



PLATINUM











CALCULATION HANDBOOK



MEGADYNE

PLATINUM

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ISO 9001
ISO 14001



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INTRODUCTION

Megadyne proudly introduces the new **PLATINUM** timing belt drive, the latest development on hi-performance systems, which significantly improve the “specific power” capacity and offer new application opportunities against alternative systems like gears, chains that always have a disadvantage in terms of weight, noise, lubrication and maintenance costs. The starting point was the long experience cumulated with the existing **RPP GOLD** line, well known and consolidated in the marketplace. We improved its even good characteristics, keeping fixed two basic assumptions:

- Develop a new belt / system always in rubber to minimise or not change the noise level of the new drives;
- Retain the parabolic design of teeth profile to guarantee an easy up-grade of the existing drives, in the spirit and concept of interchange ability which identified, along the last years, our market approach philosophy.

In general every belt component contribute to improve the global mechanical resistance, minimising the risk of belt break or failure and granting a bigger “specific power” capacity, that means higher basic design performance. However, the tensile cords of the belt have a significant role to improve the power performance, because they support tension loads always bigger. Today hi-performance timing belts are built with tensile cords made by steel or aramide fibres.

Aramide fibres, as well known, have a very poor dimensional stability over the lifetime, thus a timing belt made with this type of tensile cords will have problems in their length (pitch) stability, which will have a negative impact on lifetime, because the meshing error that is generated with the pulleys. On the other side, tensile cords made in steel have an excellent rigidity and dimensional stability over the lifetime, but the belt will have a very high specific weight. Furthermore, usage of steel cords in association with conventional process for rubber belt assembly, generate so many extra problems to make this type of construction unaffordable.

The new **PLATINUM** is a rubber based timing belt, which solve the problems related to steel and aramide cords, thanks to the development and usage of its innovative “Dual Core” hybrid cord technology. **PLATINUM** reach the highest level of performances incorporating this cord in a new rubber matrix and covering the teeth with a special and unique heavy fabric.

FEATURES

Thanks to the innovative materials used, **PLATINUM** is a reliable, lower maintenance and economical alternative to drive systems with chains and gears; it's particularly recommended for efficient, compact drives with high or pulse torque loads, offering:

- Increased basic power capacity by up to 40% compared to the current RPP GOLD;
- Use of existing RPP® pulleys, maintaining a full functional interchange with other deep pulley profile systems, like HTD, etc.
- Allows existing drives to be upgraded without the necessity to replace the pulleys, just the belt itself.
- Reduction of noise by reduced belt widths due to the higher performance rating of the system. Under the same transmission conditions, **PLATINUM** has the same noise level of RPP GOLD;
- Low noise characteristics compared to drive systems using polyurethane, steel etc. due to the rubber matrix and its teeth with the parabolic profile shape, recognised as the quietest system on the market
- A wide, continuous range of possible operating temperature, like no other system, which makes **PLATINUM** the only solution for extreme working conditions.

STRUCTURE

The new PLATINUM is made with the most innovative materials of the highest quality. The extensive development and tests performed has resulted in the homogeneous integration of all the components, the cohesive bond of which imparts superior load capacity to PLATINUM, providing to the users the maximum performance level nowadays available:

- The highest belt tension and length stability;
- Longer drive lifetime due to the higher power capacity and flex fatigue resistance;
- More compact and lightweight drives under the same power ratings;
- Exceptional resistance to abrasion and tooth shear under pulse loads;
- Full functional interchange with all the other major deep pulley profile systems;
- No stocking and packaging constraints.

THE BELT BODY ① ④

An innovative design and blend of HNBR elastomers, uniquely cross-linked to increase teeth rigidity and shear resistance, up to +25% in comparison to GOLD belts. Despite the high levels of rigidity and hardness, this compound guarantees an exceptional resistance to flex fatigue, preventing the appearance of cracks when working with very small pulleys.

Tests made have showed an incredible improvement in the flex fatigue resistance up to 10 times more than the previous Gold version, running on the smallest pulley diameters under the same load conditions.

Furthermore this compound is formulated to considerably resist the effects of mineral oils (test conditions 22h at 100°C in ASTM3 oil; -25% less absorption than GOLD), offering an incredible wide range of working temperatures: from -35° C to + 115° C.

TENSION MEMBERS ②

The tensile member is made out of the innovative “Dual Core” hybrid cord technology and it constitutes the load carrying elements inside the New PLATINUM belt.

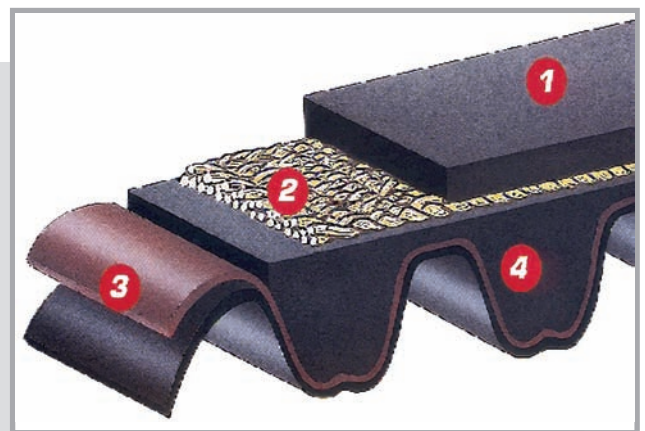
The “Dual Core” technology gives excellent characteristics to this cord, which grant to PLATINUM extreme dimension stability under static and dynamic tensions, joined with a superior flex fatigue resistance.

These performances can eliminate any kind of re-tensioning procedure, providing a real maintenance-free operation and guarantying always a perfect tooth meshing for long lasting service with reduction of abrasion, vibrations and noise.

The higher elastic modulus of PLATINUM, on average +25% rigid than GOLD, and its superior flexibility, allows consequently more compact drives and durability.

TOOTH FACING FABRIC ③

A hard-wearing polyamide fabric is bonded to the tooth surface, to improve torque carrying capacity and tooth shear resistance. Its special surface impregnation process confers self-lubricating properties, a lower friction and increased drive efficiency.



BELT SPECIFICATION

The PLATINUM belt is defined by the following parameters [figure 1]:

Belt Pitch:

the distance P in millimeters between two adjacent tooth centres as measured along the pitch line of the belt.

Belt Pitch Length:

the total length (circumference) of the belt in millimeters as measured along the pitch line (the theoretical pitch line of PLATINUM lies within the tensile member).

The pitch length is a parameter that identifies univocally a synchronous drive belt; to measure a belt it's necessary a suitable measuring equipment, as specified in the standard ISO/FDIS 13050:1999(E).

Belt Width:

the width of the belt measured in millimeters.

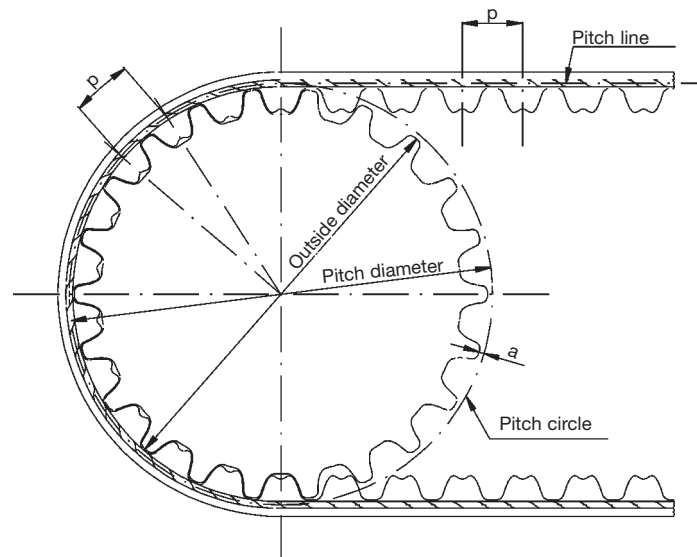
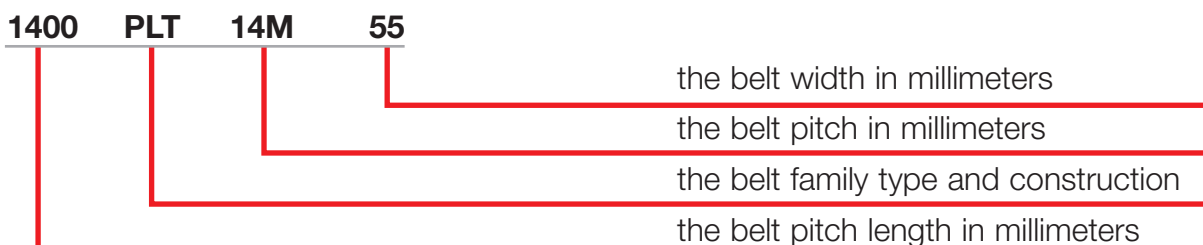


Figure 1

The new PLATINUM belt is consequently identified and coded as follow:



PLATINUM TOOTH PROFILE AND DIMENSIONS

The new **PLATINUM** belts adopt by default for their teeth shape, the innovative RPC parabolic profile, an evolution of the well know RPP profile, of which retains the basic principle, enlarging meanwhile the interchange possibility with also all those pulleys having a deep groove profile of latest generation.

RPC maintain the basic parabolic design of teeth profile to guarantee an easy up-grade of the existing RPP drives, in the spirit and concept of full drive interchange, thus the RPC based PLATINUM system will continue to work perfectly on the current RPP pulleys.

The **PLATINUM** nominal belt tooth shape and reference are shown given in figure 2, while the dimension data are listed below in Table Dimensions for each available pitch.

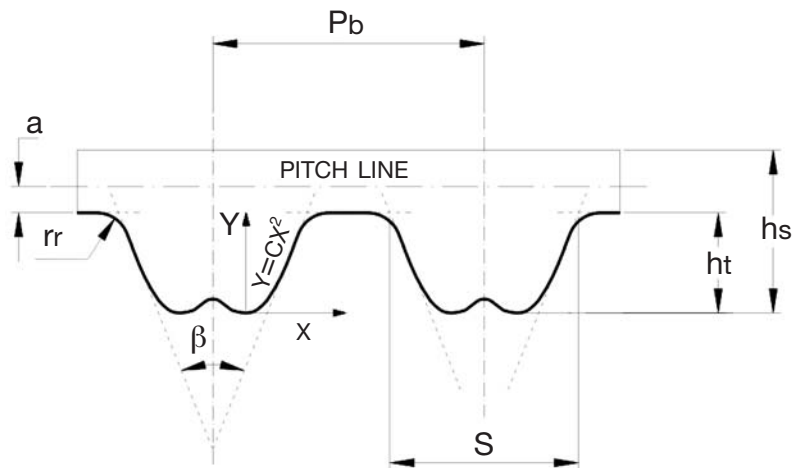


Figure 2

Table Dimensions

Belt type	Pitch	β	S	h_s	h_t	r_r	a
8M	8mm	32°	5.4	5.4	3.46	0,85	0.8
14M	14mm	32°	9.5	9.7	6.1	1.5	1.4

STANDARD BELT LENGTH RANGE

PLATINUM belts are manufactured in 8 and 14 mm pitches; standard sizes are listed in the following table.

PLATINUM 8M

TYPE	PITCH LENGTH (mm)	N° OF TEETH
248 PLT8	248	31
288 PLT8	288	36
352 PLT8	352	44
416 PLT8	416	52
456 PLT8	456	57
480 PLT8	480	60
544 PLT8	544	68
560 PLT8	560	70
608 PLT8	608	76
640 PLT8	640	80
720 PLT8	720	90
800 PLT8	800	100
840 PLT8	840	105
896 PLT8	896	112
960 PLT8	960	120
1000 PLT8	1000	125
1040 PLT8	1040	130
1120 PLT8	1120	140
1200 PLT8	1200	150
1224 PLT8	1224	153
1280 PLT8	1280	160
1440 PLT8	1440	180
1600 PLT8	1600	200
1760 PLT8	1760	220
1792 PLT8	1792	224
2000 PLT8	2000	250
2200 PLT8	2200	275
2240 PLT8	2240	280
2400 PLT8	2400	300
2520 PLT8	2520	315
2600 PLT8	2600	325
2800 PLT8	2800	350
2840 PLT8	2840	280
3048 PLT8	3048	381
3600 PLT8	3600	450
4000 PLT8	4000	500
4400 PLT8	4400	550

PLATINUM 14M

TYPE	PITCH LENGTH (mm)	N° OF TEETH
994 PLT14	994	71
1092 PLT14	1092	78
1120 PLT14	1120	80
1190 PLT14	1190	85
1260 PLT14	1260	90
1400 PLT14	1400	100
1568 PLT14	1568	112
1610 PLT14	1610	115
1750 PLT14	1750	125
1890 PLT14	1890	135
1960 PLT14	1960	140
2100 PLT14	2100	150
2240 PLT14	2240	160
2310 PLT14	2310	165
2380 PLT14	2380	170
2450 PLT14	2450	175
2520 PLT14	2520	180
2660 PLT14	2660	190
2800 PLT14	2800	200
3136 PLT14	3136	224
3304 PLT14	3304	236
3360 PLT14	3360	240
3500 PLT14	3500	250
3850 PLT14	3850	275
3920 PLT14	3920	280
4326 PLT14	4326	309
4410 PLT14	4410	315

DESIGN OF TIMING BELT DRIVES.

Symbols, Units, Terms.

Symbol	Description	Unit
α	Free span length angle	[°]
β	Wrap angle on small pulley	[°]
σ	Drive safety factor	
C_c	Corrected service factor	
C_d	Teeth in mesh factor	
C_w	Belt width factor	
$C_{wlisted}$	Belt width factor listed	
C_m	Speed up factor	
d_1	DriveR pulley pitch diameter	[mm]
d_2	DriveN pulley pitch diameter	[mm]
d_s	Small pulley pitch diameter	[mm]
d_L	Large pulley pitch diameter	[mm]
F_s	Service factor	
f	Deflection distance	[mm]
f_r	Frequency	[Hz]
i	Speed ratio	
l	Centre distance	[mm]
K_1	Belt length factor	
K_m	Class of motor factor	
L_p	Pitch belt length	[mm]
m	Belt mass per unit length	[kg/m]

Symbol	Description	Unit
n_1	Speed on driveR pulley	[rpm]
n_2	Speed on driveN pulley	[rpm]
n_s	Speed on faster shaft	[rpm]
n_L	Speed on slower shaft	[rpm]
p	Belt/pulley pitch	[mm]
P	Motor power	[kW]
P_a	Absorbed power	[kW]
P_b	Basic performance	[kW]
P_{ba}	Actual power rating	[kW]
P_c	Design power	[kW]
R	Speed ratio	
t	Free span length	[mm]
v	Belt linear speed	[m/s]
w	Belt width	[mm]
Z_1	Teeth on driveR pulley	
Z_2	Teeth on driveN pulley	
Z_s	Teeth of smallest pulley	
Z_L	Teeth of largest pulley	
Z_b	Number of belt teeth	
Z_i	Number of teeth in mesh	

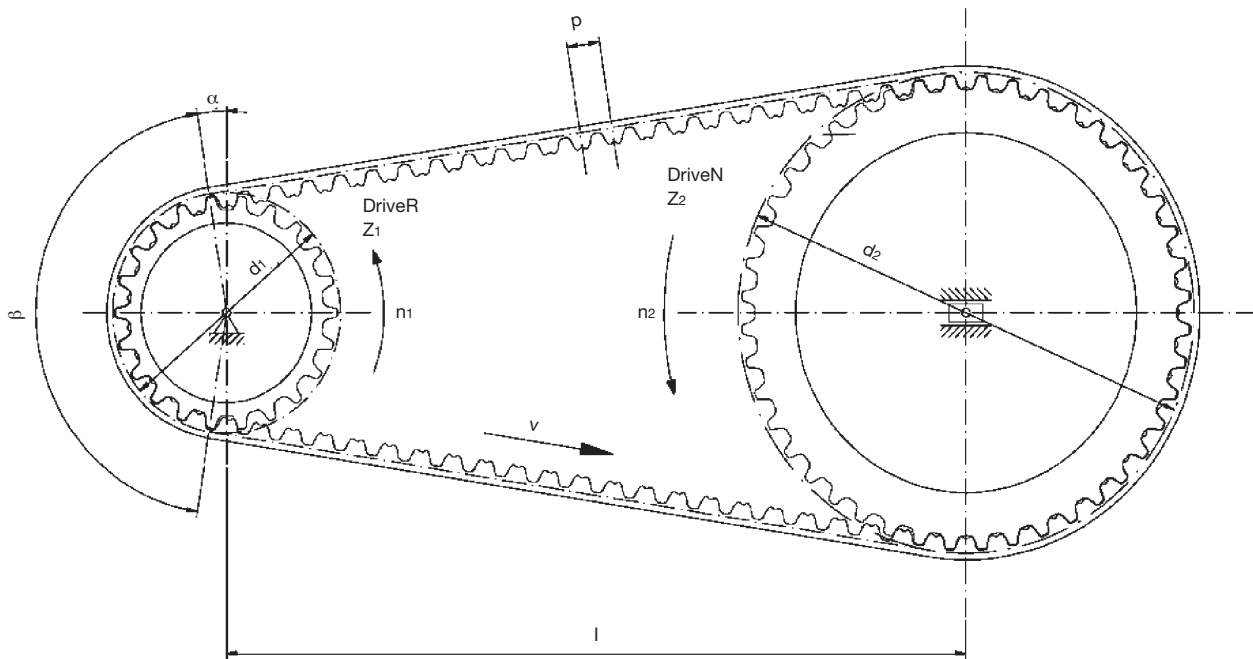
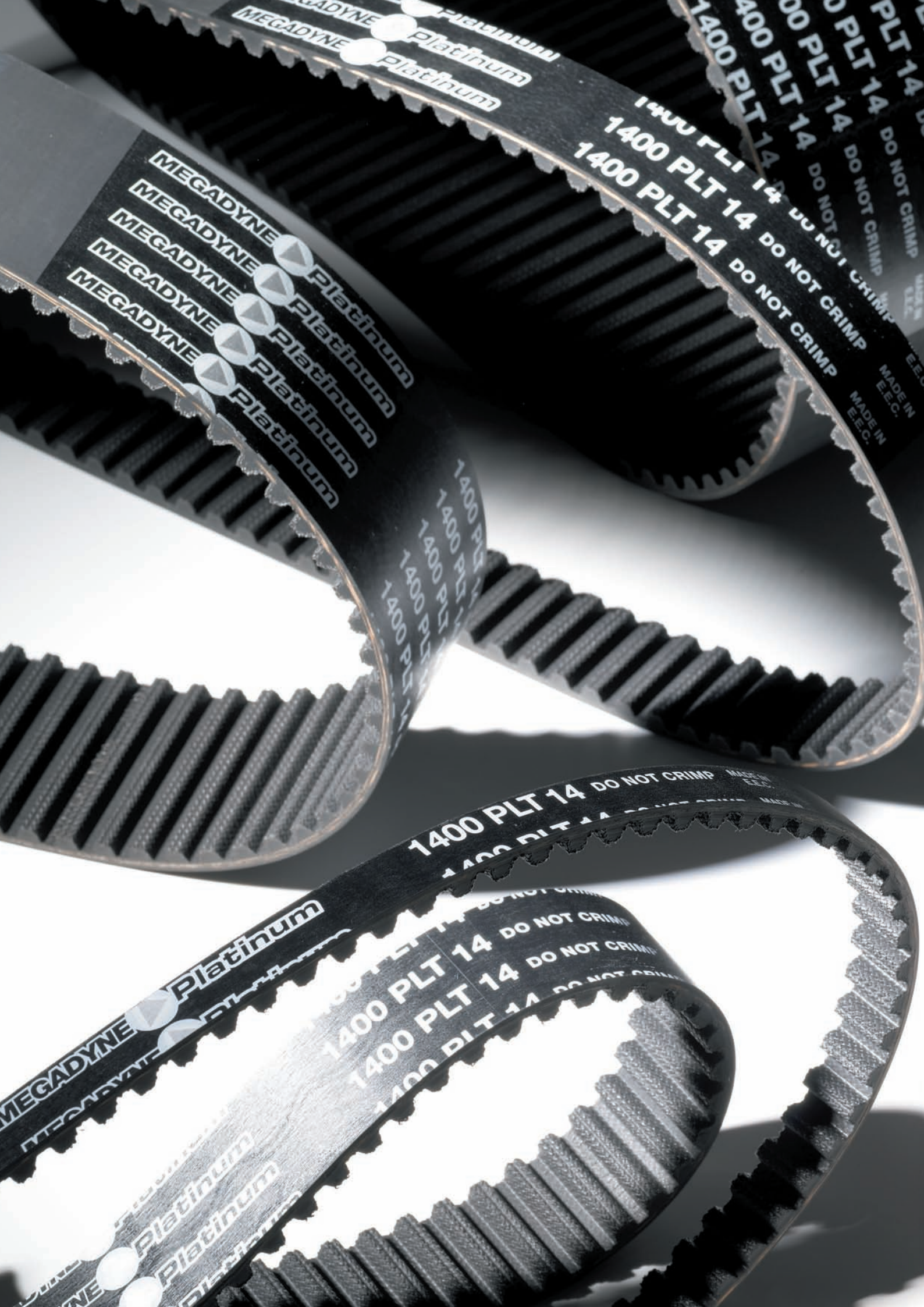


Figure 3



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1400 PLT 14 DO NOT CRIMP
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DRIVE CALCULATION PROCEDURE

DRIVE CALCULATION PROCEDURE

Basic Design Data

To properly select or design a new PLATINUM timing belt drive, you need to know the following details:

- a) **Prime mover:**
Type of motor, power rating and rpm, shaft dimension;
- b) **Driven machine:**
Type of unit, power absorbed and rpm;
- c) **Service conditions:**
intermittent, periodic or continuous;
- d) **Layout data:**
Maximum pulley diameters, approximate pulley centre distance and tolerance.

STEP 1 Calculation of power transmitted

a) From table 2 select the appropriate Service Factor F_s according to:

- the type of the driven machine;
- the class of the prime mover;
- the service conditions (duty cycle category).

b) In case you are designing a drive with a speed up ratio ($i = n_{\text{driveR}} / n_{\text{driveN}} < 0.8$) you need to add at the above mentioned service factor F_s also the correction factor C_m as reported in the following Table

Table 1 – Speed up factor (C_m)

$i = \frac{n_{\text{driveR}}}{n_{\text{driveN}}} = \frac{n_1}{n_2}$	C_m
≥ 0.8	0
$0.79 \div 0.58$	+0.1
$0.57 \div 0.40$	+0.2
$0.39 \div 0.28$	+0.3
< 0.28	+0.4

c) Then the corrected service factor C_c is calculated as follows

$$C_c = F_s + C_m \quad [1]$$

d) The design power is obtained multiplying the input power by the corrected service factor:

$$P_c = P_1 \times C_c \quad [2]$$

TABLE 2 - Service Factor F_s

	DRIVER MACHINE								
	CLASS A			CLASS B			CLASS C		
	Peak overload up to 149% of rated load			Peak overload from 150% to 249% of rated load			Peak overload from 250% to 400% of rated load		
	<ul style="list-style-type: none"> • AC Motor: Asynchronous, Synchronous, Normal Torque DC • Motor: Shunt wound • Internal combustion engines: 8 cyl. and up 			<ul style="list-style-type: none"> • AC Motor: Asynchronous: Direct switch starting • Synchronous: Normal torque • DC Motor: Compound wound • Internal combustion engines: 6 cyl. 			<ul style="list-style-type: none"> • AC Motor: Single Phase: all • Asynchronous: Double cage motor • Synchronous: High torque • DC Motor: Series wound • Internal combustion engines: 4 cyl. or under • Hydraulic motors, line shafts 		
DRIVEN MACHINE	Duty cycle category								
	Intermittent service	Normal service	Continuous service	Intermittent service	Normal service	Continuous service	Intermittent service	Normal service	Continuous service
	< 8 hours daily	8 to 16 hours daily	>16 hours daily	< 8 hours daily	8 to 16 hours daily	>16 hours daily	< 8 hours daily	8 to 16 hours daily	>16 hours daily
Category 1: LOW UNIFORM LOAD/TORQUE Office equipment; Measuring equipment; Instrumentation; Display equipment; Laundry machinery: general; Line shaft; Agitators, mixers for liquid; Bakery machines. Conveyors: belt, light package, oven belt: ore, coal, sand.	1.3	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.9
Category 2: MEDIUM UNIFORM LOAD/TORQUE Woodworking equipment (light): lathes, band saws; Agitators, Mixers for semi-liquid; Screens: drum, conical; Machine Tools: lathes, drill presses, screw machines	1.4	1.5	1.6	1.6	1.7	1.8	1.8	1.9	2.0
Category 3: NOT UNIFORM LOAD/TORQUE Textile machinery: spinning frames, twistors warpers, warping machines; Woodworking equipment (heavy): jointer, circular saws, planes; Laundry machinery: extractors, washers; Machinery for rubber processing; Machine tools: grinders, milling machines, shapers; Conveyors: apron, bucket, elevator, screw; Centrifugal compressors; Hoists, Elevators; Generators and Exciters; Printing machinery; Fans, blowers: centrifugal, induced, draft exhausters, propeller, mine fans.	1.5	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.1
Category 4: SHOCK LOAD/TORQUE Textile machinery: dobbies, looms; Hammer mills; Paper machinery; Positive fan blowers; Reciprocating compressors; Machinery for pottery and earthenware; centrifuges.	1.7	1.8	1.9	1.9	2.0	2.1	2.1	2.2	2.3
Category 5: HIGH SHOCK LOAD Crushers: roll, ball, jaw; Mills: ball, rod, pebble, etc.; Reciprocating pumps; Saw mill equipment.	1.9	2.0	2.1	2.1	2.2	2.3	2.3	2.4	2.5

Note: These service factors are adequate for most belt drive applications. Service factors can be substituted only when the input data and working conditions are exactly known. In this case service factors may be adjusted based upon an understanding of the severity of actual drive operating conditions.

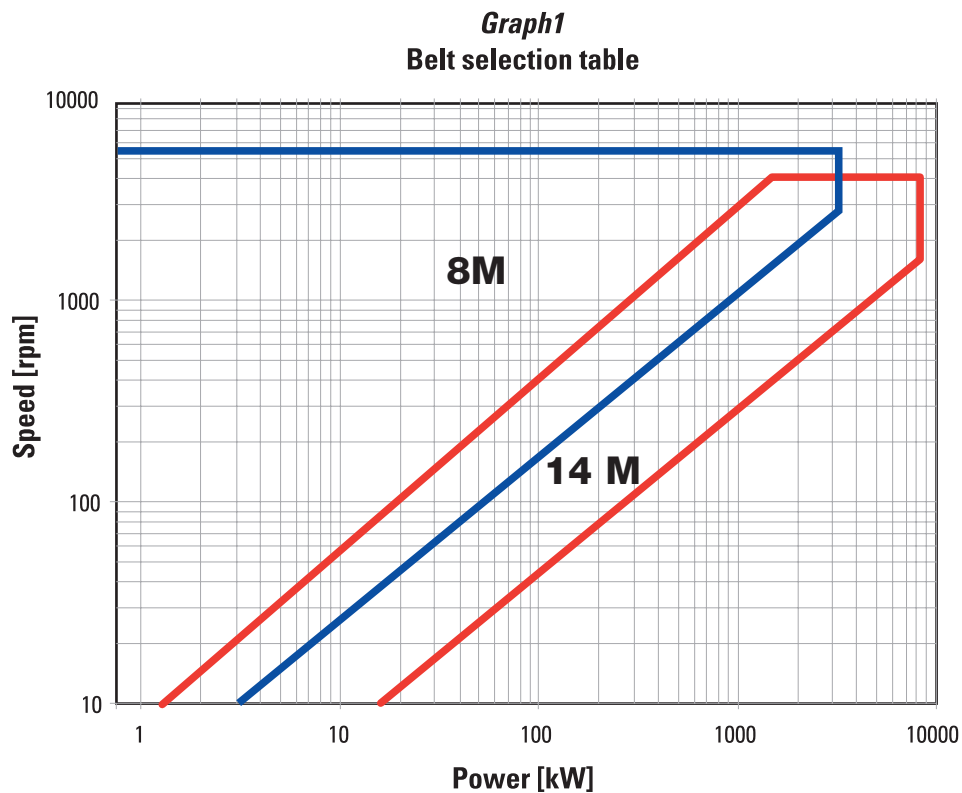
DRIVE CALCULATION PROCEDURE

STEP 2

Determine the belt pitch

The preliminary belt type and pitch can be selected from Graph 1, using:

- the corrected power (P_c) obtained in Step 1-d);
- the rpm of the faster shaft (smaller pulley) in the drive.



Locate the design power along the X-axis of the graph. Read up to the rpm of the faster shaft; the belt pitch indicated in the area surrounding the point of intersection which you located is the one you should use to start the design.

If the point of intersection falls outside of any specific area, please contact your dealer or Megadyne technical department. If the point falls in the intersection area of 8mm and 14mm, a good drive can likely be designed using either belt pitches. We suggest designing the drive with both belt pitches and select the one which best meet the layout or minimum cost requirements.

STEP 3**Selection of belt, pulleys and centre distance**

a) Determine Speed Ratio (R) by dividing the rpm of the faster shaft by the rpm of the slower shaft:

$$R = \frac{n_{\text{faster shaft}}}{n_{\text{slower shaft}}} = \frac{n_s}{n_L} \quad [3]$$

b) Refer to the centre distance selection table (table 3) to determine which pulley combinations give the desired speed ratio. The most suitable pulley combination can then be selected eliminating any pulley combination for which the required centre distance cannot be obtained with the nearest standard belt size.

If you know exactly the drive centre distance and the driver and driven diameters, you can calculate the belt pitch length with the following formula:

$$L_p = 2 \times I \times \cos \alpha + \frac{\pi \times (d_L + d_S)}{2} + \frac{\pi \times \alpha \times (d_L - d_S)}{180} \quad [4]$$

Where :

L_p = Pitch belt length [mm]

I = Centre distance [mm]

d_L = Large pulley pitch diameter [mm]

d_S = Small pulley pitch diameter [mm]

$$\alpha = \arcsen \left(\frac{d_L - d_S}{2 \times I} \right) [^\circ]$$

c) Check that the ratio of the belt teeth number and the pulleys teeth is not an integer number. If this happens modify the drive data where possible (centre distance, ratio, pulley diameter) otherwise the belt life could be strongly reduced.

d) Then select the final pulley combination according to the priorities required from the drive, in terms of flexibility, driven speed, centre distance, drive cost, etc...

DRIVE CALCULATION PROCEDURE

STEP 4

Determine the Actual Power Rating P_{ba}

The Actual Power rating is obtained by the following formula:

$$P_{ba} = P_b \times C_d \times K_1 \quad [5]$$

Where :

P_{ba} = Actual power rating [kW]

P_b = Basic performance (Step 4 - c) [kW]

C_d = teeth in mesh correction factor (Step 4 - a)

K_1 = belt length correction factor (Step 4 - b)

a) Basic performance P_b

From the basic performance tables (table 6,7), the basic performance (P_b) for a particular belt pitch and width can be obtained in kW by selecting the value corresponding to the number of teeth and the rpm of the smaller pulley.

b) Calculation of C_d factor

Power ratings listed in this handbook are based on a minimum of six teeth in mesh between the belt and the pulley. The ratings must be corrected for excessive tooth loading if there are less than six teeth in mesh. To determine the number of teeth in mesh on the smaller pulley you can use the following formula:

$$z_t = \left[0.5 - \left(\frac{4 \times p}{79 \times l} \right) \times (z_L - z_s) \right] \times z_s \quad [6]$$

where :

z_t = Number of teeth in mesh

p = Belt/Pulley pitch (Step 2) [mm]

l = Centre distance (Step 3 - b) [mm]

z_L = Number of teeth on large pulley (Step 3 - b)

z_s = Number of teeth on small pulley (Step 3 - b)

If z_t is greater than 6, then $C_d = 1$

If z_t is less than 6, then the value of C_d must be obtained from table 4.

c) Calculation of K_1 factor

The power ratings listed in this catalogue are based on specific belt lengths. To consider the influence of different belt lengths you have to use the corrective factor K_1 as listed in Table 5.

Table 5 - Belt length factor K_1

PLT 8		PLT 14	
[mm]	Factor K_1	[mm]	Factor K_1
248	0,54	994	0,69
288	0,57	1092	0,72
352	0,62	1120	0,73
416	0,67	1190	0,75
456	0,69	1260	0,77
480	0,71	1400	0,8
544	0,74	1568	0,84
560	0,75	1610	0,85
608	0,78	1750	0,89
640	0,79	1890	0,92
720	0,83	1960	0,93
800	0,87	2100	0,96
840	0,89	2240	0,99
896	0,91	2310	1
960	0,94	2380	1,01
1000	0,95	2450	1,02
1040	0,97	2520	1,03
1120	1	2660	1,05
1200	1,02	2800	1,07
1224	1,03	3136	1,11
1280	1,05	3304	1,13
1440	1,09	3360	1,14
1600	1,13	3500	1,16
1760	1,16	3850	1,19
1792	1,17	3920	1,2
2000	1,22	4326	1,24
2200	1,25	4410	1,25
2240	1,26		
2400	1,29		
2520	1,31		
2600	1,33		
2800	1,36		
2840	1,37		
3048	1,4		
3200	1,42		
3280	1,43		
3600	1,48		
4000	1,53		

Table 4 - teeth in mesh factor C_d

Number of teeth n_t	C_d
6 or more	1.00
5	0.80
4	0.60
3	0.40
2	0.20

d) It's now possible to calculate the Actual Power Rating P_{ba} using the formula [5] described at the beginning of this Step 4.

DRIVE CALCULATION PROCEDURE

STEP5

Determine the belt width

a) At this stage we can calculate the belt width, which requires the width coefficient C_w to be calculated using the following formula:

$$C_w = \frac{P_c}{P_{ba}} \quad [7]$$

where :

P_c = Design power (Step 1-d) [kW]

P_{ba} = Basic performance (Step 4-d) [kW]

b) Taking the coefficient C_w and referring to table 8, the appropriate belt width (w) can be obtained. It's recommended to select the next higher standard width (see table B) or the widths in bold.

Table 8 - belt width factor C_w

Belt width [mm]	PLATINUM 8	PLATINUM 14
12	0,599	
20	1.000	0.500
25	1.250	0.571
30	1.500	0.714
40	2.000	1.000
50	2.500	1.285
55	2.752	1.425
75	3.752	2.000
85	4.250	2.285
100		2.714
115		3.142
125		3.428

c) Once the belt width is defined, is possible to calculate the “**Drive Safety Factor**” as follows:

$$\sigma = \frac{\text{Effective Belt Power Rating}}{\text{Design Power}} = \frac{P_{ba} \times C_{w_{\text{listed}}}}{P_c} \quad [8]$$

Where the Effective Belt Power Rating can be calculated multiplying the Actual Power Rating (P_{ba}) by the belt width correction factor C_w listed in Table 8 corresponding to the selected belt width.

The Drive Safety Factor gives to the designer an indication of the maximum extra load that the drive can tolerate.

STEP 6 Static tension calculation

When installing a new PLATINUM, the belt tension is chosen so as to avoid:

- TOOTH JUMP. Assure that the belt is tensioned adequately to prevent tooth jump under the most severe load conditions that the drive will encounter.
- EXTREMELY HIGH BELT TENSION. Avoid extremely high tension which results in elevated noise levels and reduced belt and bearing life.

The required static tension is obtained by the following formula:

$$T_s = \frac{500 \times P \times K_m}{v} + m \times v^2 \quad [9]$$

Where :

T_s = Static tension		[N]
P = Motor Power		[kW]
K_m = Class of motor factor	(step 6 - a)	
v = Belt linear speed	(step 6 - b)	[m/s]
m = Belt mass per unit length	(step 6 - c)	[Kg/m]

a) Determination of K_m factor

To consider the influence of the peak torque of the motor used, you have to use the corrective factor K_m as listed in Table 12.

Table 12 - class of motor factor K_m

CLASS A	CLASS B	CLASS C
1.35	1.5	1.75

b) Calculate the belt linear speed

To determine the belt linear speed of the transmission you can use the following formula:

$$v = \frac{\pi \times d_L \times n_L}{60000} \approx \frac{d_L \times n_L}{19098} \quad [10]$$

Where :

v = Belt linear speed		[m/s]
d_L = Larger pulley pitch diameter	(step 3 - b)	[mm]
n_L = rpm of larger pulley (rpm on slower shaft)		

c) Determination of the belt mass (m)

The belt mass per unit length (m) for a particular belt pitch and width can be obtained from table 13.

Table 13. Belt mass per unit LENGTH (m)

Belt width [mm]	8M	14M
	m [Kg/m]	m [Kg/m]
12	0.0579	
20	0.0966	0.1772
25	0.1208	0.2215
30	0.1449	0.2658
40	0.1932	0.3544
50	0.2415	0.4430
55	0.2656	0.4873
75	0.3623	0.6645
85	0.4106	0.7531
100		0.8860
115		1.0189
125		1.1075

DRIVE CALCULATION PROCEDURE

d) Static Tension calculation

It's possible now to calculate the static tension using the formula [9] described at the beginning of this Step.

Note: For unusual, shock or pulsating loads consult Megadyne application Engineering Department for guidance.

To calculate the static axial load F_a please refer to the following formula:

$$F_a = 2 \times T_s \times \sin \frac{\beta}{2} \quad [11]$$

STEP 7

Static tension control

There are two methods to measure the correct static tension:

- a) The elongation method
- b) The vibration method

a) The elongation method.

The elongation procedure for determining the correct belt tension is based on measuring the force to deflect one span of the belt by a given amount (see figure 4 below).

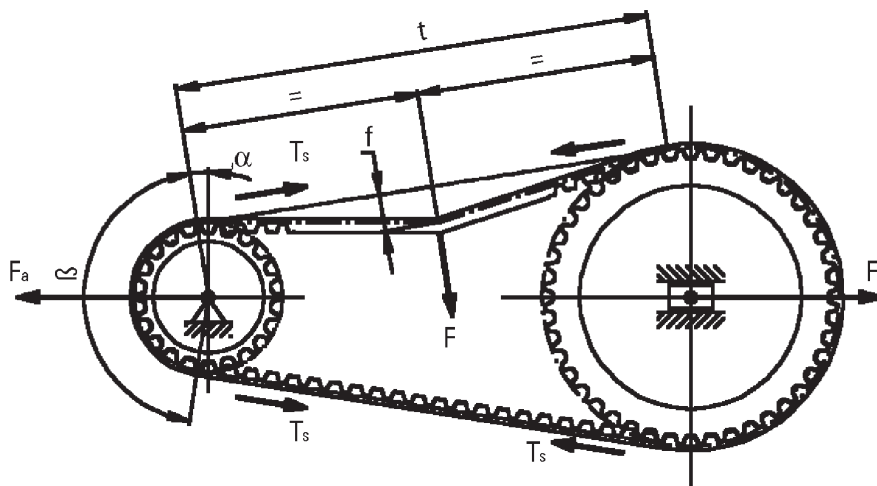


Figure 4

a1) Free span length calculation

Determine the free span length (t) of the belt. The value of (t) can be found using the following formula:

$$t = \sqrt{l^2 - \left(\frac{d_L - d_s}{2} \right)^2} \quad [12]$$

Where :

- t = Span length of the belt [mm]
- d_L = Large pulley pitch diameter (step 3 - b) [mm]
- d_s = Smaller pulley Pitch diameter (step 3 - b) [mm]
- l = Centre distance (step 3 - b) [mm]

a2) Deflection forces

Calculate the minimum and maximum deflection forces by means of the following formulas:

$$F_{\min} = \frac{T_s}{16} \quad [13] \qquad F_{\max} = \frac{1.5 \times T_s}{16} \quad [14]$$

Where :

F_{\min}	= Minimum deflection force	[N]
F_{\max}	= Maximum deflection force	[N]
T_s	= Base installation tension (step 6 - d)	[N]

a3) Deflection distance

Calculate the deflection distance by means of the following formula:

$$f = \frac{t}{64} \quad [15]$$

Where :

f	= Deflection distance	[mm]
t	= Span length of the belt (step 7 - a - 1)	[mm]

- With the belt installed on the drive and tensioned to a level required to eliminate all slack in the system (snug fit) begin the tensioning procedure. At the centre of the span (t), apply a force perpendicular to the span so that the belt is deflected by the deflection distance (f) from its normal position. Make sure that at least one pulley is free to rotate. For belts wider than 50mm, place a section of rigid material such as a length of key stock across the belt and apply the force through this rigid member to prevent belt distortion and insure proper tensioning.
- Compare the deflection force with the range of forces calculated in anterior steps.
 - If this is less than the minimum deflection force, the belt should be tightened.
 - If it's greater than the maximum deflection force, the belt should be slackeden slightly.

b) The vibration method

An alternative procedure to measure the tension of the belt is to use a Belt Tension Gauging Equipment. This device consists of a small sensing head which is held across the belt to be measured. The belt is then tapped to induce the belt to vibrate at its natural frequency. The vibrations are detected and the frequency of vibration is then displayed on the measuring unit.

The relation between belt static tension (T_s) and frequency of vibration (f) may be calculated using the following formula:

$$T_s = 4 \times m \times t^2 \times fr^2 \quad [16]$$

Where :

T_s	= Static tension	(step 6 - d)	[N]
m	= Belt mass per unit length	(step 6 - c)	[kg/m]
fr	= frequency of vibration in Hertz		[Hz]
t	= belt span length in meters	(step 7 - a - 1)	[m]



DRIVE CALCULATION PROCEDURE

Table 6 - basic performance in kW for Platinum 8M - 20 mm wide
Rated kilowatts for small sprocket

Number of grooves Z and pitch diameter in [mm]

Diam.	56,02	63,66	71,30	76,39	81,49	86,58	91,67	96,77	101,86	114,59	122,23	127,32	142,60	152,79	162,97	190,99	203,72
rpm/Z	22	25	28	30	32	34	36	38	40	45	48	50	56	60	64	75	80
10	0,12	0,14	0,16	0,18	0,19	0,21	0,22	0,23	0,25	0,28	0,29	0,31	0,34	0,37	0,39	0,46	0,49
20	0,22	0,26	0,30	0,33	0,36	0,39	0,42	0,45	0,48	0,55	0,59	0,61	0,69	0,74	0,79	0,92	0,98
40	0,41	0,48	0,56	0,61	0,66	0,72	0,77	0,83	0,88	1,02	1,11	1,17	1,35	1,47	1,57	1,84	1,96
60	0,59	0,69	0,80	0,87	0,95	1,03	1,10	1,18	1,26	1,47	1,59	1,68	1,94	2,12	2,30	2,76	2,94
100	0,93	1,09	1,26	1,37	1,49	1,61	1,73	1,86	1,98	2,30	2,50	2,64	3,05	3,33	3,61	4,42	4,80
200	1,71	2,01	2,32	2,54	2,76	2,98	3,20	3,43	3,66	4,26	4,62	4,87	5,62	6,14	6,67	8,16	8,86
300	2,45	2,88	3,33	3,63	3,94	4,26	4,58	4,91	5,24	6,09	6,61	6,97	8,05	8,79	9,54	11,68	12,69
400	3,16	3,71	4,29	4,69	5,09	5,50	5,91	6,33	6,76	7,86	8,53	8,99	10,38	11,34	12,31	15,07	16,36
500	3,84	4,52	5,23	5,71	6,20	6,70	7,20	7,72	8,24	9,57	10,39	10,95	12,65	13,81	15,00	18,36	19,93
600	4,52	5,32	6,14	6,71	7,28	7,87	8,46	9,07	9,68	11,25	12,21	12,87	14,86	16,23	17,62	21,57	23,42
700	5,18	6,09	7,04	7,69	8,35	9,02	9,70	10,39	11,09	12,89	14,00	14,74	17,04	18,60	20,20	24,72	26,84
730	5,37	6,32	7,31	7,98	8,66	9,36	10,07	10,79	11,51	13,38	14,53	15,30	17,68	19,31	20,96	25,65	27,85
800	5,83	6,86	7,92	8,65	9,40	10,15	10,92	11,70	12,49	14,51	15,75	16,59	19,17	20,93	22,73	27,82	30,20
900	6,47	7,61	8,79	9,60	10,43	11,26	12,11	12,98	13,86	16,10	17,48	18,41	21,27	23,23	25,22	30,87	33,51
1000	7,10	8,35	9,65	10,54	11,45	12,36	13,30	14,25	15,21	17,67	19,19	20,21	23,35	25,50	27,68	33,87	36,77
1200	8,34	9,82	11,34	12,38	13,45	14,53	15,62	16,74	17,87	20,76	22,54	23,74	27,43	29,95	32,51	39,78	43,19
1400	9,56	11,25	13,00	14,19	15,41	16,65	17,90	19,18	20,48	23,79	25,83	27,20	31,43	34,31	37,24	45,57	49,46
1460	9,92	11,68	13,49	14,73	15,99	17,28	18,58	19,91	21,25	24,69	26,80	28,23	32,61	35,60	38,65	47,28	51,32
1600	10,76	12,66	14,63	15,97	17,34	18,73	20,15	21,58	23,04	26,77	29,06	30,60	35,35	38,59	41,89	51,24	55,62
1800	11,94	14,05	16,23	17,72	19,24	20,79	22,35	23,95	25,56	29,69	32,24	33,95	39,21	42,81	46,46	56,82	61,66
2000	13,10	15,42	17,81	19,45	21,12	22,81	24,53	26,28	28,05	32,58	35,37	37,25	43,02	46,96	50,96	62,31	67,61
2400	15,39	18,11	20,93	22,84	24,80	26,79	28,81	30,86	32,94	38,25	41,52	43,72	50,48	55,09	59,78	73,04	79,24
2800	17,64	20,75	23,97	26,17	28,41	30,68	32,99	35,34	37,71	43,79	47,52	50,04	57,75	63,02	68,36	83,48	90,52
2880	18,08	21,27	24,57	26,82	29,12	31,45	33,82	36,22	38,66	44,88	48,71	51,29	59,19	64,58	70,05	85,53	
3200	19,84	23,34	26,96	29,43	31,95	34,50	37,09	39,73	42,40	49,21	53,40	56,22	64,87	70,76	76,74		
3500	21,47	25,26	29,17	31,84	34,56	37,32	40,12	42,97	45,85	53,21	57,73	60,77	70,10	76,45	82,89		
4000	24,15	28,41	32,80	35,79	38,85	41,94	45,09	48,28	51,51	59,75	64,80	68,21	78,63				
4500	26,78	31,50	36,36	39,67	43,05	46,48	49,95	53,48	57,04	66,14	71,71						
5000	29,37	34,54	39,86	43,49	47,18	50,92	54,72	58,57	62,47								
5500	31,93	37,53	43,31	47,24	51,24	55,29	59,40	63,57	67,78								

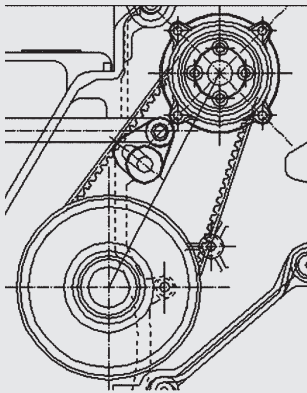
MEGADYNE PLATINUM

Table 7 - basic performance in kW for Platinum 14M - 40 mm wide
 Rated kilowatts for small sprocket

Number of grooves Z and pitch diameter in [mm]

Diam.	124,78	133,69	142,60	151,52	160,43	169,34	178,25	196,08	213,90	222,82	249,55	267,38	285,21	320,86	334,23	356,51
rpm/Z	28	30	32	34	36	38	40	44	48	50	56	60	64	72	75	80
10	1,44	1,55	1,66	1,79	1,90	2,03	2,14	2,39	2,63	2,75	3,13	3,38	3,63	4,15	4,34	4,66
20	2,52	2,73	2,93	3,14	3,34	3,56	3,76	4,19	4,61	4,84	5,49	5,93	6,38	7,28	7,63	8,20
40	4,43	4,78	5,15	5,51	5,87	6,25	6,62	7,36	8,12	8,51	9,66	10,44	11,22	12,81	13,41	14,42
80	7,79	8,42	9,05	9,70	10,33	10,98	11,64	12,96	14,28	14,95	16,98	18,36	19,74	22,53	23,60	25,37
100	9,35	10,10	10,86	11,63	12,40	13,17	13,95	15,53	17,13	17,94	20,38	22,02	23,68	27,03	28,30	30,43
200	16,44	17,77	19,10	20,45	21,81	23,17	24,54	27,32	30,13	31,55	35,84	38,73	41,64	47,54	49,77	53,51
300	22,86	24,71	26,58	28,45	30,33	32,24	34,16	38,02	41,92	43,90	49,85	53,87	57,92	66,12	69,22	74,43
400	28,90	31,24	33,59	35,96	38,35	40,74	43,16	48,04	52,98	55,46	62,99	68,07	73,18	83,52	87,43	93,99
500	34,67	37,46	40,27	43,11	45,97	48,86	51,75	57,59	63,51	66,49	75,51	81,58	87,70	100,07	104,75	112,60
600	40,21	43,45	46,71	50,00	53,33	56,66	60,01	66,79	73,64	77,09	87,52	94,56	101,64	115,95	121,36	130,43
700	45,58	49,25	52,95	56,68	60,43	64,21	68,01	75,69	83,43	87,33	99,15	107,09	115,09	131,26	137,36	147,59
730	47,15	50,96	54,78	58,64	62,52	66,44	70,36	78,30	86,31	90,35	102,55	110,77	119,04	135,75	142,06	152,62
800	50,80	54,89	59,01	63,17	67,34	71,56	75,79	84,32	92,94	97,29	110,41	119,24	128,14	146,07	152,83	164,17
900	55,89	60,40	64,93	69,49	74,09	78,71	83,36	92,73	102,20	106,97	121,36	131,04	140,79	160,41	167,83	180,22
1000	60,89	65,78	70,70	75,68	80,67	85,70	90,76	100,94	111,22	116,40	132,03	142,54	153,09	174,35	182,37	195,76
1200	70,56	76,22	81,93	87,66	93,44	99,25	105,08	116,83	128,68	134,64	152,61	164,66	176,76	201,05	210,18	225,43
1400	79,91	86,30	92,75	99,22	105,73	112,28	118,85	132,08	145,40	152,08	172,23	185,71	199,22	226,26	236,39	253,27
1460	82,66	89,26	95,91	102,61	109,34	116,09	122,89	136,55	150,28	157,18	177,94	191,83	205,74	233,54	243,95	261,26
1600	88,95	96,06	103,21	110,38	117,60	124,85	132,13	146,75	161,45	168,81	190,97	205,76	220,54	250,02	261,02	279,29
1800	97,75	105,53	113,35	121,21	129,10	137,01	144,96	160,88	176,86	184,86	208,86	224,81	240,74	272,33	284,07	
2000	106,31	114,73	123,20	131,70	140,22	148,77	157,34	174,49	191,66	200,24	225,89	242,91	259,81			
2400	122,76	132,40	142,07	151,75	161,45	171,15	180,84	200,18	219,43	229,01	257,43					
2800	138,38	149,13	159,88	170,63	181,36	192,06	202,72	223,87	244,77	255,10						
2880	141,41	152,38	163,33	174,27	185,18	196,05	206,89	228,37	249,53							
3200	153,23	164,98	176,69	188,35	199,96	211,48	222,93	245,49								
3500	163,86	176,27	188,62	200,88	213,03	225,06	236,97									
4000	180,64	193,99	207,21	220,26	233,12											

EXAMPLE: BASIC DESIGN DATA

Motor Power DriveR rpm Class motor	P = 5 kW n1 = 2000 rpm Class C	
Application Absorbed power DriveN rpm	Textile machine Unknown (assume 5 kW) n2 = 1000 rpm	
Type of driveN machine Working hours	Not uniform torque (Category 3) 8-16 hours/day	
Approximate centre distance Maximum pulley diameter	630 - 640 mm 200 mm	

Step 1. Calculation of power transmitted

Step 1a. Service Factor	Data	Result
F_s from table 2	Category 3 driveN machine Motor class C 8-16 working hours	$F_s = 2.0$
Step 1b. Speed up Factor	Data	Result
C_m from table 1	$i = \frac{n_{driveR}}{n_{driveN}} = \frac{n_1}{n_2} = \frac{2000}{1000} = 2$	$C_m = 0.0$
Step 1c. Corrected service factor	Data	Result
$C_c = F_s + C_m \quad [1]$	F_s from step 1-a C_m from step 1-b	$C_c = 2.0 + 0 = 2.0$
Step 1d. Design power	Data	Result
$P_c = P \times C_c \quad [2]$	P from basic design data C_c from step 1-c	$P_c = 5 \times 2.0 = 10 \text{ kW}$

Step 2. Belt pitch determination

Step 2. Belt pitch	Data	Result
Pitch of the belt from graph1 page 14	P_c from step 1-d rpm faster shaft from basic design data	Belt Type PLT 8M Belt pitch = 8 mm

Step 3 Selection of belt, pulleys and centre distance

<p>Step 3a. Speed Ratio</p> $R = \frac{n_{\text{faster shaft}}}{n_{\text{slower shaft}}} = \frac{n_s}{n_L} \quad [3]$	<p>Data</p> <p>from basic design data</p> <ul style="list-style-type: none"> • rpm slower shaft • from basic design data 	<p>Result</p> $R = \frac{2000}{1000} = 2$
<p>Step 3b. Belt, pulleys and centre distance</p> <p>$Z_1, Z_2, d_1, d_2, l, L_p, Z_b$ from table 3</p>	<p>Data</p> <p>Centre distance from basic design data R from step 3-a</p>	<p>Result</p> <p>Option 1 $Z_1=28$ teeth, $d_1=71.30$ mm $Z_2=56$ teeth, $d_2=142.60$ mm Centre distance=630.993mm Pitch belt length=1600 mm $Z_b=200$ teeth</p> <p>Option 2 $Z_1=40$ teeth, $d_1=101.86$ mm $Z_2=80$ teeth, $d_2=203.72$ mm Centre distance=637.966 mm Pitch belt length=1760 mm $Z_b=220$ teeth</p>
<p>Step 3c. Check belt/pulleys teeth ratio is an integer</p> $\frac{Z_b}{Z_s} \quad \frac{Z_b}{Z_L}$	<p>Data</p> <p>Z_s, Z_L, Z_b from step 3-b</p>	<p>Result</p> <p>Option 1</p> $\frac{z_b}{z_s} = \frac{200}{28} = 7.14 \quad \frac{z_b}{z_L} = \frac{200}{56} = 3.57$ <p>Option 2</p> $\frac{z_b}{z_s} = \frac{220}{40} = 5.5 \quad \frac{z_b}{z_L} = \frac{220}{80} = 2.75$
<p>Step 3d. Check options that match the requirements in terms of dimensional parameters</p>	<p>Data</p> <p>Maximum pulley diameter from basic design data</p>	<p>Result</p> <p>Option 1 according with the dimensional requirements maxpulley diameter = 200 mm)</p>

EXAMPLE: BASIC DESIGN DATA

Step 4. Actual power rating determination

Step 4a. Teeth in mesh factor	Data	Result
Cd from table 4, page 22	$z_1 = \left[0.5 - \left(\frac{4 \times p}{79 \times l} \right) \times (z_L - z_s) \right] \times z_s \quad [6]$ <p>p from step 2 Z₁, Z₂, l from step 3-b</p> $z_1 = \left[0.5 - \left(\frac{4 \times 8}{79 \times 630,993} \right) \times (66 - 28) \right] \times 28 = 13.5$	C _d = 1.0
Step 4b. Belt length factor	Data	Result
K ₁ from table 5	L _p from step 3-b	K ₁ = 1.13
Step 4c. Basic performance	Data	Result
P _b from table 7	p from step 2 Z _s from step 3-b rpm faster shaft from basic design data	P _b = 15,28 kW
Step 4d. Actual power rating	Data	Result
P _{ba} = P _b × C _d × K ₁ [5]	C _d from step 4-a K ₁ from step 4-b P _b from step 4-c	P _{ba} = 15,28 × 1 × 1.13 = 17,27 kW

Step 5 Belt width determination

Step 5a. Belt width factor	Data	Result
$= \frac{P_c}{P_{ba}} \quad [7]$	P _c from step 1-d P _{ba} from step 4-d	C _w = $\frac{10}{17,27} = 0,58$
Step 5b. Belt width	Data	Result
Belt width from table 8,	C _w from step 5-a	w = 12 mm
Step 5c. Drive service factor	Data	Result
$\sigma = \frac{P_{ba} \times C_{w \text{ listed}}}{P_c} \quad [8]$	P _{ba} from step 4-d P _c from step 1-d C _{w listed} from table 8	$\sigma = \frac{17,27 \times 0,599}{10} = 1.03$

Step 6 Static tension calculation

Step 6a. Class of motor factor	Data	Result
K_m from table 12	Class of motor from basic design data	$K_m = 1.75$
Step 6b. Belt linear speed	Data	Result
$v = \frac{\pi \times d_2 \times n_2}{60000} \quad [10]$	rpm on slower shaft from basic design data dL from step 3-b	$v = \frac{\pi \times 142.60 \times 1000}{60000} = 7.47 \text{ m/s}$
Step 6c. Belt mass per unit length	Data	Result
m from table 13	w from step 5-b p from step 2	$m = 0.0579 \text{ kg/m}$
Step 6d. Static tension	Data	Result
$T_s = \frac{500 \times P \times K_m}{v} + m \times v^2 \quad [9]$	P from basic design data K_m from step 6-a v from step 6-b m from step 6-c	$T_s = \frac{500 \times 5 \times 1.75}{7.47} + 0,0579 \times 7,47^2 = 588,9 \text{ N}$

Step 7 Static tension control

Step 7a1. Free span length	Data	Result
$t = \sqrt{l^2 - \left(\frac{d_2 - d_1}{2}\right)^2} \quad [12]$	l, d_s , d_L from step 3-b	$t = \sqrt{630.993^2 - \left(\frac{142.60 - 71.30}{2}\right)^2} = 629,9 \text{ mm}$
Step 7a2. Deflection forces	Data	Result
$F_{\min} = \frac{T_s}{16} \quad [13]$ $F_{\max} = \frac{1.5 \times T_s}{16} \quad [14]$	T_s from step 6-d	$F_{\min} = \frac{588,9}{16} = 36.80 \text{ N}$ $F_{\max} = \frac{1.5 \times 588,9}{16} = 55.2 \text{ N}$
Step 7a3. Deflection distance	Data	Result
$f = \frac{t}{64} \quad [15]$	t from step 7-a1	$f = \frac{629.9}{64} = 9.84 \text{ mm}$
Step 7b. Frequency	Data	Result
$fr = \sqrt{\frac{T_s \times 10^6}{4 \times m \times t^2}} \quad [16]$	T_s from step 6-d m from step 6-c t from step 7-a1	$fr = \sqrt{\frac{588,9 \times 10^6}{4 \times 0,0579 \times 629.9^2}} = 80 \text{ Hz}$

FORCES ON AXES AND BEARINGS

Symbols, Units, Terms.

Symbol	Description	Unit	Symbol	Description	Unit
α	Free span length angle	[°]	L_2	Bearing distance	[mm]
β	Wrap angle on small pulley	[°]	M_1	Motor torque	[Nm]
d_1	DriveR pulley pitch diameter	[mm]	M_2	Absorbed torque	[Nm]
d_2	DriveN pulley pitch diameter	[mm]	P	Motor power	[kW]
F_{dyn}	Dynamic axial load	[N]	P_a	Absorbed power	[kW]
F_1	Load on bearing	[N]	T_1	Tight side tension	[N]
F_2	Load on bearing	[N]	T_2	Slack side tension	[N]
L_1	Bearing/pulley distance	[mm]			

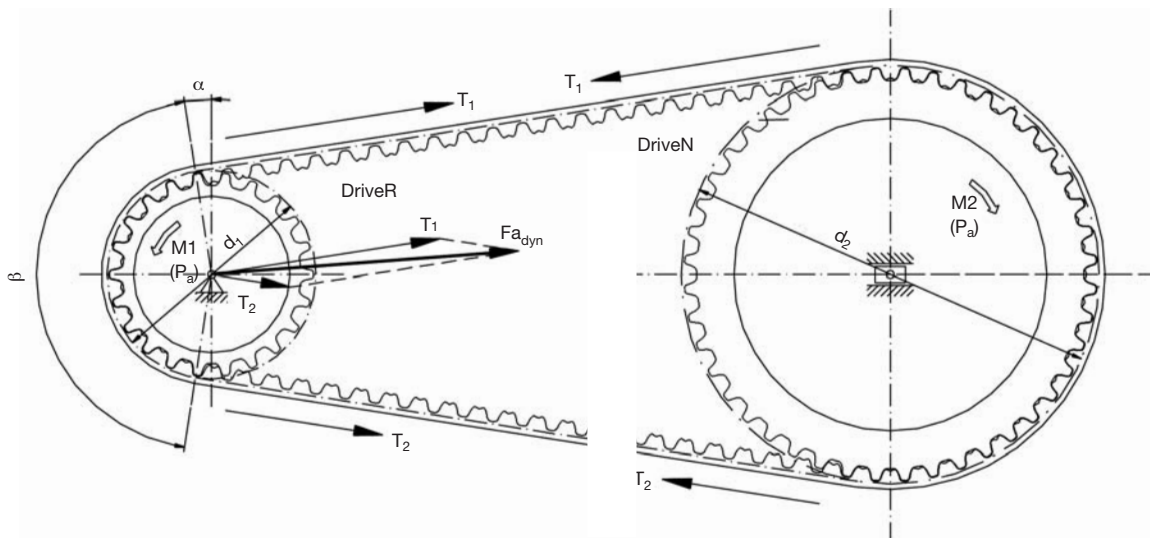


Figure 3

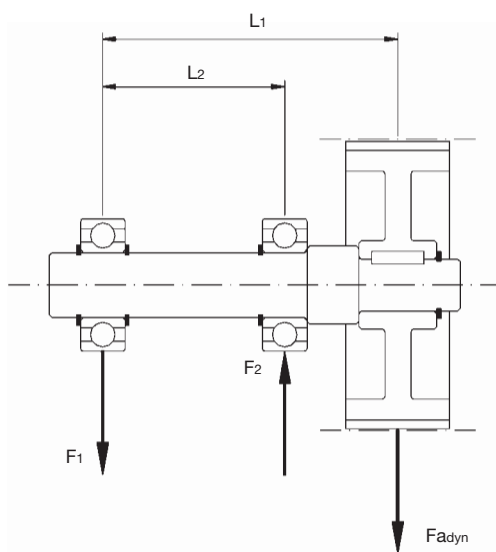


Figure 4

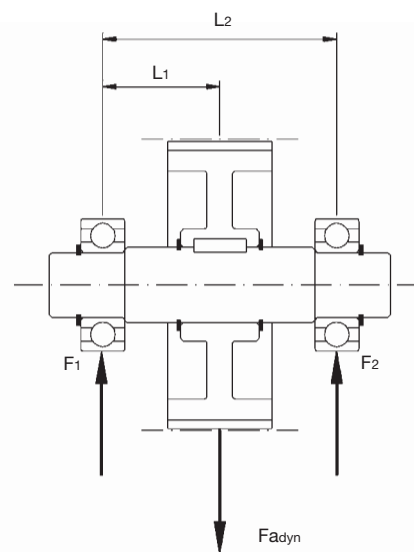


Figure 5

Calculation of the dynamic axial load F_{adyn} and forces on bearings.

The dynamic axial load is obtained by a vector addition between the tension in the tight span and the slack span as shown in the figure 5. The formula to calculate the dynamic axial load is the following:

$$F_{adyn} = \sqrt{T_1^2 + T_2^2 - 2 \times T_1 \times T_2 \times \cos \beta} = \sqrt{\frac{T_e^2}{2} + 2 \times T_s^2 - 2 \times \cos \beta \times \left(T_s^2 - \frac{T_e^2}{4} \right)}$$

Where:

T_e = Effective belt tension ($T_1 - T_2$) [N]

T_s = Static tension [N]

β = Wrap angle on small pulley [degree]

a) The effective belt tension is obtained by dividing the motor power by the belt linear speed:

$$T_e = \frac{1000 \times P}{v}$$

Where:

v = Belt linear speed (step 7a2) [m/s]

P = Motor power [kW]

b) The wrap angle on the small pulley can be calculated by using the following formula:

$$\beta = 180 - 2 \times \arcsin\left(\frac{d_L - d_S}{2 \times l}\right)$$

Where:

d_L = pitch diameter of large pulley [mm]

d_S = pitch diameter of small pulley [mm]

l = Centre distance [mm]

c) It is possible now to calculate the dynamic axial load F_{adin} using formula.... described at the beginning of this step.

d) Knowing the load on the axis, you can calculate the load on each bearing by using following formulas:

- In case of using a system like figure 5 left, where sprocket is set outside the bearing supports:

$$F_1 = \frac{L_1 - L_2}{L_2} \times F_{adyn} \quad F_2 = \frac{L_1}{L_2} \times F_{adyn}$$

- In case of using a system like figure 5 at right, with sprocket in the middle of bearing supports:

$$F_1 = \frac{L_2 - L_1}{L_2} \times F_{adyn} \quad F_2 = \frac{L_1}{L_2} \times F_{adyn}$$

Where:

F_1 = load on bearing [N]

F_2 = load on bearing [N]

L_1 = Bearing/pulley distance [mm]

L_2 = Bearings distance [mm]

F_{adin} = Dynamic axial load [N]

TABLE OF CENTRE DISTANCES: 8MM PITCH

Table 3

R	Z1	ø 1	Z2	ø 2	320-8M	352-8M	360-8M	384-8M	408-8M	456-8M	480-8M	536-8M	544-8M	560-8M	600-8M	608-8M
					40	44	45	48	51	57	60	67	68	70	75	76
1,38	32	81,49	44	112,05								114,983	119,018	127,080	147,206	151,228
1,38	26	66,21	36	91,67					78,971	103,214	115,296	143,435	147,450	155,478	175,538	179,548
1,40	80	203,72	112	285,21												
1,40	40	101,86	56	142,60												
1,41	64	162,97	90	229,18												
1,41	34	86,58	48	122,23									106,505	114,611	134,820	138,854
1,42	24	61,12	34	86,58				74,915	87,067	111,271	123,342	151,465	155,478	163,504	183,558	187,568
1,43	56	142,60	80	203,72												
1,43	28	71,30	40	101,86						90,710	102,863	131,109	135,135	143,184	163,285	167,302
1,45	44	112,05	64	162,97												
1,45	22	56,02	32	81,49			70,853	83,022	95,147	119,320	131,383	159,492	163,504	171,527	191,577	195,585
1,46	26	66,21	38	96,77						98,816	110,946	139,160	143,184	151,228	171,318	175,334
1,47	38	96,77	56	142,60												
1,47	30	76,39	44	112,05								118,659	122,703	130,783	150,946	154,974
1,50	48	122,23	72	183,35												
1,50	32	81,49	48	122,23								106,037	110,110	118,241	138,499	142,542
1,50	24	61,12	36	91,67					82,583	106,906	119,018	147,206	151,228	159,267	179,349	183,363
1,54	26	66,21	40	101,86						94,310	106,505	134,820	138,854	146,917	167,048	171,070
1,55	22	56,02	34	86,58				78,509	90,710	114,983	127,080	155,248	159,267	167,302	187,377	191,390
1,56	72	183,35	112	285,21												
1,56	36	91,67	56	142,60												117,223
1,57	28	71,30	44	112,05							93,778	122,299	126,354	134,454	154,656	158,691
1,58	24	61,12	38	96,77						102,445	114,611	142,887	146,917	154,974	175,092	179,112
1,60	40	101,86	64	162,97												
1,60	30	76,39	48	122,23								109,595	113,682	121,838	142,148	146,200
1,61	56	142,60	90	229,18												
1,64	44	112,05	72	183,35												
1,64	22	56,02	36	91,67					86,149	110,560	122,703	150,946	154,974	163,024	183,132	187,150
1,65	34	86,58	56	142,60											116,619	120,736
1,67	48	122,23	80	203,72												
1,67	24	61,12	40	101,86						97,872	110,110	138,499	142,542	150,620	170,784	174,812
1,68	38	96,77	64	162,97												
1,69	26	66,21	44	112,05							97,288	125,908	129,974	138,094	158,338	162,380
1,71	28	71,30	48	122,23								113,122	117,223	125,406	145,770	149,831
1,73	22	56,02	38	96,77					81,438	106,037	118,241	146,582	150,620	158,691	178,838	182,864
1,75	64	162,97	112	285,21												
1,75	32	81,49	56	142,60											120,091	124,222
1,78	36	91,67	64	162,97												
1,80	80	203,72	144	366,69												
1,80	40	101,86	72	183,35												
1,82	44	112,05	80	203,72												
1,82	22	56,02	40	101,86						101,399	113,682	142,148	146,200	154,295	174,493	178,527
1,83	24	61,12	44	112,05						88,302	100,765	129,488	133,565	141,706	161,994	166,043
1,85	26	66,21	48	122,23								116,619	120,736	128,945	149,366	153,436
1,87	30	76,39	56	142,60											123,537	127,684
1,88	48	122,23	90	229,18												
1,88	34	86,58	64	162,97												
1,89	38	96,77	72	183,35												
2,00	72	183,35	144	366,69												
2,00	56	142,60	112	285,21												
2,00	40	101,86	80	203,72												
2,00	36	91,67	72	183,35												
2,00	32	81,49	64	162,97												
2,00	28	71,30	56	142,60											126,961	131,123
2,00	24	61,12	48	122,23								120,091	124,222	132,459	152,937	157,017
2,00	22	56,02	44	112,05						91,687	104,212	133,040	137,129	145,291	165,626	169,683
2,05	44	112,05	90	229,18												
2,11	38	96,77	80	203,72												
2,12	34	86,58	72	183,35												
2,13	30	76,39	64	162,97												
2,15	26	66,21	56	142,60										109,252	130,363	134,540
2,18	22	56,02	48	122,23							94,116	123,537	127,684	135,949	156,485	160,575
2,22	36	91,67	80	203,72												
2,25	64	162,97	144	366,69												
2,25	40	101,86	90	229,18												
2,25	32	81,49	72	183,35												

TABLE OF CENTRE DISTANCES: 8MM PITCH

Table 3

R	Z1	ø 1	Z2	ø 2	320-8M	352-8M	360-8M	384-8M	408-8M	456-8M	480-8M	536-8M	544-8M	560-8M	600-8M	608-8M
					40	44	45	48	51	57	60	67	68	70	75	76
2,29	28	71,30	64	162,97												
2,33	48	122,23	112	285,21												
2,33	24	61,12	56	142,60									103,904	112,541	133,745	137,938
2,35	34	86,58	80	203,72												
2,37	38	96,77	90	229,18												
2,40	80	203,72	192	488,92												
2,40	30	76,39	72	183,35												
2,46	26	66,21	64	162,97												
2,50	36	91,67	90	229,18												
2,50	32	81,49	80	203,72												
2,55	44	112,05	112	285,21												
2,57	56	142,60	144	366,69												
2,57	28	71,30	72	183,35												
2,65	34	86,58	90	229,18												
2,67	72	183,35	192	488,92												
2,67	30	76,39	80	203,72												
2,67	24	61,12	64	162,97											112,233	116,699
2,77	26	66,21	72	183,35												
2,80	40	101,86	112	285,21												
2,81	32	81,49	90	229,18												
2,86	28	71,30	80	203,72												
2,91	22	56,02	64	162,97											115,369	119,860
2,95	38	96,77	112	285,21												
3,00	64	162,97	192	488,92												
3,00	48	122,23	144	366,69												
3,00	30	76,39	90	229,18												
3,00	24	61,12	72	183,35												
3,08	26	66,21	80	203,72												
3,11	36	91,67	112	285,21												
3,21	28	71,30	90	229,18												
3,27	44	112,05	144	366,69												
3,27	22	56,02	72	183,35												
3,29	34	86,58	112	285,21												
3,33	24	61,12	80	203,72												
3,43	56	142,60	192	488,92												
3,46	26	66,21	90	229,18												
3,50	32	81,49	112	285,21												
3,60	40	101,86	144	366,69												
3,64	22	56,02	80	203,72												
3,73	30	76,39	112	285,21												
3,75	24	61,12	90	229,18												
3,79	38	96,77	144	366,69												
4,00	48	122,23	192	488,92												
4,00	36	91,67	144	366,69												
4,00	28	71,30	112	285,21												
4,09	22	56,02	90	229,18												
4,24	34	86,58	144	366,69												
4,31	26	66,21	112	285,21												
4,36	44	112,05	192	488,92												
4,50	32	81,49	144	366,69												
4,67	24	61,12	112	285,21												
4,80	40	101,86	192	488,92												
4,80	30	76,39	144	366,69												
5,05	38	96,77	192	488,92												
5,09	22	56,02	112	285,21												
5,14	28	71,30	144	366,69												
5,33	36	91,67	192	488,92												
5,54	26	66,21	144	366,69												
5,65	34	86,58	192	488,92												
6,00	32	81,49	192	488,92												
6,00	24	61,12	144	366,69												
6,40	30	76,39	192	488,92												
6,55	22	56,02	144	366,69												
6,86	28	71,30	192	488,92												
7,38	26	66,21	192	488,92												
8,00	24	61,12	192	488,92												
8,73	22	56,02	192	488,92												

TABLE OF CENTRE DISTANCES: 14MM PITCH

Table 3

R	Z1	ø 1	Z2	ø 2	966-PLT14	994-PLT14	1092-PLT14	1106-PLT14	1190-PLT14	1260-PLT14	1288-PLT14	1344-PLT14
					69	71	78	79	85	90	92	96
1,00	80	356,51	80	356,51								
1,00	72	320,86	72	320,86								
1,00	64	285,21	64	285,21								
1,00	56	249,55	56	249,55							252,000	280,000
1,00	48	213,90	48	213,90				217,000	259,000	294,000	308,000	336,000
1,00	44	196,08	44	196,08			238,000	245,000	287,000	322,000	336,000	364,000
1,00	40	178,25	40	178,25	203,000	217,000	266,000	273,000	315,000	350,000	364,000	392,000
1,00	38	169,34	38	169,34	217,000	231,000	280,000	287,000	329,000	364,000	378,000	406,000
1,00	36	160,43	36	160,43	231,000	245,000	294,000	301,000	343,000	378,000	392,000	420,000
1,00	34	151,52	34	151,52	245,000	259,000	308,000	315,000	357,000	392,000	406,000	434,000
1,00	32	142,60	32	142,60	259,000	273,000	322,000	329,000	371,000	406,000	420,000	448,000
1,00	30	133,69	30	133,69	273,000	287,000	336,000	343,000	385,000	420,000	434,000	462,000
1,00	29	129,23	29	129,23	280,000	294,000	343,000	350,000	392,000	427,000	441,000	469,000
1,03	29	129,23	30	133,69	276,491	290,491	339,493	346,493	388,494	423,494	437,494	465,495
1,04	28	124,78	29	129,23	283,491	297,492	346,493	353,493	395,494	430,494	444,494	472,495
1,05	38	169,34	40	178,25	209,953	223,956	272,964	279,965	321,969	356,972	370,973	398,975
1,06	36	160,43	38	169,34	223,956	237,958	286,965	293,966	335,970	370,973	384,974	412,976
1,06	34	151,52	36	160,43	237,958	251,961	300,967	307,968	349,972	384,974	398,975	426,977
1,06	32	142,60	34	151,52	251,961	265,963	314,968	321,969	363,973	398,975	412,976	440,977
1,07	30	133,69	32	142,60	265,963	279,965	328,970	335,970	377,974	412,976	426,977	454,978
1,07	28	124,78	30	133,69	279,965	293,966	342,971	349,972	391,975	426,977	440,977	468,979
1,09	44	196,08	48	213,90			223,823	230,828	272,854	307,871	321,877	349,886
1,10	40	178,25	44	196,08	188,790	202,804	251,842	258,847	300,868	335,882	349,886	377,895
1,10	29	129,23	32	142,60	269,417	283,421	332,433	339,434	381,441	416,446	430,448	458,451
1,11	72	320,86	80	356,51								
1,11	36	160,43	40	178,25	216,817	230,828	279,858	286,862	328,879	363,891	377,895	405,902
1,12	34	151,52	38	169,34	230,828	244,838	293,865	300,868	342,884	377,895	391,899	419,905
1,13	80	356,51	90	401,07								
1,13	64	285,21	72	320,86								
1,13	32	142,60	36	160,43	244,838	258,847	307,871	314,874	356,889	391,899	405,902	433,908
1,13	30	133,69	34	151,52	258,847	272,854	321,877	328,879	370,893	405,902	419,905	447,911
1,14	56	249,55	64	285,21								
1,14	28	124,78	32	142,60	272,854	286,862	335,882	342,884	384,897	419,905	433,908	461,914
1,16	38	169,34	44	196,08	195,543	209,573	258,654	265,664	307,710	342,739	356,749	384,768
1,17	48	213,90	56	249,55						265,401	279,431	307,483
1,17	29	129,23	34	151,52	262,263	276,275	325,309	332,313	374,334	409,348	423,353	451,362
1,18	34	151,52	40	178,25	223,600	237,624	286,688	293,696	335,734	370,759	384,768	412,783
1,19	32	142,60	38	169,34	237,624	251,645	300,703	307,710	349,744	384,768	398,776	426,791
1,20	40	178,25	48	213,90			237,330	244,350	286,445	321,506	335,526	363,563
1,20	30	133,69	36	160,43	251,645	265,664	314,716	321,722	363,754	398,776	412,783	440,797
1,21	28	124,78	34	151,52	265,664	279,680	328,728	335,734	377,763	412,783	426,791	454,803
1,22	36	160,43	44	196,08	202,214	216,265	265,401	272,417	314,495	349,545	363,563	391,594
1,24	29	129,23	36	160,43	255,023	269,048	318,118	325,126	367,169	402,198	416,208	444,226
1,25	72	320,86	80	356,51								
1,25	64	285,21	72	320,86								
1,25	32	142,60	40	178,25	230,310	244,350	293,458	300,471	342,536	377,579	391,594	419,621
1,26	38	169,34	48	213,90		194,724	243,982	251,010	293,153	328,243	342,274	370,329
1,27	44	196,08	56	249,55					243,531	278,716	292,778	320,885
1,27	30	133,69	38	169,34	244,350	258,385	307,483	314,495	356,554	391,594	405,608	433,634
1,29	56	249,55	72	320,86								
1,29	34	151,52	44	196,08	208,810	222,885	272,087	279,110	321,227	356,303	370,329	398,377
1,29	28	124,78	36	160,43	258,385	272,417	321,506	328,516	370,571	405,608	419,621	447,645
1,31	29	129,23	38	169,34	247,688	261,731	310,853	317,867	359,941	394,991	409,008	437,040

1400-PLT14	1442-PLT14	1568-PLT14	1610-PLT14	1764-PLT14	1778-PLT14	1890-PLT14	1960-PLT14					
100	103	112	115	126	127	135	140	R	Z1	ø 1	Z2	ø 2
						385,000	420,000	1,00	80	356,51	80	356,51
				378,000	385,000	441,000	476,000	1,00	72	320,86	72	320,86
		336,000	357,000	434,000	441,000	497,000	532,000	1,00	64	285,21	64	285,21
308,000	329,000	392,000	413,000	490,000	497,000	553,000	588,000	1,00	56	249,55	56	249,55
364,000	385,000	448,000	469,000	546,000	553,000	609,000	644,000	1,00	48	213,90	48	213,90
392,000	413,000	476,000	497,000	574,000	581,000	637,000	672,000	1,00	44	196,08	44	196,08
420,000	441,000	504,000	525,000	602,000	609,000	665,000	700,000	1,00	40	178,25	40	178,25
434,000	455,000	518,000	539,000	616,000	623,000	679,000	714,000	1,00	38	169,34	38	169,34
448,000	469,000	532,000	553,000	630,000	637,000	693,000	728,000	1,00	36	160,43	36	160,43
462,000	483,000	546,000	567,000	644,000	651,000	707,000	742,000	1,00	34	151,52	34	151,52
476,000	497,000	560,000	581,000	658,000	665,000	721,000	756,000	1,00	32	142,60	32	142,60
490,000	511,000	574,000	595,000	672,000	679,000	735,000	770,000	1,00	30	133,69	30	133,69
497,000	518,000	581,000	602,000	679,000	686,000	742,000	777,000	1,00	29	129,23	29	129,23
493,495	514,495	577,496	598,496	675,496	682,496	738,497	773,497	1,03	29	129,23	30	133,69
500,495	521,495	584,496	605,496	682,496	689,496	745,497	780,497	1,04	28	124,78	29	129,23
426,977	447,978	510,981	531,981	608,984	615,984	671,985	706,986	1,05	38	169,34	40	178,25
440,977	461,979	524,981	545,982	622,984	629,984	685,986	720,986	1,06	36	160,43	38	169,34
454,978	475,979	538,982	559,982	636,984	643,985	699,986	734,986	1,06	34	151,52	36	160,43
468,979	489,980	552,982	573,983	650,985	657,985	713,986	748,987	1,06	32	142,60	34	151,52
482,979	503,980	566,982	587,983	664,985	671,985	727,986	762,987	1,07	30	133,69	32	142,60
496,980	517,981	580,983	601,984	678,985	685,986	741,987	776,987	1,07	28	124,78	30	133,69
377,895	398,900	461,914	482,918	559,929	566,930	622,936	657,940	1,09	44	196,08	48	213,90
405,902	426,907	489,919	510,922	587,932	594,933	650,939	685,942	1,10	40	178,25	44	196,08
486,454	507,456	570,461	591,462	668,467	675,467	731,469	766,471	1,10	29	129,23	32	142,60
				349,545	356,554	412,615	447,645	1,11	72	320,86	80	356,51
433,908	454,913	517,923	538,926	615,936	622,936	678,941	713,944	1,11	36	160,43	40	178,25
447,911	468,915	531,925	552,928	629,937	636,938	692,943	727,945	1,12	34	151,52	38	169,34
							384,354	1,13	80	356,51	90	401,07
		307,483	328,516	405,608	412,615	468,661	503,685	1,13	64	285,21	72	320,86
461,914	482,918	545,927	566,930	643,938	650,939	706,944	741,946	1,13	32	142,60	36	160,43
475,917	496,920	559,929	580,932	657,940	664,940	720,945	755,947	1,13	30	133,69	34	151,52
279,431	300,471	363,563	384,587	461,656	468,661	524,697	559,716	1,14	56	249,55	64	285,21
489,919	510,922	573,931	594,933	671,941	678,941	734,946	769,948	1,14	28	124,78	32	142,60
412,783	433,794	496,820	517,827	594,850	601,852	657,864	692,871	1,16	38	169,34	44	196,08
335,526	356,554	419,621	440,639	517,693	524,697	580,726	615,742	1,17	48	213,90	56	249,55
479,371	500,376	563,390	584,394	661,406	668,407	724,414	759,418	1,17	29	129,23	34	151,52
440,797	461,806	524,830	545,836	622,857	629,858	685,870	720,876	1,18	34	151,52	40	178,25
454,803	475,812	538,834	559,840	636,860	643,861	699,872	734,878	1,19	32	142,60	38	169,34
391,594	412,615	475,666	496,680	573,723	580,726	636,750	671,763	1,20	40	178,25	48	213,90
468,809	489,818	552,838	573,844	650,863	657,864	713,875	748,881	1,20	30	133,69	36	160,43
482,815	503,823	566,842	587,848	664,866	671,867	727,877	762,883	1,21	28	124,78	34	151,52
419,621	440,639	503,685	524,697	601,736	608,739	664,761	699,773	1,22	36	160,43	44	196,08
472,242	493,253	556,281	577,289	654,314	661,316	717,330	752,338	1,24	29	129,23	36	160,43
						375,858	411,042	1,25	72	320,86	90	401,07
				376,310	383,341	439,553	474,661	1,25	64	285,21	80	356,51
447,645	468,661	531,701	552,713	629,748	636,750	692,771	727,782	1,25	32	142,60	40	178,25
398,377	419,408	482,485	503,507	580,572	587,577	643,614	678,634	1,26	38	169,34	48	213,90
348,975	370,034	433,175	454,213	531,327	538,336	594,399	629,432	1,27	44	196,08	56	249,55
461,656	482,671	545,709	566,720	643,753	650,756	706,775	741,786	1,27	30	133,69	38	169,34
		334,096	355,209	432,530	439,553	495,717	530,802	1,29	56	249,55	72	320,86
426,418	447,445	510,514	531,533	608,592	615,597	671,630	706,649	1,29	34	151,52	44	196,08
475,666	496,680	559,716	580,726	657,758	664,761	720,780	755,790	1,29	28	124,78	36	160,43
465,068	486,086	549,134	570,147	647,189	654,193	710,217	745,230	1,31	29	129,23	38	169,34

TABLE OF CENTRE DISTANCES: 14MM PITCH

Table 3

R	Z1	ø 1	Z2	ø 2	2100-PLT14	2240-PLT14	2310-PLT14	2380-PLT14	2450-PLT14	2590-PLT14	2660-PLT14	2800-PLT14
					150	160	165	170	175	185	190	200
1,00	80	356,51	80	356,51	490,000	560,000	595,000	630,000	665,000	735,000	770,000	840,000
1,00	72	320,86	72	320,86	546,000	616,000	651,000	686,000	721,000	791,000	826,000	896,000
1,00	64	285,21	64	285,21	602,000	672,000	707,000	742,000	777,000	847,000	882,000	952,000
1,00	56	249,55	56	249,55	658,000	728,000	763,000	798,000	833,000	903,000	938,000	1008,000
1,00	48	213,90	48	213,90	714,000	784,000	819,000	854,000	889,000	959,000	994,000	1064,000
1,00	44	196,08	44	196,08	742,000	812,000	847,000	882,000	917,000	987,000	1022,000	1092,000
1,00	40	178,25	40	178,25	770,000	840,000	875,000	910,000	945,000	1015,000	1050,000	1120,000
1,00	38	169,34	38	169,34	784,000	854,000	889,000	924,000	959,000	1029,000	1064,000	1134,000
1,00	36	160,43	36	160,43	798,000	868,000	903,000	938,000	973,000	1043,000	1078,000	1148,000
1,00	34	151,52	34	151,52	812,000	882,000	917,000	952,000	987,000	1057,000	1092,000	1162,000
1,00	32	142,60	32	142,60	826,000	896,000	931,000	966,000	1001,000	1071,000	1106,000	1176,000
1,00	30	133,69	30	133,69	840,000	910,000	945,000	980,000	1015,000	1085,000	1120,000	1190,000
1,00	29	129,23	29	129,23	847,000	917,000	952,000	987,000	1022,000	1092,000	1127,000	1197,000
1,03	29	129,23	30	133,69	843,497	913,497	948,497	983,497	1018,498	1088,498	1123,498	1193,498
1,04	28	124,78	29	129,23	850,497	920,497	955,497	990,497	1025,498	1095,498	1130,498	1200,498
1,05	38	169,34	40	178,25	776,987	846,988	881,989	916,989	951,990	1021,990	1056,991	1126,991
1,06	36	160,43	38	169,34	790,987	860,988	895,989	930,989	965,990	1035,990	1070,991	1140,991
1,06	34	151,52	36	160,43	804,988	874,989	909,989	944,989	979,990	1049,991	1084,991	1154,991
1,06	32	142,60	34	151,52	818,988	888,989	923,989	958,990	993,990	1063,991	1098,991	1168,992
1,07	30	133,69	32	142,60	832,988	902,989	937,989	972,990	1007,990	1077,991	1112,991	1182,992
1,07	28	124,78	30	133,69	846,988	916,989	951,990	986,990	1021,990	1091,991	1126,991	1196,992
1,09	44	196,08	48	213,90	727,945	797,950	832,952	867,954	902,956	972,959	1007,961	1077,963
1,10	40	178,25	44	196,08	755,947	825,952	860,954	895,956	930,957	1000,960	1035,962	1105,964
1,10	29	129,23	32	142,60	836,473	906,475	941,476	976,477	1011,478	1081,479	1116,480	1186,481
1,11	72	320,86	80	356,51	517,693	587,730	622,745	657,758	692,771	762,792	797,801	867,817
1,11	36	160,43	40	178,25	783,949	853,953	888,955	923,957	958,959	1028,961	1063,963	1133,965
1,12	34	151,52	38	169,34	797,950	867,954	902,956	937,958	972,959	1042,962	1077,963	1147,965
1,13	80	356,51	90	401,07	454,454	524,527	559,556	594,582	629,606	699,645	734,662	804,691
1,13	64	285,21	72	320,86	573,723	643,753	678,766	713,777	748,788	818,806	853,814	923,828
1,13	32	142,60	36	160,43	811,951	881,955	916,957	951,958	986,960	1056,962	1091,964	1161,966
1,13	30	133,69	34	151,52	825,952	895,956	930,957	965,959	1000,960	1070,963	1105,964	1175,966
1,14	56	249,55	64	285,21	629,748	699,773	734,784	769,794	804,803	874,818	909,825	979,838
1,14	28	124,78	32	142,60	839,953	909,956	944,958	979,959	1014,961	1084,963	1119,965	1189,967
1,16	38	169,34	44	196,08	762,883	832,893	867,897	902,901	937,905	1007,911	1042,914	1112,920
1,17	48	213,90	56	249,55	685,768	755,790	790,799	825,808	860,815	930,829	965,836	1035,847
1,17	29	129,23	34	151,52	829,425	899,431	934,434	969,436	1004,438	1074,442	1109,444	1179,447
1,18	34	151,52	40	178,25	790,887	860,896	895,900	930,904	965,907	1035,914	1070,917	1140,922
1,19	32	142,60	38	169,34	804,889	874,898	909,902	944,905	979,909	1049,915	1084,918	1154,923
1,20	40	178,25	48	213,90	741,786	811,804	846,812	881,820	916,827	986,839	1021,845	1091,854
1,20	30	133,69	36	160,43	818,891	888,899	923,903	958,907	993,910	1063,916	1098,919	1168,924
1,21	28	124,78	34	151,52	832,893	902,901	937,905	972,908	1007,911	1077,917	1112,920	1182,924
1,22	36	160,43	44	196,08	769,794	839,811	874,818	909,825	944,832	1014,843	1049,849	1119,858
1,24	29	129,23	36	160,43	822,352	892,364	927,369	962,374	997,378	1067,386	1102,390	1172,396
1,25	72	320,86	90	401,07	481,328	551,541	586,628	621,706	656,775	726,893	761,944	832,033
1,25	64	285,21	80	356,51	544,833	614,966	650,022	685,072	720,117	790,196	825,230	895,290
1,25	32	142,60	40	178,25	797,801	867,817	902,824	937,831	972,837	1042,848	1077,853	1147,862
1,26	38	169,34	48	213,90	748,668	818,697	853,709	888,721	923,731	993,750	1028,759	1098,774
1,27	44	196,08	56	249,55	699,489	769,535	804,556	839,574	874,591	944,622	979,635	1049,659
1,27	30	133,69	38	169,34	811,804	881,820	916,827	951,833	986,839	1056,850	1091,854	1161,863
1,29	56	249,55	72	320,86	600,942	671,053	706,100	741,142	776,181	846,249	881,279	951,332
1,29	34	151,52	44	196,08	776,680	846,707	881,718	916,729	951,739	1021,757	1056,765	1126,780
1,29	28	124,78	36	160,43	825,808	895,823	930,829	965,836	1000,841	1070,852	1105,856	1175,865
1,31	29	129,23	38	169,34	815,253	885,273	920,282	955,290	990,297	1060,310	1095,316	1165,327

3150-PLT14	3360-PLT14	3500-PLT14	3850-PLT14	3920-PLT14	4326-PLT14	4578-PLT14	4956-PLT14						
225	240	250	275	280	309	327	354	R	Z1	ø 1	Z2	ø 2	
1015,000	1120,000	1190,000	1365,000	1400,000	1603,000	1729,000	1918,000	1,00	80	356,51	80	356,51	
1071,000	1176,000	1246,000	1421,000	1456,000	1659,000	1785,000	1974,000	1,00	72	320,86	72	320,86	
1127,000	1232,000	1302,000	1477,000	1512,000	1715,000	1841,000	2030,000	1,00	64	285,21	64	285,21	
1183,000	1288,000	1358,000	1533,000	1568,000	1771,000	1897,000	2086,000	1,00	56	249,55	56	249,55	
1239,000	1344,000	1414,000	1589,000	1624,000	1827,000	1953,000	2142,000	1,00	48	213,90	48	213,90	
1267,000	1372,000	1442,000	1617,000	1652,000	1855,000	1981,000	2170,000	1,00	44	196,08	44	196,08	
1295,000	1400,000	1470,000	1645,000	1680,000	1883,000	2009,000	2198,000	1,00	40	178,25	40	178,25	
1309,000	1414,000	1484,000	1659,000	1694,000	1897,000	2023,000	2212,000	1,00	38	169,34	38	169,34	
1323,000	1428,000	1498,000	1673,000	1708,000	1911,000	2037,000	2226,000	1,00	36	160,43	36	160,43	
1337,000	1442,000	1512,000	1687,000	1722,000	1925,000	2051,000	2240,000	1,00	34	151,52	34	151,52	
1351,000	1456,000	1526,000	1701,000	1736,000	1939,000	2065,000	2254,000	1,00	32	142,60	32	142,60	
1365,000	1470,000	1540,000	1715,000	1750,000	1953,000	2079,000	2268,000	1,00	30	133,69	30	133,69	
1372,000	1477,000	1547,000	1722,000	1757,000	1960,000	2086,000	2275,000	1,00	29	129,23	29	129,23	
1368,498	1473,498	1543,498	1718,499	1753,499	1956,499	2082,499	2271,499	1,03	29	129,23	30	133,69	
1375,498	1480,498	1550,498	1725,499	1760,499	1963,499	2089,499	2278,499	1,04	28	124,78	29	129,23	
1301,992	1406,993	1476,993	1651,994	1686,994	1889,995	2015,995	2204,995	1,05	38	169,34	40	178,25	
1315,992	1420,993	1490,993	1665,994	1700,994	1903,995	2029,995	2218,996	1,06	36	160,43	38	169,34	
1329,993	1434,993	1504,993	1679,994	1714,994	1917,995	2043,995	2232,996	1,06	34	151,52	36	160,43	
1343,993	1448,993	1518,993	1693,994	1728,994	1931,995	2057,995	2246,996	1,06	32	142,60	34	151,52	
1357,993	1462,993	1532,994	1707,994	1742,994	1945,995	2071,995	2260,996	1,07	30	133,69	32	142,60	
1371,993	1476,993	1546,994	1721,994	1756,994	1959,995	2085,995	2274,996	1,07	28	124,78	30	133,69	
1252,968	1357,971	1427,972	1602,975	1637,976	1840,978	1966,980	2155,982	1,09	44	196,08	48	213,90	
1280,969	1385,971	1455,973	1630,976	1665,976	1868,979	1994,980	2183,982	1,10	40	178,25	44	196,08	
1361,484	1466,485	1536,485	1711,487	1746,487	1949,489	2075,489	2264,490	1,10	29	129,23	32	142,60	
1042,848	1147,862	1217,870	1392,886	1427,889	1630,903	1756,910	1945,918	1,11	72	320,86	80	356,51	
1308,970	1413,972	1483,973	1658,976	1693,977	1896,979	2022,980	2211,982	1,11	36	160,43	40	178,25	
1322,970	1427,972	1497,973	1672,976	1707,977	1910,979	2036,981	2225,982	1,12	34	151,52	38	169,34	
979,747	1084,771	1154,785	1329,813	1364,818	1567,842	1693,853	1882,868	1,13	80	356,51	90	401,07	
1098,855	1203,868	1273,875	1448,890	1483,893	1686,906	1812,912	2001,921	1,13	64	285,21	72	320,86	
1336,970	1441,972	1511,974	1686,976	1721,977	1924,979	2050,981	2239,982	1,13	32	142,60	36	160,43	
1350,971	1455,973	1525,974	1700,977	1735,977	1938,980	2064,981	2253,982	1,13	30	133,69	34	151,52	
1154,862	1259,874	1329,881	1504,894	1539,897	1742,909	1868,915	2057,923	1,14	56	249,55	64	285,21	
1364,971	1469,973	1539,974	1714,977	1749,977	1952,980	2078,981	2267,982	1,14	28	124,78	32	142,60	
1287,931	1392,936	1462,939	1637,945	1672,947	1875,952	2001,955	2190,959	1,16	38	169,34	44	196,08	
1210,869	1315,879	1385,885	1560,898	1595,900	1798,912	1924,917	2113,925	1,17	48	213,90	56	249,55	
1354,454	1459,457	1529,459	1704,464	1739,464	1942,468	2068,470	2257,473	1,17	29	129,23	34	151,52	
1315,932	1420,937	1490,940	1665,946	1700,947	1903,953	2029,956	2218,960	1,18	34	151,52	40	178,25	
1329,933	1434,938	1504,941	1679,947	1714,948	1917,953	2043,956	2232,960	1,19	32	142,60	38	169,34	
1266,875	1371,884	1441,890	1616,902	1651,904	1854,914	1980,920	2169,927	1,20	40	178,25	48	213,90	
1343,934	1448,938	1518,941	1693,947	1728,948	1931,954	2057,957	2246,960	1,20	30	133,69	36	160,43	
1357,934	1462,939	1532,942	1707,948	1742,949	1945,954	2071,957	2260,960	1,21	28	124,78	34	151,52	
1294,877	1399,887	1469,892	1644,903	1679,905	1882,916	2008,921	2197,928	1,22	36	160,43	44	196,08	
1347,410	1452,416	1522,420	1697,428	1732,430	1935,437	2061,441	2250,446	1,24	29	129,23	36	160,43	
1007,201	1112,277	1182,320	1357,407	1392,422	1595,496	1721,533	1910,579	1,25	72	320,86	90	401,07	
1070,406	1175,459	1245,490	1420,553	1455,563	1658,617	1784,644	1973,678	1,25	64	285,21	80	356,51	
1322,880	1427,889	1497,894	1672,905	1707,907	1910,917	2036,922	2225,929	1,25	32	142,60	40	178,25	
1273,805	1378,820	1448,829	1623,847	1658,850	1861,867	1987,875	2176,886	1,26	38	169,34	48	213,90	
1224,708	1329,731	1399,745	1574,773	1609,778	1812,803	1938,816	2127,832	1,27	44	196,08	56	249,55	
1336,881	1441,890	1511,895	1686,906	1721,908	1924,917	2050,923	2239,929	1,27	30	133,69	38	169,34	
1126,436	1231,484	1301,512	1476,570	1511,580	1714,629	1840,655	2029,687	1,29	56	249,55	72	320,86	
1301,809	1406,824	1476,832	1651,850	1686,853	1889,869	2015,877	2204,887	1,29	34	151,52	44	196,08	
1350,882	1455,891	1525,896	1700,907	1735,908	1938,918	2064,923	2253,930	1,29	28	124,78	36	160,43	
1340,350	1445,361	1515,367	1690,381	1725,383	1928,396	2054,402	2243,410	1,31	29	129,23	38	169,34	

TABLE OF CENTRE DISTANCES: 14MM PITCH

Table 3

R	Z1	ø 1	Z2	ø 2	966-PLT14	994-PLT14	1092-PLT14	1106-PLT14	1190-PLT14	1260-PLT14	1288-PLT14	1344-PLT14
					69	71	78	79	85	90	92	96
1,33	48	213,90	64	285,21								277,709
1,33	36	160,43	48	213,90		201,221	250,572	257,611	299,807	334,932	348,975	377,052
1,33	30	133,69	40	178,25	236,952	251,010	300,173	307,192	349,289	384,354	398,377	426,418
1,36	28	124,78	38	169,34	251,010	265,063	314,210	321,227	363,317	398,377	412,398	440,436
1,38	32	142,60	44	196,08	215,338	229,440	278,716	285,748	327,909	363,015	377,052	405,117
1,38	29	129,23	40	178,25	240,249	254,318	303,510	310,532	352,648	387,725	401,752	429,801
1,40	80	356,51	112	499,11								
1,40	40	178,25	56	249,55				214,024	256,519	291,820	305,920	334,096
1,41	64	285,21	90	401,07								
1,41	34	151,52	48	213,90	193,480	207,652	257,105	264,156	306,411	341,575	355,631	383,731
1,43	56	249,55	80	356,51								
1,43	28	124,78	40	178,25	243,531	257,611	306,834	313,860	355,995	391,086	405,117	433,175
1,45	44	196,08	64	285,21						247,985	262,204	290,576
1,47	38	169,34	56	249,55			213,217	220,340	262,935	298,300	312,422	340,636
1,47	30	133,69	44	196,08	221,803	235,935	285,293	292,334	334,545	369,683	383,731	411,818
1,50	48	213,90	72	320,86								
1,50	32	142,60	48	213,90	199,811	214,024	263,585	270,649	312,967	348,173	362,244	390,371
1,52	29	129,23	44	196,08	225,013	239,161	288,562	295,609	337,845	373,002	387,056	415,154
1,56	72	320,86	112	499,11								
1,56	36	160,43	56	249,55			219,460	226,604	269,304	304,736	318,881	347,136
1,57	28	124,78	44	196,08	228,210	242,373	291,820	298,871	341,135	376,310	390,371	418,481
1,60	40	178,25	64	285,21						260,491	274,780	303,273
1,60	30	133,69	48	213,90	206,085	220,340	270,016	277,092	319,479	354,730	368,817	396,972
1,61	56	249,55	90	401,07								
1,64	44	196,08	72	320,86								
1,65	34	151,52	56	249,55			225,654	232,820	275,629	311,130	325,300	353,597
1,66	29	129,23	48	213,90	209,202	223,478	273,213	280,297	322,719	357,994	372,089	400,259
1,67	48	213,90	80	356,51								
1,68	38	169,34	64	285,21					230,687	266,682	281,007	309,563
1,71	28	124,78	48	213,90	212,306	226,604	276,400	283,490	325,949	361,248	375,351	403,537
1,75	64	285,21	112	499,11								
1,75	32	142,60	56	249,55			231,804	238,992	281,913	317,486	331,680	360,021
1,78	36	160,43	64	285,21					236,730	272,835	287,197	315,817
1,80	80	356,51	144	641,71								
1,80	40	178,25	72	320,86								270,549
1,82	44	196,08	80	356,51								
1,87	30	133,69	56	249,55			237,911	245,122	288,157	323,804	338,023	366,411
1,88	48	213,90	90	401,07								
1,88	34	151,52	64	285,21					242,737	278,952	293,351	322,037
1,89	38	169,34	72	320,86							247,303	276,557
1,93	29	129,23	56	249,55		189,888	240,950	248,172	291,265	326,949	341,182	369,593
2,00	72	320,86	144	641,71								
2,00	56	249,55	112	499,11								
2,00	40	178,25	80	356,51								
2,00	36	160,43	72	320,86							253,184	282,535
2,00	32	142,60	64	285,21					248,708	285,035	299,471	328,225
2,00	28	124,78	56	249,55		192,816	243,979	251,212	294,363	330,086	344,332	372,767
2,05	44	196,08	90	401,07								
2,11	38	169,34	80	356,51								
2,12	34	151,52	72	320,86						244,167	259,035	288,483
2,13	30	133,69	64	285,21				210,194	254,646	291,085	305,560	334,381
2,21	29	129,23	64	285,21				213,061	257,603	294,098	308,592	337,448
2,22	36	160,43	80	356,51								
2,25	64	285,21	144	641,71								

1400-PLT14	1442-PLT14	1568-PLT14	1610-PLT14	1764-PLT14	1778-PLT14	1890-PLT14	1960-PLT14						
100	103	112	115	126	127	135	140	R	Z1	ø 1	Z2	ø 2	
305,920	327,055	390,371	411,455	488,699	495,717	551,848	586,917	1,33	48	213,90	64	285,21	
405,117	426,161	489,269	510,299	587,391	594,399	650,450	685,478	1,33	36	160,43	48	213,90	
454,454	475,478	538,539	559,556	636,610	643,614	699,645	734,662	1,33	30	133,69	40	178,25	
468,470	489,493	552,551	573,567	650,618	657,622	713,652	748,668	1,36	28	124,78	38	169,34	
433,175	454,213	517,309	538,336	615,419	622,426	678,473	713,499	1,38	32	142,60	44	196,08	
457,844	478,873	541,946	562,966	640,031	647,036	703,073	738,093	1,38	29	129,23	40	178,25	
								1,40	80	356,51	112	499,11	
362,244	383,341	446,576	467,640	544,833	551,848	607,954	643,011	1,40	40	178,25	56	249,55	
					345,126	401,816	437,156	1,41	64	285,21	90	401,07	
411,818	432,876	496,019	517,059	594,181	601,191	657,260	692,297	1,41	34	151,52	48	213,90	
		303,273	324,585	402,442	409,503	465,928	501,144	1,43	56	249,55	80	356,51	
461,225	482,259	545,344	566,369	643,444	650,450	706,494	741,518	1,43	28	124,78	40	178,25	
318,881	340,076	403,537	424,660	502,021	509,048	565,242	600,345	1,45	44	196,08	64	285,21	
368,817	389,936	453,224	474,303	551,541	558,559	614,691	649,762	1,47	38	169,34	56	249,55	
439,893	460,944	524,071	545,107	622,218	629,227	685,290	720,324	1,47	30	133,69	44	196,08	
274,780	296,159	360,021	381,243	458,881	465,928	522,260	557,433	1,50	48	213,90	72	320,86	
418,481	439,553	502,735	523,786	600,942	607,954	664,043	699,091	1,50	32	142,60	48	213,90	
443,239	464,297	527,441	548,481	625,607	632,617	688,689	723,728	1,52	29	129,23	44	196,08	
								1,56	72	320,86	112	499,11	
375,351	396,493	459,839	480,934	558,220	565,242	621,401	656,487	1,56	36	160,43	56	249,55	
446,576	467,640	530,802	551,848	628,989	636,001	692,082	727,126	1,57	28	124,78	44	196,08	
331,680	352,941	416,563	437,729	515,222	522,260	578,527	613,669	1,60	40	178,25	64	285,21	
425,107	446,196	509,420	530,483	607,676	614,691	670,801	705,860	1,60	30	133,69	48	213,90	
				363,067	370,222	427,266	462,785	1,61	56	249,55	90	401,07	
287,197	308,673	372,767	394,051	471,870	478,931	535,361	570,586	1,64	44	196,08	72	320,86	
381,849	403,015	466,422	487,534	564,872	571,898	628,086	663,188	1,65	34	151,52	56	249,55	
428,407	449,505	512,751	533,820	611,033	618,049	674,170	709,236	1,66	29	129,23	48	213,90	
		328,225	349,706	428,048	435,145	491,822	527,171	1,67	48	213,90	80	356,51	
338,023	359,320	423,027	444,217	521,781	528,824	585,130	620,293	1,68	38	169,34	64	285,21	
431,698	452,805	516,075	537,150	614,383	621,401	677,534	712,606	1,71	28	124,78	48	213,90	
								1,75	64	285,21	112	499,11	
388,312	409,503	472,974	494,103	571,496	578,527	634,746	669,864	1,75	32	142,60	56	249,55	
344,332	365,665	429,460	450,675	528,312	535,361	591,708	626,893	1,78	36	160,43	64	285,21	
								1,80	80	356,51	144	641,71	
299,471	321,049	385,385	406,734	484,747	491,822	548,358	583,639	1,80	40	178,25	72	320,86	
		340,507	362,078	440,679	447,796	504,611	540,032	1,82	44	196,08	80	356,51	
394,741	415,959	479,496	500,644	578,095	585,130	641,382	676,518	1,87	30	133,69	56	249,55	
		307,654	387,648	394,857	452,283	487,999	523,615	1,88	48	213,90	90	401,07	
350,608	371,978	435,864	457,104	534,817	541,872	598,262	633,470	1,88	34	151,52	64	285,21	
305,560	327,190	391,650	413,033	491,146	498,229	554,820	590,131	1,89	38	169,34	72	320,86	
397,944	419,175	482,746	503,904	581,385	588,422	644,691	679,836	1,93	29	129,23	56	249,55	
								2,00	72	320,86	144	641,71	
								2,00	56	249,55	112	499,11	
	287,049	352,677	374,339	453,208	460,345	517,303	552,799	2,00	40	178,25	80	356,51	
311,618	333,300	397,887	419,304	497,520	504,611	561,258	596,599	2,00	36	160,43	72	320,86	
356,853	378,260	442,240	463,505	541,297	548,358	604,792	640,024	2,00	32	142,60	64	285,21	
401,139	422,384	485,990	507,158	584,668	591,708	647,994	683,149	2,00	28	124,78	56	249,55	
			319,409	399,788	407,025	464,649	500,467	2,05	44	196,08	90	401,07	
270,654	292,920	358,722	380,430	459,436	466,583	523,615	559,150	2,11	38	169,34	80	356,51	
317,647	339,382	404,097	425,549	503,869	510,969	567,674	603,046	2,12	34	151,52	72	320,86	
363,067	384,513	448,588	469,880	547,753	554,820	611,300	646,557	2,13	30	133,69	64	285,21	
366,163	387,628	451,752	473,057	550,972	558,042	614,545	649,815	2,21	29	129,23	64	285,21	
276,425	298,765	364,743	386,498	465,640	472,798	529,905	565,480	2,22	36	160,43	80	356,51	
								2,25	64	285,21	144	641,71	

TABLE OF CENTRE DISTANCES: 14MM PITCH

Table 3

R	Z1	ø 1	Z2	ø 2	2100-PLT14	2240-PLT14	2310-PLT14	2380-PLT14	2450-PLT14	2590-PLT14	2660-PLT14	2800-PLT14
					150	160	165	170	175	185	190	200
1,33	48	213,90	64	285,21	657,033	727,126	762,166	797,203	832,236	902,296	937,322	1007,369
1,33	36	160,43	48	213,90	755,527	825,567	860,585	895,601	930,616	1000,643	1035,655	1105,677
1,33	30	133,69	40	178,25	804,691	874,716	909,727	944,737	979,747	1049,764	1084,771	1154,785
1,36	28	124,78	38	169,34	818,697	888,721	923,731	958,741	993,750	1063,767	1098,774	1168,788
1,38	32	142,60	44	196,08	783,544	853,581	888,598	923,613	958,627	1028,652	1063,664	1133,685
1,38	29	129,23	40	178,25	808,128	878,158	913,171	948,183	983,194	1053,215	1088,224	1158,241
1,40	80	356,51	112	499,11		442,240	477,668	513,037	548,358	618,888	654,110	724,489
1,40	40	178,25	56	249,55	713,109	783,188	818,223	853,255	888,284	958,337	993,360	1063,402
1,41	64	285,21	90	401,07	507,691	578,095	613,262	648,410	683,544	753,773	788,872	859,046
1,41	34	151,52	48	213,90	762,362	832,415	867,439	902,461	937,481	1007,517	1042,533	1112,563
1,43	56	249,55	80	356,51	571,496	641,771	676,887	711,991	747,085	817,250	852,322	922,450
1,43	28	124,78	40	178,25	811,559	881,594	916,610	951,624	986,638	1056,662	1091,673	1161,692
1,45	44	196,08	64	285,21	670,519	740,659	775,720	810,775	845,826	915,916	950,956	1021,027
1,47	38	169,34	56	249,55	719,882	789,982	825,025	860,065	895,101	965,167	1000,196	1070,248
1,47	30	133,69	44	196,08	790,384	860,434	895,457	930,477	965,496	1035,530	1070,545	1140,573
1,50	48	213,90	72	320,86	627,721	697,950	733,049	768,138	803,219	873,362	908,426	978,538
1,50	32	142,60	48	213,90	769,174	839,243	874,273	909,301	944,327	1014,373	1049,394	1119,432
1,52	29	129,23	44	196,08	793,796	863,853	898,879	933,902	968,923	1038,962	1073,980	1144,012
1,56	72	320,86	112	499,11		467,478	503,084	538,609	574,067	644,831	680,152	750,703
1,56	36	160,43	56	249,55	726,633	796,753	831,806	866,854	901,899	971,978	1007,014	1077,078
1,57	28	124,78	44	196,08	797,203	867,267	902,296	937,322	972,346	1042,390	1077,410	1147,446
1,60	40	178,25	64	285,21	683,908	754,103	789,188	824,265	859,336	929,461	964,517	1034,618
1,60	30	133,69	48	213,90	775,963	846,049	881,087	916,122	951,154	1021,212	1056,238	1126,286
1,61	56	249,55	90	401,07	533,613	604,245	639,507	674,743	709,954	780,320	815,479	885,758
1,64	44	196,08	72	320,86	640,961	711,262	746,391	781,508	816,616	886,804	921,888	992,038
1,65	34	151,52	56	249,55	733,361	803,504	838,567	873,624	908,677	978,772	1013,815	1083,891
1,66	29	129,23	48	213,90	779,350	849,445	884,487	919,525	954,561	1024,625	1059,654	1129,707
1,67	48	213,90	80	356,51	597,742	668,192	703,383	738,556	773,712	843,986	879,107	949,321
1,68	38	169,34	64	285,21	690,569	760,793	795,891	830,980	866,062	936,207	971,272	1041,388
1,71	28	124,78	48	213,90	782,731	852,835	887,881	922,924	957,963	1028,034	1063,066	1133,124
1,75	64	285,21	112	499,11	420,318	492,337	528,133	563,825	599,433	670,451	705,882	776,624
1,75	32	142,60	56	249,55	740,067	810,235	845,308	880,375	915,438	985,549	1020,599	1090,689
1,78	36	160,43	64	285,21	697,207	767,463	802,574	837,676	872,769	942,935	978,009	1048,143
1,80	80	356,51	144	641,71							526,570	598,942
1,80	40	178,25	72	320,86	654,110	724,489	759,651	794,800	829,935	900,175	935,281	1005,471
1,82	44	196,08	80	356,51	610,725	681,272	716,505	751,716	786,908	857,244	892,392	962,656
1,87	30	133,69	56	249,55	746,752	816,945	852,030	887,108	922,180	992,308	1027,366	1097,471
1,88	48	213,90	90	401,07	559,150	630,037	665,408	700,742	736,043	806,565	841,793	912,195
1,88	34	151,52	64	285,21	703,823	774,112	809,238	844,353	879,458	949,646	984,730	1054,881
1,89	38	169,34	72	320,86	660,652	731,071	766,252	801,417	836,567	906,834	941,952	1012,164
1,93	29	129,23	56	249,55	750,086	820,293	855,384	890,467	925,544	995,682	1030,744	1100,856
2,00	72	320,86	144	641,71						513,741	550,452	623,236
2,00	56	249,55	112	499,11	444,363	516,864	552,858	588,727	624,492	695,781	731,329	802,277
2,00	40	178,25	80	356,51	623,620	694,271	729,549	764,801	800,030	870,433	905,611	975,927
2,00	36	160,43	72	320,86	667,172	737,634	772,833	808,015	843,182	913,476	948,607	1018,841
2,00	32	142,60	64	285,21	710,419	780,742	815,882	851,011	886,130	956,341	991,435	1061,605
2,00	28	124,78	56	249,55	753,415	823,636	858,733	893,822	928,904	999,051	1034,117	1104,237
2,05	44	196,08	90	401,07	571,789	642,811	678,241	713,627	748,976	819,583	854,848	925,318
2,11	38	169,34	80	356,51	630,037	700,742	736,043	771,316	806,565	877,002	912,195	982,540
2,12	34	151,52	72	320,86	673,672	744,178	779,396	814,596	849,778	920,101	955,245	1025,503
2,13	30	133,69	64	285,21	716,994	787,353	822,509	857,652	892,784	963,019	998,124	1068,313
2,21	29	129,23	64	285,21	720,274	790,651	825,815	860,966	896,104	966,352	1001,462	1071,661
2,22	36	160,43	80	356,51	636,434	707,193	742,518	777,813	813,082	883,555	918,764	989,137
2,25	64	285,21	144	641,71								

TABLE OF CENTRE DISTANCES: 14MM PITCH

Table 3

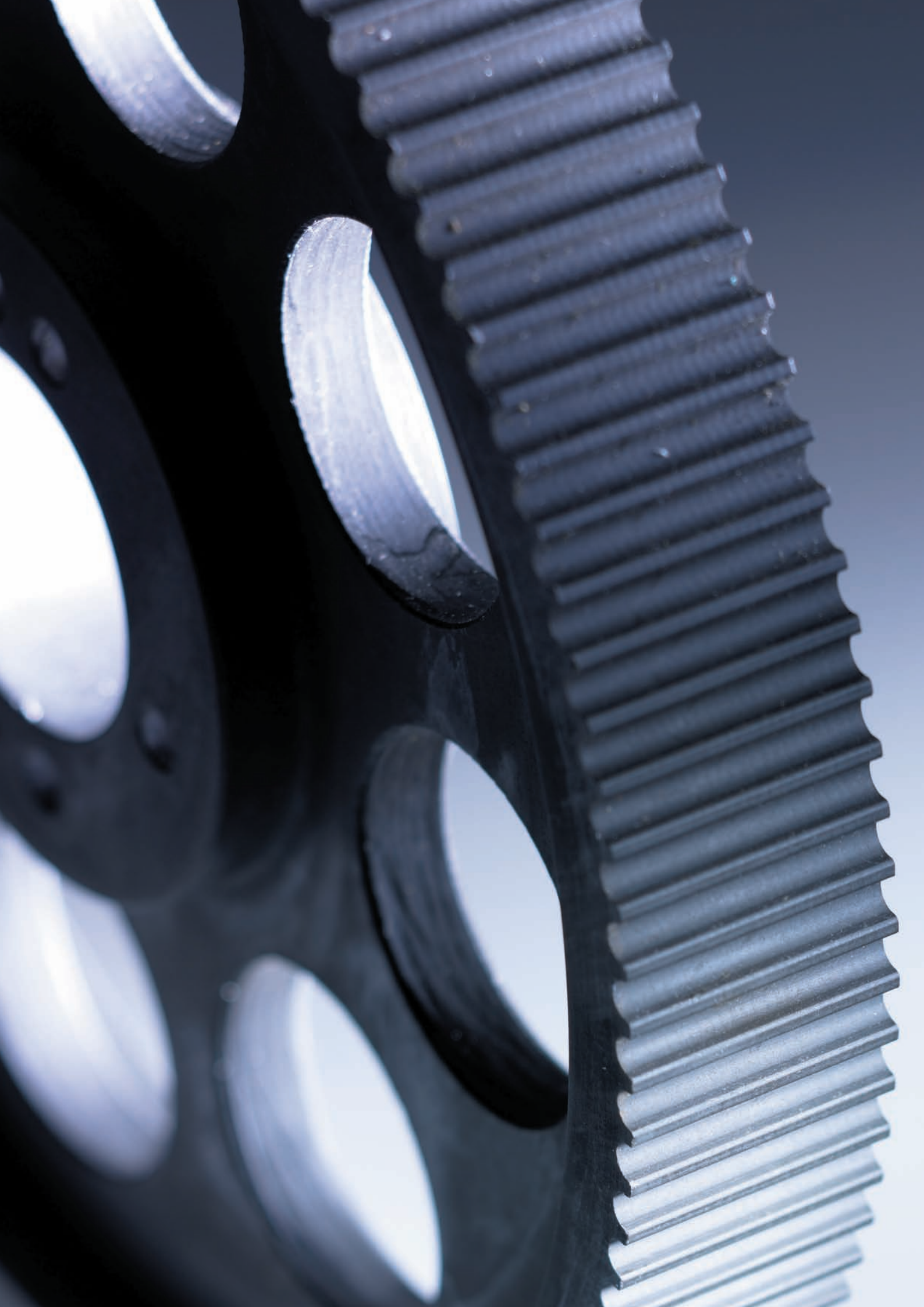
R	Z1	ø 1	Z2	ø 2	966-PLT14	994-PLT14	1092-PLT14	1106-PLT14	1190-PLT14	1260-PLT14	1288-PLT14	1344-PLT14	1400-PLT14
					69	71	78	79	85	90	92	96	100
2,25	40	178,25	90	401,07									
2,25	32	142,60	72	320,86						249,933	264,857	294,403	323,649
2,29	28	124,78	64	285,21			208,360	215,921	260,552	297,104	311,618	340,507	369,253
2,33	48	213,90	112	499,11									
2,35	34	151,52	80	356,51									282,171
2,37	38	169,34	90	401,07									
2,40	80	356,51	192	855,62									
2,40	30	133,69	72	320,86						255,674	270,654	300,296	329,624
2,48	29	129,23	72	320,86						258,534	273,542	303,234	332,602
2,50	36	160,43	90	401,07									
2,50	32	142,60	80	356,51								257,447	287,895
2,55	44	196,08	112	499,11									
2,57	56	249,55	144	641,71									
2,57	28	124,78	72	320,86					223,089	261,389	276,425	306,165	335,574
2,65	34	151,52	90	401,07									
2,67	72	320,86	192	855,62									
2,67	30	133,69	80	356,51								263,033	293,597
2,76	29	129,23	80	356,51								265,818	296,440
2,80	40	178,25	112	499,11									
2,81	32	142,60	90	401,07									
2,86	28	124,78	80	356,51								268,599	299,278
2,95	38	169,34	112	499,11									
3,00	64	285,21	192	855,62									
3,00	48	213,90	144	641,71									
3,00	30	133,69	90	401,07									
3,10	29	129,23	90	401,07									
3,11	36	160,43	112	499,11									
3,21	28	124,78	90	401,07									
3,27	44	196,08	144	641,71									
3,29	34	151,52	112	499,11									
3,43	56	249,55	192	855,62									
3,50	32	142,60	112	499,11									
3,60	40	178,25	144	641,71									
3,73	30	133,69	112	499,11									
3,79	38	169,34	144	641,71									
3,86	29	129,23	112	499,11									
4,00	48	213,90	192	855,62									
4,00	36	160,43	144	641,71									
4,00	28	124,78	112	499,11									
4,24	34	151,52	144	641,71									
4,36	44	196,08	192	855,62									
4,50	32	142,60	144	641,71									
4,80	40	178,25	192	855,62									
4,80	30	133,69	144	641,71									
4,97	29	129,23	144	641,71									
5,05	38	169,34	192	855,62									
5,14	28	124,78	144	641,71									
5,33	36	160,43	192	855,62									
5,65	34	151,52	192	855,62									
6,00	32	142,60	192	855,62									
6,40	30	133,69	192	855,62									
6,62	29	129,23	192	855,62									
6,86	28	124,78	192	855,62									

2100-PLT14	2240-PLT14	2310-PLT14	2380-PLT14	2450-PLT14	2590-PLT14	2660-PLT14	2800-PLT14						
150	160	165	170	175	185	190	200	R	Z1	ø 1	Z2	ø 2	
584,347	655,510	690,999	726,440	761,839	832,535	867,839	938,379	2,25	40	178,25	90	401,07	
680,152	750,703	785,941	821,158	856,358	926,711	961,868	1032,150	2,25	32	142,60	72	320,86	
723,549	793,944	829,117	864,275	899,421	969,680	1004,797	1075,006	2,29	28	124,78	64	285,21	
468,106	541,098	577,296	613,347	649,276	720,848	756,520	827,685	2,33	48	213,90	112	499,11	
642,811	713,627	748,976	784,293	819,583	890,092	925,318	995,720	2,35	34	151,52	80	356,51	
590,598	661,832	697,352	732,821	768,246	838,987	874,311	944,887	2,37	38	169,34	90	401,07	
								2,40	80	356,51	192	855,62	
686,613	757,210	792,468	827,704	862,920	933,304	968,475	1038,782	2,40	30	133,69	72	320,86	
689,836	760,456	795,725	830,970	866,196	936,595	971,773	1042,092	2,48	29	129,23	72	320,86	
596,830	668,136	703,688	739,186	774,637	845,423	880,769	951,381	2,50	36	160,43	90	401,07	
649,170	720,042	755,416	790,756	826,067	896,614	931,856	1002,288	2,50	32	142,60	80	356,51	
479,875	553,115	589,416	625,560	661,573	733,290	769,025	840,303	2,55	44	196,08	112	499,11	
			446,178	484,776	560,329	597,530	671,148	2,57	56	249,55	144	641,71	
693,054	763,698	798,977	834,233	869,467	939,882	975,067	1045,399	2,57	28	124,78	72	320,86	
603,044	674,424	710,007	745,534	781,011	851,845	887,211	957,861	2,65	34	151,52	90	401,07	
								2,67	72	320,86	192	855,62	
655,510	726,440	761,839	797,203	832,535	903,120	938,379	1008,842	2,67	30	133,69	80	356,51	
658,673	729,633	765,045	800,420	835,763	906,367	941,635	1012,114	2,76	29	129,23	80	356,51	
491,582	565,070	601,475	637,712	673,810	745,675	781,474	852,866	2,80	40	178,25	112	499,11	
609,241	680,695	716,310	751,866	787,370	858,252	893,639	964,327	2,81	32	142,60	90	401,07	
661,832	732,821	768,246	803,633	838,987	909,611	944,887	1015,382	2,86	28	124,78	80	356,51	
497,413	571,025	607,483	643,767	679,907	751,846	787,679	859,129	2,95	38	169,34	112	499,11	
								3,00	64	285,21	192	855,62	
		428,394	468,232	507,186	583,322	620,768	694,806	3,00	48	213,90	144	641,71	
615,421	686,949	722,597	758,182	793,714	864,644	900,053	970,780	3,00	30	133,69	90	401,07	
618,505	690,071	725,735	761,335	796,880	867,834	903,254	974,001	3,10	29	129,23	90	401,07	
503,229	576,966	613,476	649,807	685,990	758,004	793,869	865,378	3,11	36	160,43	112	499,11	
621,584	693,188	728,869	764,484	800,043	871,022	906,452	977,219	3,21	28	124,78	90	401,07	
		439,155	479,197	518,326	594,752	632,320	706,567	3,27	44	196,08	144	641,71	
509,032	582,893	619,455	655,834	692,060	764,149	800,047	871,615	3,29	34	151,52	112	499,11	
								3,43	56	249,55	192	855,62	
514,820	588,806	625,421	661,847	698,117	770,281	806,213	877,839	3,50	32	142,60	112	499,11	
		449,880	490,123	529,425	606,140	643,829	718,285	3,60	40	178,25	144	641,71	
520,596	594,706	631,374	667,848	704,160	776,401	812,365	884,051	3,73	30	133,69	112	499,11	
	413,502	455,229	495,571	534,960	611,818	649,568	724,129	3,79	38	169,34	144	641,71	
523,479	597,651	634,345	670,843	707,177	779,456	815,437	887,153	3,86	29	129,23	112	499,11	
								4,00	48	213,90	192	855,62	
	418,725	460,569	501,011	540,486	617,487	655,297	729,963	4,00	36	160,43	144	641,71	
526,358	600,593	637,314	673,835	710,191	782,507	818,506	890,252	4,00	28	124,78	112	499,11	
	423,941	465,902	506,442	546,003	623,146	661,016	735,787	4,24	34	151,52	144	641,71	
								4,36	44	196,08	192	855,62	
	429,150	471,226	511,864	551,510	628,795	666,726	741,601	4,50	32	142,60	144	641,71	
								4,80	40	178,25	192	855,62	
	434,351	476,542	517,278	557,009	634,436	672,427	747,406	4,80	30	133,69	144	641,71	
	436,949	479,197	519,982	559,755	637,253	675,273	750,304	4,97	29	129,23	144	641,71	
								5,05	38	169,34	192	855,62	
	439,546	481,851	522,684	562,499	640,067	678,118	753,201	5,14	28	124,78	144	641,71	
								5,33	36	160,43	192	855,62	
								5,65	34	151,52	192	855,62	
								6,00	32	142,60	192	855,62	
								6,40	30	133,69	192	855,62	
								6,62	29	129,23	192	855,62	
								6,86	28	124,78	192	855,62	

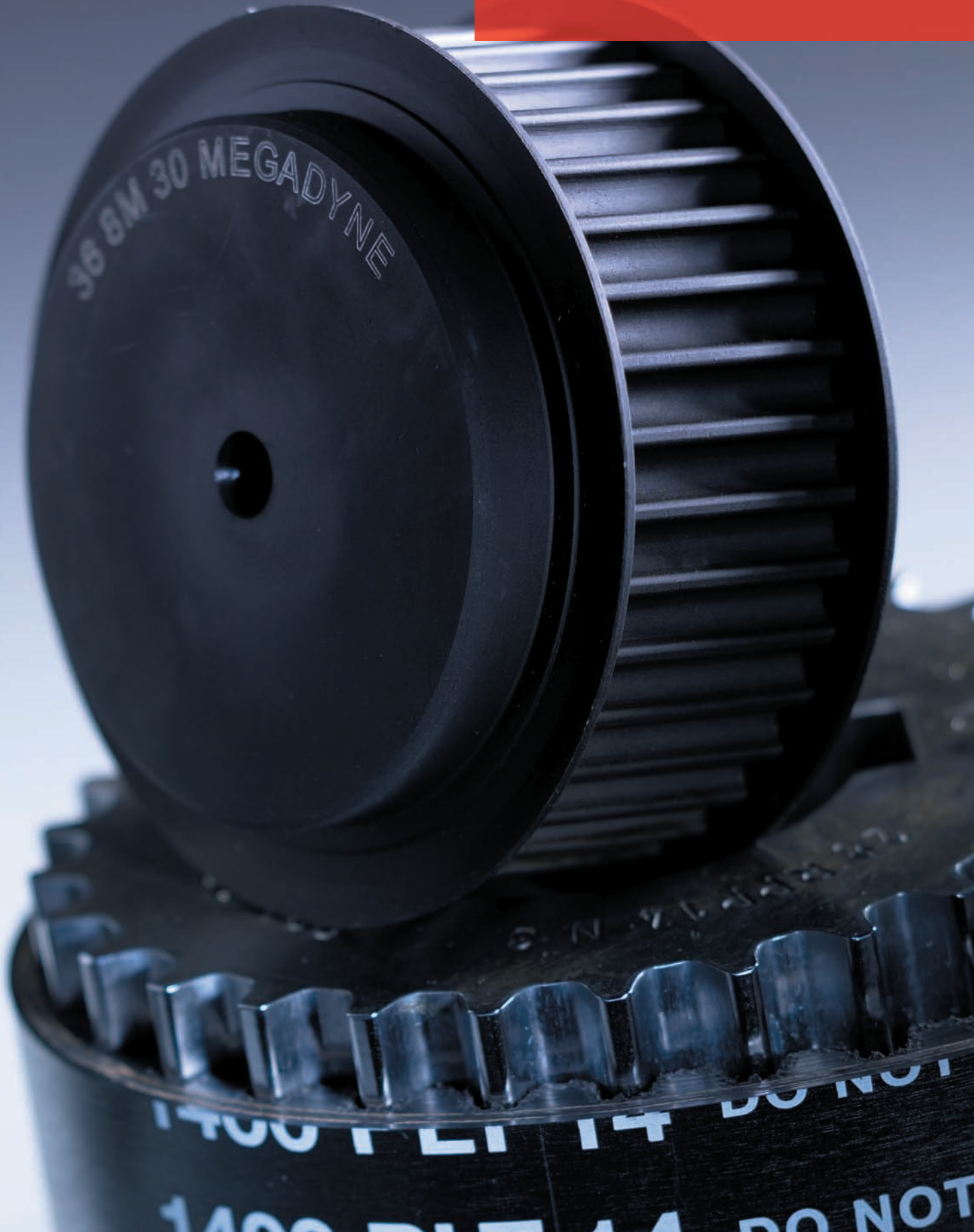
TABLE OF CENTRE DISTANCES: 14MM PITCH

Table 3

R	Z1	ø 1	Z2	ø 2	1400-PLT14	1442-PLT14	1568-PLT14	1610-PLT14	1764-PLT14	1778-PLT14	1890-PLT14	1960-PLT14
					100	103	112	115	126	127	135	140
2,25	40	178,25	90	401,07			308,667	331,072	411,837	419,103	476,928	512,851
2,25	32	142,60	72	320,86	323,649	345,437	410,281	431,768	510,195	517,303	574,067	609,472
2,29	28	124,78	64	285,21	369,253	390,737	454,909	476,228	554,185	561,258	617,785	653,068
2,33	48	213,90	112	499,11								393,893
2,35	34	151,52	80	356,51	282,171	304,586	370,739	392,541	471,823	478,991	536,173	571,789
2,37	38	169,34	90	401,07			314,398	336,871	417,830	425,110	483,036	519,013
2,40	80	356,51	192	855,62								
2,40	30	133,69	72	320,86	329,624	351,466	416,440	437,963	516,499	523,615	580,439	615,876
2,48	29	129,23	72	320,86	332,602	354,471	419,511	441,052	519,642	526,762	583,618	619,071
2,50	36	160,43	90	401,07			320,109	342,649	423,802	431,097	489,125	525,155
2,50	32	142,60	80	356,51	287,895	310,384	376,713	398,562	477,984	485,163	542,421	578,078
2,55	44	196,08	112	499,11							367,280	405,337
2,57	56	249,55	144	641,71								
2,57	28	124,78	72	320,86	335,574	357,470	422,575	444,135	522,780	529,905	586,791	622,261
2,65	34	151,52	90	401,07			325,800	348,408	429,755	437,065	495,195	531,279
2,67	72	320,86	192	855,62								
2,67	30	133,69	80	356,51	293,597	316,160	382,665	404,561	484,124	491,314	548,649	584,347
2,76	29	129,23	80	356,51	296,440	319,040	385,633	407,552	487,186	494,382	551,756	587,475
2,80	40	178,25	112	499,11							378,458	416,720
2,81	32	142,60	90	401,07			331,473	354,148	435,689	443,013	501,246	537,384
2,86	28	124,78	80	356,51	299,278	321,914	388,595	410,539	490,243	497,444	554,858	590,598
2,95	38	169,34	112	499,11							384,026	422,389
3,00	64	285,21	192	855,62								
3,00	48	213,90	144	641,71								
3,00	30	133,69	90	401,07			337,127	359,869	441,605	448,943	507,279	543,472
3,10	29	129,23	90	401,07		269,427	339,948	362,723	444,556	451,901	510,289	546,510
3,11	36	160,43	112	499,11							389,580	428,044
3,21	28	124,78	90	401,07		272,114	342,764	365,573	447,502	454,855	513,295	549,543
3,27	44	196,08	144	641,71								
3,29	34	151,52	112	499,11						331,264	395,121	433,686
3,43	56	249,55	192	855,62								
3,50	32	142,60	112	499,11					328,297	336,590	400,650	439,314
3,60	40	178,25	144	641,71								
3,73	30	133,69	112	499,11					333,581	341,905	406,165	444,929
3,79	38	169,34	144	641,71								
3,86	29	129,23	112	499,11					336,220	344,558	408,919	447,732
4,00	48	213,90	192	855,62								
4,00	36	160,43	144	641,71								
4,00	28	124,78	112	499,11					338,855	347,209	411,669	450,532
4,24	34	151,52	144	641,71								
4,36	44	196,08	192	855,62								
4,50	32	142,60	144	641,71								
4,80	40	178,25	192	855,62								
4,80	30	133,69	144	641,71								
4,97	29	129,23	144	641,71								
5,05	38	169,34	192	855,62								
5,14	28	124,78	144	641,71								
5,33	36	160,43	192	855,62								
5,65	34	151,52	192	855,62								
6,00	32	142,60	192	855,62								
6,40	30	133,69	192	855,62								
6,62	29	129,23	192	855,62								
6,86	28	124,78	192	855,62								



PULLEYS



RPP Pulleys features

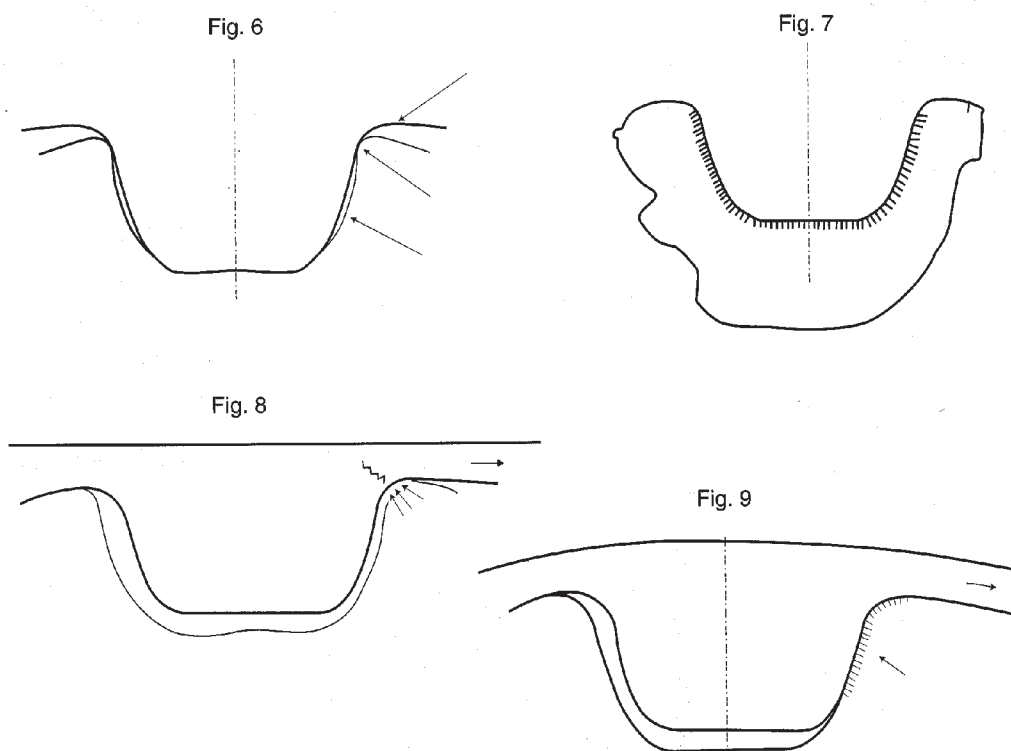
The RPP pulley tooth profile designed and perfected by Megadyne along with those of the belts, is the determining factor in the perfect functioning of the drive.

The introduction of the parabolic profile on the ISORAN RPP pulleys can be considered an evolution in the design of timing pulleys, being the trend in design towards more compact drives. The standard tooth profile has shown poor performance with reduced pulley diameters. The new drive design is more compact therefore it is necessary to use pulleys with smaller diameters. Producing the pulleys according to traditional procedures the following limitation can be found.

Decreasing the diameter of the pulley, the profile of the groove forms an edge at the tip radius (fig.6). This brings about:

- a) reduction of the contact surface between the belt, the pulley, the teeth and therefore a local increase of stress (fig.8);
- b) more wear of the belt at the base of the tooth.

For building RPP pulleys with parabolic profile Megadyne has patented a system which permits constant profiles even by reduced diameters and free from discontinuity on the top of the tooth (figures 6, 8 below).



Therefore:

1. The new **ISORAN RPP pulleys** allows a larger contact surface with the tooth of the belt (fig.9);
2. the new **ISORAN RPP pulley** reduces belt wear during mesh.

Megadyne RPP pulleys are also used with RPP SILVER and RPP GOLD belts and this gives advantages in terms of availability and supply, allowing at the same time existing drives to be easily upgraded when belt drive durability problems have been experienced. As consequence RPP pulleys offers the designers the flexibility to choose between a huge ranges of different performing belts without the necessity to change the pulleys.

Megadyne RPP pulleys are constructed from high quality materials and manufactured under high standards of quality control with particular attention to the tight dimensional tolerances required. The pulley teeth are designed to mesh exactly to those of the belt, resulting in a drive which functions with a minimum back-lash, as a precision gear system.

Extensive testing and market feedback confirms the reliable nature of the RPP system.

When Megadyne RPP pulleys are used with PLATINUM belts, the drive efficiency and cost savings can be further improved by considering the following advantages:

1. The pulley width can be reduced whilst transmitting the same torque;
2. alternatively there is the possibility to reduce the pulley diameters whilst maintaining the same belt width;
3. by using the same pulleys as used with an ISORAN RPP drive, the torque transmitted can be increased or the drive durability can be extended.

A Megadyne RPP pulley is typically designated by:

40-RPP14-55

Where:

- 40 = Number of pulley teeth
 - RPP = Tooth profile
 - 14 = Tooth pitch in millimeters
 - 55 = Corresponding belt width in millimeters
-

The pitch of the pulley teeth is the distance between tooth centres as measured along the pulley's pitch circle diameter (PCD). The PCD of the pulley coincides with the pitch line of the belt, and it's therefore always larger than the outside diameter of the pulley.

RPP pulleys are normally available ex-stock in 8 mm and 14 mm pitches.

Standard pulleys sizes are listed in the following tables.

All standard pulleys are designed, where possible, to be used in conjunction with taper-bushes and for each pulley size it is necessary to select the correct one. The use of taper-bushes allows each pulley to be fitted to a variety of shaft sizes without the need to machine or otherwise modify the pulley beforehand. Taper-bushes are available to fit both metric and imperial (inch sized) shafts.

However, for high torque applications, is not recommended to use standard bushes because severe tension conditions can be reached under particular circumstances, in case of driven shaft rapid blockage.

PLATINUM PULLEYS

Dimensions of RPP PLATINUM pulleys – PITCH 8 mm

Pulley code	number of teeth	dw pitch diameter	de external diameter	Pulley code	number of teeth	dw pitch diameter	de external diameter
22 PLT8	22	56.02	54.65	68 PLT8	68	173.16	171.79
23 PLT8	23	58.57	57.20	72 PLT8	72	183.35	181.97
24 PLT8	24	61.12	59.74	76 PLT8	76	193.53	192.16
25 PLT8	25	63.66	62.29	80 PLT8	80	203.72	202.35
26 PLT8	26	66.21	64.84	84 PLT8	84	213.90	212.53
27 PLT8	27	68.75	67.38	88 PLT8	88	224.09	222.72
28 PLT8	28	71.30	69.93	90 PLT8	90	229.18	227.81
29 PLT8	29	73.85	72.48	92 PLT8	92	234.28	232.90
30 PLT8	30	76.39	75.02	96 PLT8	96	244.46	243.09
31 PLT8	31	78.94	77.57	102 PLT8	102	259.74	258.37
32 PLT8	32	81.49	80.12	106 PLT8	106	269.93	268.55
33 PLT8	33	84.03	82.66	110 PLT8	110	280.11	278.74
34 PLT8	34	86.58	85.21	112 PLT8	112	285.20	283.83
35 PLT8	35	89.13	87.75	114 PLT8	114	290.30	288.93
36 PLT8	36	91.67	90.30	118 PLT8	118	300.48	299.11
37 PLT8	37	94.22	92.85	122 PLT8	122	310.67	309.30
38 PLT8	38	96.77	95.39	126 PLT8	126	320.86	319.48
39 PLT8	39	99.31	97.94	130 PLT8	130	331.04	329.67
40 PLT8	40	101.86	100.49	134 PLT8	134	341.23	339.86
41 PLT8	41	104.41	103.03	138 PLT8	138	351.41	350.04
42 PLT8	42	106.95	105.58	142 PLT8	142	361.60	360.23
43 PLT8	43	109.50	108.13	144 PLT8	144	366.69	365.32
44 PLT8	44	112.04	110.67	146 PLT8	146	371.79	370.41
45 PLT8	45	114.59	113.22	150 PLT8	150	381.97	380.60
46 PLT8	46	117.14	115.77	154 PLT8	154	392.16	390.78
47 PLT8	47	119.68	118.31	158 PLT8	158	402.34	400.97
48 PLT8	48	122.23	120.86	162 PLT8	162	412.53	411.16
49 PLT8	49	124.78	123.41	166 PLT8	166	422.71	421.34
50 PLT8	50	127.32	125.95	168 PLT8	168	427.81	426.44
51 PLT8	51	129.87	128.50	170 PLT8	170	432.90	431.53
52 PLT8	52	132.42	131.04	174 PLT8	174	443.09	441.71
53 PLT8	53	134.96	133.59	178 PLT8	178	453.27	451.90
54 PLT8	54	137.51	136.14	182 PLT8	182	463.46	462.09
55 PLT8	55	140.06	138.68	186 PLT8	186	473.64	472.27
59 PLT8	59	150.24	148.87	190 PLT8	190	483.83	482.46
60 PLT8	60	152.79	151.42	192 PLT8	192	488.92	487.55
64 PLT8	64	162.97	161.60				

Dimensions of RPP PLATINUM pulleys – PITCH 14 mm

Pulley code	number of teeth	dw pitch diameter	de external diameter	Pulley code	number of teeth	dw pitch diameter	de external diameter
28 PLT14	28	124.78	121.99	92 PLT14	92	409.98	407.19
29 PLT14	29	129.23	126.44	96 PLT14	96	427.81	425.02
30 PLT14	30	133.69	130.90	102 PLT14	102	454.55	451.76
31 PLT14	31	138.15	135.36	106 PLT14	106	472.37	469.58
32 PLT14	32	142.60	139.81	110 PLT14	110	490.20	487.41
33 PLT14	33	147.06	144.27	112 PLT14	112	499.11	496.32
34 PLT14	34	151.52	148.73	114 PLT14	114	508.02	505.23
35 PLT14	35	155.97	153.18	118 PLT14	118	525.85	523.06
36 PLT14	36	160.43	157.64	122 PLT14	122	543.67	540.88
37 PLT14	37	164.88	162.09	126 PLT14	126	561.50	558.71
38 PLT14	38	169.34	166.55	130 PLT14	130	579.32	576.53
39 PLT14	39	173.80	171.01	134 PLT14	134	597.15	594.36
40 PLT14	40	178.25	175.46	138 PLT14	138	614.97	612.18
41 PLT14	41	182.71	179.92	142 PLT14	142	632.80	630.01
42 PLT14	42	187.17	184.38	144 PLT14	144	641.71	638.92
43 PLT14	43	191.62	188.83	146 PLT14	146	650.62	647.83
44 PLT14	44	196.08	193.29	150 PLT14	150	668.45	665.66
45 PLT14	45	200.53	197.74	154 PLT14	154	686.27	683.48
46 PLT14	46	204.99	202.20	158 PLT14	158	704.10	701.31
47 PLT14	47	209.45	206.66	162 PLT14	162	721.93	719.14
48 PLT14	48	213.90	211.11	166 PLT14	166	739.75	736.96
49 PLT14	49	218.36	215.57	168 PLT14	168	748.66	745.87
50 PLT14	50	222.82	220.03	170 PLT14	170	757.58	754.79
51 PLT14	51	227.27	224.48	174 PLT14	174	775.40	772.61
52 PLT14	52	231.73	228.94	178 PLT14	178	793.23	790.44
53 PLT14	53	236.19	233.40	182 PLT14	182	811.05	808.26
54 PLT14	54	240.64	237.85	186 PLT14	186	828.88	826.09
55 PLT14	55	245.10	242.31	190 PLT14	190	846.70	843.91
56 PLT14	56	249.55	246.76	192 PLT14	192	855.61	852.82
57 PLT14	57	254.01	251.22	194 PLT14	194	864.53	861.74
60 PLT14	60	267.38	264.59	198 PLT14	198	882.35	879.56
64 PLT14	64	285.20	282.41	202 PLT14	202	900.18	897.39
68 PLT14	68	303.03	300.24	206 PLT14	206	918.00	915.21
72 PLT14	72	320.86	318.07	210 PLT14	210	935.83	933.04
76 PLT14	76	338.68	335.89	214 PLT14	214	953.65	950.86
80 PLT14	80	356.51	353.72	216 PLT14	216	962.57	959.78
84 PLT14	84	374.33	371.54				
88 PLT14	88	392.16	389.37				
90 PLT14	90	401.07	398.28				

CHARACTERISTIC OF RPP PULLEYS

Tolerances on the external diameter

External diameter (mm)	Tolerance (mm)
0 – 50	0 / +0.08
51 – 100	0 / +0.10
101 – 170	0 / +0.13
171 – 400	0 / +0.15
> 400	0 / +0.18

Maximum permissible eccentricity

External diameter (mm)	Eccentricity (mm)
< 100	0.100
>100	0.100+0.005x(De-100)

Maximum lateral oscillation

External diameter (mm)	Eccentricity (mm)
< 100	0.100
>100	0.100xDe

Balancing of pulleys

Balancing of pulleys	Number of teeth	Maximum out of balance component (g)
RPP 8	< 130	8
	>130	16
RPP 14	< 70	8
	>70	16

Parallelism

Pulley axes must be parallel. Differences of not more than 0.01 mm for every 10 mm of axis length are acceptable.

Taper

The taper of the pulley face diameter must be less than 0.001 mm for every 1 mm of face width. this value must be less than the tolerance on the external diameter of the pulley given in the table above.

Surface finish

The working surface of the pulley and flange faces must have a finish of less than 1.6 Ra (ISO R 468 specification)

Materials

To right choice of material depends on the torque to be transmitted and on the size of the pulley. Megadyne has tested successfully the following materials for 8M and 14M pulleys:

Steel:	39CrMoNi3, Fe40, C40.
Grey cast iron (min. grade):	GG-25

Sprocket diameter and speed

Blanks in the Belt Basic Performance Tables indicate the pulley speeds exceed the safe operating speed of 30m/s for cast iron sprockets. For speeds greater than 30m/s contact Megadyne Engineering Department for other recommendations.

Flanged pulleys

Each timing belt shows a natural trend to run on the pulley; this behaviour is due to the typical structure of the tensile members. Each cord is made of hundreds of filaments winded together to make a unique bundle and few bundles are then twisted together.

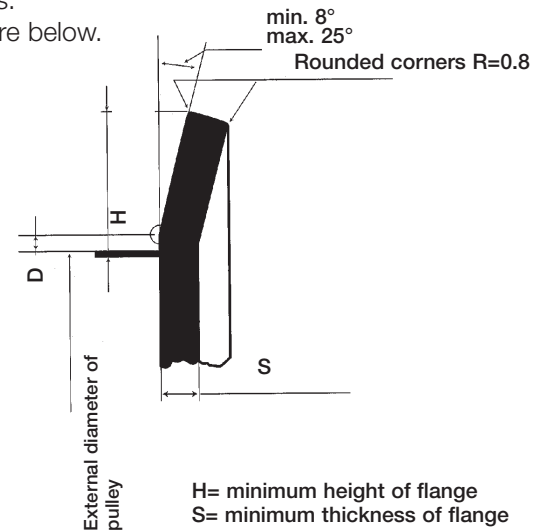
The twisting direction produces the lateral tracking off.

A timing belt is produced with two different types of twisted cord to minimize this effect; nevertheless only using flanged pulleys is possible to prevent synchronous drive belts from tracking off.

It is necessary to provide at least one toothed pulley with side flanges. This is normally the smaller one for reason of cost. In alternative is also possible to use a single sided flange on each pulley.

In case of drives with a centre distance of $\geq 8 \cdot d_w$, both toothed pulley are required to be equipped with flanges on both sides. The shape and dimension of these flanges are shown in the table and figure below.

Belt type	Pitch (mm)	S (mm)	D (mm)	H (mm)
8M	8.0	2.3	0.4	2.1
			+0.30/-0	+0.25/-0
14M	14.0	3.0	0.9	5.0
			+0.50/-0	+0.25/-0



Tensioners

We recommend to use tensioners only when they are essential. For example:

1. in fixed axes drives, as a tensioning device;
2. in the drives having a high drive ratio, to increase the arc of contact on the small pulley.

Furthermore, the tensioner:

- a) shall have a diameter not lower than the one of the smaller pulley;
- b) may be fitted both inside and outside the belt, although we recommend whenever possible that it be fitted inside;
- c) if fitted outside, it must have a flat face (not crowned);
- d) if fitted inside, it must be toothed.

The use of normal tensioners with a flat face is permitted, as long as its diameter is not lower than that of a pulley having 40 teeth.

Fixed centres (no adjustment)

True fixed centre applications are those where no provision has been made to adjust either the driveR or the driveN shaft. Fixed centres are not recommended for any synchronous belt drive other than motion transfer (low or no torque) drives. Fixed centres applications imply the need for exact tolerances. Although length tolerances for synchronous belts are considerably less than those for other belts, such as v-belts, etc., no belt can be manufactured without some tolerance.

Sprocket manufacturing tolerances also contribute to fixed centre drive problems. Fixed centre applications do not allow for proper belt installation and tensioning practices

Furthermore, if there is no possibility to use an idler or a tensioning device, contact Megadyne Engineering Department.

Operating environment

1. High Temperature

Environmental conditions expected for normal operation and use are:

Continuous temperature range: -35°C to $+115^{\circ}\text{C}$

Instantaneous peak: $+130^{\circ}\text{C}$

2. Antistatic properties

The new PLATINUM are not anti-static, consequently they do not comply with the static conductive requirements of ISO 9563 International Standard or the RMA IP3-3 bulletin.

3. ROHS Compliance

Platinum belts comply with the requirements and restrictions to the use of dangerous substances in electronic and electrical equipments and the management of their residuals as per the European directives 2002/95/CE (RoHS) and 2002/96/CE (WEEE), in force since July 2006.

CAUSES OF PREMATURE BELT FAILURE

To ensure that the performance and durability of a toothed belt drive will fully meet the requirements of the application, it's necessary firstly to accurately select the drive and then to assure the drive is correctly installed. If this procedure is not followed, the drive life and efficiency may be considerably reduced. The most frequent problems encountered and their probable causes are listed in the table below to serve as a quick-reference guide.

If the drive problem persist or isn't identified by this list contact MEGADYNE for support.

Problems	Causes	Corrective action
Abnormal wear of the belt: 1. on the side of the tooth	<ul style="list-style-type: none"> • Belt excessively tight • Excessive overloading • Incorrect contour or diameter of pulley 	<ul style="list-style-type: none"> • Reduce centre distance • Use a wider belt • Replace pulley after checking contour or diameter
	<ul style="list-style-type: none"> • Excessive installation tension 	<ul style="list-style-type: none"> • Reduce centre distance
	<ul style="list-style-type: none"> • Incorrect diameter of pulley 	<ul style="list-style-type: none"> • Replace pulley after checking diameter
	<ul style="list-style-type: none"> • Incorrect contour or diameter of pulley • Misalignment of pulleys • Oscillation of the axes and/or of the bearings • Flanges bent 	<ul style="list-style-type: none"> • Replace pulley after checking contour or diameter • Replace pulley after checking contour or diameter • Correct the positioning of the pulleys and reinforce the bearings • Straighten flanges or change them
Failure across the tensile cord or laceration of the teeth, indicating corrosion of the tension member	<ul style="list-style-type: none"> • Pulley diameter too small i.e. below the minimum • Excessive moisture 	<ul style="list-style-type: none"> • Increase the diameter of the pulleys or use belts and pulleys of smaller pitch • Eliminate the moisture
Laceration of belt teeth	<ul style="list-style-type: none"> • Number of teeth in mesh less than six • Excessive load 	<ul style="list-style-type: none"> • Increase the number of teeth in mesh or use belts and pulleys of smaller pitch • Use a wider belt
Break of tensile member	<ul style="list-style-type: none"> • Excessive tension load • Diameter of pulley below minimum recommended 	<ul style="list-style-type: none"> • Use a wider belt • Increase the diameter of the pulleys
Breaks or cracks in the top surface of the belt	<ul style="list-style-type: none"> • Exposure to excessively low temperatures (below -30°C) 	<ul style="list-style-type: none"> • Eliminate the low temperature
Softening of the top surface of the belt	<ul style="list-style-type: none"> • Exposure to excessively high temperatures (over +125°C) • Excessive amount of oil in contact with the belt 	<ul style="list-style-type: none"> • Eliminate the high temperature Eliminate the oil presence, clean the drive and change belt
Apparent elongation of the belt	<ul style="list-style-type: none"> • Reduction of centre distance due to bearings not being firmly fixed 	<ul style="list-style-type: none"> • Restore the initial centre distance and strengthen the bearings
Belt overriding the flanges	<ul style="list-style-type: none"> • Faulty installation of the flanges • Misalignment of pulleys or axes 	<ul style="list-style-type: none"> • Reinstall the flanges properly • Align pulleys
Excessive wear of pulley teeth	<ul style="list-style-type: none"> • Excessive overloading • Belt excessively taut • Pulley material insufficient hard 	<ul style="list-style-type: none"> • Use a wider belt • Reduce the centre distance • Harden the pulley surface
Drive excessively noisy	<ul style="list-style-type: none"> • Pulleys out of line • Excessive installation tension • Excessive load • Diameter of pulley below minimum 	<ul style="list-style-type: none"> • Align pulleys • Reduce the centre distance • Use a wider belt • Increase the diameter of the pulleys

USEFUL FORMULA FOR BELT DRIVE DESIGN

Data requested	Formula	Symbols used
Pitch diameter of pulley (mm)	$D_p = \frac{N \times P}{\pi}$	N =number of teeth of pulley P =pitch of pulley (mm) $\pi = 3,14159$
Linear belt speed (m/sec)	$V = \frac{\pi \times D_p \times n}{60.000} = \frac{D_p \times n}{19.098}$	D_p =pitch circle diameter of large pulley in mm n =rpm of larger pulley (min -1)
Torque (Nm)	$C = \frac{P \times 9.55 \times 10^3}{n}$	P =Power in kW n =rpm (min -1)
Power in kW (kW)	$P = \frac{T_e \times V}{10^3}$	T_e =effective belt tension in N V =linear belt speed (m/sec)
	$P = \frac{C \times n}{9.55 \times 10^3}$	C =torque in Nm n =rpm (min -1)
Centrifugal tension (N)	$T_c = \frac{W \times V^2}{10^3}$	W =weight of belt for unit length (gr. per metre) V =linear belt speed (m/sec)

The data and information contained in the present catalogue are up-to-dated to the date of the catalogue's printing. Megadyne Spa reserves the right to modify the specifications, performances and other information relating to the belts described in the present catalogue, at any time at its own discretion, without any prior notice. For updating refer to our web site www.megadynegroup.com.

Technical specifications, performances and other information provided in the present catalogue are indicative and do not bound Megadyne unless such specifications, performances or other information are expressly agreed in the agreement with the customer.

We also recommend to read carefully the following documents in our web site www.megadynegroup.com:

- Megadyne General Conditions of Sale (comprising the warranty)
- Theoretical Belt Life
- Drive Components: Storage, Installation, Maintenance and Troubleshooting Handbook
- Belts standard use condition and temperature.

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* MANUFACTURING FACILITIES

MEGADYNE HEADQUARTER
Via Trieste 16 - 10075 Mathi (TO) - ITALY
mail@megadyne.it - www.megadyne.it