



PRODUCT APPLICATION NOTES

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Design Flex[®] Pro[™]

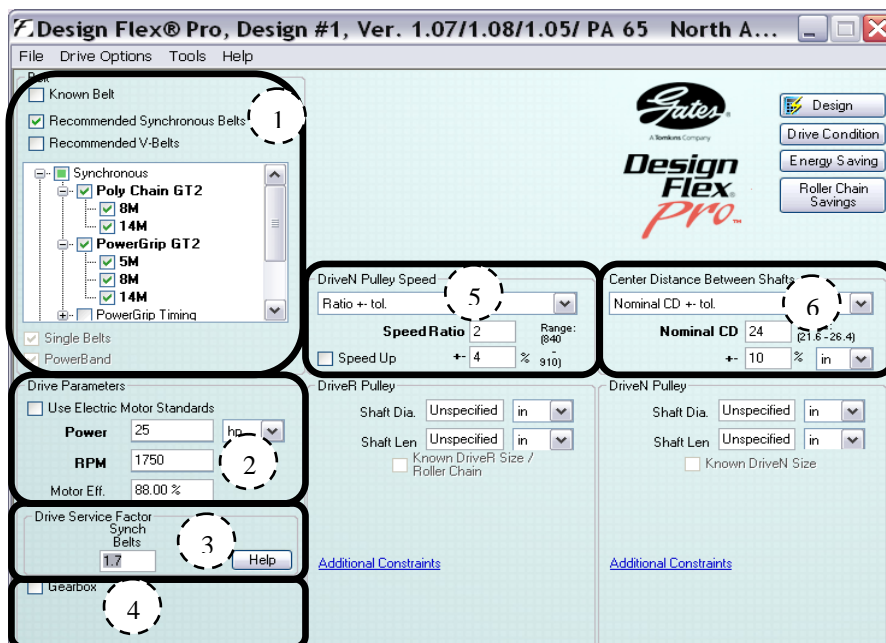
Design Flex[®] Pro[™] is a belt drive selection tool for design engineers, maintenance engineers, and power transmission distributors. In addition to designing belt drives, Design Flex[®] Pro[™] may be used to:

- Determine proper belt installation tension
- Calculate belt pull
- Determine the belt horsepower 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[®] belt drive
- Compare noise levels of various Gates synchronous belt drives

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 information is optional. The screen shot below shows the information required for Design Flex[®] Pro[™] to select a belt drive.



Required Information for Drive Design:

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

User Tips for Drive Design:

- **Use Electric Motor Standards Box:** When selected, this specifies the minimum pulley diameter for general-purpose electric motors. The minimum diameter is used to limit the motor shaft and bearing loads.
- **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 Dropdown Menu:** 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 Dropdown Menu:** 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 in the belt box, including Singles and PowerBands.
- **Additional Constraints Links:** These links can be used to specify maximum dimensions for guard clearance, bushing styles, material choices, and air-cooled heat exchanger applications.

Known Drives

The known V-belt and Synchronous option is available by selecting the **Known Belt** box when a new drive design is started. 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:

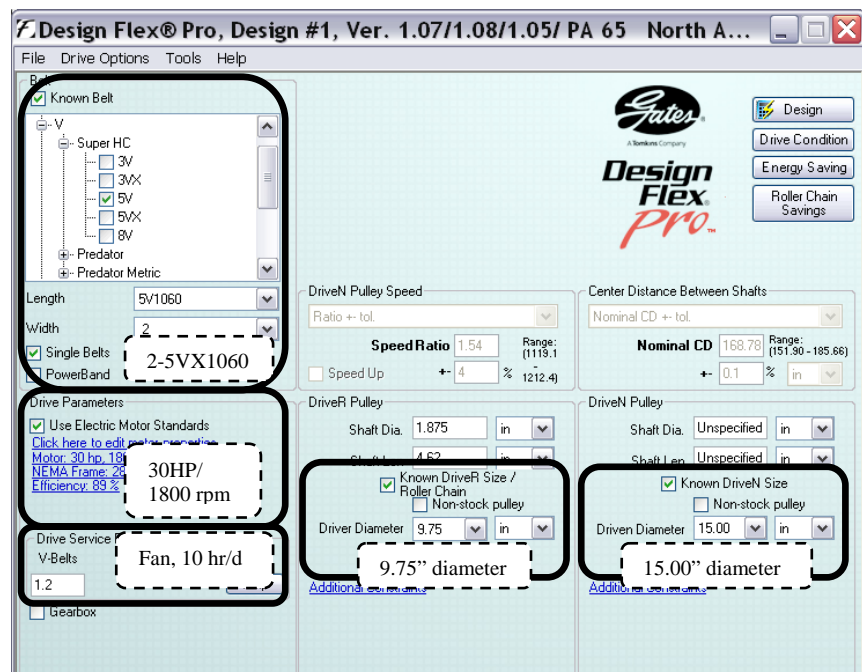
- In a known drive, the DriveN speed can be defined using a speed ratio, rpm, or both pulley diameters.
- A known DriveR rpm, DriveN rpm, and DriveR pulley diameter define the DriveN pulley diameter.
- A known center distance and pulley diameters define the belt length.
- A known belt length and pulley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

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

Belt: Gates Super HC[®]
2-5V1060

DriveR: 30 Hp, 1800 rpm,
9.75" pulley

DriveN: 15" pulley
Fan operating 10 hours/day,
5 days/week, 50 weeks/year



Known Drives (continued):

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

INPUT		Drive Information		DriveR	DriveN
Next Wider Belt		Known Belt: Super HC - 5V		Known Size: 9.75 in Datum	15.00 in Datum
Entered Drive		Speed Ratio: 1.54 Down		RPM: 1800.0	1165.8
↑ Entered Drive		Motor Power: 30 hp		Shaft Diameter: 1.875 in	Unspecified
		Service Factor: 1.2		Bushings Checked: Any	
		Design Power: 36 hp		Belts Checked: Super HC	
		Center Distance: 33.46 in			
		Motor Standards: NEMA Electric Motor, 286T frame			
SELECTED DRIVE	Belt Type: Super HC - 5V		Part No: 2-5V1060	DriveR	DriveN
	Speed Ratio: 1.54 Down		Product No: 9334-1060	QD2/SV9.75	QD2/SV15.00
	Rated Power: 53.37 hp		Top Width: --	7874-2097	7874-2150
	Belt Pull: 337.6 lb		Installed Weight: 2.4 lb	22.5 lb	34.6 lb
	Center Distance: 33.46 in		Rim/Belt Speed: 4547 ft/min	4594 ft/min	4578 ft/min
	Install/Take-Up Range: 32.46 in to 34.96 in		RPM: 514.8	1800.0	1165.8
			Bushing Part No: --	SK 1.718	SF
			Bushing Product No: --	7838-4114	
			Bore: --	0.5 in - 2.625 in	0.5 in - 2.9375 in
			Pitch Diameter: --	9.65 in	14.90 in
TENSION	New Belt		Used Belt		
	Static Tension (Per rib/strand): 142.4 lb to 152.5 lb		122.0 lb to 132.2 lb		
	Rib/Strand Deflection Distance: 0.5 in		0.5 in		
	Rib/Strand Deflection Force: 9.6 lb to 10.2 lb		8.3 lb to 8.9 lb		
	Sonic Tension Meter: 633to678 N		543to588 N		
	Belt Frequency: 33to34 Hz		31to32 Hz		
	505C/507C Model STM Settings: Weight: 200 g/m, Width: 1 mm/WR, Span: 847 mm				
Powerband Multiplier: 1.0075 to 1.0090		1.0064 to 1.0070			

Data from the Drive Detail Screen allows the user to:

1. Determine if an existing drive has adequate capacity and view the calculated 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** button on the left side of the detail screen will change the width to the width entered on the input screen. See the above screen shot for the 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 “known drive” box
2. Select the belt line(s) to use in the new design
3. Perform a new design analysis by selecting the **Design** button

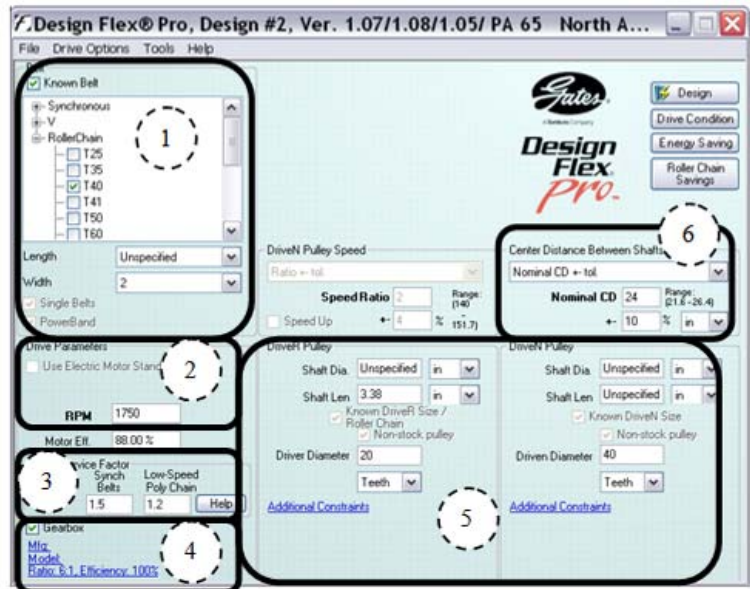
The screenshot shows the 'Design Flex Pro' software interface. The 'Drive Options' dialog box is open, and the 'Belt' section is visible. The 'Known Belt' checkbox is unchecked, and the 'Design' button is highlighted. Callouts indicate the steps: 1. Make belt unknown, 2. Select belt line(s) for new design, and 3. Design.

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. Drive service factor
4. Gearbox ratio (if belt drive will be located on the output shaft of a gearbox)
5. 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 (as 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)	E
<input type="checkbox"/>	PowerGrip GT2	2310-14MGT-40	36	56	1,157.1	-9	1.6	1.5	32.75	-0.71	
<input type="checkbox"/>	PowerGrip GT2	2310-14MGT-40	37	56	1,189.3	24	1.6	1.5	32.61	-0.84	
<input type="checkbox"/>	PowerGrip GT2	2450-14MGT-40	38	60	1,140.0	-26	1.7	1.7	34.67	1.21	
<input type="checkbox"/>	PowerGrip GT2	2450-14MGT-40	39	60	1,170.0	4	1.7	1.7	34.54	1.08	
<input type="checkbox"/>	PowerGrip GT2	2450-14MGT-40	40	60	1,200.0	34	1.8	1.8	34.40	0.95	
<input type="checkbox"/>	PowerGrip GT2	2450-14MGT-40	40	64	1,125.0	-41	1.8	1.9	33.83	0.37	
<input type="checkbox"/>	PowerGrip GT2	2450-14MGT-40	42	64	1,181.3	15	1.9	1.9	33.57	0.11	
<input type="checkbox"/>	PowerGrip GT2	2450-14MGT-40	44	68	1,164.7	-1	2.0	1.9	32.73	-0.73	
<input type="checkbox"/>	PowerGrip GT2	2590-14MGT-40	46	72	1,150.0	-16	2.1	2.0	34.65	1.19	
<input type="checkbox"/>	PowerGrip GT2	2590-14MGT-40	48	72	1,200.0	34	2.2	2.0	34.38	0.93	
<input type="checkbox"/>	PowerGrip GT2	2590-14MGT-40	50	80	1,125.0	-41	2.3	2.0	32.97	-0.49	

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 from the main design screen.
- **Double Click on a Solution:** Opens the Drive Detail screen for the particular option.

Miscellaneous Tips

- **Energy Savings:** When the **Use NEMA Minimum Diameter** 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 **Energy Saving 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).
- **Roller Chain Savings:** 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:**
 - **Shorter Belt 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.
 - **Narrower Belt and Wider Belt:** Modifies the detail report for widths other than that which Design Flex[®] Pro[™] has selected. The alternate 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. Contact Gates Power Transmission Product Application for questions regarding drive notes.

