



# PRODUCT APPLICATION NOTE

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## Design Flex™ Pro™ Drive Detail Report

This PA Note revises Vol. 56, No. 8 dated December 2015. Design Flex Pro is a free drive design program provided by Gates. Design Flex Pro Drive Detail Reports contain a great deal of information about specific belt drive systems. The purpose of this PA Note is to describe the engineering information included in Drive Detail Reports. The figure below is an actual Drive Detail Report generated by Gates Design Flex Pro drive design software.

Designed For:		Provided By:	
Application: <b>Design #1</b>		PAE Training Gates Corporation PTPASUPPORT@GATES.COM 1.303.744.5800 Phone	
<b>INPUT</b>			
<b>Drive Information</b>		<b>DriveR</b>	<b>DriveN</b>
Speed Ratio: 2.00 Down		RPM: 1750.0	875.0 +/-4%
Input Load: 10 hp, Efficiency: 88.00 %		Shaft Diameter: 1.375 in	1.5 in
Service Factor: 1.8		Bushings Checked: Any	
Design Power: 18 hp		Belts Checked: Poly Chain GT Carbon	
Center Distance: 24 in +/-10%			
Motor Standards: NEMA Electric Motor, NEMA 215T frame			
<b>SELECTED DRIVE</b>			
Belt Type: <b>Poly Chain GT Carbon - 8MGT</b>	<b>Belt</b>	<b>DriveR</b>	<b>DriveN</b>
Speed Ratio: <b>2.00 Down</b>	Part No: 8MGT-1760-12	8MX-40S-12	8MX-80S-12
dN RPM: <b>875.0</b>	Product No: 9274-0220	7718-1040	7718-1080
Rated Load: <b>28.18 hp</b>	Top Width: --	1.00 in	1.00 in
ODR: <b>1.57</b>	Weight: 0.22 lb	1.7 lb	5.8 lb
Belt Pull: <b>231 lbf</b>	Rim/Belt Speed: 1837 ft/min	1808 ft/min	1823 ft/min
Center Distance: 25.12 in	RPM: 318.2	1750.0	875.0
Install/Take-Up Range: 23.71 in to 25.16 in	Bushing Part No: --	2012 1 3/8	2012 1 1/2
Noise: 72 dB @ 1167 Hz	Bushing Product No: --	7858-2606	7858-2608
	Bore: --	1.375 in	1.5 in
	Bolt Torque: --	280 lb-in	280 lb-in
	Pitch Diameter: --	4.01 in	8.02 in
Savings: The three year savings can be up to 10989 KWh			
<b>TENSION</b>			
	<b>New Belt</b>	<b>Used Belt</b>	
Static Tension (per rib/strand):	121 to 132 lbf	88 to 99 lbf	When planning to re-install used belts, measure and record the tension before removing and re-install at the recorded tension.
Static Belt Pull (total pull):	241 to 263 lbf	175 to 197 lbf	
Rib/Strand Deflection Distance:	0.39 in	0.39 in	
Rib/Strand Deflection Force:	9.0 to 9.7 lbf	6.9 to 7.6 lbf	
Sonic Tension Meter:	537 to 586 N	391 to 439 N	
Belt Frequency:	77 to 80 Hz	65 to 69 Hz	
507C/508C Model STM Settings: Mass 4.7g/m, Width: 12 mm/#R, Span: 636 mm			
<b>NOTES</b>			
- Yearly Usage: 24 Hrs / Day, 7 Days / Wk, 50 Wks / Yr			
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Examples of individual Drive Detail Report sections with explanations follow.

## Input Section

INPUT		Drive Information	DriveR	DriveN
Speed Ratio:	2.00 Down		RPM: 1750.0	875.0 +/-4%
Input Load:	10 hp, Efficiency: 88.00 %			
Service Factor:	1.8		Shaft Diameter: 1.375 in	1.5 in
Design Power:	18 hp			
Center Distance:	24 in +/-10%		Bushings Checked: Any	
Motor Standards:	NEMA Electric Motor, NEMA 215T frame		Belts Checked: Poly Chain GT Carbon	

**Speed Ratio:** Desired change in speed expressed as a ratio of the larger diameter pulley to the smaller diameter pulley. The term “Up” is used when the DriveN speed is faster than the input speed, and the term “Down” is used when the DriveN speed is slower than the input speed.

**Input Load:** Name plate load rating or load capacity of the prime mover or power source.

**Service Factor:** Multiplier used to account for drive design characteristics such as daily run time, shock or impulse loading, and motor starting characteristics.

**Design Power:** Input load multiplied by the Service Factor. Design Flex Pro uses Design Power to size belt drive systems.

**Center Distance:** Minimum and maximum distance between the centers of the DriveR and DriveN shafts.

**RPM:** Rotational speed of the DriveR shaft, and the desired rotational speed of the DriveN shaft.

**Bushings Checked:** Indicates specific user selected bushing family types. The default is “Any”.

**Belts Checked:** Indicates specific user selected belt types for Design Flex Pro to use in the drive selection process.

## Selected Drive Section

SELECTED DRIVE		Belt	DriveR	DriveN
Belt Type:	<b>Poly Chain GT Carbon - 8MGT</b>	Part No: 8MGT-1760-12	8MX-40S-12	8MX-80S-12
Speed Ratio:	<b>2.00 Down</b>	Product No: 9274-0220	7718-1040	7718-1080
dN RPM:	<b>875.0</b>	Top Width: --	1.00 in	1.00 in
Rated Load:	<b>28.18 hp</b>	Weight: 0.22 lb	1.7 lb	5.8 lb
ODR:	<b>1.57</b>	Rim/Belt Speed: 1837 ft/min	1808 ft/min	1823 ft/min
Belt Pull:	<b>231 lbf</b>	RPM: 318.2	1750.0	875.0
Center Distance:	25.12 in	Bushing Part No: --	2012 1 3/8	2012 1 1/2
Install/Take-Up Range:	23.71 in to 25.16 in	Bushing Product No: --	7858-2606	7858-2608
		Bore: --	1.375 in	1.5 in
Noise:	72 dB @ 1167 Hz	Bolt Torque: --	280 lb-in	280 lb-in
		Pitch Diameter: --	4.01 in	8.02 in
Savings:	The three year savings can be up to 10989 KWh			

**Speed Ratio:** Calculated speed change expressed as a ratio of the selected larger diameter pulley to the selected smaller diameter pulley.

**dN RPM:** Calculated rotational speed of the selected DriveN shaft, based on the drive speed ratio and input rotational speed.

**Rated Load:** The rated load capacity of the selected drive.

**ODR:** Over Design Ratio, which is the ratio of Rated Load compared to Design Power.

**Belt Pull (Dynamic):** The vector sum of tight and slack side belt span tensions based on input load (not design load). It represents the estimated magnitude of dynamic pull that belt drives exert on shafts while transmitting input loads. The Belt Pull calculation assumes belts are pre-

tensioned to the ideal level, which assumes a dynamic tension ratio of 5:1 for V-belt drives and 8:1 for synchronous belt drives. Belt pull is not equivalent to shaft load, as shaft load includes the added contribution of pulley weight.

**Center Distance:** Calculated distance between shaft centers of the selected drive, using nominal pulley and belt dimensions.

**Install/Take-up Range:** Calculated distance between shaft centers of the selected drive including recommended allowances for belt installation and take-up.

**Noise:** Crude indication of possible drive noise level of the selected drive. Value is intended to be compared with other Gates drive alternatives, and not used as an absolute noise estimate. Values are calculated for synchronous drive systems only.

### Tension Section

<b>TENSION</b>	<b>New Belt</b>	<b>Used Belt</b>	
Static Tension (per rib/strand):	121 to 132 lbf	88 to 99 lbf	When planning to re-install used belts, measure and record the tension before removing and re-install at the recorded tension.
Static Belt Pull (total pull):	241 to 263 lbf	175 to 197 lbf	
Rib/Strand Deflection Distance:	0.39 in	0.39 in	
Rib/Strand Deflection Force:	9.0 to 9.7 lbf	6.9 to 7.6 lbf	
Sonic Tension Meter:	537 to 586 N	391 to 439 N	
Belt Frequency:	77 to 80 Hz	65 to 69 Hz	
			507C/508C Model STM Settings: Mass 4.7g/m, Width: 12 mm/#R, Span: 636 mm

**Static Tension (per rib/strand):** Magnitude of tension imposed in the belt with the drive in a static state after belt installation. Static tension is based on input horsepower, pulley diameter, rotational speed, and belt mass for a synchronous belt. Static tension for V-belts is based on all of these factors, plus the arc of contact factor. Standard industry convention is to specify static belt tension on a per span basis rather than total tension (shaft separation). Also, values apply to individual belts or ribs in the case of V-belts and Micro-V belts, and to entire strands in the case of synchronous belts.

**New Belt Static Tension (per rib/strand):** Represents a lower and upper range of static belt tension for new belts being installed for the first time. Tension values are higher than for used belts because belt tension decays initially at a higher rate until “broken in”. These values are calculated by multiplying the Static Tension by standard multipliers.

**Used Belt Static Tension (per rib/strand):** Represents a range of static belt tension for used belts that have already been “broken in” by running under load for at least 24 to 48 hours. Tension values are lower than for new belts because used belt tension decays at a much slower rate, therefore not requiring as much installation tension to compensate for the anticipated tension loss.

**Static Belt Pull:** Total magnitude of tension imposed onto the shafts by both belt spans after belt installation and pre-tensioning. This can also be referred to as Total Installation Tension. Lower and upper ranges for new and used Static Belt Pull values coincide with new and used static belt tension values.

**Rib/Strand Deflection Distance:** Calculated value based on a deflection distance of 1/64” per inch of belt span length.

**Rib/Strand Deflection Force:** Force required to deflect the belt span (at mid-point) to the calculated deflection distance based on new and used Static Tension values (per rib/strand).

**Sonic Tension Meter:** Static Tension values (per rib/strand) expressed in units of Newtons (N), as opposed to pounds (lb).

**Belt Frequency:** Static Tension values (per rib/strand) expressed in frequency units (Hz).

**507C/508C Model Settings:** Constants required to use the Gates Sonic Tension Meter (either model 507C or 508C) to measure Static Tension. These values can also be used in the older 505C model.

## Notes Section

### **NOTES**

- Yearly Usage: 24 Hrs / Day, 7 Days / Wk, 50 Wks / Yr

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The notes section is used to communicate any concerns or warnings. This can range from noting bushings requiring shallow keys to warnings of high pulley rim speeds requiring special materials and dynamic balancing.

## Conclusion

Design Flex Pro is a simple, yet powerful drive design tool. With a greater understanding of the drive design report content, users will be able to make better drive selections. In addition, an improved understanding of the engineering calculations will enable a deeper understanding of the influence on other drive system components.

For further information about Design Flex Pro or assistance designing belt drive systems, contact Gates Product Application Engineering at [ptpasupport@gates.com](mailto:ptpasupport@gates.com) or +1.303.744.5800.