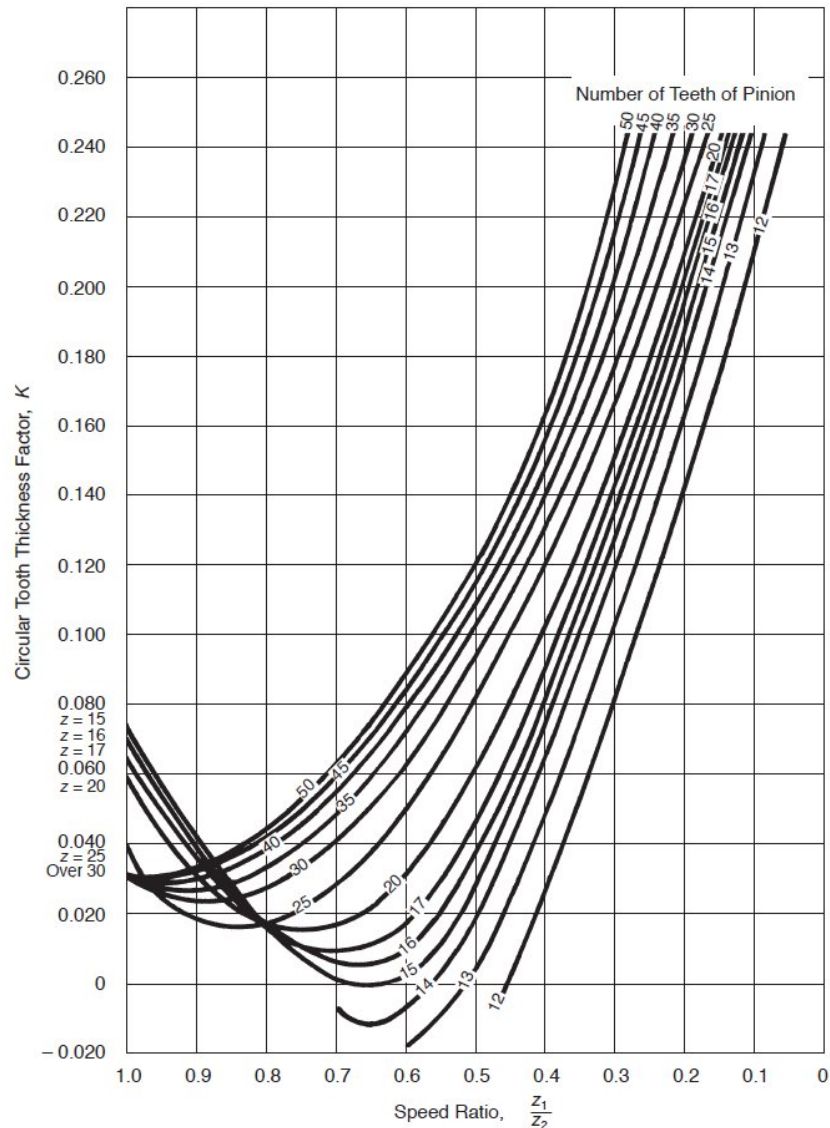


Chart to Determine the Circular Tooth Thickness Factor K for Gleason Spiral Bevel Gears

Manufacturing Method

Manufacturing Method defines the manufacturing standard for the gear. Select Gleason, DIN 3971, Non-standard or Free-Form.

Selecting Non-standard allows the user control over these parameters:

- Coefficients of addendum, clearance and fillet radius
- Pressure angle

The Free-Form standard allows the user control over these parameters:

- Pressure angle
- Fillet radius
- Face angle
- Pitch angle
- Addendum
- Dedendum

Module

Module is used in metric system gears. $\text{Module} = 25.4 / \text{Diametral Pitch}$

Mounting Distance

Mounting Distance defines the distance from the apex to the end of the bevel gear. This dimension will include the hub projection.

Number of Teeth

Number of Teeth defines the number of teeth for the component.

Outside Diameter

Outside Diameter displays the outside diameter of the bevel gear. This value cannot be changed directly and is a result of the pitch diameter, addendum and back angle.

Pitch Angle

The Pitch Angle is from the apex point to a point on the pitch diameter measured from the shaft.

Pitch Angles, sum

Pitch Angles, sum defines the shaft angle for the bevel gear set.

Pitch Diameter

Pitch Diameter is a theoretical diameter of the gear.

Pressure Angle

Pressure Angle is the angle of the tooth at the pitch diameter.

Root Angle

The Root Angle is from the apex point to the bottom of the dedendum.

Spiral Angle

Spiral Angle defines the angle of the spiral. Specify 0 degrees for a straight bevel gear. Normally 35 degrees is specified for spiral bevel gears.

Spiral Direction

Spiral Direction defines the direction of the spiral for spiral bevel gears. Select right hand or left hand.

Sum of Pitch Angles

Sum of Pitch Angles defines the sum of the pitch angles for the set of bevel gears.

Tooth Thickness

Tooth Thickness is the arc thickness of the tooth at the pitch diameter.

Units

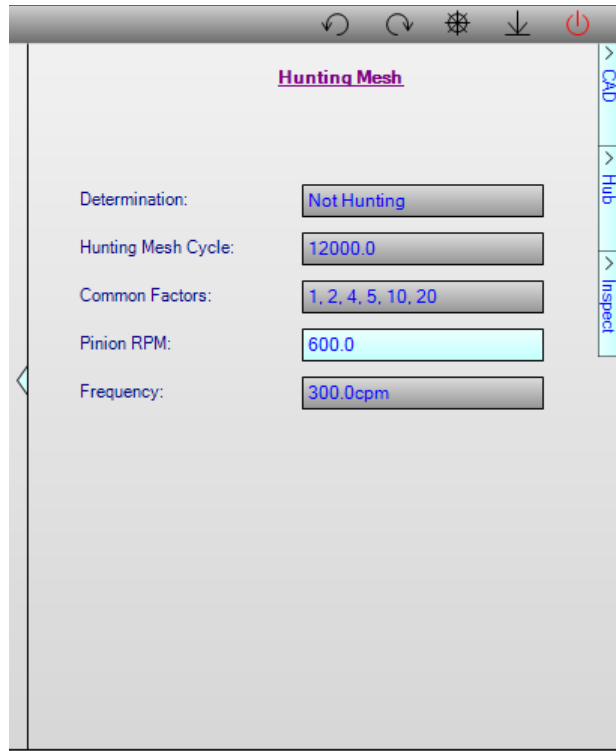
Units sets the measurement units for the component; select Inches or Metric for millimeters.

Web Thickness

Web Thickness defines the thickness between the face of the bevel gear and the back face, not including the hub projection. For a miter type gear, set this value to 0.0.

Hunting Mesh

The Hunting Mesh can be accessed by clicking on the side button next to the Gear Ratio text box.



Determination

Determination indicates whether the gear set is hunting or not hunting.

Hunting Mesh Cycle

Hunting mesh Cycle equals the number of teeth in the pinion multiplied by the pinion RPM.

Common Factors

Common Factors displays the common factors between the pinion and the gear. It is recommended that the cutting tool selected should not share any of these common factors.

Pinion RPM

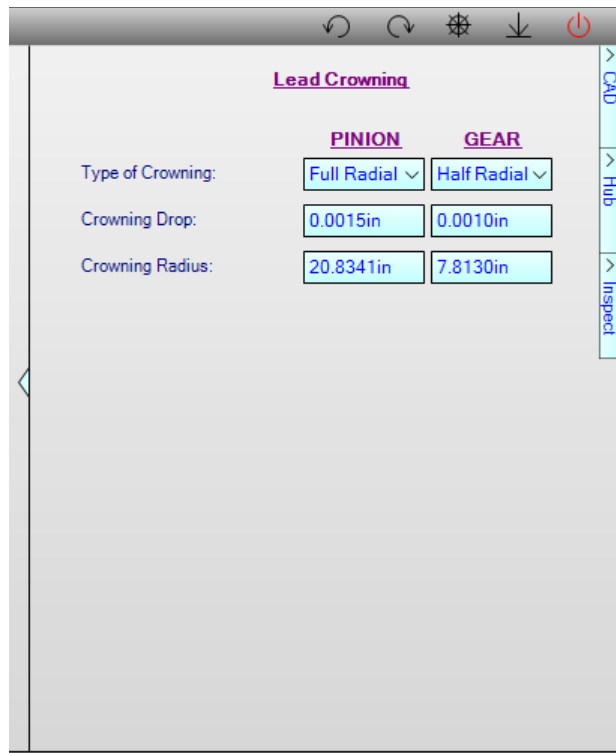
Pinion RPM (revolutions per minute) is a user input.

Frequency

Frequency is displayed in cycles per minute. $\text{Frequency} = (\text{pinion RPM} * \text{pinion teeth}) * \text{largest common factor} / (\text{pinion teeth} * \text{gear teeth})$

Lead Crowning

Crowning is available in GearTraxPRO. Crowning is the alteration to the tooth thickness along the length of the face width. This can also be referred to as lead or longitudinal crowning. The Lead Crowning can be accessed by clicking on the side button next to the Face Width text box.



Type of Crowning

Select between:

None

There will be no curvature along the length of the face width

Full radial

Full tooth thickness at the center of the tooth with a radial thinning of the tooth along its length

Half Radial

Full tooth thickness for the center half of the tooth with a radial thinning of the tooth along the rest of the length.

Crowning Drop

Crowning drop is the amount of tooth thinning at the inside and outside of the length of tooth. This thinning is per side of tooth so the total tooth thinning will be double this value.

Crowning Radius

Crowning radius is the curvature used to alter the tooth thickness along the face width.

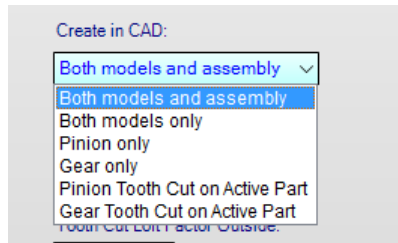
CAD

Create

Tooth Pattern in CAD

Number of Tooth Loft Sketches

Create in CAD



The Create in CAD drop down box allows the user to select what is to be created in CAD. Select from:

Both models and assembly

Create the pinion and the gear as separate models then creates an assembly and adds those models to the assembly.

Both models only

Created the pinion and gear models, each as a separate part file.

Pinion only

Creates the pinion model only.

Gear only

Creates the gear model only.

Pinion Tooth Cut on Active Part

A series of sketches are created with the apex point being at the part origin. The placement orientation is fixed and cannot be changed via GearTrax.

Gear Tooth Cut on Active Part

A series of sketches are created with the apex point being at the part origin. The placement orientation is fixed and cannot be changed via GearTrax.

Tooth Cut Loft Factor, Inside

Tooth Cut Loft Factor Inside:

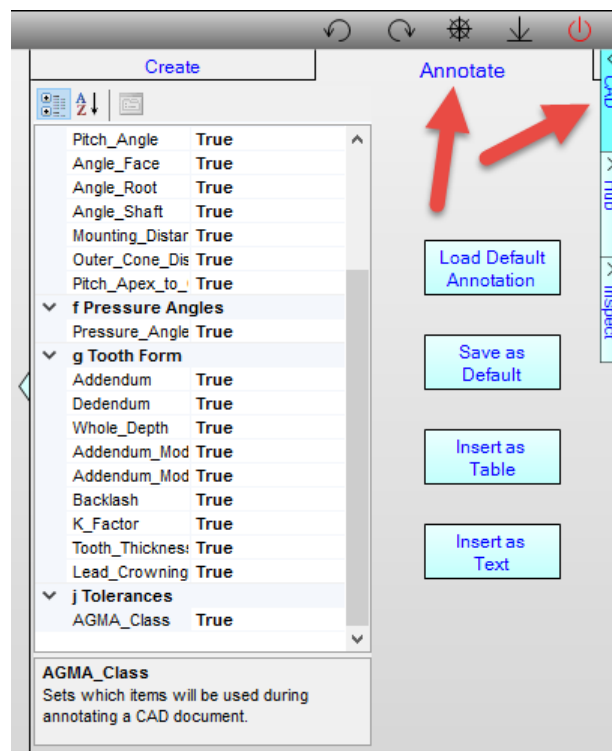
Tooth Cut Loft Factor, Inside defines how much longer the loft should be to facilitate the complete lofting of the bevel tooth cut toward the apex point. Increasing this value for wide face widths may help assure that the tooth cut is long enough.

Tooth Cut Loft Factor, Outside

Tooth Cut Loft Factor Outside:

Tooth Cut Loft Factor, Outside defines how much longer the loft should be to facilitate the complete lofting of the bevel tooth cut outward from the pitch diameter. Increase this value if changes to the base revolve might increase the blank diameter of the gear.

Annotate

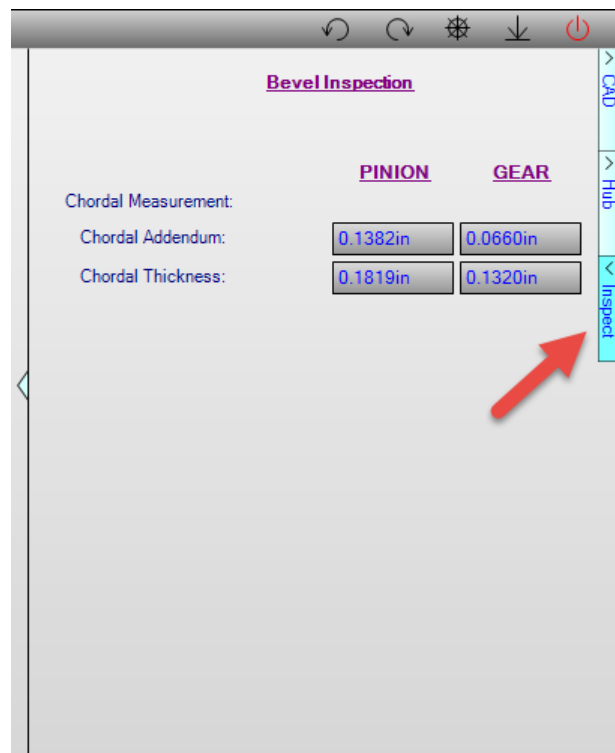
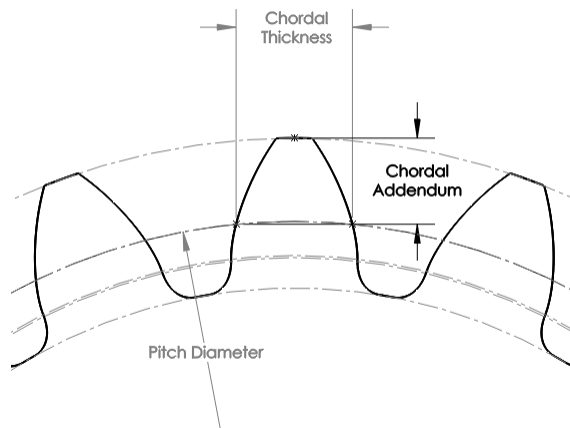


HUB

See the Hub Mounting (general) section for more detailed information.

Inspect

Chordal measurement uses a tooth caliper that is referenced from the gear's outside diameter. Chordal thickness is measured at the pitch diameter.



Sprockets

Menu Sprockets GearTraxPRO-2017

Chain Number: ANSI 25 ISO 04C Chain

Number of Teeth: 20

Units: Inches

☐ Pointed Tooth

☐ Double Pitch Single Duty

Number of Strands: 1

Chain Series: Standard Series

Chain Pitch: 0.2500in

Roller Diameter: 0.1300in

Sprocket Width: 0.1100in

Chamfer Width: 0.0313in

Chamfer Depth: 0.1250in

Pitch Diameter: 1.5981in

Outside Diameter: 1.7284in

< CAD

< Hub

Chain Number

Chain Number defines the ANSI, ISO or DIN specification number for the sprocket.

Number of Teeth

Number of Teeth defines the number of teeth for the component.

Units

Units sets the measurement units for the component; select Inches or Metric.

Pointed Tooth

Pointed Tooth defines if the sprocket should be created with a pointed tooth.

Double Pitch Single Duty

Double Pitch Single Duty defines if the component is double pitch, single duty.

Number of Strands

Number of Strands defines the number of strands to be created.

Chain Series

Chain Series defines if the sprocket is standard series or heavy series.

Chain Pitch

Chain Pitch defines the linear dimension of a single chain pitch. This is a read only value unless the Special ASA standard is selected.

Roller Diameter

Roller Diameter defines the diameter of the roller. This is a read only value unless the Special ASA standard is selected.

Sprocket Width

Sprocket Width defines the width of the sprocket. In the case of a multi-strand sprocket, it defines the width of each plate. This is a read only value unless the Special ASA standard is selected.

Sprocket Chamfer Width

Sprocket Chamfer Width defines the width of the chamfer at the tooth tip. This is a read only value unless the Special ASA standard is selected.

Sprocket Chamfer Depth

Sprocket Chamfer Depth defines the depth of the chamfer at the tooth tip. This is a read only value unless the Special ASA standard is selected.

Pitch Diameter

Pitch Diameter is a read only value that defines the value of the pitch diameter. The pitch diameter of chain sprockets equals the chain pitch divided by the sine of PI divided by the number of teeth.

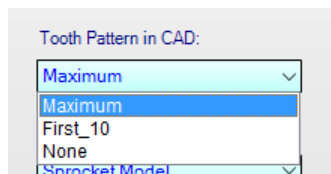
Sprocket Outside Diameter

Sprocket Outside Diameter displays the outside diameter of the sprocket. This is a read only value.

CAD

Create

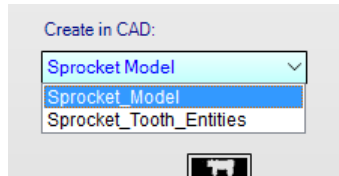
Tooth Pattern in CAD



Teeth to Pattern defines the number of teeth to pattern when creating the model in CAD. The options are All, None, or First 10. If this is set to All, GearTrax will create a pattern that contains all the teeth. If this is set to none, then a pattern will not be created. Set this to 'First 10' to

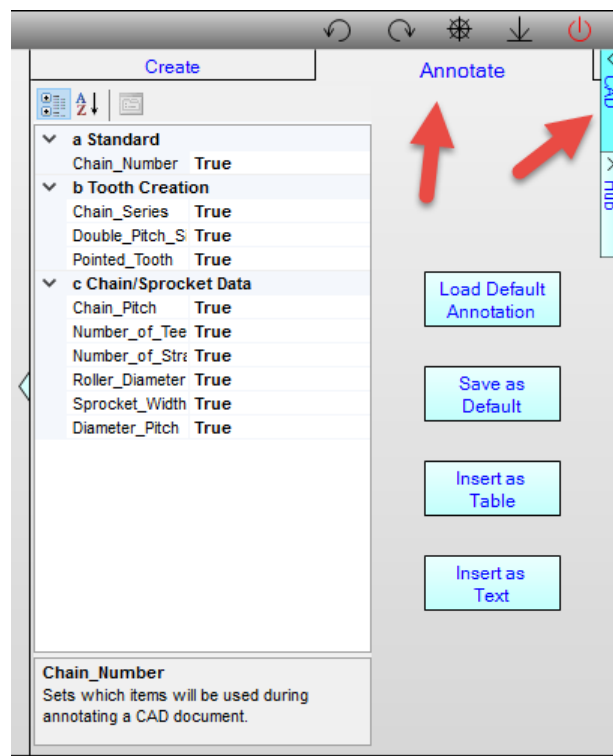
create a pattern with 10 teeth that can easily be expanded in the CAD system.

Create in CAD

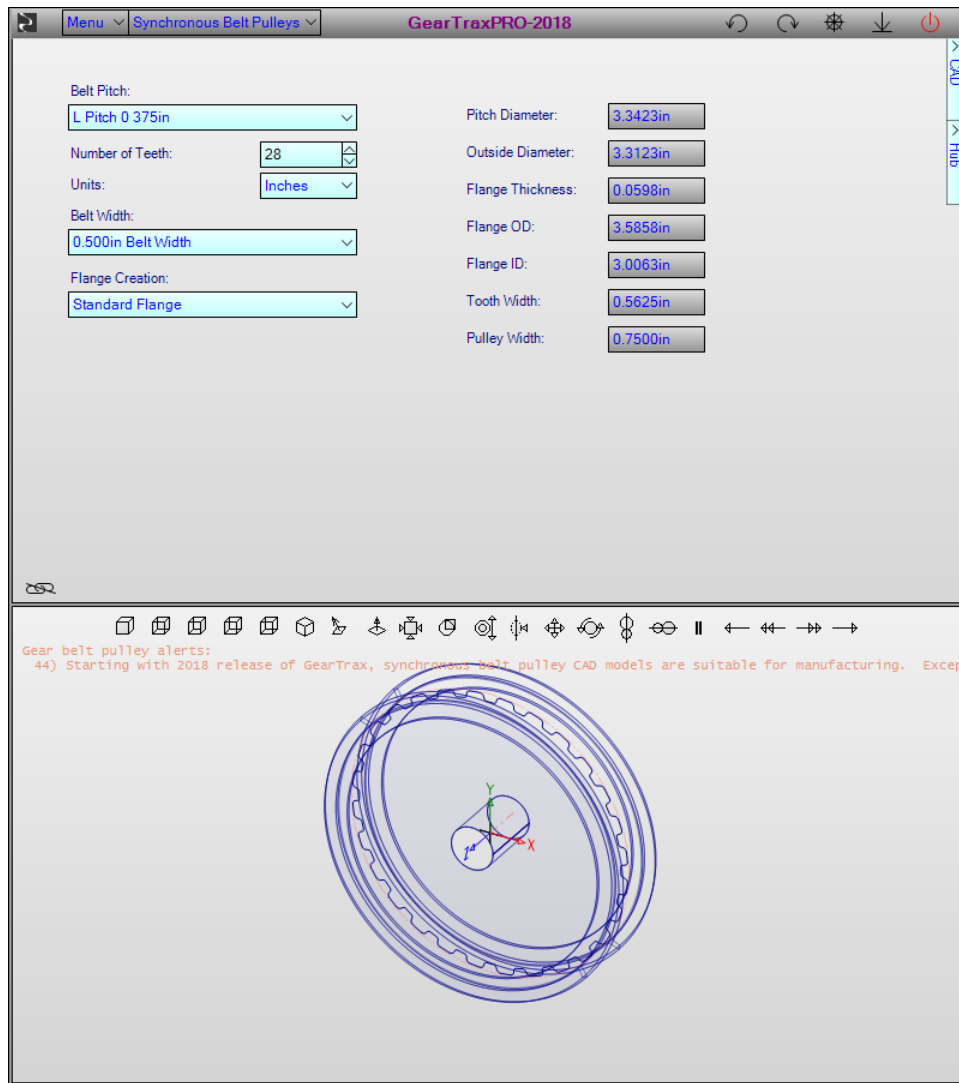


Select between Sprocket Model and Sprocket Tooth Entities. If Sprocket Tooth Entities is selected then an open sketch must be active in CAD. The center of the sprocket will be at the part origin.

Annotate



Synchronous Belt Pulleys



Standards

MXL, XL, L, H, XH AND XXH uses ISO 5296-1 1st Edition 1989-07-15*

T 2,5; T 5; T 10; T 20, Form SE and N uses DIN 7721 Teil 2

PolyChain GT 8 and 14mm uses ISO 13050 System G**

PowerGrip GT 3, 5, 8, 14, 20mm uses ISO 13050 System R

HTS 8 and 14mm uses ISO 13050 System S

HTD 3, 5, 8, 14mm uses ISO 13050 System H

* Starting with 2018 these belt tooth profiles are created using the involute method.

** At this time, there appears to be an error in this section of the standard making the PolyChain GT models unsuitable for manufacturing purposes.

Belt Pitch

Belt Pitch defines the belt series and pitch.

Belt Width

Belt Width defines the width of belt to be used with this component.

Flange Creation

Flange Creation defines the type of flange to be created, if any.

Flange ID

Flange ID defines the inside diameter of the flange. This is a read only value and cannot be changed. This is a reference dimension; different manufacturers may use other values.

Flange OD

Flange OD defines the outside diameter of the flange. This is a read only value and cannot be changed. This is a reference dimension; different manufacturers may use other values.

Flange Thickness

Flange Thickness defines the thickness of the flange. This is a read only value and cannot be changed. This is a reference dimension; different manufacturers may use other values.

Number of Teeth

Number of Teeth defines the number of teeth for the component.

Outside Diameter

Outside Diameter defines the diameter of the pulley body, not the flange diameter. This is a read only value and cannot be changed.

Pitch Diameter

Pitch Diameter is a read only value that defines the value of the pitch diameter. The pitch diameter of gear belt pulleys equals the belt pitch multiplied by the number of teeth divided by PI.

Pulley Width

Pulley Width defines the width of the pulley at the bore not including any hub projections.

Teeth to Pattern

Teeth to Pattern defines the number of teeth to pattern when creating the model in CAD. The options are All, None, or First 10. If this is set to All, GearTrax will create a pattern that contains all the teeth. This might be very time consuming if there are a large number of teeth and/or the component is a helical gear. If this is set to none, then a pattern will not

be created. Set this to 'First 10' to create a pattern with 10 teeth that can easily be expanded in the CAD system.

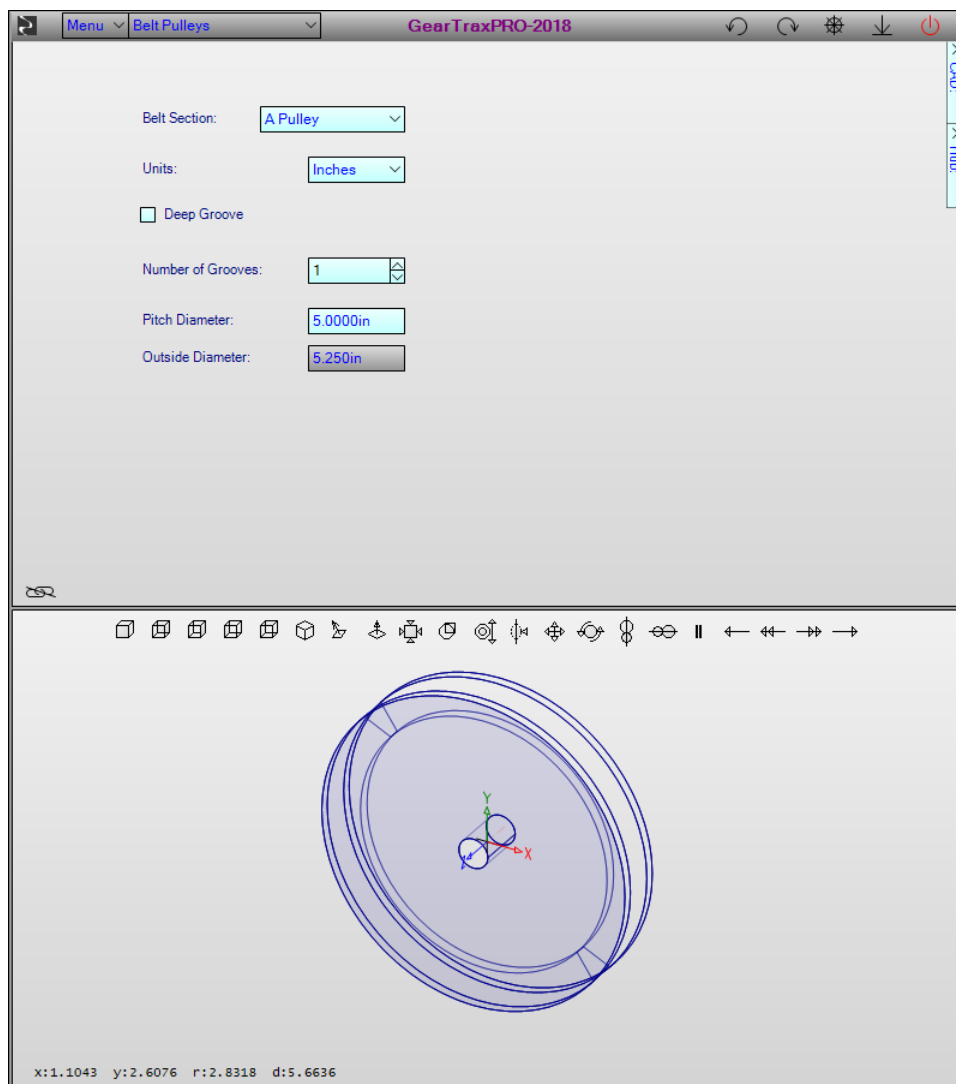
Tooth Width

Tooth Width is the width of the pulley between the flanges. This is a read only value and cannot be changed.

Units

Units sets the measurement units for the component; select Inches or Metric.

Belt Pulleys



Belt Section

Belt Section defines the belt section for the component.

Deep Groove

Deep Groove defines if the component is to have a deep groove. Select True or False.

Number of Grooves

Number of Grooves defines the number of grooves for the component.

Pitch Diameter

Pitch Diameter defines the pitch diameter for the component.

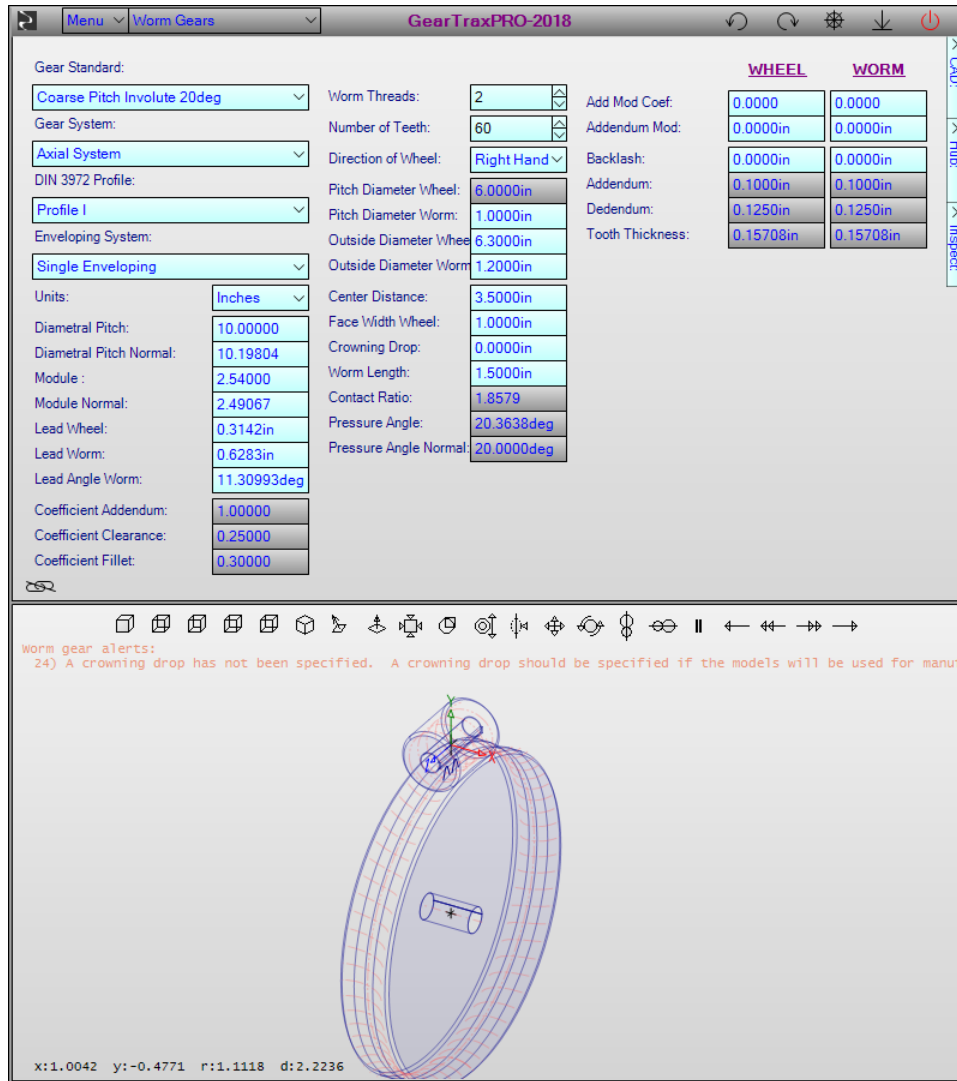
Pulley OD

Pulley OD defines the outside diameter of the pulley. Changing this value will change the pitch diameter.

Units

Units sets the measurement units for the component, select Inches or Metric.

Worm Gears



Addendum, Gear

Addendum, Gear is the length of the gear tooth from the pitch diameter to the major diameter.

Addendum Modification

Addendum Modification is the amount of addendum change of a worm tooth. A positive value increases the addendum of the worm and decreases the addendum of the gear (wheel).

Addendum Modification Coefficient

Addendum Modification Coefficient is the ratio of change of a worm tooth. A positive value increases the addendum of the worm and decreases the addendum of the gear (wheel).

Addendum, Worm

Addendum, Worm is the length of the worm tooth from the pitch diameter to the major diameter.

Backlash, Gear

Backlash, Gear is the thinning (or thickening, if a negative value) of the gear tooth profile after any modification to the tooth form.

Backlash, Worm

Backlash, Worm is the thinning (or thickening, if a negative value) of the worm tooth profile after any modification to the tooth form.

Bore

Bore defines the diameter of the bore for the gear (wheel) component.

Bore, Chamfer

Bore, Chamfer defines the chamfer size for the bore of the gear (wheel) component.

Bore, Worm

Bore, Worm defines the diameter of the bore for the worm component.

Bore, Worm Chamfer

Bore, Worm Chamfer defines the chamfer size for the bore of the worm component.

Cut adjustment

Cut Adjustment is available in GearTraxPRO (SolidWorks version only). The Cavity cut tooth adjustment gives the user a method to tweak how the "hobs" are places on the wheel for cutting. Depending on the number of teeth, starts and pitch diameter of the worm this value may need to be adjusted to properly create the cavity cut. Values between 0.5 and 2.0 are valid. Typically, the greater the number of teeth the higher the value. Recommended starting values are < 50 teeth, .75; < 100 teeth, 1.0; < 200 teeth, > 200 teeth, 2.0

Center Distance

Center Distance defines the distance between the centers of the worm and the wheel gear. This is a read only value and cannot be directly changed.

Coefficient, Addendum

Addendum Coefficient is a constant that is divided by the diametral pitch to determine the length of the addendum before any modification. The addendum length of a 10 diametral-pitch gear with an addendum coefficient of 0.8 is 0.080 in.

Coefficient, Clearance

Clearance Coefficient is a constant that is divided by the diametral pitch to determine the clearance in the root of the gear tooth.

Coefficient, Fillet

Fillet Coefficient is a constant that is divided by the diametral pitch to determine the radius of the hob tip that creates the gear tooth root.

Contact Ratio

Contact Ratio defines the contact ratio for the worm gear set.

Create Worm and or Wheel

Select between Both, Worm Only and Wheel Only.

Cut Method

Cut Method is available in GearTraxPRO (SolidWorks version only). This give the user an option to select between lofting or cavity tooth cut methods. The loft cut method which is available to all CAD systems uses a series of sketches to create the tooth cut. The cavity method available to SolidWorks users creates the tooth cut using a series of "hobs" to create half of the tooth cut. This cut is then circle patterned to complete the whole tooth cut.

Dedendum, Gear

Dedendum, Gear is the radial length of the gear tooth between the pitch diameter and the minor diameter.

Dedendum, Worm

Dedendum, Worm is the radial length of the worm tooth between the pitch diameter and the minor diameter.

Diameter, Pitch, Gear

Gear Pitch Diameter is a theoretical diameter of the gear.

Diameter, Pitch, Worm

Worm Pitch Diameter is a theoretical diameter of the worm.

Diametral Pitch

Diametral Pitch (transverse) is used for imperial system gears.

Diametral Pitch, Normal

Select between Profile I and Profile II designations for the DIN standard only. A Profile I has a clearance coefficient of 0.167 and Profile II has a clearance coefficient of 0.250

DIN 3972 Profile

Normal Diametral Pitch is used for imperial system gears. Normal diametral pitch = diametral pitch / cosine (lead angle).

Direction, Gear

Direction, Gear determines whether the teeth on the gear are right hand or left hand.

Enveloping System

Select between Single and Double Enveloping. The worm of a single enveloping system is basically a straight screw whereas the double enveloping system worm wraps partially around the wheel. At this time, double enveloping worms should only be used with helical gears.

Face Width

Face Width (rim width) defines the width of the gear wheel parallel to the shaft without any hub projections.

Fillet Radius

Fillet Radius defines the radius on the tip of the cutter, which forms a trochoidal curve tangent to the tooth root.

Outside Diameter Wheel

Outside Diameter Wheel is the maximum diameter of the gear wheel.

Gear Standard

Gear Standard sets the AGMA or DIN standard for the component.

Gear System

Specify either Axial or Normal systems. These two systems determine how the addendum and dedendum are calculated.

Lead Wheel

Lead Wheel defines the length of one pitch of the gear wheel. The lead of the gear equals the lead of the worm divided by the number of worm threads (starts).

Lead Worm

Lead Worm defines the length of one pitch of the worm. The lead of the worm equals the lead of the gear wheel multiplied by the number of worm threads (starts).

Lead Angle, Worm

Lead Angle, Worm defines the angle of the worm lead.

Loft Sketches

This option is available in GearTraxPRO. It is fixed at 9 in GearTrax. Number of Sketches defines the number of sketches that will be used to construct the wheel tooth loft cut. Values between 5 and 21 are valid. An odd number of sketches is recommended so a sketch will be positioned at the center of the tooth.

Module

Module (transverse) is used in imperial system gears.

Module, Normal

Module, Normal is used in metric system gears. Module equals the normal module multiplied by the cosine of the worm angle.

Number of Teeth

Number of Teeth defines the number of teeth for the gear (wheel).

Number of Threads

Number of Threads defines the number of threads of the worm. This is also referred to as “starts”.

Pressure Angle

Pressure Angle is the angle of the tooth at the pitch diameter in the transverse plane.

Pressure Angle Normal

Pressure Angle Normal is the angle of the tooth at the pitch diameter normal to the cutter.

Teeth to Pattern

Teeth to Pattern defines the number of teeth to pattern when creating the model in CAD. The options are All, None, or First 10. If this is set to All, GearTrax will create a pattern that contains all the teeth. This might be very time consuming if there are a large number of teeth and/or the component is a helical gear. If this is set to none, then a pattern will not be created. Set this to ‘First 10’ to create a pattern with 10 teeth that can easily be expanded in the CAD system.

If the Cavity tooth cut method is used, creating the pattern of the tooth cut could take more than a few minutes.

Units

Units sets the measurement units for the component; select Inches or Metric.

Whole Depth

Whole Depth is the depth of the tooth (from the major diameter to the minor diameter).

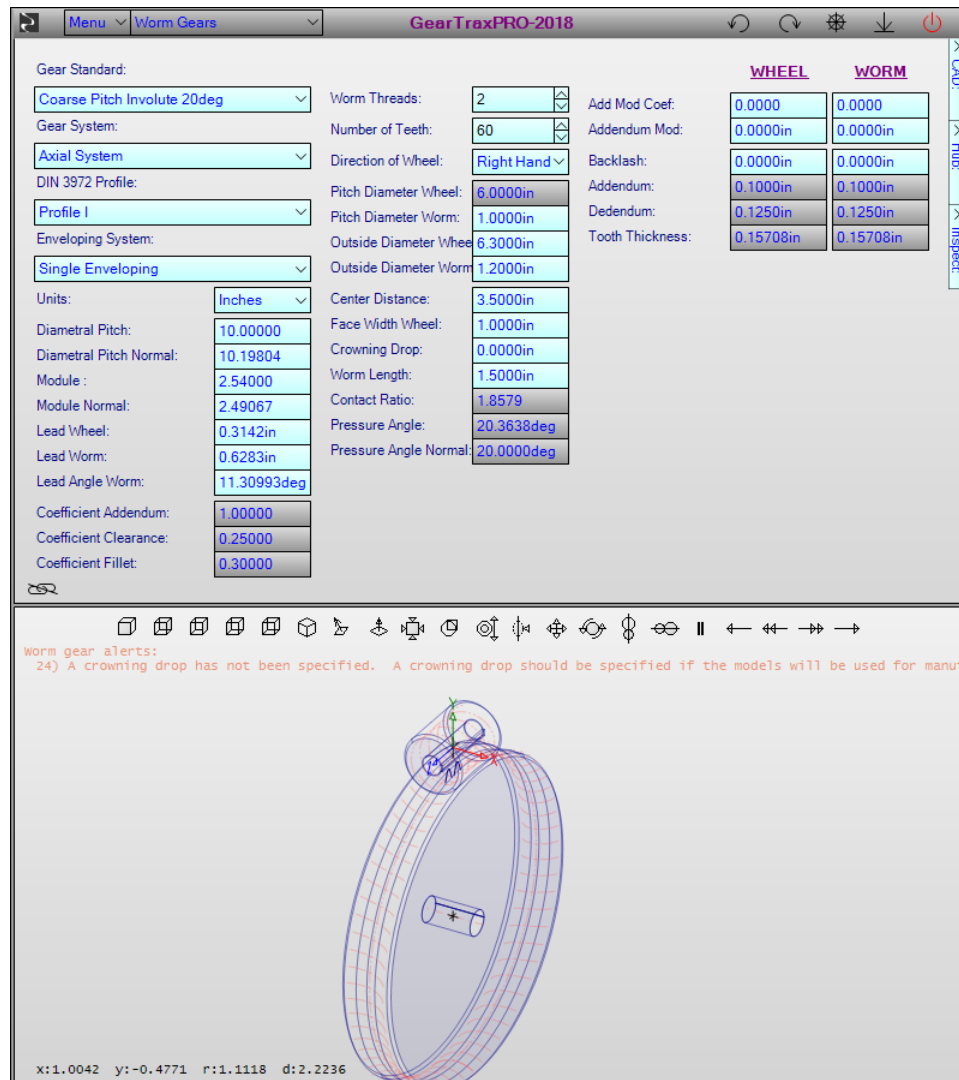
Worm Length

Worm Length defines the axial length of the worm.

Outside Diameter Worm

Outside Diameter Worm defines the maximum diameter of the worm, unless it is a double-enveloping worm, which then determines the outside diameter at the axial center.

Splines



Addendum

Addendum is the length of the tooth from the pitch diameter to the major diameter.

Addendum Modification

Addendum Modification is the amount of addendum change of a modified tooth. This value can be positive or negative. If the sum of change to a pair of gears equals zero then there is no change to the center distance.

Addendum Modification Coefficient

Addendum Modification Coefficient is the ratio of change of a modified tooth. This value can be positive or negative. If the sum of change to a pair of gears equals zero then there is no change to the center distance.

As

(DIN 5480) Upper tooth thickness deviation

Chordal Measurement

Chordal Measurement is a straight-line measurement across a specified number of teeth. The range is based on the maximum effective and the maximum actual tooth thickness.

Chordal Measurement Teeth to Gage Over

Teeth to Gage Over defines the number of teeth that are used with the chordal measurement. This value is automatically generated but the user may input another value. The value can be reset by clicking on the GearTrax menu item Tools>Reset Chordal Measurement.

Circular Pitch

Circular Pitch is the arc length of a single pitch at the pitch diameter.

Coefficient, Addendum

Addendum Coefficient is a constant that is divided by the diametral pitch to determine the length of the addendum before any modification. The addendum length of a 10 diametral-pitch gear with an addendum coefficient of 0.8 is 0.080 in.

Coefficient, Dedendum

Dedendum Coefficient is a constant that is divided by the diametral pitch to determine the length of the dedendum before any modification.

Coefficient, Fillet

Fillet Coefficient is a constant that is divided by the diametral pitch to determine the radius of the hob tip that creates the gear tooth root.

Dedendum

Dedendum is the radial length of the tooth between the pitch diameter and the minor diameter.

Designation

(DIN 5480) Designation is a read-only property that displays the parameters of the individual spline.

For example, DIN 5480-W35x2x30x16x8h:

DIN 5480, the standard used
W, W for a shaft, N for a hub
35, reference diameter
2, module
30, pressure angle
16, number of teeth
8h, tolerance grade and deviation

Deviation

(DIN 5480) Tolerance Position. Select "a" through "v" for the DIN standard. If "no class" is selected then the individual properties of the gear can be controlled by the user.

Diameter, Base

Base Diameter is a diameter that is tangent to the pressure angle. The involute curve cannot be within this diameter.

Diameter, Major, Maximum

Diameter, Major, Maximum defines the maximum major diameter. This is normally read only unless “No Class” is selected for the Tolerance Class, ANSI and JIS splines only.

Diameter, Major, Minimum

Diameter, Major, Minimum defines the minimum major diameter. This is normally read only unless “No Class” is selected for the Tolerance Class, ANSI and JIS splines only.

Diameter, Minor, Maximum

Diameter, Minor, Maximum defines the maximum minor diameter. This is normally read only unless “No Class” is selected for the Tolerance Class, ANSI and JIS splines only.

Diameter, Minor, Minimum



Diameter, Minor, Minimum defines the minimum minor diameter. This is normally read only unless “No Class” is selected for the Tolerance Class, ANSI and JIS splines only.

Diameter, Nominal SAE

Defines the SAE Nominal Diameter.

Diameter, Pitch

Pitch Diameter is the theoretical diameter of the spline.

Diameter, True, Involute Form

True Involute Form diameter (TIF) is the diameter of the circle beyond which the tooth profile must conform to the specified involute curve.

Diametral Pitch

Diametral Pitch is used in imperial system gears. This defines the diametral pitch in the transverse plane.

Diametral Pitch, Stub

Stub Diametral Pitch is used in imperial system gears. This defines the stub diametral pitch in the transverse plane and is normally equal to twice the diameter pitch.

Fillet Radius

Fillet Radius defines the radius on the tip of the cutter, which forms a trochoidal curve tangent to the tooth root.

Form Clearance

Form Clearance is the radial depth of the involute profile beyond the depth of engagement with the mating spline component.

Length

Length is the length of the tooth parallel to the shaft.

Manufacturing Method DIN

Manufacturing Method DIN sets the manufacturing method for the component. The manufacturing method has a direct effect on the dedendum depth. For external splines the options are broaching, hobbing, shaping and cold rolling. For internal the options are broaching, hobbing and shaping.

Measurement Between Pins; Actual Maximum

Measurement Between Pins is the measurement between two pins diametrically opposed in an internal spline and is normally used for inspection. GearTrax will calculate the space width for internal spline if a value is entered for the between pin measurement.

Measurement Between Pins; Actual Minimum

Measurement Between Pins is the measurement between two pins diametrically opposed in an internal spline and is normally used for inspection. GearTrax will calculate the space width for internal spline if a value is entered for the between pin measurement.

Measurement Between Pins; Effective Minimum

Measurement Between Pins is the measurement between two pins diametrically opposed in an internal spline and is normally used for inspection. GearTrax will calculate the space width for internal spline if a value is entered for the between pin measurement.

Measurement Over Pins; Actual Maximum

Measurement Over Pins is the measurement between two pins diametrically opposed in an external spline and is normally used for inspection. GearTrax will calculate the tooth thickness for an external spline entered for the over pin measurement.

Measurement Over Pins; Actual Minimum

Measurement Over Pins is the measurement between two pins diametrically opposed in an external spline and is normally used for inspection. GearTrax will calculate the tooth thickness for an external spline if a value is entered for the over pin measurement.

Measurement Over Pins; Effective Maximum

Measurement Over Pins is the measurement between two pins diametrically opposed in an external spline and is normally used for inspection. GearTrax will calculate the tooth thickness for an external spline if a value is entered for the over pin measurement.

Module

Module (transverse) is used in metric system gears. Module equals the normal module divided by the cosine of the helical angle.

Number of Teeth

Number of Teeth defines the number of teeth for the component.

Pin Diameter

Pin Diameter defines the diameter of the pins or wires used with Measurement of Pins. A user defined pin diameter may be entered. To reset the value to the standard value select Tools>Reset Over/Under Pin Measurement in the GearTrax menu.

Pressure Angle

Pressure Angle is the angle of the tooth at the pitch diameter.

Root and Fit

Root and Fit defines the type of fit for the component. Select fillet root side fit, flat root side fit or flat root major diameter fit.

Space Width; Actual Maximum

The actual space width is the circular width on the pitch circle of any single space. Please consult other gear manuals for a fuller description.

Space Width; Actual Minimum

The actual space width is the circular width on the pitch circle of any single space. Please consult other gear manuals for a fuller description.

Space Width; Basic

The basic space width is the basic circular width on the pitch circle of any single space. Please consult other gear manuals for a fuller description.

Space Width; Effective Maximum

Space Width Effective Maximum of an internal spline is equal to the circular tooth thickness on the pitch circle of an imaginary perfect external spline, which would fit the internal spline without looseness or interference, considering the engagement of the entire axial length of the spline. Please consult other gear manuals for a fuller description.

Space Width; Effective Minimum

Space Width Effective Minimum of the internal spline is always basic.

Spline Fit Class

Spline Fit Class (ANSI) is a user selectable property. For internal splines, the class is always "H". For external splines the options are "H_d", "H_e", "H_f" and "H_h".

Standard

Standard, select between 4 different standards:

ANSI Diametral B92.1 1996

ANSI Module B92.2M 1980 R1989

DIN 5480 and 5482

JIS B 1603

Tact

(DIN 5480 and 5482) Actual tooth thickness (or space width) tolerance. To view this value click on the Chart button.

Teeth to Pattern

Teeth to Pattern defines the number of teeth to pattern when creating the model in CAD. The options are All, None, or First 10. If this is set to All, GearTrax will create a pattern that contains all the teeth. This might be very time consuming if there are a large number of teeth and/or the component is a helical gear. If this is set to none, then a pattern will not be created. Set this to 'First 10' to create a pattern with 10 teeth that can easily be expanded in the CAD system.

Teff

(DIN 5480 and 5482) Effective tooth thickness (or space width) tolerance. To view this value click on the Chart button.

TG

(DIN 5480 and 5482) Total tooth thickness (or space width) tolerance. To view this value click on the Chart button.

Tolerance Class

(ANSI and JIS) Specifies the tolerance class for ANSI and JIS splines. If "No Class" is selected then the user may enter values for individual parameters of the component

Tolerance Grade

(DIN 5480 and 5482) Values between 4 and 12 inclusive are valid.

Tooth Thickness; Actual Maximum

Space Width and Tooth Thickness

	INTERNAL	EXTERNAL
Basic:	0.0982in	0.0982in
Actual Maximum:	0.1009in	0.0967in
Actual Minimum:	0.0997in	0.0955in
Effective Maximum:	0.0994in	0.0982in
Effective Minimum:	0.0982in	0.0970in

Navigation: CAD, Inspect, Chart, Options

Actual Maximum Tooth Thickness is the maximum circular thickness on the pitch circle of any single tooth.

Tooth Thickness; Actual Minimum

Space Width and Tooth Thickness

	INTERNAL	EXTERNAL
Basic:	0.0982in	0.0982in
Actual Maximum:	0.1009in	0.0967in
Actual Minimum:	0.0997in	0.0955in
Effective Maximum:	0.0994in	0.0982in
Effective Minimum:	0.0982in	0.0970in

Navigation: CAD, Inspect, Chart, Options

Actual Minimum Tooth Thickness is the minimum circular thickness on the pitch circle of any single tooth.

Tooth Thickness; Basic

	INTERNAL	EXTERNAL
Basic:	0.0982in	0.0982in
Actual Maximum:	0.1009in	0.0967in
Actual Minimum:	0.0997in	0.0955in
Effective Maximum:	0.0994in	0.0982in
Effective Minimum:	0.0982in	0.0970in

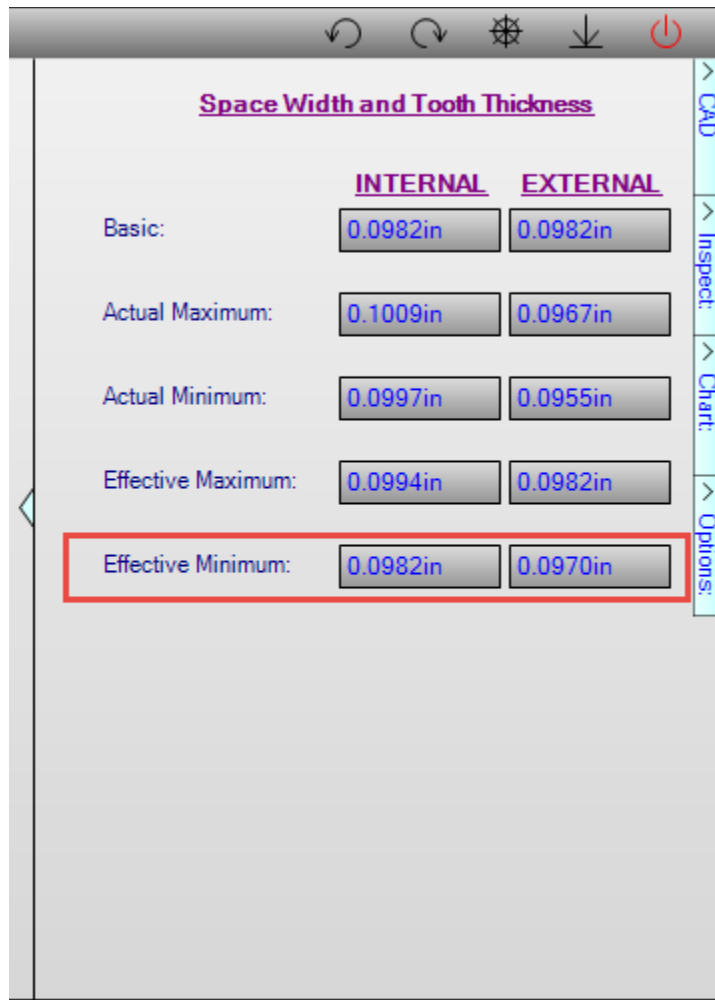
Tooth Thickness Basic is the basic circular thickness on the pitch circle of any single tooth.

Tooth Thickness; Effective Maximum

	INTERNAL	EXTERNAL
Basic:	0.0982in	0.0982in
Actual Maximum:	0.1009in	0.0967in
Actual Minimum:	0.0997in	0.0955in
Effective Maximum:	0.0994in	0.0982in
Effective Minimum:	0.0982in	0.0970in

The effective tooth thickness of an external spline is equal to the circular space width on the pitch circle of an imaginary perfect internal spline, which would fit the external spline without looseness or interference, considering engagement of the entire axial length of the spline. Please consult other gear manuals for a fuller description.

Tooth Thickness; Effective Minimum



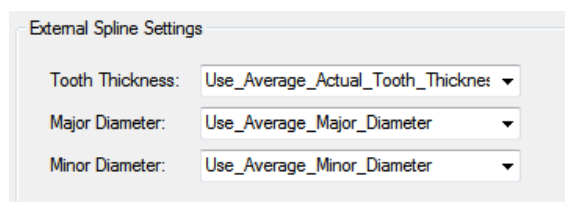
	INTERNAL	EXTERNAL
Basic:	0.0982in	0.0982in
Actual Maximum:	0.1009in	0.0967in
Actual Minimum:	0.0997in	0.0955in
Effective Maximum:	0.0994in	0.0982in
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The effective tooth thickness of an external spline is equal to the circular space width on the pitch circle of an imaginary perfect internal spline, which would fit the external spline without looseness or interference, considering engagement of the entire axial length of the spline. Please consult other gear manuals for a fuller description.

Units

Units sets the measurement units for the component; select Inches or Metric. DIN and JIS are always metric units.

External Spline Settings



External Spline Settings

Tooth Thickness: Use_Average_Actual_Tooth_Thicknes ▼

Major Diameter: Use_Average_Major_Diameter ▼

Minor Diameter: Use_Average_Minor_Diameter ▼

Tooth Thickness

The Tooth Thickness combo box gives the user a method determine how to create the tooth thickness of external splines when creating a CAD model. This option is saved as a default for the next time GearTrax is started. The options are:

- Use Average Actual Tooth Thickness
- Use Maximum Actual Tooth Thickness
- Use Minimum Actual Tooth Thickness

Major Diameter

The Major Diameter combo box gives the user a method determine how to create the major diameter of external splines when creating a CAD model. This option is saved as a default for the next time GearTrax is started. The options are:

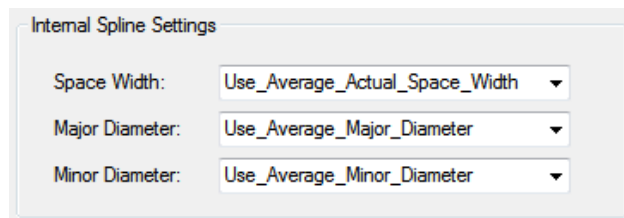
- Use Average Major Diameter
- Use Maximum Major Diameter
- Use Minimum Major Diameter

Minor Diameter

The Minor Diameter combo box gives the user a method to determine how to create the minor diameter of external splines when creating a CAD model. This option is saved as a default for the next time GearTrax is started. The options are:

- Use Average Minor Diameter
- Use Maximum Minor Diameter
- Use Minimum Minor Diameter

Internal Spline Settings



Space Width

The Space Width combo box gives the user a method to determine how to create the tooth thickness of external splines when creating a CAD model. This option is saved as a default for the next time GearTrax is started. The options are:

- Use Average Actual Space Width
- Use Maximum Actual Space Width
- Use Minimum Actual Space Width

Major Diameter

The Major Diameter combo box gives the user a method to determine how to create the major diameter of internal splines when creating a CAD model. This option is saved as a default for the next time GearTrax is started. The options are:

- Use Average Major Diameter
- Use Maximum Major Diameter
- Use Minimum Major Diameter

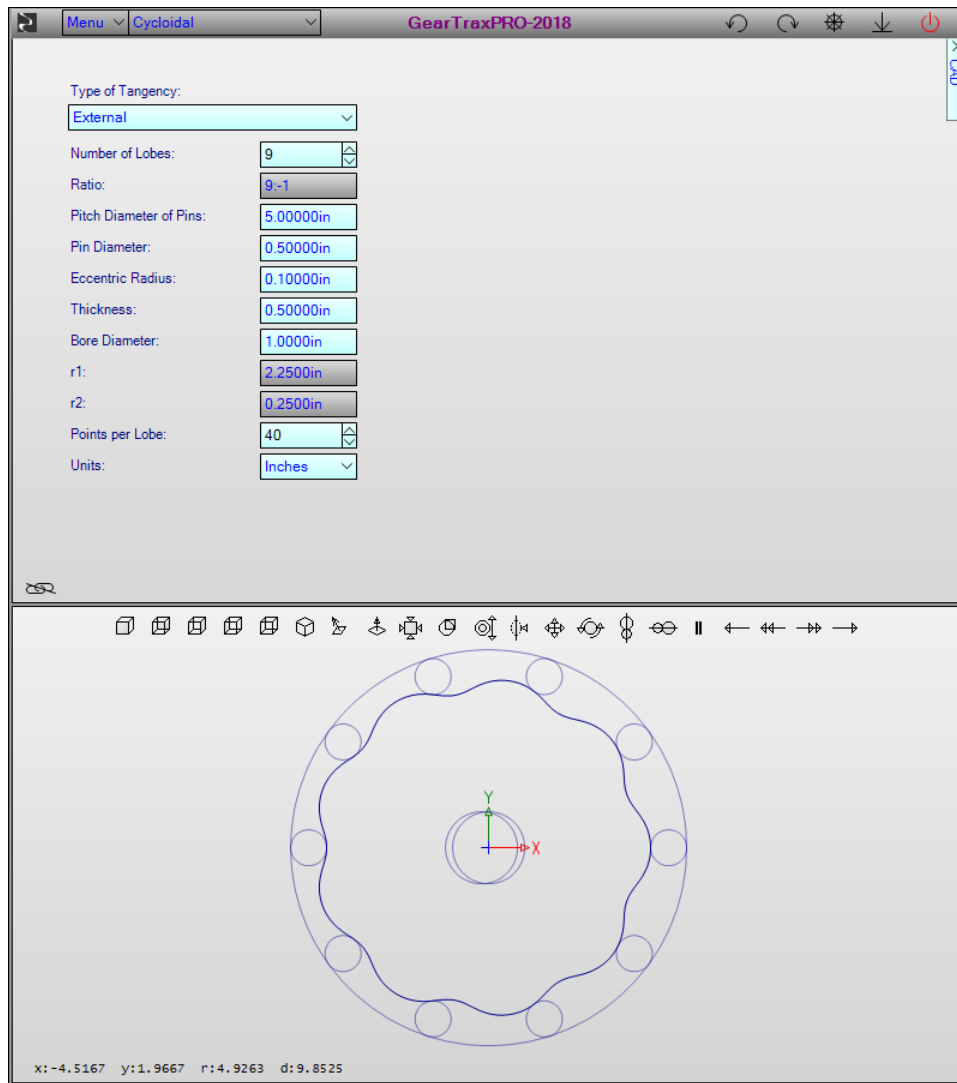
Minor Diameter

The Minor Diameter combo box gives the user a method to determine how to create the minor diameter of internal splines when creating a CAD model. This option is saved as a default for the next time GearTrax is started. The options are:

- Use Average Minor Diameter
- Use Maximum Minor Diameter
- Use Minimum Minor Diameter

Cycloidal

Cycloidal components are available starting with GearTrax-2017.



Type of Tangency

Select between External and Internal tangencies.

Number of Lobes

The numeric up/down box controls the number of lobes. The number of pins is always one greater.

Ratio

The gear ratio is always the number of lobes to the -1.

Pitch Diameter of Pins

Pitch diameter of the pins is measured at the center of the pins.

Pin Diameter

Addendum is the length of the tooth from the pitch diameter to the major diameter.

Eccentric Radius

Eccentric radius is the distance of the orbit of the driver to the center of the lobe part.

Thickness

Thickness is the length of the pins and the thickness of the lobe part.

Bore Diameter

Bore diameter defines the center hole of the lobe and pin part models.

r1 & r2

r1 and r2 are generating diameters used to create the center of the cycloidal path.

$$\text{Number of lobes} = r1/r2 = 12$$

$$r = d/2 = 5.00/2 = 2.50\text{in}$$

$$r1 = 12 \times r2$$

$$r1 = r - r2$$

$$r2 = r/13 = 0.1923\text{in}$$

$$r1 = 12 \times r2 = 2.3077\text{in}$$

Points per Lobe

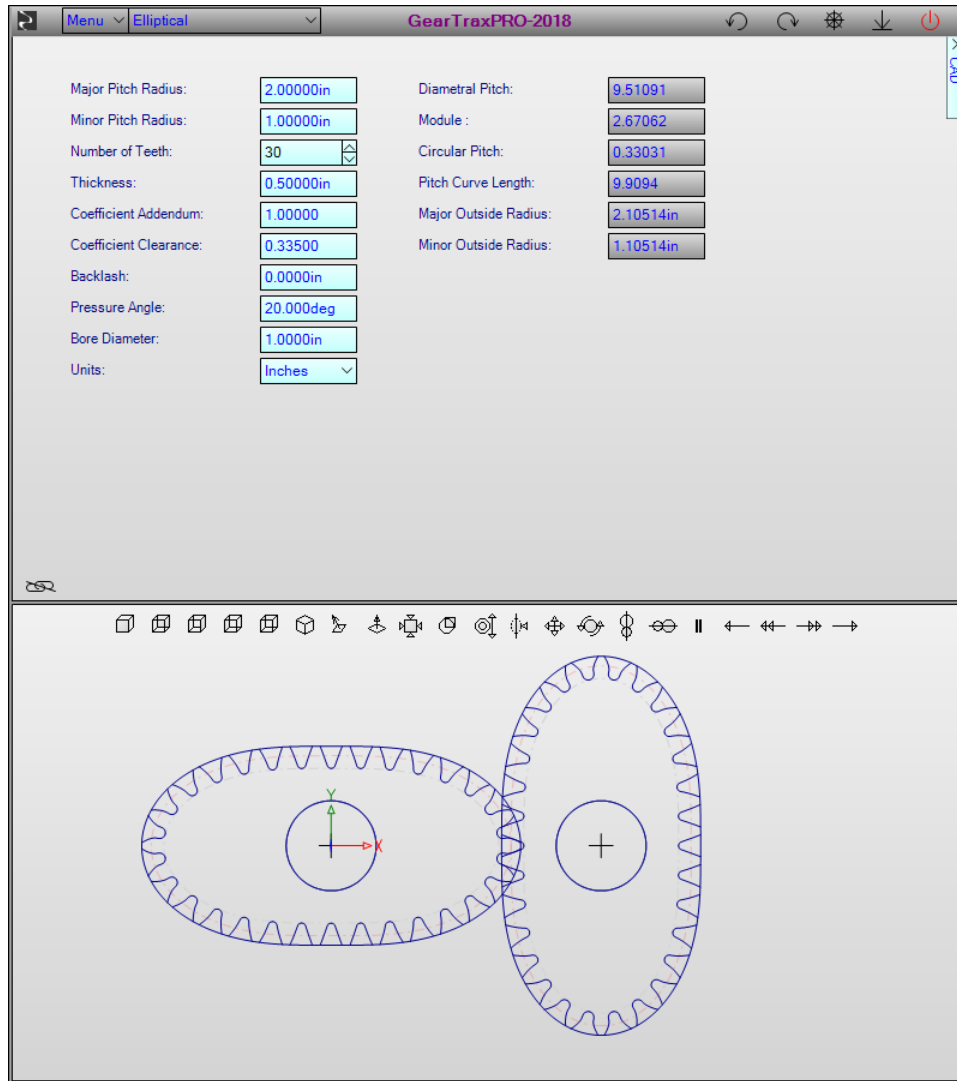
Points per lobe set the number of points to be used to create the CAD spline. Always inspect the cad model to assure there are enough points along the curve for a properly defined spline.

Units

Units sets the measurement units for the component; select Inches or Metric.

Elliptical

Elliptical gear sets are available starting with GearTrax-2017.



Each gear will be limited to 2 lobes and will be identical.

Major Pitch Radius

Radius from the center of the gear to the maximum pitch curve.

Minor Pitch Radius

Radius from the center of the gear to the minimum pitch curve.

Number of Teeth

The number of teeth in each gear.

Thickness

The thickness of the gear blank or face width.

Coefficient Addendum

The coefficient addendum is normally 1.0, 0.8 for a stub tooth standard.

The addendum height = coefficient addendum / diametral pitch.

Coefficient Clearance

The coefficient clearance defines the clearance between the tip of one gear and the root of its mate. A 10 DP gear with a 0.25 clearance coefficient would have a linear clearance of 0.025" (0.25/10).

Backlash

Backlash defines the total backlash for the gear set at the pitch curve, along the pitch curve. This is not a feeler gage type of measurement.

Pressure Angle

Pressure angle defines the tooth angle at the pitch point between a line normal to the tooth surface and a line tangent to the pitch curve. This angle is controlled by the generating rack.

Bore Diameter

Bore diameter defines the hole size at the center of the gear, if any.

Units

Select between Metric and Inches.

Hub Mounting (general)

Hubs can be added to each part by clicking on the Hub Mounting side button. Hub mounting is not available for splines. The hub mounting dialog may change slightly for each type of component.

	PINION	GEAR
Bore Diameter:	0.5000in	0.5000in
Bore Chamfer:	0.0000in	0.0000in
Hub Diameter 1st:	0.0000in	0.0000in
Hub Projection 1st:	0.0000in	0.0000in
Hub Chamfer 1st:	0.0000in	0.0000in
Hub Diameter 2nd:	0.0000in	0.0000in
Hub Projection 2nd:	0.0000in	0.0000in
Hub Chamfer 2nd:	0.0000in	0.0000in
Keyway:	0	0
Keyway Depth:	0.0000in	0.0000in
Keyway Width:	0.0000in	0.0000in
Keyway Position:	On Space Center	On Space Center
Bushing Side:	Bushing on 1st Side	Bushing on 1st Side
Taper Bushing Pinion:	None	
Taper Bushing Gear:	None	

Bore Diameter

Bore Diameter defines the diameter of the bore.

Bore Chamfer

Bore Chamfer defines the size of the chamfer at the ends of the bore.

Hub 1st Side Chamfer

Hub 1st Side Chamfer defines the size of the chamfer and fillet for the hub revolve on side one of the component.

Hub 1st Side Diameter

Hub 1st Side Diameter defines the size of the diameter of the hub revolve on side one of the component.

Hub 1st Side Projection

Hub 1st Side Projection defines the size of the projection of the hub revolve on side one of the component.

Hub 2nd Side Chamfer

Hub 2nd Side Chamfer defines the size of the chamfer and fillet for the hub revolve on side two of the component.

Hub 2nd Side Diameter

Hub 2nd Side Diameter defines the size of the diameter of the hub revolve on side two of the component.

Hub 2nd Side Projection

Hub 2nd Side Projections defines the size of the projection of the hub revolve on side two of the component.

Keyway

Keyway defines the type of keyway, if any, to be created with the component. A valid bore diameter must be specified.

Keyway Position

Keyway Position defines the keyway relative to the tooth; select On Tooth Center or On Space Center. If the component is part of a planetary set it should be left at the On Space Center option.

Bushing Side

Bushing Side defines on which side of the component the bushing will be mounted.

Split Taper Bushing

Mounting Split Taper Bushing defines, if any, the bushing to be used with the component.

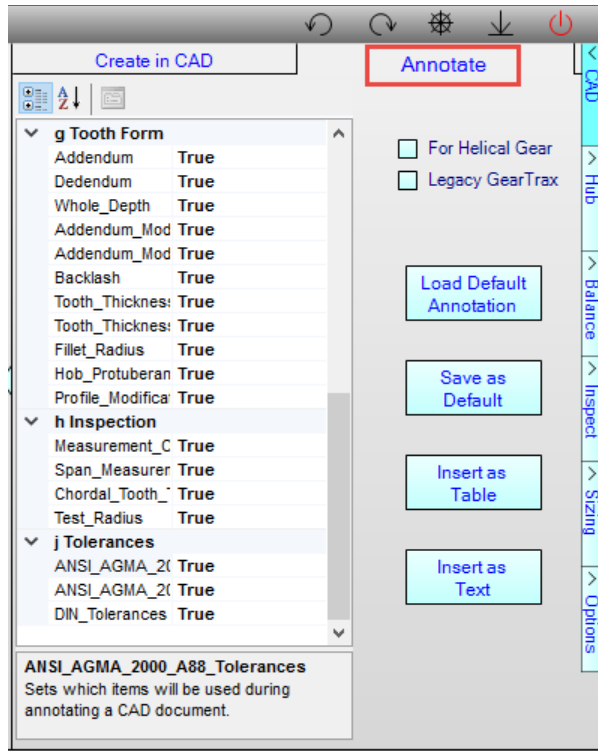
Standard Set Screw

Standard Set Screw check box defines if a standard set screw should be used with a keyway. The setscrew hole will only be created if a hub and keyway are also created.

Annotations



Annotations in the form of tables and text can be added to a CAD drawing document.



The Annotation window can be opened by clicking on the Annotation tab of the CAD expanded window. Set each of the properties to True items if you would like that item to be added to the table or text in the CAD drawing.

Insert as Table

Click on the Insert as Table button to have the table added to the CAD drawing document.

Insert as Text

Click on the Insert as Text button to have the text added to the CAD drawing document.

* Note to SolidWorks users:

- A view must be active in the drawing for the text or table to be added
- The parameters displayed in the text or table are derived from the Configuration Specific properties of the part document. If any of those values are change in the part file, the drawing will reflect those changes.

Tool Bars

Standard Views

**Front**

Clicking the Front tool bar button changes the view orientation to Front at the current view scale.

**Back**

Clicking the Back tool bar button changes the view orientation to Back at the current view scale.

**Left**

Clicking the Left tool bar button changes the view orientation to Left at the current view scale.

**Right**

Clicking the Right tool bar button changes the view orientation to Right at the current view scale.

**Top**

Clicking the Top tool bar button changes the view orientation to Top at the current view scale.

**Bottom**

Clicking the Bottom tool bar button changes the view orientation to Bottom at the current view scale.

**Isometric**

Clicking the Isometric tool bar button changes the view orientation to Isometric at the current view scale.

**Zoom Normal To Cutter**

Clicking the Normal To Cutter tool bar button changes the view orientation to normal to the cutter at the current view scale. When this button is active some of the other buttons are disabled until another button is selected or this button is deactivated.

**Zoom Normal To Transverse View**

Clicking the Zoom Normal To Transverse View tool bar changes the view orientation to the transverse orientation. When this button is active some of the other buttons are disabled until another button is selected or this button is deactivated.

View



Zoom to Fit

Clicking the Zoom to Fit tool bar button changes the current view orientation to fit inside of the window.



Zoom Area

Clicking the Zoom Area tool bar button allows the user to draw a box over an area to be displayed at full screen.



Zoom In Out

Clicking the Zoom In Out tool bar button allows the user to use the mouse left button to zoom in or out by dragging the cursor on the screen. Dragging the cursor vertically up increases the scale of the display. Dragging the cursor down decreases the scale of the display. The amount of change can be increased by dragging from the upper left hand corner to the lower right hand corner. Conversely, the change can be decreased by dragging from the upper right hand corner to the lower left hand corner.



Rotate the View

Clicking the Rotate the View tool bar button allows the user to rotate the view by using either the mouse left or middle buttons to drag the cursor on the screen.



Pan

Clicking the Pan tool bar button allows the user to move the view by using either the mouse left or middle buttons to drag the cursor on the screen.



Drive

Clicking the Drive tool bar button allows the user to drive the components by using the mouse left button to drag the cursor on the screen.

Vertical Orientation

Clicking the Vertical Orientation tool bar button will position the pinion vertically above the gear.



Horizontal Orientation

Clicking the Horizontal Orientation tool bar button will position the pinion horizontally to the left the gear. This is the default setting.

Simulation



Stop

Clicking the Stop tool bar button will stop a running simulation.



Back

Clicking the Back tool bar button will drive the components back one spin increment. Set the spin increment in the options menu.



Play

Clicking the Play tool bar button will drive the components for a short simulation.



Play Reverse

Clicking the Play Reverse tool bar button will drive the components in the opposite direction for a short simulation.



Forward

Clicking the Forward tool bar button will drive the components forward one spin increment. Set the spin increment in the options menu.

Mouse controls

Mouse wheel

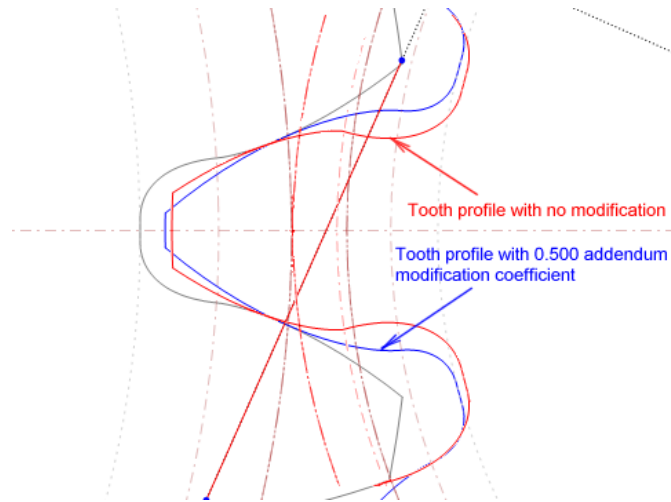
Wheel up and down scales the view of the components. All scaling is done from the center of the screen, not the mouse position. Pan the geometry to the center of the screen then use the mouse wheel to enlarge or reduce the view scale. The direction of the mouse wheel is controllable by a setting in the Options menu.

Middle Mouse Button (wheel)

Drag the view with the middle button held down. The wheel can be rotated at the same time to zoom the view.

Addendum Modification and Addendum Modification Coefficient.

With the pinion gear normally having fewer teeth than its mating gear, it has a disadvantage of being the weaker of the two components. To compensate for this inherent weakness, the addendum of the pinion can be made stronger by increasing its tooth thickness. The pinion's mating gear is normally adjusted to compensate, thereby making the gear's tooth thinner. The process that controls this adjustment also varies the length of the addendum and dedendum. If the pinion's mating gear does not compensate for this adjustment then the center distance of the pair will be enlarged or reduced. Under certain circumstances, this can be used to the designer's advantage.



It is recommended that the designer think in the terms of the coefficient rather than the simpler length adjustment. Once the designer is accustomed to thinking in terms of the coefficient, then the size of the diametral pitch (or Module) does not need to be considered. For example, a 0.25 addendum modification coefficient will affect a 12 diametral pitch gear the same way it will affect a 24 diametral pitch gear, proportionally for the size of diametral pitch. The simpler addendum modification is a derivative of the diametral pitch (or module) and the coefficient.

Tutorials

Instructional Videos

Instructional videos can be found on the Camnetics web site:

<http://www.camnetics.com/media.htm>

Creating Parts and Assemblies in CAD



Creating parts and assemblies in CAD is easy:

On tabs with only one part, clicking the Create Model in CAD will create a new model in CAD without any prompts.

On tabs with two parts the options are to create:

- Assembly and both models
- Both models
- Either of the two models
- In some case, the tooth profile can be added to an open sketch in CAD

When creating assemblies the part files must be saved. GearTrax always uses the same name for each of the different parts. It is required that if the parts were previously created in CAD they need to be closed. The part files will be overwritten when the new parts are created. It is highly recommended to save those CAD files right away with new names if they are to be preserved.

Inserting tooth cut entities into a open sketch in CAD



The tooth cut entities of following components can be created in an open sketch in CAD:

- Spur pinion
- Spur gear
- Chain sprocket
- Internal spline
- External spline

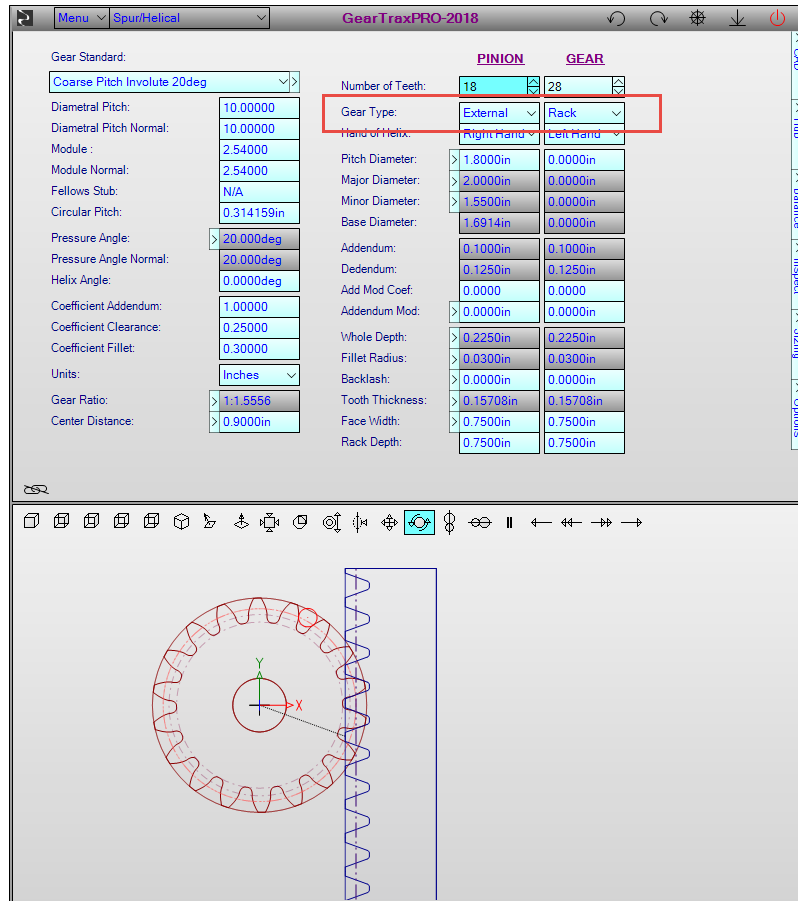
To create only the tooth cut entities select the appropriate option in the Create in CAD drop down box. Then click the create button.

Rack and Pinion

Creating a rack and pinion set in GearTrax is easy:

For the Gear, Gear Type select Rack.

Set all the other required parameters like diametral pitch and number of teeth.



Internal Gear Set

Creating an internal gear set in GearTrax is easy:

For the Gear, Gear Type select Internal.

Set all the other required parameters like diametral pitch and number of teeth.

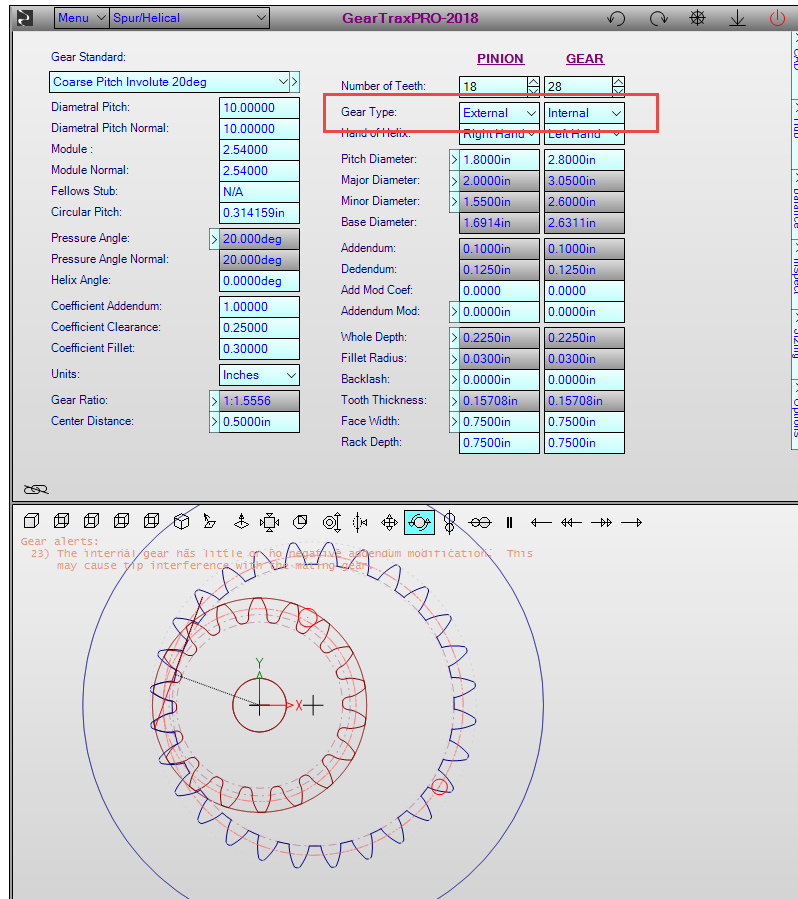


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

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


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