PRODUCT APPLICATION NOTE

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Design Flex™ Pro™

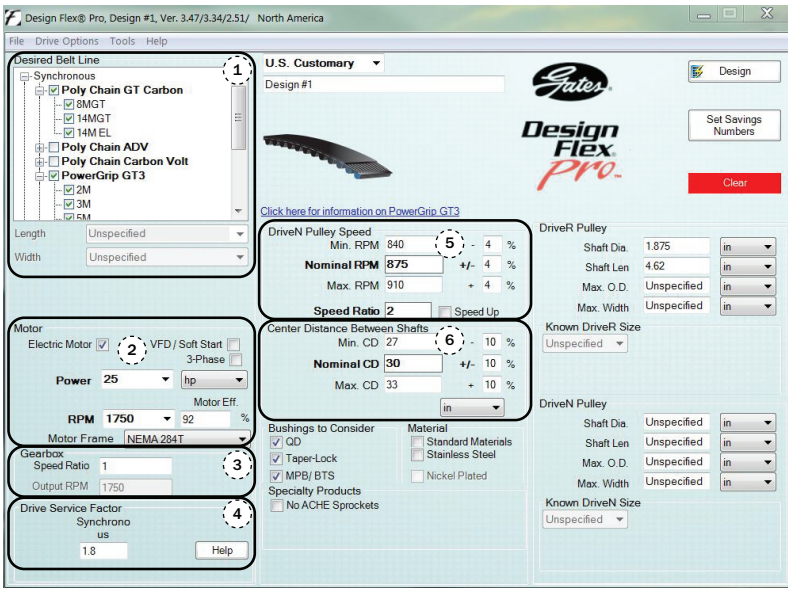
Design Flex Pro is a belt drive selection tool for design engineers, maintenance engineers, and power transmission distributors. In addition to designing belt drives, Design Flex Pro may be used to:

- Determine proper belt installation tension
- Calculate belt pull
- Determine the rated belt capacity
- Estimate the energy savings of a synchronous belt drive compared to a V-belt drive
- Estimate the cost saving of replacing roller chain with a Poly Chain® GT™ Carbon™ belt drive
- Compare Gates synchronous belt drives noise levels

The features of Design Flex Pro are explored in detail below. Miscellaneous user tips are also provided.

New Drive Design

When designing a belt drive, some program fields are optional. The screen shot below shows the information required for Design Flex Pro to select a belt drive. Note that required input fields are bolded in the program for easy identification, but additional information and modifications may be needed.



Required Information for Drive Design:

1. Desired belt type(s)
2. Motor power/torque and rpm
3. Gearbox information (only if belt drive will be located on the output shaft of a gearbox)
4. Service factor
5. Desired DriveN pulley rpm or speed ratio
6. Center distance between shafts

User Tips for Drive Design:

- **Electric Motor Box:** When selected, this specifies the minimum pulley diameter for most general-purpose electric motors. The minimum diameter is used to limit the motor shaft and bearing loads.
- **Motor Frame Size Dropdown:** When a standard frame size is selected, the program will automatically fill in shaft diameter and length for the motor.
- **Drive Service Factor Help Button:** This assists in assigning a service factor based on drive characteristics and the hours of service per day.
- **Driven Pulley Speed Options:** This allows the user to select either rpm or speed ratio. There is also an option to use a tolerance on a specific rpm or to assign an rpm range.
- **Center Distance Between Shafts:** This is used to set nominal values with a tolerance or a range for the shaft center distance.
- **Motor Efficiency:** This value is used as part of the energy saving calculations of a synchronous belt drive compared to a V-belt drive.
- **Single Belts and PowerBand™ Boxes:** Design Flex™ Pro™ will find solutions using the checked boxes, including Singles and PowerBands (joined V–belts).
- **Additional Constraints:** Optional fields may be used to specify maximum dimensions for guard clearance, bushing styles, material choices, and air-cooled heat exchanger applications.

Known Drives

Existing belt drives can be analyzed in the program. This option can be used to confirm the load capacity, belt pull values, or belt installation tension values of an existing belt drive.

User Tips for Known Drives:

- DriveN speed can be defined using a speed ratio, rpm, or both pulley diameters.
- DriveR rpm, DriveN rpm, and DriveR pulley diameter define the DriveN pulley diameter.
- Center distance and pulley diameters define the belt length.
- Belt length and pulley diameters define the center distance.

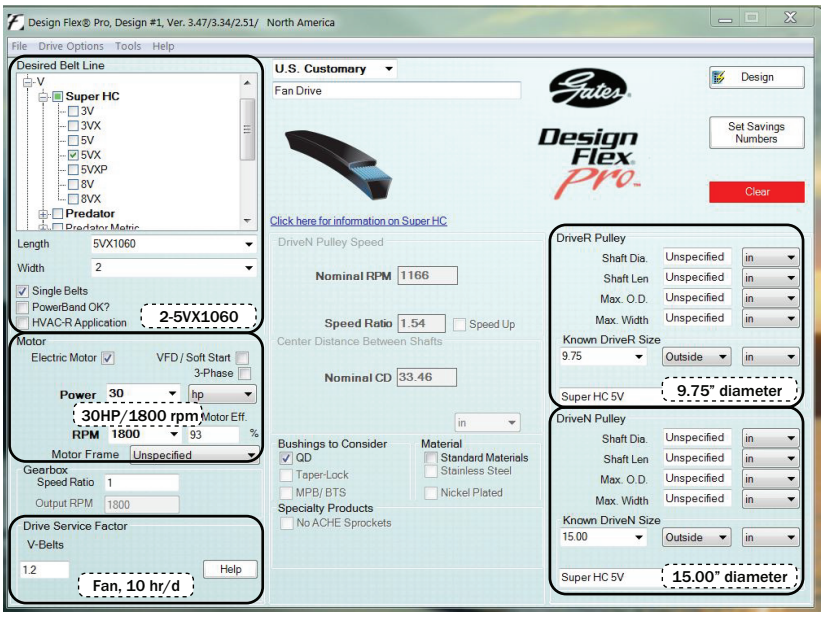
The screen shot to the right shows the following known drive:

Belt: Super HC™ 2-5VX1060

DriveR: 30 hp, 1800 rpm, 9.75” diameter

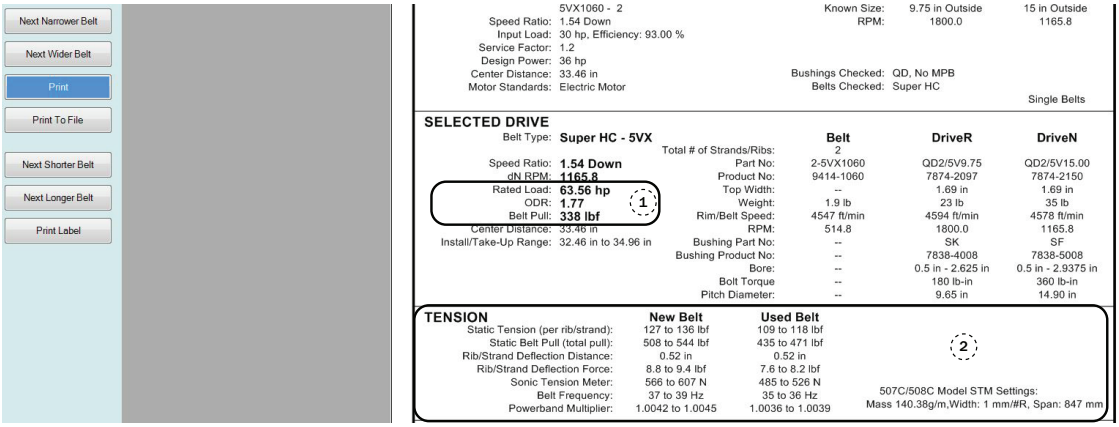
DriveN: 15.00” diameter

Service Factor: Fan operating 10 hours/day, 5 days/week



Known Drives (continued):

A section of the Drive Detail Screen for this known drive is shown below.



Data from the Drive Detail Screen allows the user to:

1. Determine if an existing drive has adequate capacity and view the calculated dynamic belt pull
2. View the recommended installation tension for the force deflection method and for the Gates Sonic Tension Meter.

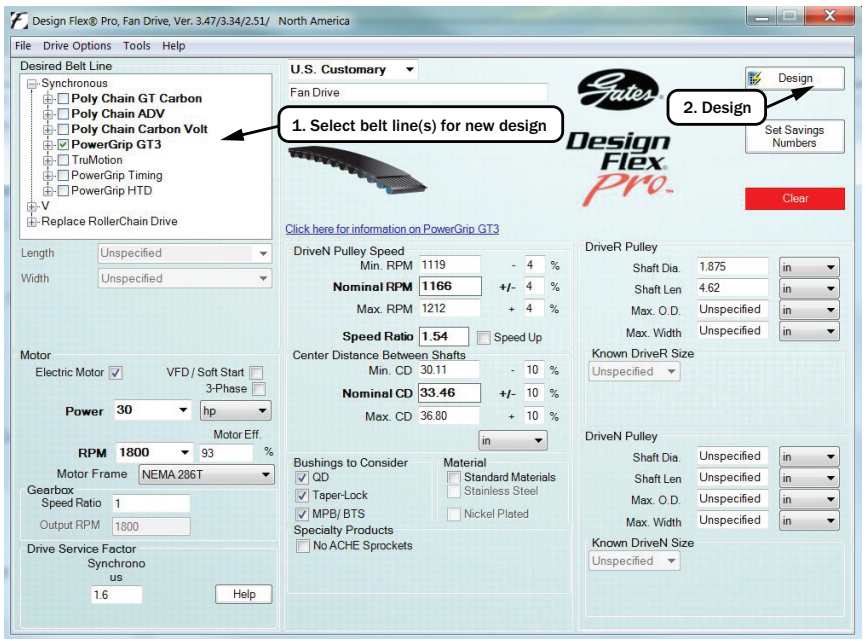
User Tip for Known Drives/Drive Detail Screen:

Design Flex™ Pro™ defaults to the belt width required to transmit the load, which may be narrower or wider than the known belt width. The Entered Drive tab will allow the user to switch to the report for the specified drive. Belt widths can also be adjusted using the "next narrower belt" and "next wider belt" buttons to the left of the detail report screen. See screen shot above for location.

Designing a New Drive Based on a Known Drive

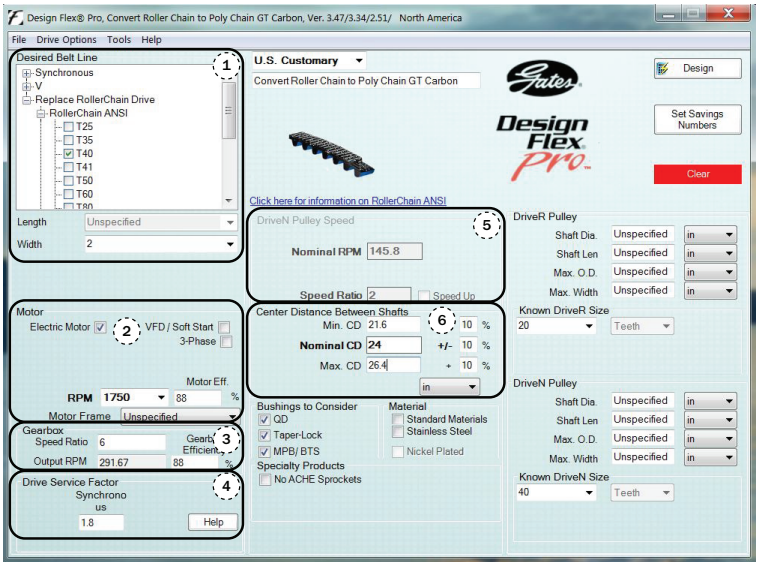
Once a known drive is entered, a new drive can be designed without adding any additional parameters by using the following steps:

1. Uncheck the selected belt and select the new belt lines(s) to use in the design
2. Perform a new design analysis by selecting the Design button



Designing Based on an Existing Roller Chain Drive

A Poly Chain® GT™ belt drive may also be designed using the parameters of an existing roller chain drive.

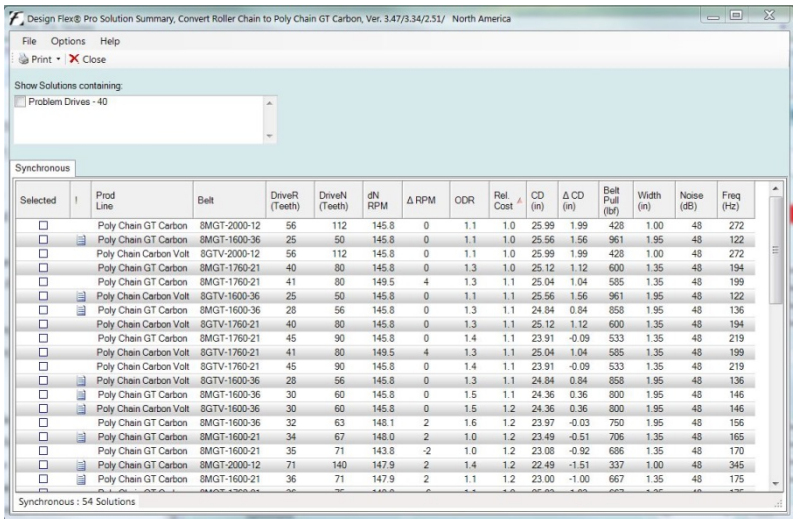


Required Roller Chain Information:

1. Roller Chain size (pitch and number of strands)
2. Motor RPM
3. Gearbox ratio (if belt drive will be located on the output shaft of a gearbox)
4. Drive service factor
5. DriveN RPM (defined by entering the number of teeth on the DriveR and DriveN chain sprockets)
6. Center distance between shafts

Multiple Drive Solutions

When designing a drive, it is common for multiple solutions to appear in the Solution Summary screen (an example screen shot is shown below).



Selected	!	Prod Line	Belt	DriveR (Teeth)	DriveN (Teeth)	dN RPM	Δ RPM	ODR	Rel. Cost	CD (in)	Δ CD (in)	Belt Pull (lbf)	Width (in)	Noise (dB)	Freq (Hz)
☐		Poly Chain GT Carbon	8MGT-2000-12	56	112	145.8	0	1.1	1.0	25.99	1.99	428	1.00	48	272
☐		Poly Chain GT Carbon	8MGT-1600-36	25	50	145.8	0	1.1	1.0	25.56	1.56	961	1.95	48	122
☐		Poly Chain Carbon Volt	8GTV-2000-12	56	112	145.8	0	1.1	1.0	25.99	1.99	428	1.00	48	272
☐		Poly Chain GT Carbon	8MGT-1760-21	40	80	145.8	0	1.3	1.0	25.12	1.12	600	1.35	48	194
☐		Poly Chain GT Carbon	8MGT-1760-21	41	80	149.5	4	1.3	1.1	25.04	1.04	585	1.35	48	199
☐		Poly Chain Carbon Volt	8GTV-1600-36	25	50	145.8	0	1.1	1.1	25.56	1.56	961	1.95	48	122
☐		Poly Chain GT Carbon	8MGT-1600-36	28	56	145.8	0	1.3	1.1	24.84	0.84	858	1.95	48	136
☐		Poly Chain Carbon Volt	8GTV-1760-21	40	80	145.8	0	1.3	1.1	25.12	1.12	600	1.35	48	194
☐		Poly Chain GT Carbon	8MGT-1760-21	45	90	145.8	0	1.4	1.1	23.91	-0.09	533	1.35	48	219
☐		Poly Chain Carbon Volt	8GTV-1760-21	41	80	149.5	4	1.3	1.1	25.04	1.04	585	1.35	48	199
☐		Poly Chain Carbon Volt	8GTV-1760-21	45	90	145.8	0	1.4	1.1	23.91	-0.09	533	1.35	48	219
☐		Poly Chain Carbon Volt	8GTV-1600-36	28	56	145.8	0	1.3	1.1	24.84	0.84	858	1.95	48	136
☐		Poly Chain GT Carbon	8MGT-1600-36	30	60	145.8	0	1.5	1.1	24.36	0.36	800	1.95	48	146
☐		Poly Chain Carbon Volt	8GTV-1600-36	30	60	145.8	0	1.5	1.2	24.36	0.36	800	1.95	48	146
☐		Poly Chain GT Carbon	8MGT-1600-36	32	63	148.1	2	1.6	1.2	23.97	-0.03	750	1.95	48	156
☐		Poly Chain GT Carbon	8MGT-1600-21	34	67	148.0	2	1.0	1.2	23.49	-0.51	706	1.35	48	165
☐		Poly Chain GT Carbon	8MGT-1600-21	35	71	143.8	-2	1.0	1.2	23.08	-0.92	686	1.35	48	170
☐		Poly Chain GT Carbon	8MGT-2000-12	71	140	147.9	2	1.4	1.2	22.49	-1.51	337	1.00	48	345
☐		Poly Chain GT Carbon	8MGT-1600-21	36	71	147.9	2	1.1	1.2	23.00	-1.00	667	1.35	48	175

User Tips for Multiple Drive Solutions

- **Sort Criteria:** Drive solutions may be sorted to help the designer find an optimum solution. Sort Criteria includes relative cost (default sort criteria), product line, belt size, pulley size, DriveN rpm, over design ratio, center distance, belt pull, pulley top width, and noise (synchronous drives only).

- **! (Notes):** Position the cursor in the note column to display any notes associated with the drive.
- **Problem Drives:** If selected, this includes drive options which may have critical notes. Problem drive options are highlighted in yellow.
- **Print:** Print All will print a report in similar format to the Solution Summary screen; an "X" placed in the Selected column next to desired drive(s) and selecting Print - Selected Drives prints only the selected drive(s).
- **File - Save:** Enables the user to save drive information; saved drives can be retrieved using the File - Open option form the main design screen.
- **Double Click on a Solution:** Opens the Drive Detail screen for the particular option.

Estimate Savings:

Set Savings Numbers - Energy Savings: When the Electric Motor feature is enabled for a synchronous drive design; energy savings are calculated and displayed on the detailed drive printout. This is the projected energy savings for using a synchronous belt drive rather than a V-belt drive. The hours per year are set when the service factor is selected. The energy cost may be added using the Set Savings Numbers button. Energy cost is not required (the savings are displayed in Kwh/year savings rather than a dollar amount when the energy cost is not specified).

Set Savings Numbers - Roller Chain: This allows the user to input the maintenance cost per year for labor and lost production for a roller chain drive. The estimated cost savings by switching to a Poly Chain® belt drive are calculated and displayed on the detailed drive printout.

Drive Detail Report Screen:

Next Shorter and Longer Belt: Modifies the detail report to reflect belt lengths in addition to the length selected by Design Flex™ Pro™. The drive may not meet the original center distance or capacity requirements.

Next Wider and Narrower Belt: Modifies the detail report for widths other than that which Design Flex Pro selected. The alternative drives will have less or more than the requested capacity.

Print to File: Saves Drive Detail Reports or Solution Summaries in PDF format.

Drive Comparison: Multiple drive detail report screens may be open at one time for the user to compare information between various drives.

Notes: Many drives may have "notes" associated with them. These notes are located at the bottom of a printed drive detail report. Notes for a drive may also be viewed by hovering over a drive in the Solution Summary view. Contact Gates Power Transmission Product Application at 303.744.5800 or ptpasupport@gates.com for questions regarding drive notes.