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SYNCHRONOUS BELTS
BLACKHAWK Pd
EUROPEAN METRIC CONVENTIONAL DRIVE DESIGN MANUAL
GOODYEAR
ENGINEERED PRODUCTS

BLACKHAWK
SYNCHRONOUS BELTS

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BLACKHAWK
SYNCHRONOUS BELTS

BlackHawk Pd™

reaches new heights with universal performance.

Goodyear BlackHawk Pd synchronous belts offer an overall universal performance that stands alone, due to their great strength and unique construction. Designed to fit virtually every high-capacity synchronous application, BlackHawk Pd belts fulfill existing drive requirements, matching competitive belt widths and lengths. It is a simple solution amidst the confusing multiple tooth profiles and power ratings in the market. The BlackHawk Pd part numbering system is even compatible with industry numbers for ease of ordering.

The key to the all-round performance of our BlackHawk Pd belt lies in its unique construction. Goodyear incorporates new material technology in the latest generation of synchronous drive belting and the result is a higher power rating. The Universal Positive Drive (UPD) profile tooth, with its Hibrex® elastomer compound, provides increased hardness, twice the tooth shear protection and improved abrasion resistance, giving BlackHawk Pd the 'edge' over its competition.

The reduced drive width of the BlackHawk Pd belt creates a more compact drive. This minimizes the belt and sprocket costs which is a significant advantage over older drives. BlackHawk Pd synchronous belts embody the strength and durability of the Goodyear name and take universal performance to a higher level.

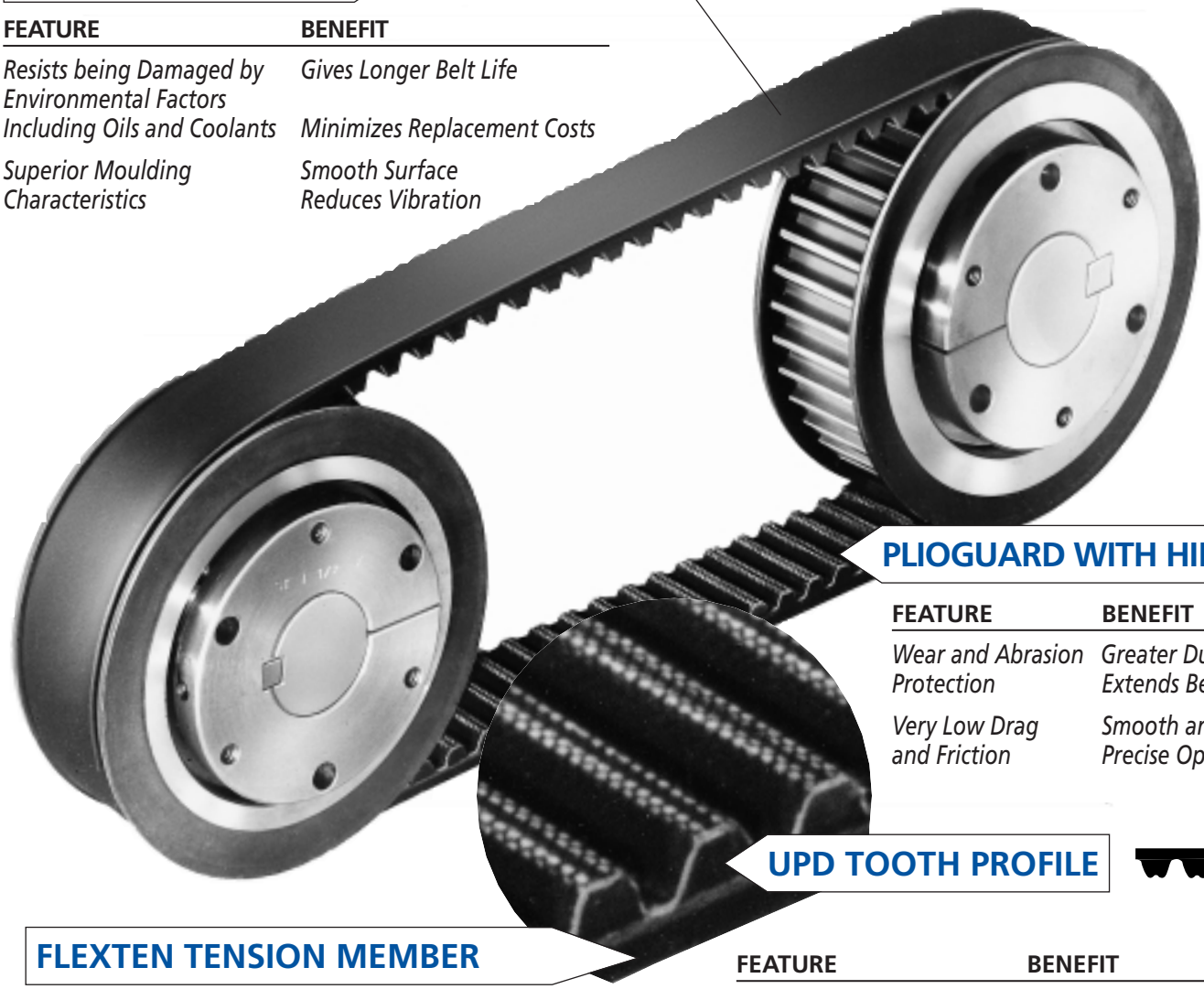
To upgrade your drive to BlackHawk Pd, call your local Goodyear distributor or call Goodyear offices.

BLACKHAWK
SYNCHRONOUS BELTS

Great features that give Blackhawk™ its wings

HIBREX® COMPOUND

FEATURE	BENEFIT
Resists being Damaged by Environmental Factors Including Oils and Coolants	*Gives Longer Belt Life*
	Minimizes Replacement Costs
Superior Moulding Characteristics	*Smooth Surface Reduces Vibration*



PLIOGUARD WITH HIBREX

FEATURE	BENEFIT
Wear and Abrasion Protection	*Greater Durability Extends Belt Life*
Very Low Drag and Friction	*Smooth and Precise Operation*

UPD TOOTH PROFILE

FLEXTEN TENSION MEMBER

FEATURE	BENEFIT
Excellent Dimensional Stability	*Less Maintenance*
High Impact Strength	*Retensioning Generally not Required*
Allows for Small Sprocket and Short Centre Drives	*Economical and Compact Drive Designs*

FEATURE	BENEFIT
Minimal Interference Between Belt and Sprocket	*Greater Power Capacity*
Reduced Tooth Stress	*Longer Belt Life*
Reduced Backlash	*Accurate Movement of Belt and Sprocket for Precise Applications*
UPD Tooth Profile	*Interchangeable with Other Synchronous Belts; Ease of Replacement*

Bred for long life, BlackHawk Pd provides virtually maintenance-free operation. The Hibrex elastomer compound is specially formulated to resist tooth deformity and increase tooth rigidity. The UPD tooth profile is designed to improve the life of the belt. It is this innovative technology that takes performance up a few notches.

BLACKHAWK
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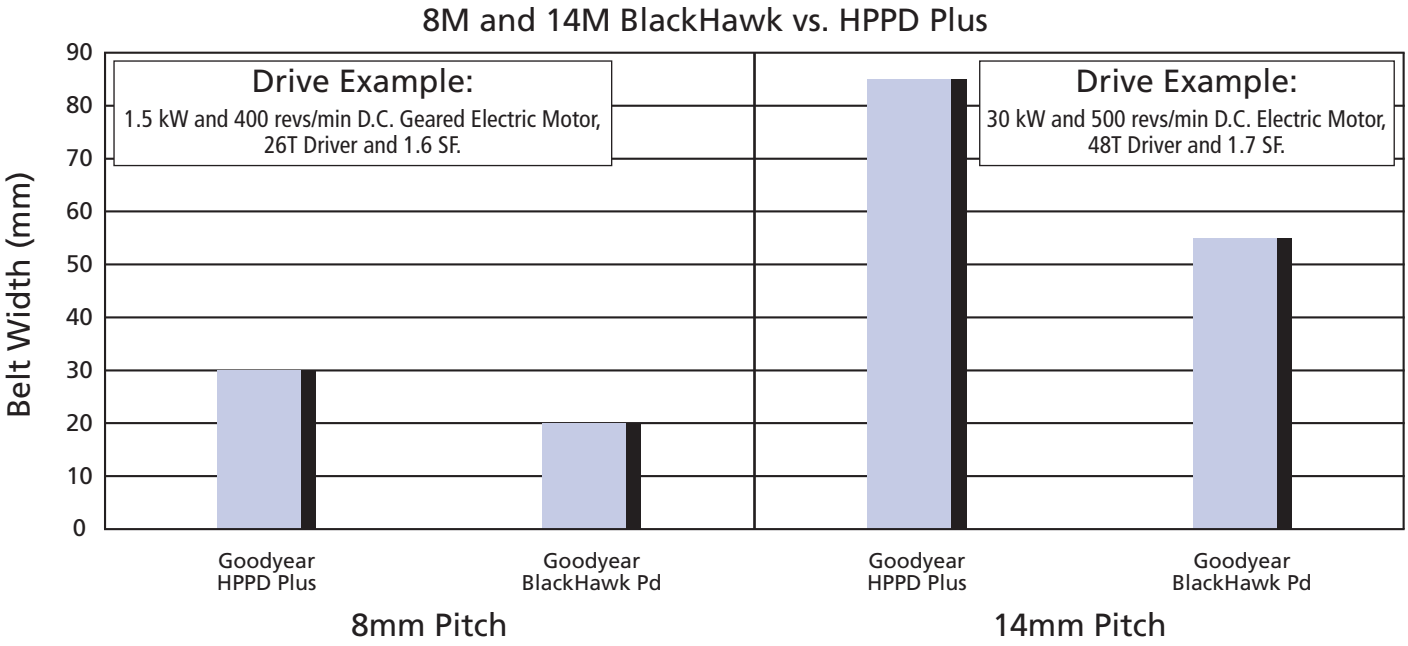
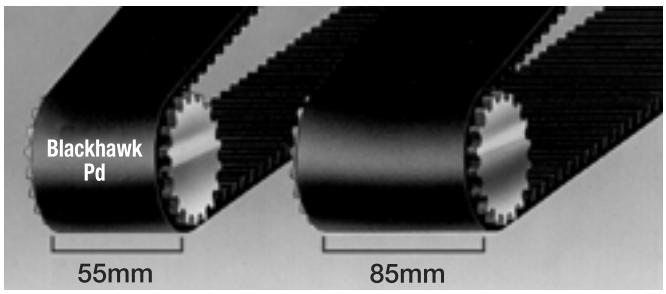
Drive Width Comparison



BlackHawk Pd, with its higher power ratings, will reduce drive costs. Higher ratings mean reduced drive width, as shown in the drive example above:- an 8mm, BlackHawk Pd can reduce drive width by 10mm without any decrease in performance. This reduced drive width, more compact solution, will also reduce belt replacement costs..



14mm BlackHawk Pd vs. HPPD Plus

Space Saving Design Opportunities

When face width and hub loads are a concern, BlackHawk Pd allows a more compact drive, with less shaft overhang.

Advantages Over Other Drive Systems

BlackHawk Pd belts will commonly be used on drives requiring synchronization. They can also be used to replace V-belt drives and non-synchronous chain drives.

Vs. Chain

- No Stretch
- Reduced Downtime and Maintenance Costs
- Eliminates Lubricating System
- Not Affected by Corrosion
- Wide Speed Range
- Longer Service Life
- Greater Precision
- Reduced Noise

Vs. V-belt

- No Stretch
- Reduced Downtime and Maintenance Costs
- Lower Belt Tension/Reduced Bearing Loads
- High Mechanical Efficiency
- No Slippage

An improvement in materials means an improvement in performance. BlackHawk Pd will replace most belt types that are currently running in HTD, RPP, or PowerGrip GT sprockets.

Reduced Maintenance Costs

BlackHawk Pd belts do not require lubrication, as do chain drives. The omission of a lubrication system and the cost of cleaning and maintaining those systems will reduce the overall maintenance cost of the drive. In addition, BlackHawk Pd belts do not require retensioning as do V-belt and chain drives.

BLACKHAWK
SYNCHRONOUS BELTS

Belt Specifications

BlackHawk Pd belts are available in two stock sections, **8M** and **14M** (8mm and 14mm pitch respectively), to handle a wide range of applications. Each BlackHawk PD belt is defined by three dimensions.

PITCH LENGTH PITCH WIDTH

Pitch Length

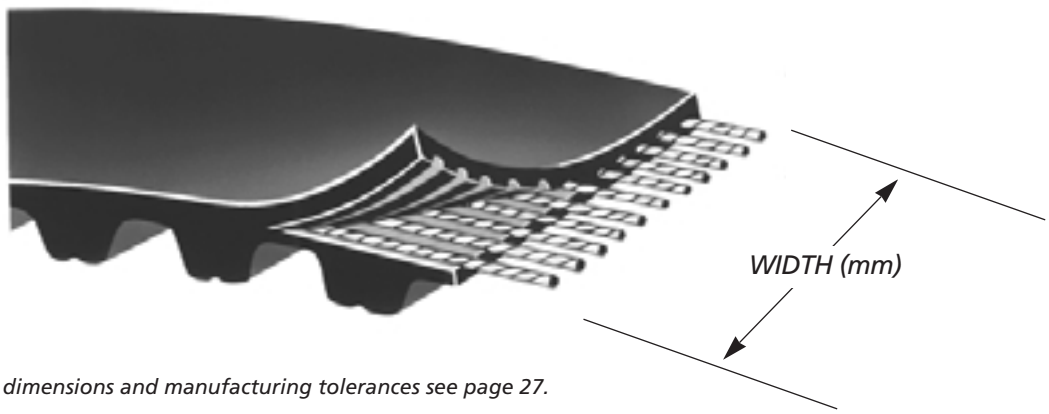
Belt Pitch Length is defined as the length of the belt along the Belt Pitch Line (see figure, page 20). Pitch Length can be determined by multiplying the number of teeth in the belt by the belt pitch. For example, an 8mm belt with 60 teeth would have a pitch length of 480 mm. (60 teeth x 8mm pitch = 480mm). Refer to Stock Belt Specifications for a listing of standard pitch lengths.

Pitch

Belt Pitch is defined as the distance between tooth centres. BlackHawk Pd belts are available in 8mm and 14mm pitches.

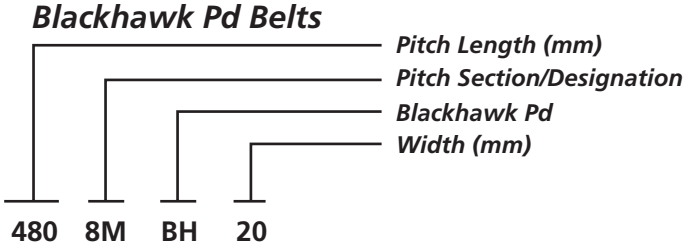
Width

Belt Width is defined as the "side to side" measurement of the belt. Standard belt widths are listed in the Stock Belt Specifications.



For other dimensions and manufacturing tolerances see page 27.

Part Number Explanation



BLACKHAWK
SYNCHRONOUS BELTS

Stock Belt Specification

8M (8mm)

Belt Designation Length-Pitch	Number of Teeth	Belt Pitch Length (mm)
480 8M BH	60	480
560 8M BH	70	560
600 8M BH	75	600
640 8M BH	80	640
720 8M BH	90	720
800 8M BH	100	800
880 8M BH	110	880
960 8M BH	120	960
1040 8M BH	130	1040
1120 8M BH	140	1120
1200 8M BH	150	1200
1280 8M BH	160	1280
1440 8M BH	180	1440
1600 8M BH	200	1600
1760 8M BH	220	1760
1800 8M BH	225	1800
2000 8M BH	250	2000
2400 8M BH	300	2400
2600 8M BH	325	2600
2800 8M BH	350	2800
3048 8M BH	381	3048
3280 8M BH	410	3280
3600 8M BH	450	3600
4400 8M BH	550	4400

14M (14mm)

Belt Designation Length-Pitch	Number of Teeth	Belt Pitch Length (mm)
966 14M BH	69	966
1190 14M BH	85	1190
1400 14M BH	100	1400
1610 14M BH	115	1610
1778 14M BH	127	1778
1890 14M BH	135	1890
2100 14M BH	150	2100
2310 14M BH	165	2310
2450 14M BH	175	2450
2590 14M BH	185	2590
2800 14M BH	200	2800
3150 14M BH	225	3150
3360 14M BH	240	3360
3500 14M BH	250	3500
3850 14M BH	275	3850
4326 14M BH	309	4326
4578 14M BH	327	4578
4956 14M BH	354	4956

8M Belts are available in the following widths:

Belt Width Code	Belt Width (mm)
20	20
30	30
50	50
85	85

14M Belts are available in the following widths:

Belt Width Code	Belt Width (mm)
40	40
55	55
85	85
115	115
170	170

Part Number Explanation

966 14M BH 40

- 966 — Pitch Length (mm)
- 14M — Pitch Section/Designation
- BH — BlackHawk Pd
- 40 — Width (mm)

Design Policy – To ensure proper belt selection, consult Goodyear power transmission engineering manuals. Due to the high load capacity of these belts, make sure that all drive components are adequately designed. Consult sprocket, and other component manufacturers for design assistance or if verification of application is needed.

Safety Reminder – Follow all safety policies and requirements of central government and local authorities, as well as regulations of the employer when working on electrically powered equipment. Always lock out the power source to the machinery when performing any work.

BLACKHAWK
SYNCHRONOUS BELTS

BlackHawk Pd Selection Procedure

1. Gather together the Relevant Drive Parameters using the Data Sheet

A basic Data Sheet has been provided, which can be photocopied, (see page 35). On the assumption that a completely New Drive is to be designed, the minimum basic information required is signified by the prefix '§' on the data sheet, which is as follows:- *Rated power* for the drive-unit/motor, together with its *starting characteristics* and *rotational speed revs/min*, the type of *driven equipment*, together with its *hours of operation* and *driven rotational speed revs/min* with the *nominal shaft centre distance*. Additional information obtained towards completion of the Data Sheet will enhance the likely service life of the drive.

2. Determine the Optimum Service Factor using the Service Factor Tables

Firstly establish whether the drive-unit/motor falls into the *Normal* or *High Torque Starting Characteristic Category*. Turn to pages 12-13 and scan down the Driven Unit Type Column on the left hand side and select that nearest in nature to the subject driven equipment; then knowing the starting characteristics of the drive-unit/motor and the nature of service of the driven equipment, select the respective basic service factor from the correct column of six. Use the guidelines given on the service factor pages to assist in this task, applying any advisory relevant 'Add-On' service factor as may be necessary.

3. Determine the Design Power for the Drive

Take the *Rated power for the drive-unit/motor* and multiply by the resultant *service factor* obtained from Step 2. above.

e.g. Design Power (kW) = Rated Power (kW) x Service Factor.

A more optimal drive design can be achieved if the *driven equipment Absorbed Power* (at peak load condition) is provided in the Data Sheet.

e.g. Design Power (kW) = Absorbed Power (kW) x Service Factor ≥ Rated Power (kW)*

*If this condition is NOT met, use the Rated Power (kW) as the Design Power (kW) as an absolute minimum value.

4. Establish Most Suitable Belt Pitch for the Drive

Take the chosen Design Power and the given faster rotational speed revs/min from the Data Sheet and refer to the Belt Pitch Selection Chart on page 14. Look for the intersection of the two axes/(parameters) and note the suggested optimum belt pitch designation 8M/14M.

Occasionally the intersection point will fall outside the shaded regions. It will be necessary to contact the Power Transmission Products Technical Department for advice/drive assistance. If on the other hand the intersection point falls into the area of both belt pitches, either pitch will provide a satisfactory drive and both should be considered.

5. Determine Speed Ratio – Sprocket Combination

Calculate the required Speed Ratio from one of the following equations.

For speed reduction drives:

		Based on revs/min		To Convert V/Wedge Belt Drives		To Convert Chain or Other Synchronous Drives
Speed Ratio ("SR")	=	$\frac{\text{DriveR revs/min (n)}}{\text{DriveN revs/min (N)}}$	*or*	$\frac{\text{DriveN Pulley Diameter (D)}}{\text{DriveR Pulley Diameter (d)}}$	*or*	$\frac{\text{DriveN Sprocket Number of Teeth (T)}}{\text{DriveR Sprocket Number of Teeth (t)}}$

For speed-up drives:

		Based on revs/min		To Convert V/Wedge Belt Drives		To Convert Chain or Other Synchronous Drives
Speed Up Speed Ratio	=	$\frac{\text{DriveN revs/min (N)}}{\text{DriveR revs/min (n)}}$	*or*	$\frac{\text{DriveR Pulley Diameter (d)}}{\text{DriveN Pulley Diameter (D)}}$	*or*	$\frac{\text{DriveR Sprocket Number of Teeth (t)}}{\text{DriveN Sprocket Number of Teeth (T)}}$

For the belt section 8M or 14M chosen, refer to the standard drive tables in the HPPD/HPPD+ manual (or other suitable manual) and progress down the 'Left Hand' column in the table until the correct/nearest Speed Ratio is found. If more than one Speed Ratio is found suitable, select on basis of suitable Centre Distance (see Step 6.).

Where no Standard Drive tables are available turn to the standard sprocket lists and select one sprocket number of teeth and multiply up or down by the required Speed Ratio, go to the nearest standard number of teeth large sprocket, if not already nearly or exactly selected and multiply down by the Speed Ratio and select nearest exact number of teeth standard sprocket.

Notes:

a. Ensure your belt speed (sprocket rim speed) is below 33.0 m/sec for normal use/sprocket material (see Step 7.). If the deviation above 33.0 m/sec is less than 20%, it is often worthwhile to check with the sprocket manufacturer to discover whether the standard material in use is suitable, subject perhaps to dynamic balancing.

b. Ensure your small sprocket pitch diameter is above that recommended for the belt pitch/width selected (see Step 8. and page 22).

BLACKHAWK
SYNCHRONOUS BELTS

6. Select/Calculate the nearest Standard Pitch Length Belt and its Nominal Centre Distance

From the sprocket combination(s) selected in Step 5, read across the Standard Drive Table and look for the nearest listed Centre Distance (mm) to that within the range provided in the Data Sheet, then note the respective standard Belt Pitch Length at the top of the column.

Alternatively, calculate the required L_p (Belt Pitch Length) from:

$$L_p = 2C_n + \frac{\pi}{2}(D + d) + \frac{(D - d)^2}{4C_n}$$

Then select the nearest Standard Belt Pitch Length (for the Belt pitch chosen) from the table on page 6.

Using this L_{ps} (Standard Belt Pitch Length) re-calculate the Design Centre Distance from:

$$C_d = \frac{L_{ps} - \frac{\pi}{2}(D + d)}{4} + \sqrt{\left\{\frac{L_{ps} - \frac{\pi}{2}(D + d)}{4}\right\}^2 - \frac{(D - d)^2}{8}}$$

(Specify this back to customer with chosen drive selection/quote.)

Where: L_p = Calculated required Belt Pitch Length (mm).
L_{ps} = Selected nearest Standard Belt Pitch Length (mm).
C_n = Nominal Centre Distance from the Data Sheet (mm).
C_d = Calculated Design Centre Distance for the drive (mm).
π = 3.1416.
d = Pitch diameter of the smaller (faster) sprocket (mm).
D = Pitch diameter of the larger (slower) sprocket (mm).

7. Calculate and Check Belt (Sprocket Rim) Speed

The Belt Speed 'v' should not exceed 33.0 m/sec in normal circumstances. Use the pitch diameter of either sprocket (mm) 'd' or 'D' and its corresponding rotational speed revs/min (min^{-1}) 'n' or 'N'.

$$v = \frac{\pi \, d \times n}{1000 \times 60} \text{ (m/sec)} = \frac{d \times n}{19098.5} \leq 33.0 \text{ m/sec} \quad \text{or} \quad v = \frac{\pi \, D \times N}{1000 \times 60} \text{ (m/sec)} = \frac{D \times N}{19098.5} \leq 33.0 \text{ m/sec}$$

8. Determine the Power Rating and Respective Belt Width

From the appropriate 8M or 14M Power Tables (see pages 15 to 19), determine the Power Rating from the sprocket and belt selected in Step 5. These tables provide the rated power (kW) of all standard belt widths, for a specific sprocket number of teeth and its corresponding revs/min (min^{-1}). It is suggested that the smaller/faster sprocket number of teeth with its corresponding revs/min (min^{-1}) is used. The point of intersection of the number of teeth and revs/min (min^{-1}) axes gives the power capacity of that width of belt under the conditions used.

Calculate the Corrected Power rating by multiplying the Power rating (kW) from the table by the Belt Length Correction Factor (see tables on pages 15 to 19). The Corrected Power must equal or exceed the Design Power as calculated in Step 3.

The selection of the optimum belt width for a drive may involve some degree of 'trial and error', in order to reach the correct Power rating.

The following rules should be generally followed when selecting the belt width:

a) Larger diameter sprockets require less belt width and increase belt life whilst reducing bearing loads.
b) The belt width should not exceed the smaller sprocket diameter.
c) Select the minimum recommended sprocket diameters only when the drive requirements such as 'Speed Ratio' or/and 'Centre Distance' force the situation.

9. Determine and List Part Numbers for Drive Belt and Sprockets

Using the sprocket dimension tables on pages 21-22, recheck to ensure that the sprockets selected in Step 5 are within any design limitations provided with the Data Sheet. The Flange Diameters should be compared to the maximum diameter than can be accommodated on the drive. These tables should be used for design reference only and confirmed with the sprocket manufacturer. It is also important to ensure correct sprocket material is available for the speed and load conditions and that the design is suitable for the bushing system/shaft diameter it has to accommodate.

An example of a BlackHawk Pd belt reference is:

1760 – 8M – BH – 85
- 1760 — Belt Pitch Length (mm)
- BH — BlackHawk Pd
- 8M — Teeth Pitch Ref.
- 85 — Belt Width (mm)

A typical sprocket reference is:

P64 – 8M – 85 – 2517/50
- P64 — Sprocket Number of Teeth
- 8M — Teeth Pitch Ref.
- 85 — Sprocket Ref. Width to suit belt
- 2517/50 — TaperLock Bush Ref./Bore

10. Determine Installation Tension, Take-up Requirements and Driven Speed

An installation and take-up allowance will be necessary when installing a synchronous/positive drive belt. Determine the Centre Distance Take-up and Slack-off allowances from the table on page 29.

Establish the correct installation tension and drive set-up procedures from the information provided on pages 23 to 31 inc. Calculate the actual driven speed revs/min using the true speed ratio of the selected sprockets.

BLACKHAWK
SYNCHRONOUS BELTS

Goodyear Belt Drive Data Sheet – Form

SURVEY or EXISTING DRIVE CHECK OR REPLACEMENT

Machine/Drive Ref: MAIN UNIT COOLING BLOWER

DRIVER UNIT:

Current Sprocket: New Drive

§Rated Power kW/~~(HP)~~*: 30

§Shaft Speed:- (Plated) revs/min 960

Shaft Diam. 50 mm/~~(ins)~~* Shaft Extn. ..... (mm)

§Starting Characteristics:- ACSC 6 Pole Normal Torque (Star-Delta)

CENTRE DISTANCE:

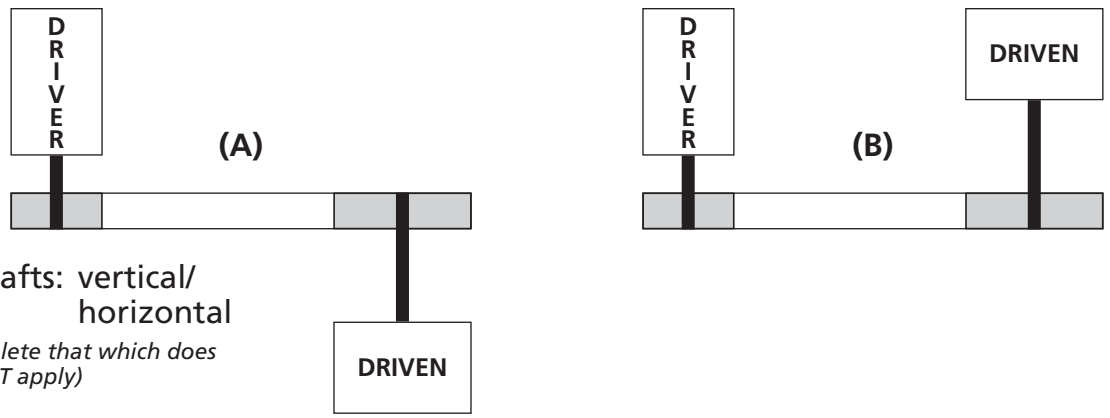
§Nominal "C_n" 690 (mm) Belt Refs: .....

Max: 700 (mm) No Belts: .....

Min: 650 (mm)

BASIC LAYOUT:

Tick One ☐ ☐



Shafts: vertical/
horizontal

(Delete that which does NOT apply)

DRIVEN UNIT:

Current Sprocket: .....

Absorbed Power/(if known) kW/(HP)*: .....

§Required Shaft Speed (N.revs/min) 425 Allowable % Tol. (if known) +1% / –0%

Shaft Diam. 60 mm/~~(ins)~~* Shaft Extn. ..... (mm)

§Hours per Day 24 Days per Week 7

§Type of DriveN Equipment CENTRIFUGAL PUMP

IMPORTANT – If there are any known space restrictions that could affect the diameter or/and width of either sprocket, please supply a sketch with measurements and explanations on a separate sheet

** Delete as required – if one not deleted, kW/mm will be assumed.*
§ Minimum Required Drive Parameters.

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SYNCHRONOUS BELTS

Drive Design/Selection Example

Example:

A 30 kW 6 pole AC motor at 960 revs/min with 'Normal Torque' starting characteristics is to drive a centrifugal pump at 425 revs/min, 24 hours a day, seven days a week. Centre Distance to be within range 650 mm and 700 mm. Motor shaft diameter is 50 mm and that of the pump is 60 mm.

1. Data Sheet Drive Design Parameters

Driver Equipment (Motor)
Rated Power: 30 kW
Speed: 960 revs/min
Starting Characteristics: 'Normal Torque'
Shaft Dia.: 50 mm
Duty: Continuous
Centre Distance Range: 650-700 mm

Driven Equipment
Type: Centrifugal pump
Speed: 425 revs/min + 1% / – 0%
Shaft Dia.: 60 mm
Duty: Continuous

2. Service Factor

Normal Torque Start: Left hand set of 3 columns
Continuous Duty: Right hand column
Reduction Drive: No add-on factor
Centrifugal Pump:

Service Factor (SF) = 1.8

3. Design Power

Rated Power: 30 kW
Service Factor (SF): 1.8

Design Power = Rated Power x SF
= 30 x 1.8 = 54.0 kW

4. Belt Pitch Selection

Design Power: 54.0 kW
Small sprocket speed: 960 revs/min

Belt Section (Pitch) = 14M (14mm)

5. Speed Ratio – Sprocket Selection

Faster shaft (Motor): 960 revs/min
Slower shaft (Blower): 425 revs/min

$$\text{Speed Ratio (Reduction)} = \frac{\text{Faster revs/min}}{\text{Slower revs/min}} : 1$$

$$= \frac{960}{425} = 2.26:1$$

a) Using 'Standard Drive Tables for 14M' in HPPD+, HPPD or other equivalent manuals. Look for standard sprocket number of teeth combinations at or close to the Speed Ratio: 2.26

b) Using 14M Standard Sprocket list on page 21. Select a small sprocket over 124 mm diameter (28t) and multiply up by SF. Go to nearest sprocket above and divide back down. Select nearest small sprocket.

For 2.25 Speed Ratio
{'d' = 64t, 'D' = 144T} or {'d' = 40t, 'D' = 90T} or {'d' = 32t, 'D' = 72T}

Starting logically with middle option, only investigate other two if this proves to be unsuitable.
Note: A speed ratio of 2.27 would give a lower driven speed than min.

Chosen Sprockets:
Motor 'd' = 40t (14M) Pump 'D' = 90T (14M)
d = 178.25 mm, D = 401.07 mm

6. Belt Length and Centre Distance Selection

a) Using the same 'Standard Drive Tables for 14M' as in Step 5a (if used), go to the same speed ratio – 2.25 row and sprocket combination 40t - 90T. Go to right hand side and look for Centre Distance 650 to 700 mm. Average 690 for first attempt. (Need more distance below for belt fitment.)

There is a Centre Distance of 691.0 listed. Note it and the belt length designation at the top of that column: 2310. This is the selected pitch length (mm).

b) Alternatively, see page 8 or 28 and calculate L_p from –

$$L_p = 2\,C_n + \frac{\pi}{2}(D + d) + \frac{(D - d)^2}{4\,C_n}$$

$$L_p = 2 \times 690 + 1.5708\,(401.07 + 178.25) + \frac{(401.07 - 178.25)^2}{4 \times 690}$$

1380 + 910 + 18 = 2308 mm

Nearest 'Standard Belt Pitch Length' = 2310 mm = + 2.0 mm approx. Increase Centre Distance by half this amount to obtain 'Calculated Design Centre Distance' C_d for this drive.

For a more accurate C_d calculation see the formula on page 8 or 28.

Belt Length Correction Factor = 1.00

$$C_d \text{ (approx.)}^* = 690 + \frac{2.0}{2}$$

$$= 690 + 1 = 691 \text{ mm}$$

**Note: For speed ratios below 3.0 and Centre Distances ≥ d + D which this is, this approximation is accurate enough.*

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7. Calculate and Check Belt Speed

Small (motor) sprocket diameter 'd' = 178.25 mm
Driver Speed 'n' = 960 revs/min

Belt speed 'v' = $\frac{d \times n}{19098.5}$

= $\frac{178.25 \times 960}{19098.5}$ = 8.96 m/sec

This is well within the top recommended limit of 33.0 (m/sec).

8. Calculate Power Rating and Select Belt Width

Small (motor) sprocket = 40t
Driver Speed 'n' = 960 revs/min
Design Power = 54.0 kW {Step 3.}
Belt Length Correction Factor = 1.00 {Step 6.}

From 14M Power Rating Tables
40 mm wide = 56.49 kW
Corrected Power = 56.49 x 1.00 = 56.49 kW

Corrected Power ≥ Design Power
56.49 kW is > 54.00 kW {Step 3.}

Chosen standard belt and sprocket width = 40 mm.

9. Component Part Numbers

Sprocket Dimensions (see page 21 and consult sprocket manufacturer)

Driver 'd' = P40F–14M–40–2517/50
Driven 'D' = P90–14M–40–3020/60

Belt = 2310–14M–BH–40

Verify sprocket dimensions including bore range/bush/keyway and flanges are within space limitations and suitable for shafts.

10. Take-up Requirements, Installation Tension and Driven Speed

Centre Distance Allowance Table (see page 29)
Belt Length = 2310 mm
Deflection Force Table (see page 24)
Belt Span is approximately same as centre distance for low Speed Ratio Drives. (For more accuracy use the formula on page 23.)

Installation Allowance = 39.0 mm
Tensioning Allowance = 5.0 mm
A force of 25.5 kg should be used to deflect the belt 10.35 mm for proper installation tension. (15mm per metre of span)

Centre Distance Range required is:
Minimum – 650 mm and Maximum – 700 mm

Speed Ratio of selected sprockets = $\frac{T}{t}$ = SR

Speed Ratio (SR) = $\frac{90}{40}$ = 2.25

Estimated driven speed 'N' = $\frac{'n'}{SR}$

Estimated driven speed = $\frac{960}{2.25}$ = 426.7 revs/min

BLACKHAWK
SYNCHRONOUS BELTS

THE CORRECT SERVICE FACTOR IS DETERMINED BY:

1. The extent and frequency of peak loads.
2. The number of operating hours per year, broken down into average hours per day of continuous service.
3. The proper service category (intermittent, normal or continuous). Select the one that most closely approximates your application condition.

INTERMITTENT SERVICE

a. Light Duty – Not more than 6 hours per day.
b. Never exceeding rated load.

NORMAL SERVICE

a. Daily service 6 to 16 hours per day.
b. Where occasional starting or peak load does not exceed 200% of the full load.

CONTINUOUS SERVICE

a. Where starting or peak load is in excess of 200% of the full load or where starting or peak loads and overloads occur frequently.
b. Continuous service 16 to 24 hours per day.

Typical Service Factors

DRIVEN MACHINE TYPES	SPEED-UP DRIVES ADDITIONAL SERVICE FACTOR	
Driven Machine Types noted below are representative samples only. Select a category most closely approximating your application from those listed below	Speed-Up Ratio Range	Service Factor Add-On
	Less than 1.25	0.00
	1.25 to 1.74	0.10
	1.75 to 2.49	0.20
	2.50 to 3.49	0.30
	Greater than 3.49	0.40

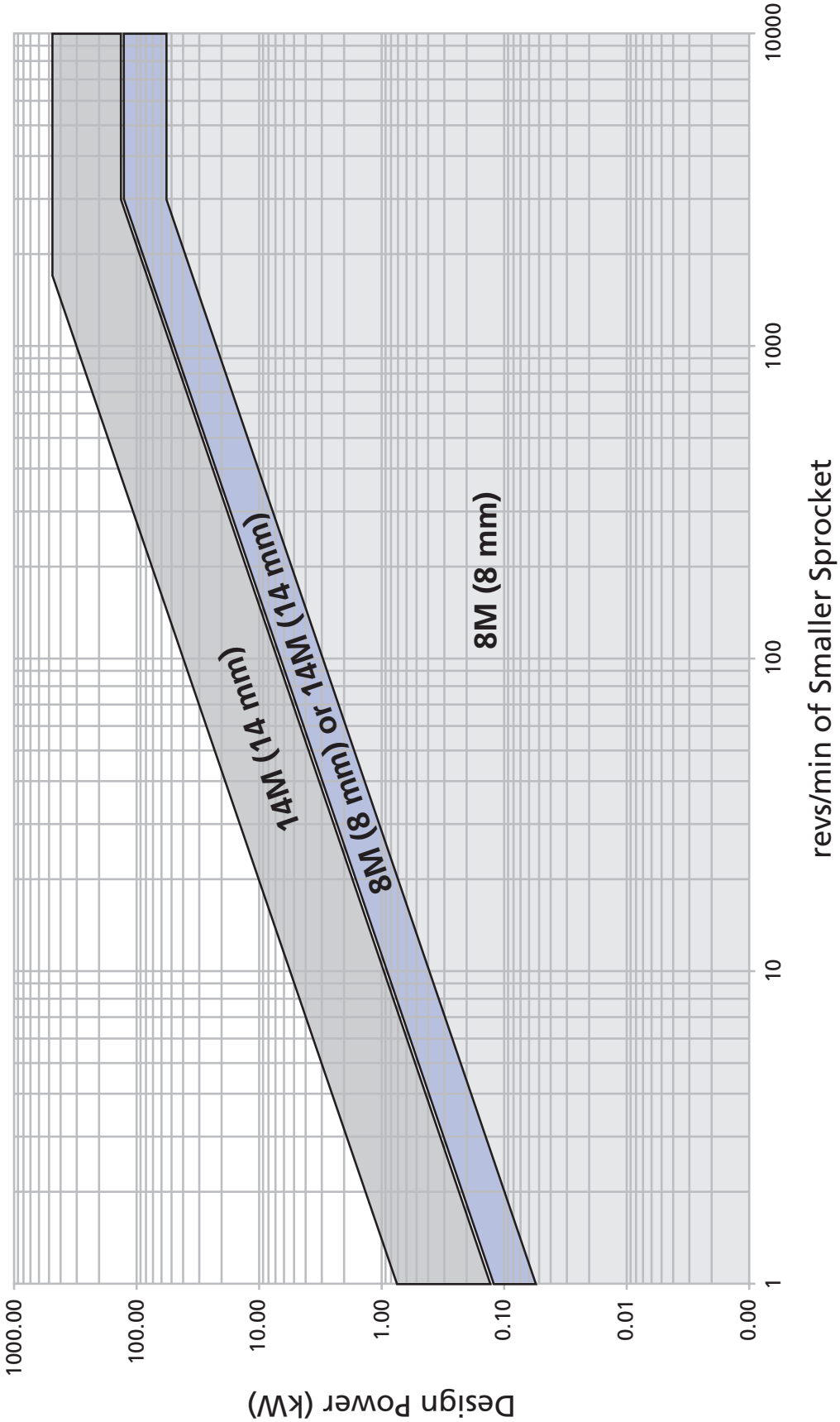
DRIVEN UNIT SERVICE FACTOR	DRIVER TYPES: 'SOFT'/NORMAL TORQUE STARTS			'HEAVY'/HIGH TORQUE STARTS		
	Intermittent Service	Normal Service	Continuous Service	Intermittent Service	Normal Service	Continuous Service
	ELECTRIC MOTORS: AC Normal Torque Squirrel Cage and Synchronous Inverters Softstarts; AC Split Phase; DC Shunt Wound; Internal Combustion Engines over 600 revs/min			ELECTRIC MOTORS: AC Hi-Torque; AC Hi-Slip; AC Repulsion-Induction; AC Single Phase Series Wound; AC Slip Ring; DC Compound Wound, Series Wound; Single Cylinder Engines and Internal Combustion Engines under 600 revs/min, line shafts, brakes, clutches, direct on line starting.		
Agitator: Liquid	1.3	1.5	1.7	1.5	1.7	1.9
Agitator: Semi Liquid	1.4	1.6	1.8	1.6	1.8	2.0
Bakery Machinery: Dough Mixers	1.3	1.5	1.7	1.5	1.7	1.9
Brick & Clay Machinery: Augers, Granulators, Mixers	1.4	1.6	1.8	1.6	1.8	2.0
Brick & Clay Machinery: Pug Mills	1.7	1.9	2.1	1.9	2.1	2.3
Centrifuges	1.6	1.8	2.0	1.8	2.0	2.2
Chokable Equipment: All Types	2.2	2.4	2.6	2.4	2.6	2.8
Compressors: Centrifugal	1.4	1.6	1.9	1.6	1.8	2.0
Compressor: Reciprocating	1.7	1.9	2.1	1.9	2.1	2.3
Conveyors: Apron, Bucket, Elevator, Pan	1.5	1.7	1.9	1.7	1.9	2.1
Conveyors: Heavy Duty Belt	1.4	1.6	1.8	1.6	1.8	2.0
Conveyors: Flight, Screw	1.6	1.8	2.0	1.8	2.0	2.2
Conveyors: Light Package Belt	1.2	1.4	1.6	1.4	1.6	1.8
Dispensing and Display Equipment	1.0	1.1	1.2	1.1	1.3	1.5
Elevators	1.5	1.7	1.9	1.7	1.9	2.1
Exciters	1.5	1.7	1.9	1.7	1.9	2.1
Fans & Blowers: Centrifugal, Induced Draft Exhausters < 7.5 kW	1.5	1.7	1.9	1.7	1.9	2.1
Fans & Blowers: Mine Fans, Propeller, Positive Displacement Blowers	1.7	1.9	2.1	1.9	2.1	2.3
Generators	1.5	1.7	1.9	1.7	1.9	2.1
Hammer Mills	1.6	1.8	2.0	1.8	2.0	2.2

BLACKHAWK
SYNCHRONOUS BELTS

DriveN Unit Service Factor	'SOFT'/NORMAL TORQUE STARTS			'HEAVY'/HIGH TORQUE STARTS		
	Intermittent Service	Normal Service	Continuous Service	Intermittent Service	Normal Service	Continuous Service
Hoists	1.5	1.7	1.9	1.7	1.9	2.1
Instrumentation	1.0	1.1	1.2	1.1	1.3	1.5
Laundry Machinery: Extractors, Washers	1.5	1.7	1.9	1.7	1.9	2.1
Laundry Machinery: General	1.3	1.5	1.7	1.5	1.7	1.9
Line Shafts	1.4	1.6	1.8	1.6	1.8	2.0
Machine Tools: Boring Mill, Grinder, Milling Machine, Shaper, Shears	1.5	1.7	1.9	1.7	1.9	2.1
Machine Tools: Drill Press, Lathes, Screw Machine	1.3	1.5	1.7	1.5	1.7	1.9
Measuring Devices	1.0	1.1	1.2	1.1	1.3	1.5
Medical Equipment	1.0	1.1	1.2	1.1	1.3	1.5
Mills: Ball, Rod, Pebble etc.	1.6	1.8	2.0	1.8	2.0	2.2
Mixer: Liquid	1.3	1.5	1.7	1.5	1.7	1.9
Mixer: Semi Liquid	1.4	1.6	1.8	1.6	1.8	2.0
Office Equipment	1.1	1.3	1.5	1.3	1.5	1.7
Paper Machinery: Agitators, Calenders, Driers	1.2	1.4	1.6	1.4	1.6	1.8
Paper Machinery: Beaters, Jordans, Mash Pumps	1.3	1.5	1.7	1.5	1.7	1.9
Paper Machinery: Pulpers	1.6	1.8	2.0	1.8	2.0	2.2
Printing Machinery: Linotype Machines, Cutters, Folders	1.3	1.5	1.7	1.5	1.7	1.9
Printing Machinery: All Presses	1.5	1.7	1.9	1.7	1.9	2.1
Projection Equipment	1.0	1.1	1.2	1.1	1.3	1.5
Pumps: Centrifugal, Gear	1.4	1.6	1.8	1.6	1.8	2.0
Pumps: Rotary, Positive Displacement, Slush	1.5	1.7	1.9	1.7	1.9	2.1
Pumps: Piston (Reciprocating)	1.9	2.1	2.3	2.1	2.3	2.5
Rock Crushers	1.9	2.1	2.3	2.1	2.3	2.5
Rubber Plant Machinery: Calenders, Extruders, Mills	1.5	1.7	1.9	1.7	1.9	2.1
Saw Mill Machinery	1.5	1.7	1.9	1.7	1.9	2.1
Screens: Drum, Conical	1.2	1.4	1.6	1.4	1.6	1.8
Screens: Vibrating (cam), Shaker	1.4	1.6	1.8	1.6	1.8	2.0
Sewing Machines	1.1	1.3	1.5	1.3	1.5	1.7
Sweepers	1.1	1.3	1.5	1.3	1.5	1.7
Textile Machinery: Reel, Warper	1.4	1.6	1.8	1.6	1.8	2.0
Textile Machinery: Loom, Spinning Frame, Twister	1.5	1.7	1.9	1.7	1.9	2.1
Woodworking Machinery: Band Saw, Drill Press, Lathe	1.1	1.3	1.5	1.3	1.5	1.7
Woodworking Machinery: Circular Saw, Jointer, Planer	1.3	1.5	1.7	1.5	1.7	1.9

BLACKHAWK
SYNCHRONOUS BELTS

BlackHawk Pd Pitch Selection



BLACKHAWK
SYNCHRONOUS BELTS

8M BLACKHAWK POWER RATING TABLE – 20mm WIDE (8M BH 20)

No. Teeth	22	24	26	28	30	32	34	36	38	40	44	48	56	64	72	80
P.D. (mm)	56.02	61.12	66.21	71.30	76.39	81.49	86.58	91.67	96.77	101.86	112.05	122.23	142.60	162.97	183.35	203.72
RPM of Faster Shaft	Base Rated Kilowatts for Small Sprocket															
10	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.15	0.17	0.19	0.23	0.26	0.30	0.34
20	0.13	0.15	0.16	0.18	0.20	0.21	0.23	0.24	0.26	0.28	0.31	0.34	0.41	0.47	0.54	0.60
30	0.19	0.21	0.23	0.26	0.28	0.31	0.33	0.35	0.38	0.40	0.45	0.49	0.59	0.68	0.77	0.87
50	0.30	0.34	0.38	0.41	0.45	0.49	0.53	0.56	0.60	0.64	0.71	0.79	0.94	1.09	1.24	1.39
70	0.41	0.46	0.51	0.57	0.62	0.67	0.72	0.77	0.82	0.87	0.98	1.08	1.28	1.49	1.69	1.90
100	0.57	0.65	0.72	0.79	0.86	0.93	1.00	1.07	1.15	1.22	1.36	1.50	1.79	2.08	2.36	2.65
200	1.08	1.22	1.35	1.49	1.62	1.76	1.89	2.03	2.16	2.30	2.57	2.84	3.38	3.92	4.46	5.00
300	1.56	1.75	1.95	2.14	2.33	2.53	2.72	2.92	3.11	3.30	3.69	4.08	4.85	5.63	6.40	7.18
400	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.75	5.24	6.24	7.24	8.23	9.23
500	2.43	2.73	3.03	3.34	3.64	3.94	4.24	4.54	4.85	5.15	5.75	6.36	7.56	8.77	9.98	11.18
600	2.84	3.19	3.54	3.90	4.25	4.60	4.96	5.31	5.66	6.02	6.72	7.43	8.84	10.24	11.65	13.06
720	**3.31**	**3.73**	**4.14**	**4.55**	**4.96**	**5.37**	**5.78**	**6.20**	**6.61**	**7.02**	**7.84**	**8.66**	**10.31**	**11.95**	**13.59**	**15.23**
800	3.62	4.07	4.52	4.97	5.42	5.87	6.32	6.77	7.22	7.67	8.57	9.47	11.26	13.06	14.85	16.63
960	**4.22**	**4.75**	**5.27**	**5.80**	**6.32**	**6.85**	**7.37**	**7.89**	**8.42**	**8.94**	**9.99**	**11.03**	**13.12**	**15.21**	**17.29**	**19.36**
1000	4.37	4.91	5.46	6.00	6.54	7.08	7.63	8.17	8.71	9.25	10.34	11.42	13.58	15.74	17.89	20.03
1100	4.73	5.32	5.91	6.50	7.09	7.68	8.26	8.85	9.44	10.02	11.20	12.37	14.71	17.04	19.36	21.68
1200	5.09	5.73	6.36	6.99	7.63	8.26	8.89	9.52	10.15	10.78	12.04	13.30	15.81	18.32	20.81	23.29
1440	**5.94**	**6.68**	**7.42**	**8.15**	**8.89**	**9.63**	**10.36**	**11.10**	**11.83**	**12.57**	**14.03**	**15.49**	**18.41**	**21.31**	**24.20**	**27.06**
1600	6.50	7.30	8.11	8.91	9.72	10.52	11.33	12.13	12.93	13.73	15.33	16.93	20.10	23.26	26.39	29.50
2000	7.86	8.83	9.80	10.77	11.74	12.71	13.68	14.65	15.61	16.58	18.50	20.41	24.21	27.97	31.68	35.35
2500	9.52	10.69	11.87	13.04	14.21	15.38	16.55	17.71	18.87	20.02	22.33	24.61	29.13	33.57	37.93	42.18
2880	**10.76**	**12.09**	**13.41**	**14.73**	**16.05**	**17.36**	**18.67**	**19.98**	**21.28**	**22.58**	**25.15**	**27.70**	**32.73**	**37.63**	**42.40**	**47.02**
3000	11.15	12.52	13.89	15.26	16.62	17.98	19.34	20.69	22.03	23.37	26.03	28.66	33.83	38.87	43.76	48.48
3500	12.75	14.32	15.88	17.44	18.99	20.53	22.06	23.59	25.11	26.62	29.61	32.56	38.31	43.85		
4000	14.33	16.09	17.84	19.57	21.30	23.02	24.73	26.42	28.10	29.77	33.06	36.29	42.54			
4500	15.89	17.83	19.76	21.67	23.57	25.45	27.32	29.17	31.01	32.82	36.38	39.86				
5000	17.43	19.55	21.65	23.73	25.79	27.83	29.85	31.84	33.81	35.76	39.56	43.24				

Service life will be reduced in this area due to high belt flexing.

8M BLACKHAWK POWER RATING TABLE - 30mm WIDE (8M BH 30)

No. Teeth	22	24	26	28	30	32	34	36	38	40	44	48	56	64	72	80
P.D. (mm)	56.02	61.12	66.21	71.30	76.39	81.49	86.58	91.67	96.77	101.86	112.05	122.23	142.60	162.97	183.35	203.72
RPM of Faster Shaft	Base Rated Kilowatts for Small Sprocket															
10	0.11	0.13	0.14	0.16	0.17	0.19	0.20	0.21	0.23	0.24	0.27	0.30	0.36	0.41	0.47	0.53
20	0.20	0.23	0.26	0.28	0.31	0.33	0.36	0.38	0.41	0.43	0.48	0.54	0.64	0.74	0.84	0.94
30	0.29	0.33	0.37	0.40	0.44	0.48	0.51	0.55	0.59	0.62	0.70	0.77	0.92	1.06	1.21	1.36
50	0.47	0.53	0.59	0.65	0.71	0.77	0.82	0.88	0.94	1.00	1.12	1.23	1.47	1.70	1.94	2.17
70	0.65	0.73	0.81	0.89	0.97	1.05	1.13	1.21	1.29	1.37	1.53	1.69	2.01	2.33	2.65	2.97
100	0.90	1.01	1.12	1.23	1.35	1.46	1.57	1.68	1.79	1.91	2.13	2.35	2.80	3.25	3.70	4.14
200	1.70	1.91	2.12	2.33	2.54	2.75	2.97	3.18	3.39	3.60	4.02	4.44	5.29	6.13	6.98	7.82
300	2.44	2.74	3.05	3.35	3.65	3.96	4.26	4.56	4.87	5.17	5.78	6.38	7.60	8.81	10.02	11.23
400	3.14	3.53	3.92	4.31	4.70	5.09	5.48	5.87	6.26	6.65	7.43	8.21	9.77	11.33	12.89	14.44
500	3.80	4.28	4.75	5.22	5.69	6.17	6.64	7.11	7.59	8.06	9.00	9.95	11.84	13.73	15.61	17.50
600	4.44	5.00	5.55	6.10	6.65	7.21	7.76	8.31	8.86	9.41	10.52	11.62	13.83	16.03	18.24	20.44
720	**5.18**	**5.83**	**6.47**	**7.12**	**7.76**	**8.41**	**9.05**	**9.70**	**10.34**	**10.99**	**12.27**	**13.56**	**16.13**	**18.70**	**21.27**	**23.83**
800	5.67	6.37	7.08	7.78	8.49	9.19	9.89	10.60	11.30	12.01	13.41	14.82	17.63	20.43	23.23	26.03
960	**6.61**	**7.43**	**8.25**	**9.07**	**9.89**	**10.71**	**11.53**	**12.35**	**13.17**	**13.99**	**15.63**	**17.27**	**20.54**	**23.80**	**27.06**	**30.30**
1000	6.84	7.69	8.54	9.39	10.24	11.09	11.94	12.78	13.63	14.48	16.18	17.87	21.25	24.63	27.99	31.35
1100	7.41	8.33	9.25	10.17	11.09	12.01	12.93	13.85	14.77	15.69	17.52	19.35	23.01	26.66	30.30	33.92
1200	7.97	8.96	9.95	10.94	11.93	12.92	13.91	14.90	15.89	16.87	18.85	20.82	24.75	28.66	32.57	36.45
1440	**9.30**	**10.45**	**11.61**	**12.76**	**13.91**	**15.07**	**16.22**	**17.37**	**18.52**	**19.67**	**21.96**	**24.25**	**28.81**	**33.35**	**37.87**	**42.35**
1600	10.17	11.43	12.69	13.95	15.21	16.47	17.73	18.98	20.24	21.49	23.99	26.49	31.46	36.40	41.30	46.16
2000	12.29	13.82	15.34	16.86	18.38	19.90	21.41	22.92	24.43	25.94	28.95	31.94	37.89	43.77	49.58	55.32
2500	14.89	16.74	18.58	20.41	22.24	24.07	25.90	27.71	29.53	31.34	34.94	38.52	45.59	52.54	59.36	66.02
2880	**16.84**	**18.91**	**20.99**	**23.06**	**25.12**	**27.18**	**29.23**	**31.27**	**33.30**	**35.33**	**39.36**	**43.35**	**51.22**	**58.89**	**66.36**	**73.58**
3000	17.44	19.60	21.74	23.88	26.02	28.14	30.26	32.38	34.48	36.57	40.73	44.85	52.95	60.84	68.49	75.87
3500	19.96	22.41	24.85	27.29	29.72	32.13	34.53	36.92	39.30	41.66	46.34	50.95	59.96	68.63		
4000	22.43	25.18	27.91	30.63	33.34	36.03	38.70	41.35	43.98	46.59	51.74	56.80	66.58			
4500	24.87	27.91	30.92	33.92	36.89	39.84	42.76	45.66	48.52	51.36	56.94	62.38				
5000	27.28	30.59	33.88	37.13	40.36	43.55	46.71	49.83	52.92	55.96	61.91	67.67				

8M LENGTH CORRECTION FACTORS	Belt Pitch Length Lp (mm)	460-600	640-880	960-1200	1280-1760	1800 & above
	Length Correction Factor	0.80	0.90	1.00	1.10	1.20

BLACKHAWK
SYNCHRONOUS BELTS

8M BLACKHAWK POWER RATING TABLE - 50mm WIDE (8M BH 50)

No. Teeth	22	24	26	28	30	32	34	36	38	40	44	48	56	64	72	80
P.D. (mm)	56.02	61.12	66.21	71.30	76.39	81.49	86.58	91.67	96.77	101.86	112.05	122.23	142.60	162.97	183.35	203.72
RPM of Faster Shaft	Base Rated Kilowatts for Small Sprocket															
10	0.20	0.22	0.25	0.27	0.30	0.32	0.35	0.37	0.40	0.42	0.47	0.52	0.62	0.72	0.81	0.91
20	0.35	0.40	0.44	0.49	0.53	0.58	0.62	0.66	0.71	0.75	0.84	0.93	1.10	1.28	1.46	1.63
30	0.51	0.57	0.64	0.70	0.76	0.83	0.89	0.96	1.02	1.08	1.21	1.34	1.59	1.85	2.10	2.35
50	0.82	0.92	1.02	1.12	1.23	1.33	1.43	1.53	1.63	1.73	1.94	2.14	2.55	2.96	3.36	3.77
70	1.12	1.26	1.40	1.54	1.68	1.82	1.96	2.09	2.23	2.37	2.65	2.93	3.49	4.04	4.60	5.16
100	1.56	1.75	1.95	2.14	2.34	2.53	2.72	2.92	3.11	3.31	3.69	4.08	4.86	5.64	6.41	7.19
200	2.95	3.31	3.68	4.04	4.41	4.78	5.14	5.51	5.88	6.24	6.98	7.71	9.17	10.64	12.11	13.57
300	4.23	4.76	5.28	5.81	6.34	6.86	7.39	7.91	8.44	8.97	10.02	11.07	13.18	15.28	17.38	19.49
400	5.44	6.12	6.80	7.47	8.15	8.83	9.50	10.18	10.86	11.53	12.89	14.24	16.95	19.65	22.35	25.06
500	6.60	7.42	8.24	9.06	9.88	10.70	11.52	12.34	13.16	13.98	15.62	17.26	20.54	23.81	27.09	30.36
600	7.71	8.67	9.62	10.58	11.54	12.50	13.46	14.42	15.37	16.33	18.25	20.16	23.99	27.81	31.64	35.45
720	**9.00**	**10.11**	**11.23**	**12.35**	**13.47**	**14.59**	**15.71**	**16.82**	**17.94**	**19.06**	**21.29**	**23.53**	**27.99**	**32.45**	**36.90**	**41.34**
800	9.83	11.05	12.28	13.50	14.72	15.94	17.16	18.39	19.61	20.83	23.27	25.71	30.58	35.45	40.31	45.16
960	**11.46**	**12.89**	**14.31**	**15.74**	**17.16**	**18.59**	**20.01**	**21.43**	**22.85**	**24.28**	**27.12**	**29.96**	**35.63**	**41.29**	**46.94**	**52.57**
1000	11.86	13.34	14.81	16.29	17.76	19.23	20.71	22.18	23.65	25.12	28.06	31.00	36.87	42.72	48.56	54.38
1100	12.85	14.45	16.05	17.65	19.24	20.84	22.43	24.03	25.62	27.21	30.40	33.58	39.92	46.25	52.56	58.85
1200	13.83	15.55	17.27	18.99	20.70	22.42	24.13	25.85	27.56	29.27	32.70	36.11	42.93	49.73	56.50	63.24
1440	**16.13**	**18.13**	**20.14**	**22.14**	**24.14**	**26.14**	**28.14**	**30.13**	**32.13**	**34.12**	**38.10**	**42.07**	**49.99**	**57.86**	**65.69**	**73.47**
1600	17.64	19.83	22.01	24.20	26.39	28.57	30.75	32.93	35.11	37.28	41.62	45.95	54.58	63.14	71.65	80.09
2000	21.33	23.97	26.61	29.25	31.89	34.52	37.15	39.77	42.39	45.00	50.22	55.41	65.73	75.93	86.02	95.96
2500	25.84	29.03	32.23	35.41	38.59	41.76	44.92	48.08	51.23	54.36	60.61	66.82	79.09	91.16	102.98	114.53
2880	**29.21**	**32.81**	**36.41**	**40.00**	**43.58**	**47.15**	**50.70**	**54.24**	**57.78**	**61.29**	**68.28**	**75.21**	**88.85**	**102.17**	**115.12**	**127.66**
3000	30.26	34.00	37.72	41.43	45.14	48.83	52.50	56.17	59.82	63.45	70.67	77.81	91.86	105.55	118.81	131.61
3500	34.62	38.88	43.12	47.34	51.55	55.74	59.91	64.05	68.17	72.27	80.39	88.39	104.01	119.06		
4000	38.91	43.68	48.43	53.14	57.84	57.55	67.13	71.73	76.30	80.83	89.77	98.53	115.50			
4500	43.15	48.41	53.64	58.84	63.99	63.64	68.31	79.20	84.18	89.10	98.78	108.22				
5000	47.33	53.07	58.77	64.42	70.02	69.57	74.62	79.61	84.53	97.08	107.40	117.39				

Service life will be reduced in this area due to high belt flexing.

8M BLACKHAWK POWER RATING TABLE - 85mm WIDE (8M BH 85)

No. Teeth	22	24	26	28	30	32	34	36	38	40	44	48	56	64	72	80
P.D. (mm)	56.02	61.12	66.21	71.30	76.39	81.49	86.58	91.67	96.77	101.86	112.05	122.23	142.60	162.97	183.35	203.72
RPM of Faster Shaft	Base Rated Kilowatts for Small Sprocket															
10	0.35	0.39	0.43	0.47	0.52	0.56	0.60	0.65	0.69	0.73	0.82	0.90	1.08	1.25	1.42	1.59
20	0.62	0.69	0.77	0.85	0.93	1.00	1.08	1.16	1.23	1.31	1.46	1.62	1.92	2.23	2.54	2.85
30	0.89	1.00	1.11	1.22	1.33	1.44	1.55	1.66	1.77	1.89	2.11	2.33	2.77	3.21	3.66	4.10
50	1.42	1.60	1.78	1.96	2.13	2.31	2.49	2.67	2.84	3.02	3.38	3.73	4.44	5.15	5.86	6.57
70	1.95	2.19	2.43	2.68	2.92	3.16	3.40	3.65	3.89	4.13	4.62	5.10	6.07	7.04	8.01	8.98
100	2.72	3.05	3.39	3.73	4.07	4.41	4.74	5.08	5.42	5.76	6.43	7.11	8.46	9.81	11.17	12.52
200	5.13	5.77	6.41	7.04	7.68	8.32	8.96	9.60	10.23	10.87	12.15	13.42	15.98	18.53	21.08	23.63
300	7.37	8.28	9.20	10.12	11.03	11.95	12.87	13.78	14.70	15.62	17.45	19.28	22.95	26.61	30.27	33.94
400	9.48	10.65	11.83	13.01	14.19	15.37	16.55	17.73	18.91	20.08	22.44	24.80	29.51	34.22	38.93	43.63
500	11.49	12.92	14.34	15.77	17.20	18.63	20.06	21.49	22.92	24.34	27.20	30.05	35.76	41.47	47.17	52.87
600	13.42	15.09	16.76	18.43	20.10	21.77	23.44	25.10	26.77	28.44	31.78	35.11	41.78	48.44	55.09	61.74
720	**15.66**	**17.61**	**19.56**	**21.51**	**23.46**	**25.40**	**27.35**	**29.30**	**31.24**	**33.19**	**37.08**	**40.97**	**48.74**	**56.50**	**64.26**	**72.00**
800	17.12	19.25	21.38	23.51	25.64	27.76	29.89	32.02	34.14	36.27	40.52	44.77	53.26	61.73	70.19	78.64
960	**19.96**	**22.44**	**24.93**	**27.41**	**29.89**	**32.37**	**34.84**	**37.32**	**39.80**	**42.28**	**47.23**	**52.17**	**62.05**	**71.91**	**81.74**	**91.54**
1000	20.66	23.23	25.80	28.36	30.93	33.50	36.06	38.62	41.19	43.75	48.87	53.99	64.20	74.40	84.56	94.70
1100	22.38	25.17	27.95	30.73	33.51	36.29	39.07	41.84	44.62	47.39	52.93	58.47	69.53	80.55	91.54	102.48
1200	24.09	27.08	30.07	33.06	36.05	39.04	42.03	45.01	48.00	50.98	56.94	62.89	74.76	86.60	98.39	110.12
1440	**28.09**	**31.58**	**35.07**	**38.55**	**42.04**	**45.52**	**49.00**	**52.47**	**55.94**	**59.41**	**66.34**	**73.26**	**87.05**	**100.76**	**114.40**	**127.94**
1600	30.71	34.53	38.34	42.14	45.95	49.75	53.55	57.34	61.13	64.92	72.48	80.02	95.04	109.96	124.77	139.46
2000	37.14	41.75	46.35	50.94	55.53	60.11	64.69	69.26	73.82	78.37	87.45	96.50	114.46	132.23	149.79	167.11
2500	44.99	50.56	56.12	61.66	67.20	72.72	78.23	83.73	89.21	94.67	105.55	116.36	137.74	158.74	179.33	199.44
2880	**50.86**	**57.14**	**63.41**	**69.66**	**75.89**	**82.10**	**88.29**	**94.46**	**100.61**	**106.74**	**118.91**	**130.97**	**154.73**	**177.92**	**200.47**	**222.30**
3000	52.70	59.20	65.69	72.15	78.60	85.03	91.43	97.81	104.16	110.49	123.06	135.50	159.97	183.80	206.91	229.20
3500	60.29	67.70	75.09	82.45	89.77	97.07	104.32	111.54	118.72	125.85	139.99	153.92	181.13	207.33		
4000	67.77	76.07	84.33	92.55	100.72	108.84	116.91	124.92	132.87	140.75	156.32	171.59	201.14			
4500	75.14	84.31	93.42	102.46	111.44	120.35	129.18	137.93	146.59	155.16	172.02	188.45				
5000	82.42	92.42	102.34	112.18	121.93	131.58	141.12	135.33	143.70	169.05	187.03	204.43				

8M LENGTH CORRECTION FACTORS	Belt Pitch Length Lp (mm)	460-600	640-880	960-1200	1280-1760	1800 & above
	Length Correction Factor	0.80	0.90	1.00	1.10	1.20

BLACKHAWK
SYNCHRONOUS BELTS

14M BLACKHAWK POWER RATING TABLE - 40mm WIDE (14M BH 40)

No. Teeth	28	29	30	32	34	36	38	40	44	48	52	56	60	64	68	72	80
P.D. (mm)	124.78	129.23	133.69	142.60	151.52	160.43	169.34	178.25	196.08	213.90	231.73	249.55	267.38	285.21	303.03	320.86	356.51
RPM of Faster Shaft	Base Kilowatt Rating for Small Sprocket																
10	0.64	0.67	0.71	0.77	0.83	0.90	0.95	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	2.00
20	1.21	1.27	1.32	1.44	1.56	1.69	1.78	1.88	2.06	2.25	2.44	2.63	2.82	3.00	3.19	3.38	3.75
30	1.74	1.82	1.91	2.08	2.25	2.44	2.57	2.71	2.98	3.25	3.52	3.79	4.06	4.33	4.60	4.87	5.41
50	2.76	2.89	3.02	3.29	3.57	3.85	4.07	4.28	4.71	5.14	5.57	5.99	6.42	6.85	7.28	7.71	8.56
70	3.72	3.90	4.08	4.44	4.82	5.20	5.49	5.78	6.36	6.94	7.52	8.09	8.67	9.25	9.83	10.41	11.56
100	5.11	5.35	5.60	6.10	6.61	7.15	7.54	7.94	8.73	9.53	10.32	11.11	11.91	12.70	13.50	14.29	15.88
200	9.42	9.87	10.32	11.24	12.19	13.17	13.90	14.63	16.09	17.56	19.02	20.48	21.94	23.41	24.87	26.33	29.25
300	13.43	14.06	14.70	16.02	17.37	18.77	19.81	20.85	22.93	25.02	27.10	29.18	31.26	33.34	35.42	37.50	41.66
400	17.24	18.05	18.87	20.56	22.30	24.09	25.42	26.76	29.43	32.10	34.77	37.44	40.11	42.78	45.44	48.10	53.42
500	20.90	21.88	22.88	24.92	27.03	29.20	30.82	32.44	35.67	38.91	42.14	45.37	48.60	51.82	55.04	58.26	64.68
600	24.44	25.59	26.76	29.14	31.61	34.14	36.04	37.93	41.71	45.48	49.25	53.02	56.78	60.54	64.29	68.04	75.51
720	**28.56**	**29.90**	**31.26**	**34.05**	**36.93**	**39.89**	**42.10**	**44.30**	**48.71**	**53.11**	**57.51**	**61.89**	**66.27**	**70.64**	**75.00**	**79.35**	**88.02**
800	31.24	32.71	34.19	37.24	40.38	43.62	46.03	48.44	53.26	58.06	62.86	67.64	72.41	77.18	81.93	86.66	96.09
960	**36.46**	**38.16**	**39.90**	**43.45**	**47.11**	**50.88**	**53.69**	**56.49**	**62.09**	**67.67**	**73.23**	**78.78**	**84.30**	**89.81**	**95.29**	**100.75**	**111.60**
1000	37.73	39.50	41.29	44.97	48.75	52.66	55.56	58.46	64.24	70.01	75.76	81.49	87.20	92.88	98.54	104.17	115.35
1100	40.88	42.79	44.73	48.71	52.81	57.03	60.17	63.30	69.55	75.78	81.98	88.15	94.30	100.42	106.50	112.54	124.52
1200	43.97	46.02	48.11	52.38	56.79	61.32	64.69	68.05	74.75	81.42	88.06	94.66	101.22	107.75	114.23	120.67	133.39
1440	**51.17**	**53.55**	**55.98**	**60.93**	**66.04**	**71.29**	**75.18**	**79.06**	**86.79**	**94.46**	**102.08**	**109.64**	**117.13**	**124.55**	**131.90**	**139.17**	**153.45**
1600	55.82	58.41	61.05	66.44	71.99	77.70	81.92	86.13	94.49	102.79	111.01	119.14	127.19	135.14	142.99	150.73	165.85
2000	66.95	70.05	73.19	79.60	86.20	92.97	97.95	102.90	112.71	122.38	131.90	141.26	150.44	159.44	168.24		
2500	80.00	83.66	87.37	94.94	102.69	110.63	116.42	122.15	133.43	144.43	155.15	165.54					
2880	**89.32**	**93.37**	**97.47**	**105.80**	**114.33**	**123.04**	**129.33**	**135.53**	**147.64**	**159.34**							
3000	92.16	96.32	100.53	109.10	117.85	126.77	133.20	139.52	151.85								
3500	103.47	108.06	112.70	122.10	131.67	141.38	148.25	154.97									

Service life will be reduced in this area due to high belt flexing.

14M BLACKHAWK POWER RATING TABLE - 55mm WIDE (14M BH 55)

No. Teeth	28	29	30	32	34	36	38	40	44	48	52	56	60	64	68	72	80
P.D. (mm)	124.78	129.23	133.69	142.60	151.52	160.43	169.34	178.25	196.08	213.90	231.73	249.55	267.38	285.21	303.03	320.86	356.51
RPM of Faster Shaft	Base Kilowatt Rating for Small Sprocket																
10	0.93	0.97	1.02	1.11	1.20	1.30	1.37	1.44	1.59	1.73	1.87	2.02	2.16	2.31	2.45	2.59	2.88
20	1.74	1.82	1.91	2.08	2.25	2.43	2.57	2.70	2.97	3.24	3.51	3.78	4.05	4.32	4.59	4.86	5.41
30	2.51	2.63	2.75	2.99	3.25	3.51	3.70	3.90	4.29	4.68	5.07	5.46	5.85	6.23	6.62	7.01	7.79
50	3.97	4.16	4.35	4.73	5.13	5.55	5.86	6.16	6.78	7.40	8.01	8.63	9.25	9.86	10.48	11.10	12.33
70	5.36	5.61	5.87	6.39	6.94	7.49	7.91	8.33	9.16	9.99	10.82	11.66	12.49	13.32	14.15	14.99	16.65
100	7.36	7.71	8.06	8.78	9.52	10.29	10.86	11.43	12.58	13.72	14.86	16.00	17.15	18.29	19.43	20.58	22.86
200	13.57	14.21	14.86	16.18	17.55	18.96	20.02	21.07	23.18	25.28	27.39	29.49	31.60	33.70	35.81	37.91	42.12
300	19.34	20.25	21.17	23.06	25.01	27.03	28.53	30.03	33.03	36.03	39.02	42.02	45.02	48.02	51.01	54.01	59.99
400	24.83	25.99	27.18	29.60	32.11	34.69	36.61	38.54	42.38	46.23	50.08	53.92	57.76	61.60	65.43	69.27	76.93
500	30.10	31.51	32.95	35.89	38.92	42.05	44.38	46.71	51.37	56.03	60.68	65.33	69.98	74.62	79.26	83.89	93.14
600	35.20	36.85	38.53	41.97	45.51	49.17	51.89	54.61	60.06	65.49	70.93	76.35	81.77	87.18	92.58	97.98	108.74
720	**41.13**	**43.06**	**45.02**	**49.03**	**53.17**	**57.44**	**60.62**	**63.80**	**70.14**	**76.48**	**82.81**	**89.13**	**95.43**	**101.72**	**108.00**	**114.27**	**126.75**
800	44.99	47.10	49.24	53.63	58.15	62.82	66.29	69.76	76.69	83.61	90.51	97.40	104.28	111.13	117.97	124.79	138.36
960	**52.50**	**54.95**	**57.45**	**62.57**	**67.84**	**73.27**	**77.31**	**81.35**	**89.40**	**97.44**	**105.45**	**113.44**	**121.40**	**129.32**	**137.22**	**145.08**	**160.70**
1000	54.33	56.88	59.46	64.75	70.21	75.82	80.00	84.18	92.51	100.82	109.09	117.34	125.56	133.75	141.90	150.01	166.10
1100	58.87	61.62	64.42	70.14	76.05	82.12	86.64	91.15	100.15	109.12	118.05	126.94	135.79	144.60	153.36	162.06	179.31
1200	63.32	66.27	69.28	75.43	81.77	88.30	93.15	97.99	107.63	117.24	126.80	136.31	145.76	155.16	164.49	173.76	192.08
1440	**73.68**	**77.12**	**80.61**	**87.74**	**95.09**	**102.65**	**108.26**	**113.85**	**124.97**	**136.02**	**146.99**	**157.88**	**168.67**	**179.36**	**189.94**	**200.41**	**220.97**
1600	80.38	84.11	87.91	95.68	103.67	111.88	117.97	124.02	136.07	148.02	159.85	171.57	183.15	194.60	205.90	217.05	238.83
2000	96.41	100.87	105.39	114.63	124.13	133.87	141.05	148.18	162.30	176.23	189.94	203.42	216.64	229.59	242.26		
2500	115.20	120.48	125.82	136.71	147.88	159.31	167.65	175.90	192.13	207.98	223.41	238.38					
2880	**128.63**	**134.45**	**140.35**	**152.36**	**164.64**	**177.17**	**186.23**	**195.16**	**212.60**	**229.46**							
3000	132.71	138.70	144.77	157.10	169.70	182.55	191.80	200.91	218.66								
3500	148.99	155.61	162.28	175.83	189.60	203.59	213.48	223.15									

14M LENGTH CORRECTION FACTORS	Belt Pitch Length Lp (mm)	966-1190	1400-1610	1778-1890	2100-2450	2590-3150	3360 & above
	Length Correction Factor	0.80	0.90	0.95	1.00	1.05	1.10

BLACKHAWK
SYNCHRONOUS BELTS

14M BLACKHAWK POWER RATING TABLE - 85mm WIDE (14M BH 85)

No. Teeth	28	29	30	32	34	36	38	40	44	48	52	56	60	64	68	72	80
P.D. (mm)	**124.78**	**129.23**	**133.69**	**142.60**	**151.52**	**160.43**	**169.34**	**178.25**	**196.08**	**213.90**	**231.73**	**249.55**	**267.38**	**285.21**	**303.03**	**320.86**	**356.51**
RPM of Faster Shaft	**Base Kilowatt Rating for Small Sprocket**																
10	1.48	1.55	1.62	1.77	1.92	2.07	2.19	2.30	2.53	2.76	2.99	3.22	3.45	3.68	3.91	4.14	4.60
20	2.78	2.91	3.04	3.32	3.60	3.89	4.10	4.32	4.75	5.18	5.61	6.04	6.48	6.91	7.34	7.77	8.63
30	4.01	4.20	4.39	4.78	5.18	5.60	5.91	6.22	6.85	7.47	8.09	8.71	9.34	9.96	10.58	11.20	12.45
50	6.34	6.64	6.94	7.56	8.20	8.86	9.35	9.85	10.83	11.82	12.80	13.78	14.77	15.75	16.74	17.72	19.69
70	8.56	8.97	9.37	10.21	11.08	11.97	12.63	13.30	14.63	15.96	17.29	18.62	19.95	21.28	22.61	23.94	26.59
100	11.76	12.31	12.87	14.02	15.21	16.43	17.35	18.26	20.09	21.91	23.74	25.56	27.39	29.21	31.04	32.87	36.52
200	21.67	22.69	23.73	25.85	28.03	30.29	31.97	33.65	37.02	40.38	43.74	47.11	50.47	53.83	57.19	60.56	67.28
300	30.89	32.34	33.82	36.84	39.95	43.17	45.56	47.96	52.75	57.54	62.33	67.12	71.91	76.69	81.48	86.26	95.82
400	39.65	41.51	43.41	47.28	51.28	55.40	58.48	61.55	67.70	73.84	79.98	86.12	92.25	98.39	104.51	110.64	122.87
500	48.07	50.33	52.62	57.32	62.17	67.16	70.88	74.61	82.05	89.49	96.92	104.35	111.77	119.19	126.59	133.99	148.77
600	56.22	58.86	61.54	67.03	72.69	78.53	82.88	87.23	95.92	104.61	113.28	121.95	130.60	139.25	147.88	156.49	173.68
720	**65.70**	**68.78**	**71.91**	**78.32**	**84.93**	**91.75**	**96.82**	**101.90**	**112.04**	**122.16**	**132.27**	**142.36**	**152.43**	**162.48**	**172.51**	**182.51**	**202.45**
800	71.86	75.22	78.65	85.66	92.88	100.33	105.88	111.42	122.49	133.54	144.57	155.58	166.55	177.51	188.43	199.32	221.00
960	**83.85**	**87.77**	**91.76**	**99.93**	**108.35**	**117.02**	**123.48**	**129.93**	**142.80**	**155.63**	**168.43**	**181.19**	**193.90**	**206.56**	**219.17**	**231.73**	**256.67**
1000	86.78	90.84	94.97	103.42	112.14	121.11	127.78	134.45	147.76	161.02	174.25	187.43	200.55	213.62	226.64	239.59	265.30
1100	94.02	98.42	102.89	112.04	121.46	131.17	138.39	145.59	159.97	174.29	188.55	202.76	216.89	230.96	244.94	258.85	286.40
1200	101.13	105.86	110.66	120.48	130.61	141.03	148.78	156.51	171.92	187.26	202.53	217.72	232.82	247.82	262.73	277.53	306.80
1440	**117.69**	**123.18**	**128.75**	**140.15**	**151.88**	**163.96**	**172.91**	**181.84**	**199.61**	**217.26**	**234.78**	**252.17**	**269.40**	**286.47**	**303.37**	**320.09**	**352.94**
1600	128.38	134.35	140.41	152.81	165.58	178.70	188.42	198.09	217.34	236.42	255.32	274.03	292.54	310.82	328.87	346.67	381.46
2000	153.99	161.11	168.33	183.09	198.26	213.83	225.28	236.67	259.23	281.48	303.38	324.90	346.02	366.71	386.94		
2500	184.01	192.43	200.96	218.36	236.20	254.46	267.77	280.95	306.88	332.20	356.84	380.74					
2880	**205.44**	**214.75**	**224.17**	**243.35**	**262.96**	**282.99**	**297.45**	**311.71**	**339.57**	**366.49**							
3000	211.97	221.54	231.23	250.92	271.05	291.58	306.35	320.90	349.25								
3500	237.98	248.54	259.20	280.84	302.84	325.17	340.98	356.42									

Service life will be reduced in this area due to high belt flexing.

14M BLACKHAWK POWER RATING TABLE - 115mm WIDE (14M BH 115)

No. Teeth	28	29	30	32	34	36	38	40	44	48	52	56	60	64	68	72	80
P.D. (mm)	**124.78**	**129.23**	**133.69**	**142.60**	**151.52**	**160.43**	**169.34**	**178.25**	**196.08**	**213.90**	**231.73**	**249.55**	**267.38**	**285.21**	**303.03**	**320.86**	**356.51**
RPM of Faster Shaft	**Base Kilowatt Rating for Small Sprocket**																
10	2.04	2.14	2.24	2.44	2.64	2.85	3.01	3.17	3.49	3.81	4.12	4.44	4.76	5.08	5.39	5.71	6.34
20	3.83	4.01	4.19	4.57	4.96	5.35	5.65	5.95	6.54	7.14	7.73	8.33	8.92	9.52	10.11	10.71	11.90
30	5.52	5.78	6.05	6.59	7.15	7.72	8.15	8.58	9.44	10.29	11.15	12.01	12.87	13.73	14.58	15.44	17.16
50	8.74	9.15	9.57	10.42	11.30	12.21	12.89	13.57	14.93	16.28	17.64	19.00	20.36	21.71	23.07	24.43	27.14
70	11.80	12.36	12.92	14.08	15.27	16.50	17.41	18.33	20.16	21.99	23.83	25.66	27.49	29.32	31.16	32.99	36.65
100	16.21	16.97	17.74	19.33	20.96	22.65	23.91	25.17	27.68	30.20	32.72	35.23	37.75	40.26	42.78	45.30	50.33
200	29.87	31.28	32.70	35.62	38.64	41.75	44.06	46.38	51.02	55.66	60.29	64.93	69.56	74.20	78.83	83.46	92.73
300	42.58	44.57	46.61	50.77	55.07	59.49	62.80	66.10	72.70	79.31	85.91	92.51	99.11	105.70	112.30	118.89	132.06
400	54.65	57.22	59.82	65.17	70.68	76.36	80.60	84.83	93.30	101.77	110.24	118.70	127.15	135.60	144.05	152.49	169.35
500	66.26	69.37	72.53	79.00	85.68	92.56	97.70	102.83	113.09	123.34	133.58	143.82	154.05	164.27	174.48	184.68	205.04
600	77.48	81.12	84.81	92.38	100.19	108.23	114.23	120.23	132.21	144.18	156.13	168.08	180.00	191.92	203.81	215.69	239.38
720	**90.55**	**94.79**	**99.11**	**107.94**	**117.06**	**126.45**	**133.45**	**140.44**	**154.41**	**168.37**	**182.30**	**196.20**	**210.08**	**223.94**	**237.76**	**251.55**	**279.03**
800	99.04	103.68	108.39	118.06	128.02	138.28	145.93	153.57	168.82	184.06	199.26	214.42	229.56	244.65	259.70	274.71	304.59
960	**115.56**	**120.97**	**126.47**	**137.73**	**149.34**	**161.29**	**170.19**	**179.07**	**196.81**	**214.50**	**232.14**	**249.72**	**267.24**	**284.69**	**302.08**	**319.39**	**353.76**
1000	119.61	125.21	130.90	142.54	154.55	166.92	176.12	185.31	203.65	221.93	240.16	258.32	276.41	294.43	312.37	330.22	365.66
1100	129.59	135.65	141.81	154.41	167.41	180.79	190.73	200.66	220.48	240.22	259.88	279.45	298.93	318.32	337.60	356.76	394.73
1200	139.38	145.90	152.51	166.06	180.01	194.38	205.05	215.71	236.95	258.09	279.14	300.07	320.88	341.57	362.11	382.51	422.85
1440	**162.21**	**169.77**	**177.45**	**193.16**	**209.34**	**225.98**	**238.32**	**250.62**	**275.11**	**299.44**	**323.59**	**347.55**	**371.30**	**394.84**	**418.13**	**441.17**	**486.44**
1600	176.94	185.17	193.53	210.62	228.21	246.30	259.69	273.02	299.55	325.84	351.90	377.69	403.19	428.39	453.27	477.80	525.75
2000	212.24	222.05	232.01	252.35	273.25	294.71	310.50	326.20	357.29	387.95	418.13	447.80	476.91	505.42	533.31		
2500	253.61	265.21	276.97	300.96	325.54	350.71	369.06	387.22	422.96	457.85	491.81	524.77					
2880	**283.15**	**295.98**	**308.97**	**335.40**	**362.43**	**390.03**	**409.96**	**429.62**	**468.02**	**505.12**							
3000	292.16	305.34	318.69	345.84	373.58	401.87	422.23	442.28	481.36								
3500	327.99	342.55	357.25	387.07	417.39	448.18	469.96	491.24									

14M LENGTH CORRECTION FACTORS	Belt Pitch Length Lp (mm)	966-1190	1400-1610	1778-1890	2100-2450	2590-3150	3360 & above
	Length Correction Factor	0.80	0.90	0.95	1.00	1.05	1.10

BLACKHAWK
SYNCHRONOUS BELTS

14M BLACKHAWK POWER RATING TABLE - 170mm WIDE (14M BH 170)

No. Teeth	28	29	30	32	34	36	38	40	44	48	52	56	60	64	68	72	80
P.D. (mm)	**124.78**	**129.23**	**133.69**	**142.60**	**151.52**	**160.43**	**169.34**	**178.25**	**196.08**	**213.90**	**231.73**	**249.55**	**267.38**	**285.21**	**303.03**	**320.86**	**356.51**
RPM of Faster Shaft	**Base Kilowatt Rating for Small Sprocket**																
10	3.06	3.20	3.35	3.65	3.96	4.28	4.52	4.75	5.23	5.70	6.18	6.65	7.13	7.61	8.08	8.56	9.51
20	5.74	6.01	6.29	6.85	7.43	8.02	8.47	8.92	9.81	10.70	11.59	12.48	13.37	14.26	15.16	16.05	17.83
30	8.28	8.67	9.06	9.87	10.71	11.57	12.21	12.85	14.14	15.42	16.71	18.00	19.28	20.57	21.85	23.14	25.71
50	13.10	13.71	14.34	15.62	16.94	18.30	19.32	20.33	22.37	24.40	26.43	28.47	30.50	32.53	34.57	36.60	40.67
70	17.69	18.52	19.36	21.09	22.88	24.72	26.09	27.46	30.21	32.96	35.70	38.45	41.19	43.94	46.69	49.43	54.92
100	24.29	25.43	26.59	28.96	31.41	33.94	35.83	37.71	41.48	45.25	49.02	52.79	56.56	60.33	64.10	67.87	75.41
200	44.76	46.86	49.00	53.38	57.90	62.55	66.03	69.50	76.45	83.40	90.34	97.29	104.23	111.18	118.12	125.06	138.94
300	63.80	66.79	69.84	76.08	82.51	89.15	94.10	99.04	108.94	118.84	128.73	138.62	148.50	158.39	168.27	178.15	197.89
400	81.89	85.73	89.64	97.65	105.91	114.42	120.77	127.12	139.81	152.50	165.18	177.86	190.53	203.19	215.84	228.49	253.76
500	99.28	103.94	108.67	118.38	128.39	138.70	146.39	154.08	169.45	184.82	200.17	215.51	230.83	246.14	261.44	276.72	307.23
600	116.10	121.55	127.09	138.43	150.13	162.18	171.17	180.15	198.10	216.04	233.95	251.85	269.72	287.57	305.40	323.19	358.70
720	**135.67**	**142.04**	**148.50**	**161.75**	**175.40**	**189.47**	**199.96**	**210.44**	**231.38**	**252.28**	**273.16**	**293.99**	**314.79**	**335.55**	**356.26**	**376.93**	**418.11**
800	148.40	155.35	162.42	176.90	191.82	207.20	218.66	230.11	252.97	275.79	298.57	321.30	343.97	366.59	389.14	411.64	456.41
960	**173.16**	**181.27**	**189.51**	**206.38**	**223.77**	**241.68**	**255.01**	**268.33**	**294.91**	**321.41**	**347.84**	**374.19**	**400.44**	**426.59**	**452.64**	**478.57**	**530.08**
1000	179.23	187.61	196.14	213.59	231.58	250.11	263.90	277.67	305.15	332.55	359.86	387.07	414.18	441.18	468.06	494.81	547.91
1100	194.18	203.26	212.49	231.38	250.85	270.89	285.80	300.68	330.37	359.94	389.40	418.74	447.93	476.97	505.86	534.58	591.47
1200	208.85	218.61	228.53	248.82	269.73	291.26	307.26	323.22	355.05	386.73	418.26	449.63	480.82	511.81	542.60	573.17	633.60
1440	**243.06**	**254.39**	**265.89**	**289.43**	**313.67**	**338.61**	**357.10**	**375.53**	**412.23**	**448.69**	**484.88**	**520.78**	**556.37**	**591.63**	**626.53**	**661.06**	**728.89**
1600	265.13	277.46	289.98	315.60	341.96	369.06	389.12	409.11	448.85	488.25	527.29	565.94	604.15	641.92	679.19	715.95	787.80
2000	318.03	332.73	347.65	378.12	409.45	441.60	465.26	488.78	535.37	581.31	626.54	670.99	714.61	757.34	799.12		
2500	380.02	397.40	415.02	450.96	487.80	525.51	553.00	580.22	633.78	686.06	736.94	786.32					
2880	**424.28**	**443.50**	**462.96**	**502.57**	**543.08**	**584.43**	**614.30**	**643.75**	**701.29**	**756.89**							
3000	437.77	457.53	477.53	518.21	559.78	602.17	632.69	662.73	721.28								
3500	491.47	513.28	535.31	579.99	625.43	671.56	704.20	736.09									

Service life will be reduced in this area due to high belt flexing.

Sprocket Diameter vs. Speed

Drives shaded in the Kilowatt Tables use sprocket diameters below minimum recommendations, which can lead to reduced belt life. The amount of reduction will depend on speed. The greater the speed the greater the reduction in belt life. Blanks may occur in the tables when the speed of the sprocket exceeds 33 m/sec. Centrifugal forces beyond 33 m/sec will prevent the use of stock cast iron sprockets. Contact sprocket manufacturer for availability. (See also Note 'a' on page 7 concerning this subject.)

14M LENGTH CORRECTION FACTORS	Belt Pitch Length Lp (mm)	966-1190	1400-1610	1778-1890	2100-2450	2590-3150	3360 & above
	Length Correction Factor	0.80	0.90	0.95	1.00	1.05	1.10

BLACKHAWK
SYNCHRONOUS BELTS

Sprocket

The sprocket is also defined by three dimensions.

NUMBER OF TEETH **PITCH** **SPROCKET WIDTH**

Number of Teeth

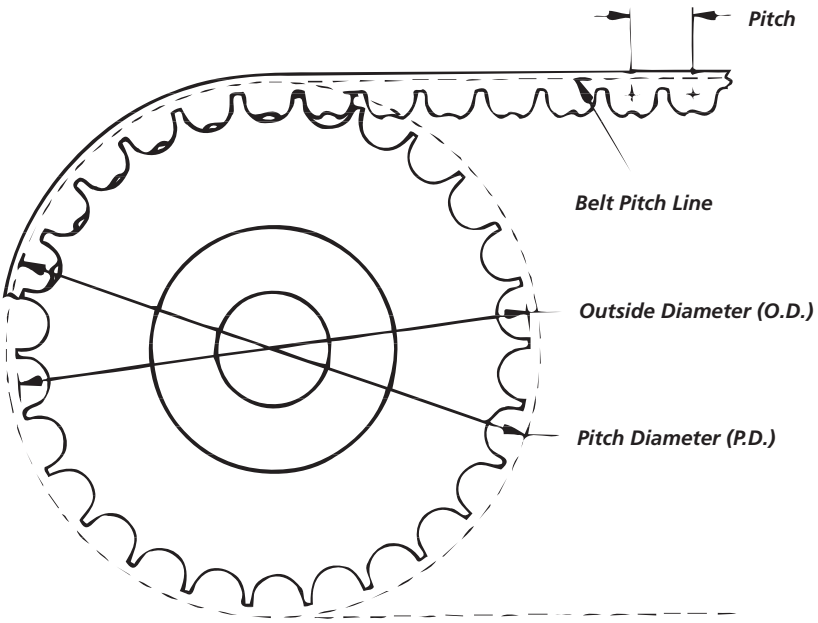
The Number of Teeth are the number of grooves cut into the Outside Diameter of the sprocket. The Number of Teeth and Pitch will determine the size of the sprocket. Standard sizes are listed in the Sprocket Dimension Tables on pages 21-22.

Pitch

On the sprocket, Pitch is the distance between tooth centres and is measured on the sprocket's pitch circumference. Sprockets are manufactured in both 8mm and 14mm pitches.

Sprocket Width

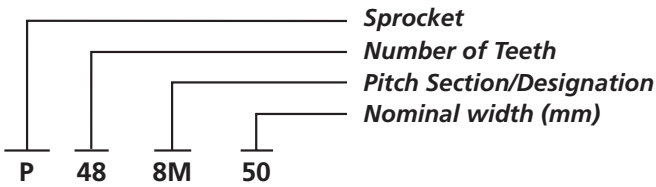
The nominal sprocket width is the same as the maximum belt width for which it was designed. Belt Width is defined as the "side to side" distance of the belt.



Sprocket Pitch Circumference

The Pitch Diameter of the sprocket coincides with the Belt Pitch Line. The Belt Pitch Line is located within the tension member of the belt and is outside of the sprocket Outside Diameter. The Pitch Diameter is greater than the Outside Diameter.

Part Number Explanation



Bush Style

The bush style, available with a given sprocket, can also be designated within the sprocket part number. A sprocket might be available as a minimum pilot bore (MPB) or fitted for a standard Taper-Lock bush. **Contact sprocket manufacturers for the specific bush and sprocket part numbers**.

BlackHawk Pd Belts are compatible with the following sprockets:

Sprocket Tooth Profile	Part Number Description
RPP	P30-8M-20-*
HTD	P30-8M-20-*
PGGT	P30-8MGT-20-*

* – MPB or Taper-Lock as available

BLACKHAWK
SYNCHRONOUS BELTS

Sprocket Dimensions

8M For Design Reference Only. Contact sprocket manufacturer for engineering detail and availability.

Sprocket Number	Number of Teeth	Sprocket P.D.	Sprocket O.D.	Flange O.D.*
FOR BELTS 20mm WIDE • 8mm PITCH (8M-20) Face Width = 28mm				
P22-8M-20	22	56.02	54.65	60.0
P24-8M-20	24	61.12	59.75	66.0
P26-8M-20	26	66.21	64.84	71.0
P28-8M-20	28	71.30	69.93	75.0
P30-8M-20	30	76.39	75.02	83.0
P32-8M-20	32	81.49	80.12	87.0
P34-8M-20	34	86.58	85.22	91.0
P36-8M-20	36	91.67	90.30	98.5
P38-8M-20	38	96.77	95.40	103.0
P40-8M-20	40	101.86	100.49	106.0
P44-8M-20	44	112.05	110.68	119.0
P48-8M-20	48	122.23	120.86	127.0
P56-8M-20	56	142.60	141,23	148.0
P64-8M-20	64	162.97	161.60	168.0
P72-8M-20	72	183.35	181.98	192.0
P80-8M-20	80	203.72	202.35	—
P90-8M-20	90	229.18	227.81	—
FOR BELTS 50mm WIDE • 8mm PITCH (8M-50) Face Width = 60mm				
P28-8M-50	28	71.30	69.93	75.0
P30-8M-50	30	76.39	75.02	83.0
P32-8M-50	32	81.49	80.12	87.0
P34-8M-50	34	86.58	85.22	91.0
P36-8M-50	36	91.67	90.30	98.5
P38-8M-50	38	96.77	95.40	103.0
P40-8M-50	40	101.86	100.49	106.0
P44-8M-50	44	112.05	110.68	119.0
P48-8M-50	48	122.23	120.86	127.0
P56-8M-50	56	142.60	141.23	148.0
P64-8M-50	64	162.97	161.60	168.0
P72-8M-50	72	183.35	181.98	192.0
P80-8M-50	80	203.22	202.35	—
P90-8M-50	90	229.18	227.81	—
P112-8M-50	112	285.21	283.84	—
P144-8M-50	144	366.69	365.32	—
P192-8M-50	192	488.92	487.55	—

Sprocket Number	Number of Teeth	Sprocket P.D.	Sprocket O.D.	Flange O.D.*
FOR BELTS 30mm WIDE • 8mm PITCH (8M-30) Face Width = 38mm				
P22-8M-30	22	56.02	54.65	60.0
P24-8M-30	24	61.12	59.75	66.0
P26-8M-30	26	66.21	64.84	71.0
P28-8M-30	28	71.30	69.93	75.0
P30-8M-30	30	76.39	75.02	83.0
P32-8M-30	32	81.49	80.12	87.0
P34-8M-30	34	86.58	85.22	91.0
P36-8M-30	36	91.67	90.30	98.5
P38-8M-30	38	96.77	95.40	103.0
P40-8M-30	40	101.86	100.49	106.0
P44-8M-30	44	112.05	110.68	119.0
P48-8M-30	48	122.23	120.86	127.0
P56-8M-30	56	142.60	141.23	148.0
P64-8M-30	64	162.97	161.60	168.0
P72-8M-30	72	183.35	181.98	192.0
P80-8M-30	80	203.72	202.35	—
P90-8M-30	90	229.18	227.81	—
P112-8M-30	112	285.21	283.84	—
FOR BELTS 85mm WIDE • 8mm PITCH (8M-85) Face Width = 95mm				
P34-8M-85	34	86.58	85.22	91.0
P36-8M-85	36	91.67	90.30	98.5
P38-8M-85	38	96.77	95.40	103.0
P40-8M-85	40	101.86	100.49	106.0
P44-8M-85	44	112.05	110.68	119.0
P48-8M-85	48	122.23	120.86	127.0
P56-8M-85	56	142.60	141.23	148.0
P64-8M-85	64	162.97	161.60	168.0
P72-8M-85	72	183.35	181.98	192.0
P80-8M-85	80	203.72	202.35	—
P90-8M-85	90	229.18	227.81	—
P112-8M-85	112	285.21	283.84	—
P144-8M-85	144	366.69	365.32	—
P192-8M-85	192	488.92	487.55	—

14M For Design Reference Only. Contact sprocket manufacturer for engineering detail and availability.

Sprocket Number	Number of Teeth	Sprocket P.D.	Sprocket O.D.	Flange O.D.*
FOR BELTS 40mm WIDE • 14mm PITCH (14M-40) Face Width = 54mm				
P28-14M-40	28	124.78	121.98	127.0
P29-14M-40	29	129.23	126.43	138.0
P30-14M-40	30	133.69	130.89	138.0
P32-14M-40	32	142.60	139.80	154.0
P34-14M-40	34	151.52	148.72	160.0
P36-14M-40	36	160.43	157.63	168.0
P38-14M-40	38	169.34	166.54	183.0
P40-14M-40	40	178.25	175.45	188.0
P44-14M-40	44	196.08	193.28	211.0
P48-14M-40	48	213.91	211.11	226.0
P52-14M-40	52	231.73	228.93	241.0
P56-14M-40	56	249.56	246.76	256.0
P60-14M-40	60	267.38	264.48	281.0
P64-14M-40	64	285.21	282.41	296.0
P68-14M-40	68	303.03	300.23	318.0
P72-14M-40	72	320.86	318.06	—
P80-14M-40	80	356.51	353.71	—
P90-14M-40	90	401.07	398.27	—
P112-14M-40	112	499.11	496.31	—
P144-14M-40	144	641.71	638.91	—

Sprocket Number	Number of Teeth	Sprocket P.D.	Sprocket O.D.	Flange O.D.*
FOR BELTS 55mm WIDE • 14mm PITCH (14M-55) Face Width = 70mm				
P28-14M-55	28	124.78	121.98	127.0
P29-14M-55	29	129.23	126.43	138.0
P30-14M-55	30	133.69	130.89	138.0
P32-14M-55	32	142.60	139.80	154.0
P34-14M-55	34	151.52	148.72	160.0
P36-14M-55	36	160.43	157.63	168.0
P38-14M-55	38	169.34	166.54	183.0
P40-14M-55	40	178.25	175.45	188.0
P44-14M-55	44	196.08	193.28	211.0
P48-14M-55	48	213.91	211.11	226.0
P52-14M-55	52	231.33	228.93	241.0
P56-14M-55	56	249.56	246.76	256.0
P60-14M-55	60	267.38	264.48	281.0
P64-14M-55	64	285.21	282.41	296.0
P68-14M-55	68	303.03	300.23	318.0
P72-14M-55	72	320.86	318.06	—
P80-14M-55	80	356.51	353.71	—
P90-14M-55	90	401.07	398.27	—
P112-14M-55	112	499.11	496.31	—
P144-14M-55	144	641.71	638.91	—
P168-14M-55	168	748.67	745.87	—
P192-14M-55	192	855.62	852.82	—
P216-14M-55	216	962.57	959.77	—

BLACKHAWK
SYNCHRONOUS BELTS

14M *continued*

Sprocket Number	Number of Teeth	Sprocket P.D.	Sprocket O.D.	Flange O.D.*
FOR BELTS 85mm WIDE • 14mm PITCH (14M-85) Face Width = 102mm				
P28-14M-85	28	124.78	121.98	127.0
P29-14M-85	29	129.33	126.43	138.0
P30-14M-85	30	133.69	130.89	138.0
P32-14M-85	32	142.60	139.80	154.0
P34-14M-85	34	151.52	148.72	160.0
P36-14M-85	36	160.43	157.63	168.0
P38-14M-85	38	169.34	166.54	183.0
P40-14M-85	40	178.25	175.45	188.0
P44-14M-85	44	196.08	193.28	211.0
P48-14M-85	48	213.91	211.11	226.0
P52-14M-85	52	231.73	228.93	241.0
P56-14M-85	56	249.56	246.76	256.0
P60-14M-85	60	267.38	264.48	281.0
P64-14M-85	64	285.21	282.41	296.0
P68-14M-85	68	303.03	300.23	318.0
P72-14M-85	72	320.86	318.06	—
P80-14M-85	80	356.51	353.71	—
P90-14M-85	90	401.07	398.27	—
P112-14M-85	112	499.11	496.31	—
P144-14M-85	144	641.71	638.91	—
P168-14M-85	168	748.67	745.87	—
P192-14M-85	192	855.62	852.82	—
P216-14M-85	216	962.57	959.77	—
FOR BELTS 170mm WIDE • 14mm PITCH (14M-170) Face Width = 187mm				
P36-14M-170	36	160.43	157.63	168.0
P38-14M-170	38	169.34	166.54	183.0
P40-14M-170	40	178.25	175.45	188.0
P44-14M-170	44	196.08	193.28	211.0
P48-14M-170	48	213.91	211.11	226.0
P52-14M-170	52	231.73	228.93	241.0
P56-14M-170	56	249.56	246.76	256.0
P60-14M-170	60	267.38	264.48	281.0
P64-14M-170	64	285.21	282.41	296.0
P68-14M-170	68	303.03	300.23	318.0
P72-14M-170	72	320.86	318.06	—
P80-14M-170	80	356.51	353.71	—
P90-14M-170	90	401.07	398.27	—
P112-14M-170	112	499.11	496.31	—
P144-14M-170	144	641.71	638.91	—
P168-14M-170	168	748.67	745.87	—
P192-14M-170	192	855.62	852.82	—
P216-14M-170	216	962.57	959.77	—

Sprocket Number	Number of Teeth	Sprocket P.D.	Sprocket O.D.	Flange O.D.*
FOR BELTS 115mm WIDE • 14mm PITCH (14M-115) Face Width = 133mm				
P28-14M-115	28	124.78	121.98	127.0
P29-14M-115	29	129.33	126.43	138.0
P30-14M-115	30	133.69	130.89	138.0
P32-14M-115	32	142.60	139.80	154.0
P34-14M-115	34	151.52	148.72	160.0
P36-14M-115	36	160.43	157.63	168.0
P38-14M-115	38	169.34	166.54	183.0
P40-14M-115	40	178.25	175.45	188.0
P44-14M-115	44	196.08	193.28	211.0
P48-14M-115	48	213.91	211.11	226.0
P52-14M-115	52	231.73	228.93	241.0
P56-14M-115	56	249.56	246.76	256.0
P60-14M-115	60	267.38	264.48	281.0
P64-14M-115	64	285.21	282.41	296.0
P68-14M-115	68	303.03	300.23	318.0
P72-14M-115	72	320.86	318.06	—
P80-14M-115	80	356.51	353.71	—
P90-14M-115	90	401.07	398.27	—
P112-14M-115	112	499.11	496.31	—
P144-14M-115	144	641.71	638.91	—
P168-14M-115	168	748.67	745.87	—
P192-14M-115	192	855.62	852.82	—
P216-14M-115	216	962.57	959.77	—

**Flange O.D.s are approximate and can vary from one sprocket manufacturer to another sprocket manufacturer. If important check the drawings/specifications of the respective sprocket manufacturer.*

Minimum Sprocket Diameters

I. Minimum Sprocket Diameters for Maximum Belt Life

To maximize belt life consider the following minimum recommended sprocket diameters for BlackHawk Pd

Pitch	Speed revs/min (min^{-1})	Number of Grooves	Pitch Diameter (mm)
8M	2880	32	81.49
	1440	26	66.21
	960	24	61.12
	720	22	56.02
14M	1440	30	133.69
	960	28	124.78
	720	28	124.78

II. Minimum Sprocket Diameters for Electric Motors Power (kW) at Speed - revs/min (min^{-1})

For optimum drive design and maximum life of motor bearings and shafts consult the motor manufacturer or/and the respective technical literature.

Diameters for Non-Standard Number of Teeth

Calculate Pitch Diameter as follows:

$$\text{Pitch Diameter (P.D.)} = \frac{\text{No. of Teeth x Pitch (mm)}}{\pi}$$

Where: $\pi = 3.1416$

For Outside Diameter (O.D.) subtract 1.37 mm for 8M and 2.80 mm for 14M from the Pitch Diameter (P.D.)

BLACKHAWK
SYNCHRONOUS BELTS

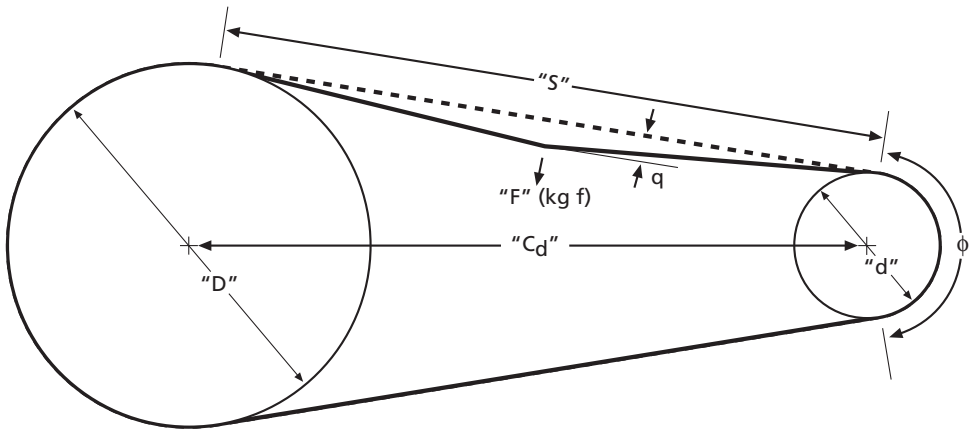
Belt Installation and Tensioning

OBJECTIVE:

The BlackHawk Pd belt must be installed and tensioned properly to ensure optimum performance. Both 'axial' and 'radial' sprocket alignment must be preserved while tensioning the drive.

Before commencing, inspect the belt for damage and confirm that the sprockets are correctly installed. Refer to sprocket and bush manufacturers installation procedures. Belts should never be crimped or bent to a diameter less than the minimum sprocket diameter, approximately 50mm for 8M belts and 128mm for 14M belts.

1. Reduce the centre distance or release the tensioning idler to install the Goodyear BlackHawk Pd belt. Do not force/lever the belt on to the sprocket. Refer to the Centre Distance Allowance tables on page 29, for the required centre distance adjustment.
2. Place the belt over and on to each sprocket and ensure proper engagement between the sprocket and belt teeth.
3. Increase the centre distance or adjust the tensioning idler to remove any belt slack.
4. Using a tape measure, measure the free tangential span length "S" (mm) of the drive. Refer to dimension "S" in the diagram below. The span length can be calculated using the formula below left.
5. Place a straight edge or reference line across the top of the belt. Note: If available with correct adaptors, a laser alignment tool is better.
6. First determine the proper deflection force to tension the belt. Deflection forces are given in the tables on page 24 and can also be calculated using the formulae on page 25. Deflection forces are also provided on the output of the "Maximizer" computer drive analysis programme.
   a) If using a Goodyear tension gauge the deflection scale is calibrated in cms of span length. Check the force required to deflect the belt the proper amount. There is an O-ring to help record the force. If the measured force is less than the required deflection force then increase the centre distance. If the measured force is greater than the required deflection force then reduce the centre distance. See chart on page 24 for deflection values and the tension gauges that are available.
   b) If using other means to apply force to the belt then adjust the centre distance so that the belt is deflected 15mm per metre of span length when the proper force is applied. See chart on page 24 regarding the RSM2000 Belt Tension Meter which automatically calculates belt tension (N) by measuring span vibrations (Hz).
7. After the belt is properly tensioned lock down the centre distance adjustments and recheck the sprocket alignment. Recheck the belt tension, alignment, and capscrew torque after 8 hours of operation to ensure that the drive has not moved in any way.



Formula to calculate Span Length "S":

$$S = \left[\sqrt{C_d^2 - \left\{\frac{(D - d)}{2}\right\}^2}\right]$$

Where:

S	=	Span length (mm)
F	=	Deflection force (kg f)
q	=	Deflection (mm)
C_d	=	Design centre distance (mm)
D	=	Pitch diameter (mm) of the driveN sprocket
d	=	Pitch diameter (mm) of the motor/driveR sprocket
ϕ	=	Arc of contact of belt on smaller sprocket
HL_S	=	Static hub load (N)

BLACKHAWK
SYNCHRONOUS BELTS

Deflection Force "F" (kg) for Belt Tensioning

Use with Deflection Gauges

Belt Type	0-100 revs/min (min⁻¹)		101-1000 revs/min (min⁻¹)		1000-up revs/min (min⁻¹)	
	New Belt	Used Belt	New Belt	Used Belt	New Belt	Used Belt
8MBH 20	9.4	6.7	6.9	4.9	5.5	4.0
8MBH 30	14.1	10.1	10.3	7.4	8.3	5.9
8MBH 50	23.5	16.8	17.2	12.3	13.8	9.9
8MBH 85	39.9	28.5	29.3	20.9	23.5	16.8
14MBH 40	33.5	23.9	25.5	18.2	21.9	15.6
14MBH 55	46.0	32.9	35.0	25.0	30.1	21.5
14MBH 85	71.1	50.8	54.1	38.6	46.6	33.3
14MBH115	96.2	68.7	73.2	52.3	63.0	45.0
14MBH170	142.2	101.6	108.2	77.3	93.1	66.5

Part Number
Small Tension Tester (PN 20044882)

Application
8M BlackHawk Pd 20 & 30mm wide

Part Number
Eagle Pd Tension Tester
(PN 20039447)

Application
8M BlackHawk Pd 50 & 85mm wide
14M BlackHawk Pd 40, 55, 85, 115 and 170mm wide

Belt Strand Tension (Newtons) "T_S" (either 'T_N' or 'T_U')

Use only with RSM2000 Tension Meter

Belt Type	0-100 revs/min (min⁻¹)		101-1000 revs/min (min⁻¹)		1000-up revs/min (min⁻¹)		Belt Weight (gms/m)
	T_N New Belt	T_U Used Belt	T_N New Belt	T_U Used Belt	T_N New Belt	T_U Used Belt	
8MBH 20	1367	976	974	696	752	537	97
8MBH 30	2050	1465	1461	1044	1128	806	146
8MBH 50	3417	2441	2435	1739	1880	1343	243
8MBH 85	5810	4150	4139	2957	3196	2283	414
14MBH 40	4937	3527	3688	2634	3131	2237	321
14MBH 55	6789	4849	5071	3622	4306	3075	442
14MBH 85	10492	7494	7836	5597	6654	4753	682
14MBH115	14195	10139	10602	7573	9002	6430	923
14MBH170	20983	14988	15673	11195	13308	9506	1365

Caution:
Tension measurements should not be taken when the belt is running.

Part Number
RSM200 – Tension Meter
(PN 20147843)

The RSM2000 belt tensioning device can be used to tension all industrial transmission belts.

For the meter to read belt strand tension in Newtons, the only inputs required are specific belt mass (gms/m) and free tangential span length (mm).

The belt strand tension in Newtons is provided in the adjacent table along with the specific mass of the belt (gms/m). (See adjacent table.)

The microcontroller-based RSM2000 measures belt vibrating frequency with a highly sensitive sensor and provides an easy and accurate means of tensioning the belt to the correct installation tension.

1) The table values are typically larger than necessary to cover the broad speed (revs/min) range.
2) For drives where hub loads are critical, high speed drives or other drives with special circumstances, the table values (deflection force, installation tension) should be calculated using the tension formulae on page 25.
3) Consult the RSM2000 User Manual Version 2.05 (European) for detailed information on using the frequency-based tension gauge.
4) Goodyear offers three different tension gauges for properly tensioning power transmission belts. See your Goodyear sales representative or your local Goodyear Power Transmission distributor for more information on the tension gauges listed on this page.

Converting to Frequency Values "f" (Hz) for Static Strand Tension (other meters)

$$f = \frac{1}{2L_f} \times \sqrt{\frac{T_S}{M}} \quad \left\{ \text{or } T_S = 4 \times M \times L_f^2 \times f^2 \right\}$$

Where f = frequency (Hz)
T_S = Static Strand Tension (N) {see table above}
L_f = Measured Free Tangential Strand Length (m)
M = Unit Mass of the Belt (kg/m) {see table to the right}

Belt Mass "M" per Unit Length (kg/m)

Belt Type	Width (mm)	M (kg/m)
8MBH 20	20	0.097
8MBH 30	30	0.146
8MBH 50	50	0.243
8MBH 85	85	0.414
14MBH 40	40	0.321
14MBH 55	55	0.442
14MBH 85	85	0.682
14MBH115	115	0.923
14MBH170	170	1.365

BLACKHAWK
SYNCHRONOUS BELTS

Calculating the Installation Tension based on Drive Conditions

If a more accurate tensioning value is needed, the installation static strand tension "T_N" (New Belts) or "T_U" (Used Belts) can be calculated using the following procedure and formulae:-

Linear Belt Speed "v" = $\dfrac{d\ (mm) \times n\ (min^{-1})}{19098.5}$ (m/sec)

Where: d = Pitch diameter of the motor/driveR sprocket (usually smaller/faster)
n = revs/min (min^{-1}) of "d"

Effective Belt Tension "T_e" = $\dfrac{P\ (kW) \times 1{,}000}{v\ (m/sec)}$ (N)

Where: P = the 'Rated' or selected prime* power to be transmitted (not the design power e.g. Service Factor x P)

**Note: Where a drive is overbelted for whatever reason it is advisable to increase rated power so that when multiplied by the correctly chosen service factor the result is equal to just less than the belt power capacity. Failure to do this could lead to undertensioning and possible consequential premature belt failure.*

Centrifugal Tension "T_c" = M (kg/m) x v^2 {$(m/sec)^2$} (N)

Where: M is the mass per unit length of the belt (see table at the bottom of page 24).

Tightside Tension "T_1" = (T_e x AR) + T_c (N)

Slackside Tension "T_2" = (T_e x {AR – 1}) + T_c (N)

Where: AR and {AR – 1} are a ratio factor and its derivative, as provided in the table below left.

Installation Static Strand Tension "T_s" for a 'New Belt' "T_N" = 0.7 (T_1 + T_2) (N)

Installation Static Strand Tension "T_s" for a 'Used Belt' "T_U" = 0.5 (T_1 + T_2) (N)

Static Hub Load "HL_s" = (T_1 + T_2) Sin $\dfrac{\theta}{2}$ (N)

Where: θ is the Arc of Contact on the small sprocket (degrees) – see table below left.

Deflection Force "F" (kg) = $\dfrac{\left\{T_s + \dfrac{S}{L_{ps}} \times K\right\}}{9.81 \times 16}$ = $\dfrac{\left\{T_s + \dfrac{S}{L_{ps}} \times K\right\}}{156.96}$

Where: S = Free tangential Span Length (mm) {Measure with tape or calculate using formula on page 23.}
L_{ps} = Standard Belt Pitch Length (mm)
K = Belt Modulus Factor (N) (see table below right)
T_s = T_N or T_U (new or used belt, as appropriate)

Table: 'θ'/'AR'/'AR – 1'

$\frac{D-d}{C}$	θ Arc of Contact (degrees)	AR	AR – 1
0.00	180	1.070	0.070
0.10	174.5	1.080	0.080
0.20	169	1.090	0.090
0.30	162.5	1.095	0.095
0.40	157	1.100	0.100
0.50	150.5	1.115	0.115
0.60	145	1.130	0.130
0.70	139	1.145	0.145
0.80	133	1.160	0.160
0.90	126.5	1.180	0.180
1.00	120	1.200	0.200
1.10	113	1.220	0.220
1.20	106	1.250	0.250
1.30	99	1.290	0.290
1.40	91	1.340	0.340
1.50	83	1.400	0.400

Table: K Belt Modulus Factor (N)

Pitch	Width (mm)	K (N)
8M	20	278
8M	30	417
8M	50	695
8M	85	1181
14M	40	609
14M	55	837
14M	85	1295
14M	115	1751
14M	170	2588

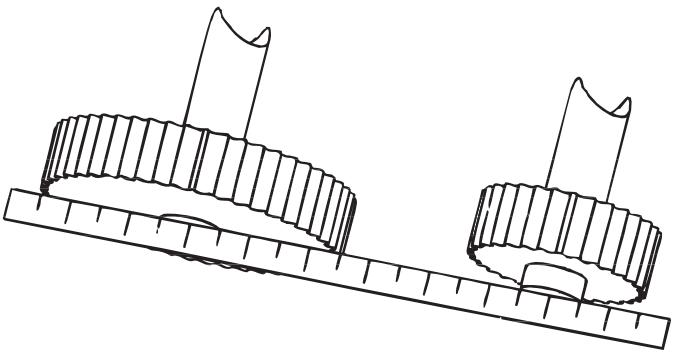
BLACKHAWK
SYNCHRONOUS BELTS

Drive Alignment

Synchronous belts are very sensitive to misalignment. Tension carrying members are generally twisted, multiple strands, of Flexten cord. Flexten has a high tensile strength and resistance to elongation, resulting in a very stable belt product. Any misalignment will lead to inconsistent belt wear, uneven load distribution and premature tensile failure. In general, synchronous drives should not be used where misalignment is a problem. Misalignment should be limited to 1/4 degree or 4.3 mm per metre of centre distance.

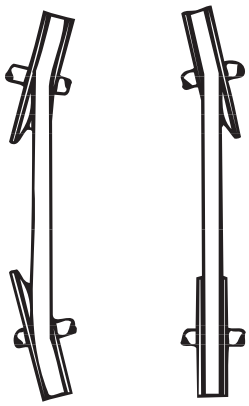
Misalignment can be defined in one of two ways. First, if two sprockets are not located equally on shafts, sprockets are then misaligned, as in Figure A. Second, shafts may not be parallel, resulting in misalignment, as in Figure B.

Figure A



Misaligned

Figure B



Not This Way

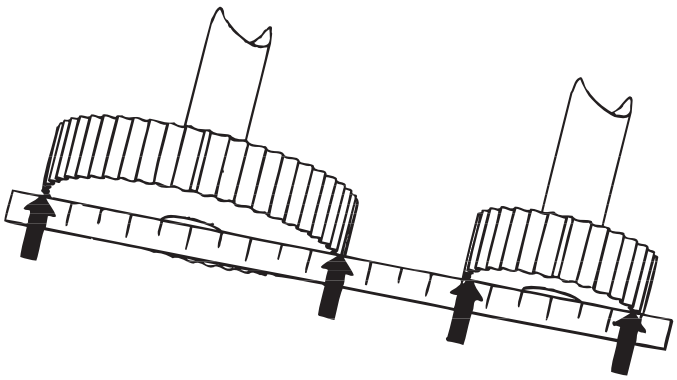
Any degree of misalignment will reduce belt life and cause edge wear. Therefore, a straight edge should be used to check proper alignment verifying that sprockets and shafts are parallel, as in Figure C.

Note: If available with correct adaptors, a laser alignment tool is better.

THIS WAY

Straight edge should touch sprockets at the four points indicated. Both front and back alignment should be checked.

Figure C



Aligned

Misalignment, at times, may cause tracking problems. Although some tracking is normal and won't affect belt performance, it may be caused by poorly aligned sprockets. Flanges may control a tracking problem. Considering a two sprocket drive, belt contact on a single flange is acceptable. Belt contact with the opposite flanges of two sprockets should be avoided.

Misalignment can also be attributed to the improper installation of a bushing or loose drive framework. Refer to sprocket manufacture guidelines for proper bushing installation. Secure motor and framework to eliminate vibration centre to centre fluctuations.

BLACKHAWK
SYNCHRONOUS BELTS

Manufacturing Tolerances

Width Tolerances

Belt Width (mm)	Width Tolerances on Belt Lengths 0 to 838 mm	Width Tolerances on Belt Lengths Over 838 to 1676 mm	Width Tolerances on Belt Lengths Over 1676 mm
Up to 38	+0.8 –0.8	+0.8 –1.2	+0.8 –1.2
Over 38 to 51	+0.8 –1.2	+1.2 –1.2	+1.2 –1.6
Over 51 to 76	+1.2 –1.6	+1.6 –1.6	+1.6 –2.0
Over 76 to 102	+1.6 –1.6	+1.6 –2.0	+2.0 –2.0
Over 102	+2.4 –2.4	+2.4 –2.8	+2.4 –3.2

Belt Thickness and Overall Gauge Tolerances (mm)

Belt Pitch	Nominal Web Thickness	Nominal Overall Gauge	Overall Gauge Tolerance	Overall Gauge Variation Single Belt
8mm	2.0	5.5	±0.40	0.40
14mm	3.4	10.0	±0.50	0.50

Length Tolerances

Belt Length (mm)	*Standard Length Tolerances (Centre-to-Centre)	Belt Length (mm)	*Standard Length Tolerances (Centre-to-Centre)
Over 254 to 381	± 0.23	Over 2540 to 2794	± 0.53
Over 381 to 508	± 0.25	Over 2794 to 3048	± 0.56
Over 508 to 762	± 0.30	Over 3048 to 3302	± 0.58
Over 762 to 1016	± 0.33	Over 3302 to 3556	± 0.61
Over 1016 to 1270	± 0.38	Over 3556 to 3810	± 0.64
Over 1270 to 1524	± 0.41	Over 3810 to 4064	± 0.66
Over 1524 to 1778	± 0.43	Over 4064 to 4318	± 0.69
Over 1778 to 2032	± 0.46	Over 4318 to 4572	± 0.71
Over 2032 to 2286	± 0.48	Over 4572 to 4826	± 0.74
Over 2286 to 2540	± 0.51	Over 4826 to 5080	± 0.76

*NOTE: *The length tolerances given for positive drive belts refer to the centre to centre tolerance between belts when checked on a standard measuring fixture. The actual pitch length tolerance is twice the value shown. If a special tension member is used consult the factory for proper length tolerances.*

BLACKHAWK
SYNCHRONOUS BELTS

BlackHawk Pd Design Factors

How to Find Belt Length

Once the driveR and driveN sprockets have been selected to suit the required speeds and assuming a centre distance range has been provided, the belt length can be calculated from the following formula:

$$L_p = 2C_n + \frac{\pi}{2}(D + d) + \frac{(D - d)^2}{4C} \quad (mm)$$

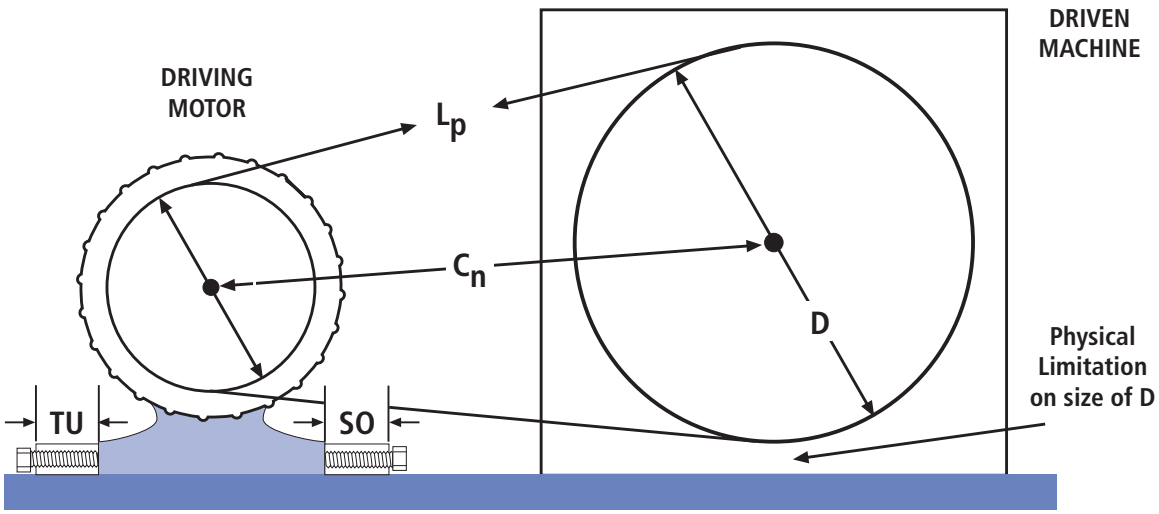
Once a calculation has estimated a belt length, check the calculation against the standard belt length list on page 6 and adjust centres by half the difference to suit and re-calculate, checking first that the new chosen 'C' lies between the minimum and maximum allowable values dictated by the application (see **TU** – Take-up and **SO** – Slack-off above).

If this can NOT be fully achieved, consult with and advise the customer what deviations are necessary.

Alternatively:

$$C_d = \frac{L_{ps} - \frac{\pi}{2}(D + d)}{4} + \sqrt{\left\{\frac{L_{ps} - \frac{\pi}{2}(D + d)}{4}\right\}^2 - \frac{(D - d)^2}{8}}$$

Where: L_p = Calculated required Belt Pitch Length (mm).
L_{ps} = Selected nearest Standard Belt Pitch Length (mm).
C_n = Nominal Centre Distance from the Data Sheet (mm).
C_d = Calculated Design Centre Distance for the drive (mm).
π = 3.1416.
d = Pitch diameter (mm) of the motor/driveR sprocket (mm) (smaller*).
D = Pitch diameter (mm) of the driveN sprocket (mm) (larger*).
**Note: True of conventional 'reduction' drives, the converse applies to 'speed-up' drives.*



Using a Fixed Centre Distance

As sprocket, belt and drive geometry tolerances exist, a drive with a Fixed Centre Distance is not recommended. BlackHawk Pd Manufacturing Tolerances for the sprocket and belt can be used in calculating possible centre distance variation. BlackHawk Pd belts are manufactured with Flexten cord, which is a very stable tension member. It will, however, still require a proper belt tension for satisfactory performance. Consult the Installation and Tensioning allowances and BlackHawk Pd Belt Tensioning for the proper installation of the BlackHawk Pd belt.

BLACKHAWK
SYNCHRONOUS BELTS

Centre Distance Allowances

In addition to the calculated or tabulated centre distance, a provision must be made for belt installation to avoid belt damage and insure proper belt tension. A centre distance adjustment, or reduction in centre distance, is necessary to install a belt. In addition, an increase in centre distance will be necessary for proper tensioning.

If a belt is to be installed together with sprockets, allow the following reduction in centre distance for installation and an increase in centre distance for tensioning.

Note: This method is usually only practical where both sprockets are bushed.

Pitch Length Range (mm)	Allowance (Reduction) For Installation 8M, 14M Belts (mm)	Allowance (Increase) For Take-Up 8M, 14M Belts (mm)
Less than 1525	2.5	2.5
1525–3050	5.0	5.0
Greater than 3050	7.5	7.5

If the belt is to be installed over one flanged sprocket and one unflanged sprocket with the sprockets already installed on the drive, allow the following reduction in centre distance for installation and increase in centre distance for tensioning.

Pitch Length Range (mm)	Allowance (Reduction) For Installation (mm)		Allowance (Increase) For Take-Up 8M, 14M Belts (mm)
	8M, Belts	14M, Belts	
Less than 1525	22.5	36.5	2.5
1525–3050	25.0	39.0	5.0
Greater than 3050	27.5	41.5	7.5

If the belt is to be installed over two flanged sprockets that are already installed on the drive, allow the following reduction in centre distance for installation and increase in centre distance for tensioning.

Pitch Length Range (mm)	Allowance (Reduction) For Installation (mm)		Allowance (Increase) For Take-Up 8M, 14M Belts (mm)
	8M, Belts	14M, Belts	
Less than 1525	34.5	59.5	2.5
1525–3050	37.0	62.0	5.0
Greater than 3050	39.5	64.5	7.5

BLACKHAWK
SYNCHRONOUS BELTS

Using Idlers

Idlers can be used either inside or outside of the belt, preferably on the outside. They are usually used as a tensioning mechanism when the drive has a fixed centre distance. When an idler is necessary, follow these general rules.

- Locate on the slack side of the belt
- Small, inside idlers should be grooved (up to 40 teeth).
- Outside idlers should be flat (NOT crowned).
- Minimum outside idler diameter should be 100 mm for 8M drives and 200 mm for 14M drives.
- Idler arc of contact should be held to a minimum.
- Spring Loaded tensioners should NOT be used.
- Lock idlers firmly in place to minimize movement or deflection during drive start-up and operation.

Teeth in Mesh

Drive Selection Tables, where available, consider only drives of 6 teeth in mesh or greater. Should drives be designed using less than 6 Teeth in Mesh, the power rating of the belt must be reduced for excessive tooth loading.

Teeth in Mesh or TIM can be calculated as follows:

$$TIM = \left[0.5 - \left(\frac{D - d}{6C_d}\right)\right] \times \text{Number Grooves Small Sprocket}$$

Where: D = Pitch diameter (mm) of the driveN sprocket (mm) (larger*).
d = Pitch diameter (mm) of the motor/driveR sprocket (mm) (smaller*).
C_d = Calculated Design Centre Distance for the drive (mm).

**Note: True of conventional 'reduction' drives, the converse applies to 'speed-up' drives.*

Should a drive design require less than six teeth in mesh, the power rating of the belt must be reduced. Multiply the belt rating by factor K_{TM}, to get the Corrected Belt Power. Based on the TIM, a correction factor, K_{TM} can be determined and applied as follows:

Teeth In Mesh	K_{TM}
6+	1.00
5	0.80
4	0.60
3	0.40
2	0.20

Corrected Belt Power = Power Rating x K_{TM} (kW)

Flanged Sprockets

Flanges are used to keep the belt in the sprocket and prevent "tracking-off". As each belt has its own tracking characteristics, even belts with perfect drive alignment can have a tracking problem. Synchronous belts will have an inherent side thrust while in motion and can be controlled with flanged sprockets. If side thrust is severe, the drive should be checked for sprocket alignment, parallel shafts, and shaft deflection.

For a Two Sprocket Drive:

1. A minimum requirement should be two flanges on one sprocket. For economical reasons, the smaller sprocket is usually flanged.
2. When the centre distance of the drive exceeds 8 times the diameter of the smaller sprocket, it is suggested that flanges be included on both sides of each sprocket.

For a Multiple Sprocket Drive:

Two flanges are required on every other sprocket or a single flange on every sprocket, alternating sides.

For a Vertical Shaft Drive

There should be a single flange on the lower side of all sprockets in the drive and ideally the smallest sprocket should be flanged on the top side, as well.

BLACKHAWK
SYNCHRONOUS BELTS

Environmental Factors

Storage:

The maximum belt life and serviceability of BlackHawk Pd belts can be obtained with favourable storage conditions. Good storage facilities and practices will help retain belt quality, while unfavourable storage conditions will have adverse effects, shortening belt life.
Belt quality will not change significantly within 10 years of proper storage. A proper storage environment has been defined as an ambient temperature of less than 30°C and relative humidity of less than 70%. Service life is expected to decrease 10% per year for each storage year beyond 10 years. In addition, storage limitation decreases by 50% for each 8°C increase in storage temperature. Storage temperature should never exceed 46°C.

Overall the following guidelines should be used for proper belt storage.

- Store in a cool, dry environment
- Avoid floor storage and excess moisture.
- Do not store near radiators and heaters
- Avoid high ozone environments
- Store away from direct sunlight
- Avoid sharp bends or crimping of belt
- Recommend storage in a 'nested' configuration
- Avoid distortion or excess weight on the belt

Proper storage will help maintain belt quality and deliver the maximum intended belt life.

Temperature:

BlackHawk Pd belts are fully functional in ambient temperatures from –60°C to 85°C. The backing rubber is specially designed to handle intermittent surface temperatures up to 135°C. Higher temperatures will decrease belt life and performance.

Oil Environments:

As with any belt drive, contact with oil should be avoided. When an oily environment is necessary, BlackHawk Pd and the HiBrex compound will provide improved performance over competitive polychloroprene products.

Chemical Environments:

HiBrex rubber is chemically stable and will not degrade when exposed to many chemicals. For more information on specific chemicals see the table to the right or call the power transmission experts at Goodyear.

Noise:

Drive noise might come from a variety of rotating components including bearings or sprockets. Noise can be created with a misaligned drive system. While belt type and profile can have an effect on drive noise, belt noise is largely a function of belt speed and belt width. The faster the belt is travelling when it engages the sprockets the louder the belt noise. The wider the belt width the louder the belt noise. Upon request, Goodyear can provide a drive noise prediction with its Maximizer™ computer drive selection analysis programme.

Note: Where high noise levels are a major concern, it may be beneficial to seek a Goodyear Eagle Pd® drive solution which, in general, would provide a quieter performance than straight tooth Pd drives.

HiBrex® Chemical Resistance

Chemical	Rating	Chemical	Rating
Steam	B	Iso Octane	A
Acetic Acid	B	Toluene	C
Hydrochloric Acid	A	Trichlorethylene	C
Phosphoric Acid	A	Methyl Alcohol	A
Nitric Acid	B	Ethyl Alcohol	A
Sodium Hydroxide	A	Ethyl Ether	C
Aqueous Ammonia (28%)	A	Ethyl Acetate	U
Sodium Chloride (30%)	A	Methyl Ethyl Ketone	U
Sodium Carbonate (10%)	A	Furfural	B
Hydrogen Peroxide (3%)	B	Triethanol Amine	A
Sodium Hypochlorite (5%)	B	Carbon Disulfide	C
Chlorine	U	5% Diluted Chlorine	B

Rating:
A – Little or minor effect
B – Minor to moderate effect
C – Moderate to severe effect
U – Not recommended

The above table is for the chemical resistance of the HiBrex tooth compound only and should only be used for reference. Concentration, temperature and time of exposure will play a major role in actual belt life and performance. The chemical resistance of the Flexten cord and tension member and Plioguard tooth facing system should also be taken into consideration in order to optimize drive life and performance. Consult the Goodyear power transmission experts for additional information.

BLACKHAWK
SYNCHRONOUS BELTS

BlackHawk Pd
Causes of Premature Failure

Type of Failure	Cause of Failure	Check Alignment	Adjust Tension	Check Power Rating	Check Belt/Sprocket Compatibility	Replace Sprocket	Use Correct Sprocket Diameter	Eliminate or Control Condition	Clean and Protect Drive	Follow Proper Handling Procedure	Reinstall, Replace, Repair Flange	Remount Bushing and Sprocket	Change Sprocket Material	Use Inside Idler	Redesign Drive
		Corrective Action													
Excessive Edge Wear	Misalignment or Improper Tracking	●													
	Bent or Rough Flange										●				
	Damage Due to Handling									●					
	Belt Too Wide				●										
	Low Belt Tension		●												
	Belt Hitting Obstruction								●						
Excessive Tooth Wear	Excessive Load			●											
	Belt Overtensioned/Undertensioned		●												
	Rough or Damaged Sprocket					●									
	Partial Belt Engagement	●													
	Bushing/Sprocket Assembly											●			
	Misalignment	●													
	Incorrect Match of Belt and Sprocket				●										
	Worn Sprocket					●									
	Sprocket Out of Tolerance					●									
	Soft Sprocket Material												●		
	Debris in Sprocket								●						
Apparent Belt Stretch	Change in Centre Distance		●												
	Centre Distance Fluctuates														●
	Weak Drive Structure or Mounts														●
	Worn Sprocket					●									
	Fixed Centre													●	
	Debris in Sprocket								●						
	Excessive Load			●											
	Sprocket Diameter below Minimum Recommendation						●								
	Excessive Low or High Temperature (–35°C to +76°C)							●							
	Exposure to Oil, Solvents, Harsh Chemicals							●							
Cracks in Backing	Excessive Low or High Temperature							●							
	Sprocket Diameter Below Minimum Recommendation						●								
	Backside Idler													●	
	Exposure to Oil, Solvents, Harsh Chemicals							●							

BLACKHAWK
SYNCHRONOUS BELTS

BlackHawk Pd
Causes of Premature Failure

Type of Failure	Cause of Failure	Check Alignment	Adjust Tension	Check Power Rating	Check Belt/Sprocket Compatibility	Replace Sprocket	Use Correct Sprocket Diameter	Eliminate or Control Condition	Clean and Protect Drive	Follow Proper Handling Procedure	Reinstall, Replace, Repair Flange	Remount Bushing and Sprocket	Change Sprocket Material	Use Inside Idler	Redesign Drive
		Corrective Action													
Tooth Shear	Excessive Load/Shock Load			●											
	Sprocket Diameter Below Minimum Recommendation						●								
	Less Than 6 Teeth in Mesh			●											
	Excessive Sprocket Runout					●									
	Worn Sprocket					●									
	Backside Idler													●	
	Incorrect Match of Belt and Sprocket				●										
	Misalignment	●													
	Belt Overtensioned/Undertensioned		●												
Tensile Failure	Excessive Load/Shock Load			●											
	Sprocket Diameter below Minimum Recommendation						●								
	Damage Due to Handling									●					
	Debris in Sprocket or Drive								●						
	Excessive Sprocket Runout					●									
Excessive Drive Noise	Misalignment	●													
	Belt Overtensioned/Undertensioned		●												
	Excessive Load			●											
	Sprocket Diameter Below Minimum Recommendation						●								
	Backside Idler													●	
	Worn Sprocket					●									
	Damaged Flange										●				
	Excessive Belt Speed														●
	Incorrect Match of Belt and Sprocket				●										
Unmounting of Flange	Misalignment	●													
	Flange Incorrectly Mounted										●				
Belt Tracking	Misalignment	●													
	Centre Distance Exceeds 8 x Small Sprocket Diameter	●													
Excessive Sprocket Wear	Soft Sprocket Material												●		
	Excessive Load			●											
	Misalignment	●													
	Debris in Sprocket								●						
	Belt Overtensioned/Undertensioned		●												
	Incorrect Match of Belt and Sprocket				●										
Excessive Drive Vibration	Bushing/Sprocket Assembly											●			
	Incorrect Match of Belt and Sprocket				●										
	Belt Overtensioned/Undertensioned		●												

BLACKHAWK
SYNCHRONOUS BELTS

Useful Conversions

Torque and Power Equivalents

$$kW = \frac{Nm \times revs/min}{9550} \quad \text{and} \quad Nm = \frac{kW \times 9550}{revs/min}$$

Length

inches x 25.4 = mm
(inches x 0.0254 = m)
feet x 304.8 = mm

Mass

pound (lb) x 0.4535 = kilogram (kg)
kilogram (kg) x 2.205 = pound (lb)

Power

Horsepower (HP) x 0.7457 = kilowatt (kW)
Cheval Vapeur (CV) (and Pferdestärk (PS)) x 0.735 = kilowatt (kW)

Force

kilogram force (kgf) or kilopond (kp) x 9.81 = Newtons (N)
pound force (lbf) x 4.45 = Newtons (N)
Newtons (N) x 0.225 = pound force (lbf)
Newtons (N) x 0.102 = kilogram force (kgf) or kilopond (kp)
pound force (lbf) x 0.4535 = kilogram force (kgf) or kilopond (kp)
kilogram force (kgf) or kilopond (kp) x 2.205 = pound force (lbf)

Torque

kilogram force metre (kgf m) x 9.81 = Newton metre (mn)
pound force feet (lbf ft) x 1.356 = Newton metre (Nm)
pound force inches (lbf in) x 0.113 = Newton metre (Nm)

Belt Speed

feet/min (ft/min) x 0.00508 = metres/sec (m/sec)

Goodyear Belt Drive Data Sheet – Form

SURVEY or EXISTING DRIVE CHECK OR REPLACEMENT

Machine/Drive Ref: .....

DRIVER UNIT:

Current Sprocket: .....

§Rated Power kW/(HP)*: .....

§Shaft Speed:- (Plated) revs/min .....

Shaft Diam. ..... mm/(ins)* Shaft Extn. ..... (mm)

§Starting Characteristics:- .....

CENTRE DISTANCE:

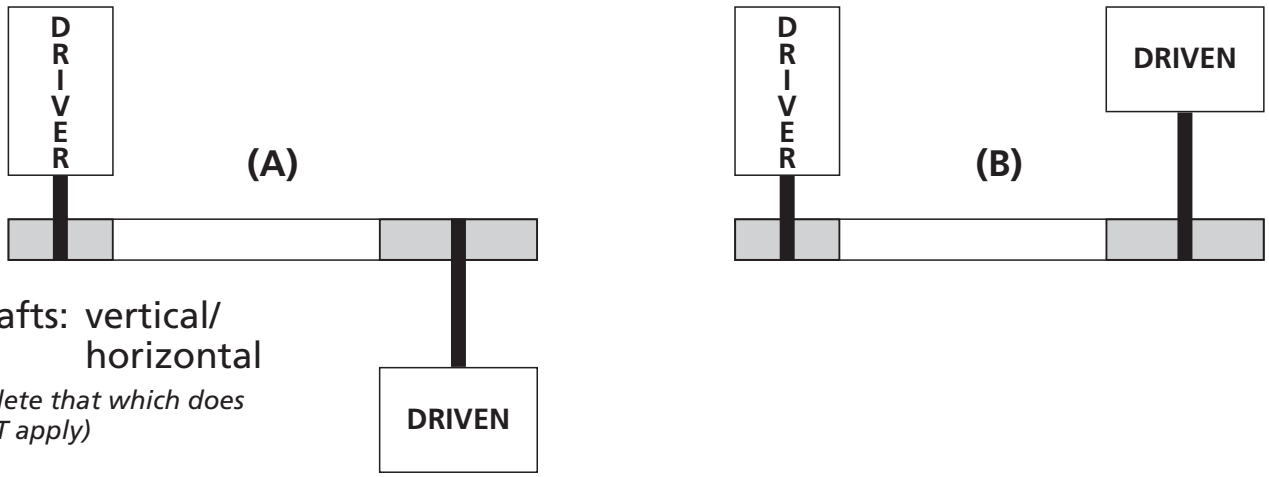
§Nominal "C_n" ..... (mm) Belt Refs: .....

Max: ..... (mm) No Belts: .....

Min: ..... (mm)

BASIC LAYOUT:

Tick One



Shafts: vertical/
horizontal

(Delete that which does NOT apply)

DRIVEN UNIT:

Current Sprocket: .....

Absorbed Power/(if known) kW/(HP)*: .....

§Required Shaft Speed (N.revs/min) ..... Allowable % Tol. (if known) .....

Shaft Diam. ..... mm/(ins)* Shaft Extn. ..... (mm)

§Hours per Day ..... Days per Week .....

§Type of DriveN Equipment .....

IMPORTANT – If there are any known space restrictions that could affect the diameter or/and width of either sprocket, please supply a sketch with measurements and explanations on a separate sheet

** Delete as required – if one not deleted, kW/mm will be assumed.*

§ Minimum Required Drive Parameters.

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