CLAVIS Belt Frequency Meter Type 7 User Manual

General safety tips

Safety first – read and understand this manual before operating the CLAVIS Belt Frequency Meter.

Never use your CLAVIS Belt Frequency Meter on moving belts.

Switch off and isolate any belt drive system prior to taking tension measurements or attempting any other installation work.

Do not drop the meter or subject either the meter or the sensor to other sharp impact.

Do not put water, solvents (including cleaning solutions) or any other liquid on the unit. Clean meter and sensor with dry cotton cloth.

Do not pull on sensor cable. Disconnect sensor from meter by grasping the connector grip only.

Do not leave the unit in places that are humid, hot, dust filled or in direct sunlight.

Hint: When CLAVIS Belt Frequency Meter is not used for a while, remove batteries and store unit in the case provided.

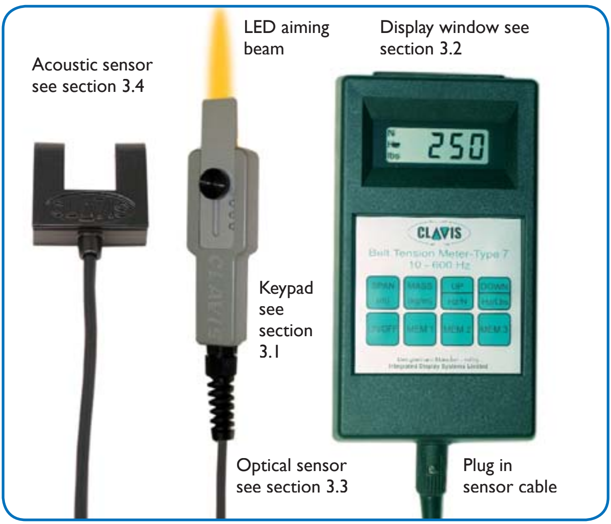
Do not use your CLAVIS Belt Frequency Meter in any potentially explosive environment.

Do not disassemble or attempt to modify either the meter or the sensing head.

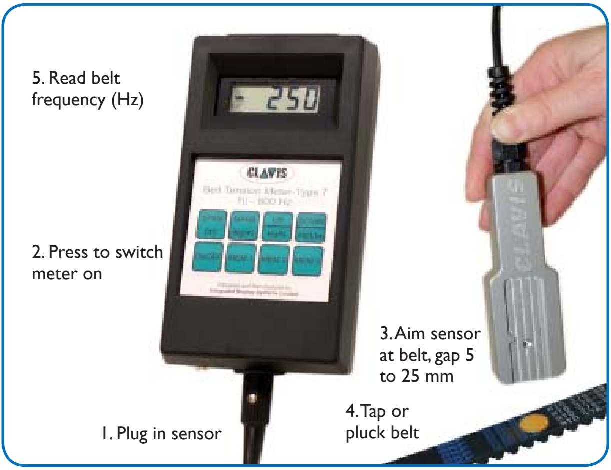
Table of contents

1.0 Device description

The CLAVIS Belt Frequency Meter is a two component system consisting of a hand-held meter attached to an sensor via an electronic cable. Two differing types of sensor are used with the CLAVIS meter. The first is the acoutic sensor which is available in a range of sizes and profiles. The second is an optical sensor which uses an infrared beam to detect the vibration of a belt strand and sends a signal to the meter. The detected belt vibration signal is compared with the vibration of a quartz crystal by the the meter which then computes the natural frequency of the belt. The result is shown in the display window as hertz (oscillations per second). The internal programming of the meter is also able to report the belt tension in units of force (either newton or pounds-force) provided the operator has entered the belt mass and span length using the manually operated key pad.



2.0 Quick start



or

3.0 Functions

3.1 Keys

ON/OFF

This key switches the meter on or off. If the meter is on and sits idle for more than 3 minutes, it automatically switches off to preserve battery life. When the meter is first switched on a battery check is made see Section 3.4 for a description

SPAN (m)

This key is used to enter the belt span length. The span key is held down while the UP or DOWN keys are used to set the belt span in metres. Releasing the SPAN key results in an audible beep to indicate the setting has been accepted. Pressing the SPAN key alone, shows the current setting.

MASS (kg/m)

This key is used to enter the belt mass. The mass key is held down while the UP or DOWN keys are used to set the belt mass in kg/m. Releasing the MASS key results in an audible beep to indicate the setting has been accepted. Pressing the MASS key alone shows the current setting.

Important Note:

Belt span and belt mass are required entries if tension results in force units (N or lbf) are desired. Entries must be in SI units (m and kg/m)

UP (Hz/N)

This key has two functions. The first is to increase either the SPAN or MASS parameters when used in conjunction with these keys. The second use is to toggle between the Hz and the newton measurement modes.

DOWN (Lbs)

This key has two functions. The first is to decrease either the SPAN or MASS parameters when used in conjunction with those keys. The second use is to toggle between the Hz and the pound measurement modes.

MEM 1

MEM 2

MEM 3

The memory keys allow up to 3 sets of belt parameters to be stored in the meter registry. Pressing the MEM 1 key recalls the first set of belt parameters and likewise for MEM 2 and MEM 3.

To store the belt parameters to a key, the belt span and mass parameters must first be entered and then immediately after release of either the SPAN or MASS keys the appropriate MEM key should be pressed. Two beeps indicate that the parameters have been successfully assigned to the key.

3.2 Audio/visual display

The CLAVIS Belt Frequency Meter is an interactive tool. It provides both visual and audible communication with the operator. Each signal or combination of signals has a meaning. While all these signals are discussed in other sections of this manual, a compilation of all the available signals will be presented here.

Generally visual signals alone give measurement results while audible signals, either alone or in combination with a visual signal, indicate some operational step.

Visual measurement results

A line segment will appear to indicate the units associated with the number displayed

Frequency mode, results displayed as hertz

Tension displayed in newton

Tension displayed in pound-force.

Audible signals

Signal	When	Means
One Beep	Upon release of "Span" key	Input accepted
One Beep	Upon release of "Mass" key	Input accepted
One Beep	While sensor is aimed at vibrating belt	Measurement taken
Two Beeps	Upon pushing "Memory" key after releasing "Span" key	Span data has been stored
	Upon pushing "Memory" key after releasing 'Mass' key	Mass data has been stored
Four Beeps	Combined with "0000" N display	Newton result is out of range
	Combined with "0000" lb display	Pound result is out of range
	After pushing "On" key combined with "zero" countdown	Low battery condition

3.3 Optical sensor

The sensor uses an invisible infrared beam to detect vibrations of the belt. A narrow angle orange LED generated beam is provided to guide the aiming of the sensor.

The very best signal from the belt is seen when the sensor is held perpendicular to the belt at the centre of the span at 9,5 mm (3/8 in) distance. When physical restrictions are present, it is possible to get useable readings with the sensor up to 50 mm (2 in) distance from the belt and/or tipped up to 45° from perpendicular.

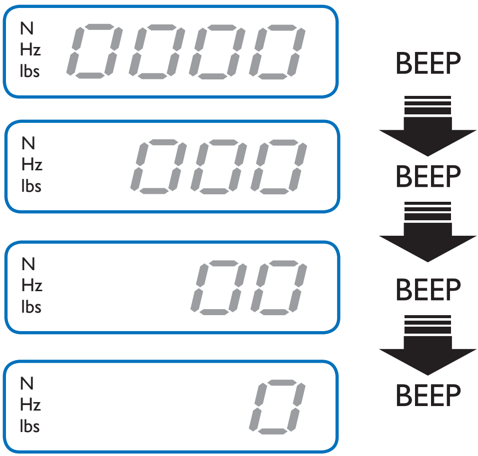
It is possible to take measurements from the edge of the belt. The toothed side of a belt is equally acceptable as a target for the sensor. The sensor LEDs should be kept clean by wiping with a soft cotton cloth. Solvents are never to be used.

3.4 Acoustic sensor

The acoustic sensor uses a CLAVIS patented technique for detecting the belt vibration signal whilst minimising ambient noise. The acoustic sensor is particularly suitable for belts which vibrate poorly or where the amplitude of belt vibration is very small. The 'jaws' of the sensor should be positioned over the centre of the belt and placed mid length of the belt span. The sensor should not be allowed to touch the belt as this will reduce the belt vibration signal. A range of sensors is available to suit belts of differing widths. The standard Type 3 sensor is suitable for all automotive applications.

3.5 Battery condition

When the CLAVIS Belt Frequency Meter is first switched on, a battery condition check is automatically performed. A low battery condition is signalled both visually and audibly. The display window will flash an array of zeros, starting with four and progressing to only one. There will be an audible signal of four "beeps" as the display changes



If these signals are seen and heard, batteries should be replaced. Batteries are accessed through the removable cover on the back of the meter. New batteries should be inserted within 30 seconds of removal of old batteries. Taking longer risks loss of any data stored by the memory keys. Batteries are expected to provide approximately 20 hours of continuous operation before replacement is required when the optical sensor is used. Over 100 hours of use is possible when the acoustic sensor is used.

3.6 Charging batteries

Do not charge batteries with the sensor head attached to the meter. Do not attempt to use the meter while batteries are being charged.

The CLAVIS Belt Frequency Meter is compatible with rechargeable batteries and charging unit. A convenient 3,5 mm, positive centre charging socket is located on the bottom end of the meter body adjacent to the sensor cable plug-in port.

Batteries:	1 300 mAh minimum (IDS accessory)
Charging unit:	12 to 15 volt DC output (IDS accessory)
Connection:	3,5 mm positive tip mini plug/socket

The built in circuit of the meter controls the charging current. Charging current is internally limited to 100 mA. Charging time is typically 12 to 14 hours for a full charge.

You may turn the unit on while charging. The meter's software will then signal that the batteries are charging. The display window will flash an array of zeros, starting with only one and progressing to four. There will be an audible signal of four 'beeps' as the display changes.

Suitable rechargeable batteries and charger may be obtained directly from IDS.

3.7 RS232C serial communication

Each time a reading is taken the value is transmitted through the RS232 serial port. The following protocol is employed; Baud Rate 9600, 8 data bits, 1 stop bit. The value string is terminated by a 'CR', (Decimal 13). Output is through a 9 way 'D' type plug, (Pin 5 common, Pin 3 Transmit). Handshaking is not employed. An example of the text output is shown below.

CLAVIS TYPE 7 - REV 7.010699
250 HZ
250 HZ
250 HZ
3124 N
0702 LBS

4.0 Setup and use

1. Plug sensor head into meter body. This is a keyed plug. Line it up, do not use force!

2. Turn unit on using [ON/OFF] .

3. Load span and mass data or recall previously loaded data.

To load span data simply hold down [SPAN (m)] while using [UP (Hz/N)] or [DOWN (Lbs)] to set the number.

When the correct number appears in the display window, simply release the span key. The unit will beep once to acknowledge acceptance of this setting.

To load mass data simply hold down [MASS (kg/m)] while using [UP (Hz/N)] or [DOWN (Lbs)] to set the number.

When the correct number appears in the display window, simply release the mass key. The unit will beep once to acknowledge acceptance of this setting.

To save individual entries into memory, press appropriate key

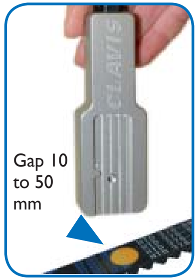
[MEM 1] , [MEM 2] or [MEM 3] .

As soon as the span or mass keys have been released, the meter will beep twice to acknowledge the entry into memory.

To recall stored span and mass data simply press [MEM 1], [MEM 2] or [MEM 3].

Depending upon where you stored the data for this specific drive.

4. Aim sensor at centre of selected belt span. Tap or pluck the belt. The meter will beep once to indicate that a measurement was taken.



or

Place sensor across the selected belt span at the mid-span position. Make sure that the jaws of the sensor do not touch the belt. Position the sensor so that the sensing elements are located mid-width of the belt. (Acoustic sensors are available from IDS for all widths of belts). Tap or pluck the belt. The meter will beep once to indicate that a measurement was taken.

5. Display window will show frequency result.

6. Press [UP (Hz/N)] to toggle to newton.

7. Press [DOWN (Lbs)] to toggle to pounds.

Note: Pressing the same key a second time will return display to the hertz value.
8. Re-adjust belt tension and repeat measurement until target tension results are attained.

5.0 Operating tips

Here are some procedures and "best" practices that may ease use or help increase the reliability of your belt tensioning efforts.

Take your tension reading as close to the centre of the selected span as practical.

Use the longest belt span that can be readily accessed. Minimum useable span length is equal to 20 times the belt tooth pitch for synchronous belts and 30 times the belt top width for "v" configuration belts. Using too short a span yields indicated tensions that may be much higher than actual belt tension due to effects of belt stiffness.

Where possible, orientate the sensor head with the long edge of the sensor parallel to the centre-line of the belt. This tends to eliminate any non-reading conditions due to aiming error.

On new installations, rotate the system by hand at least one full revolution of the belt to seat and normalise the components.

If the top surface of the belt is not accessible, try to beam the sensor against the edge of the belt. The inside surface of the belt is equally acceptable.

The meter will not give a measurement for a belt under extremely low tension. Simply increase the drive tensioning until the meter responds. The meter will beep to indicate that a reading has been taken.

It is good practice to take three successive readings. This will show the consistency of your methods. If the readings vary by more than 10% reassess your measurement technique.

Taking multiple readings at different belt orientations may help you identify problems with other drive components. Tension excursions are indicative of component problems such as a belt shaft, poorly mounted sprocket or pulley or an irregular pulley groove.

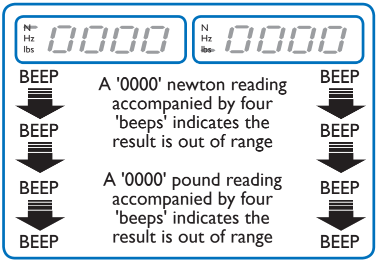
When tensioning an array of multiple V-belts, use a single belt toward the centre of the array.

6.0 Meter range

The CLAVIS Belt Frequency Meter is capable of measuring belt vibration frequencies between 10 Hz and 600 Hz.

If the measured frequency is below 10 Hz, the meter will display "10.00" briefly and then change to "000.0".

If the measured frequency is above 600 Hz, the meter will display "600" briefly and then change to "000".



On multi-shaft (three or more shafts) it may be possible to get valid measurements by selecting a different belt span for measurement. If the measured frequency is below 10 Hz choose an available shorter span. If the measured frequency is above 600 Hz choose a longer span if available.

Based upon the measured belt frequency, the meter is capable of calculating belt tensions up to 9 990 N (2 200 lb.). When these limits are exceeded the meter will react as previously described.

Belt tensions greater than these values are unusual. It is therefore advisable to check that the span and mass parameters have been entered correctly. If they are found to be correct then check the calculation of your target values. If everything looks correct then this drive is simply beyond the capacity of the CLAVIS Belt Frequency Meter. The drive will have to be tensioned by traditional force and deflection techniques.

Special Note:
Tensioning a drive generally involves moving one component shaft with respect to another. On some drives, especially larger installations, tensioning the drive will involve sufficient movement that the span length is appreciably altered. Frequency (Hz) values will remain accurate but if a precise tension value is to be calculated it may become necessary to update the span input to reflect the new shaft spacing.

7.0 Calibration

7.1 Spot check

The measurement system of the CLAVIS Belt Frequency Meter is based upon a very stable quartz crystal that should never wander. However, a precision mechanical resonator (tuning fork) is included with the meter so that a calibration check at a spot frequency of 250 Hz may be performed at any time.

Results within ±1% are acceptable. There is no adjustment possible. If greater variance is experienced, the meter should be returned for calibration. See section 7.2 for manufacturer's contact information.

7.2 Annual certification

Technical support relating to calibration certification and/or operation of the CLAVIS Belt Frequency Meter can be obtained from the manufacturer at:

techsupport@clavis.co.uk

phone: +44 191 262 7869

fax: +44 191 262 0091

The meter may be returned to the manufacturer for repair or recalibration at any time.

A factory calibration certificate is included with each meter. Although the very stable solid-state quartz crystal based system is not likely to go out of calibration, some operating procedures call for annual gauge certification. For certification/calibration purposes the meter may be returned to the manufacturer at yearly intervals to have the meter recalibrated and certified to NAMAS/ UKAS (National Accreditation of Measurement and Sampling/United Kingdom Accreditation Standards) standards.

The manufacturer must be contacted for detailed costs and shipping procedures prior to any return. Contact information for Integrated Display Systems Limited (IDS) is shown in Appendix 2.

There will be a charge for these services.

8.0 Technical specification

Measurement range	
Frequency range	10 to 600 Hz
Measurement accuracy	
Below 100 Hz	± 1 significant digit
Above 100 Hz	± 1%
Belt mass input range	0,001 to 9,990 kg/m
Belt span input range	0,001 to 9,99 m
Maximum belt tension display	9 990 N 2 200 lb
Environmental conditions	
Operating temperature	+10 to +50 °C
Shipment and storage temp	- 40 to +70 °C
Protection class	IP54
Sensor Optical	
Type	Infrared optical
IR wavelength	970 mm
Visible aiming beam	Narrow angle orange LED
Housing	Machined aluminium
Cable length	1 m
Sensor Acoustic	
Type	Twin transducer noise cancelling
Housing	Cast aluminium
Cable length	1 m
Power supply	
Battery type	AA (MN1500) Alkaline only
Number	4
Expected life	20 hrs (Optical sensor) 100 hrs (Acoustic sensor)
Compartment location	Back of meter
Optional rechargeable batteries	
Battery type	AA (1 300 mAh minimum)
Charger	12 to 15 V DC output
Socket/polarity	3,5 mm positive centre

9.0 Formulae and conversions

Force conversion constants

newton x 0,2248 = lb
pound x 4,4482 = N
kilogram x 9,8067 = N

Length conversion constants

inch x 0,0254 = m
metre x 39,3701 = in
mm x 0,001 = m

Span length calculation

$$S = \sqrt{CD^2 - \frac{(D - d)^2}{4}}$$

where:
S = Span length (mm)
CD = Centre distance (mm)
D = Large pulley diameter (mm)
d = Small pulley diameter (mm)

Weight (for mass calculation use)

ounce x 0,02835 = kg
pound x 0,45359 = kg

Reminder: Belt span and mass inputs to the meter must be in SI units, m for the belt span and kg/m for the belt mass.

Appendix

1.0 Theory of operation

There is a direct relationship between belt tension and a belt's natural frequency of vibration. As the tension is increased, the vibration frequency also increases. The relationship between tension and frequency has been determined to be:

$$T = 4ml^2 f^2$$

Where
T = Belt tension (N)
m= mass per unit length (kg/m)
l = span length (m)
f = vibration frequency (Hz)

The CLAVIS Belt Frequency Meter is a dual function tool. The optical sensing head uses an invisible infrared beam to detect vibration. The acoustic sensing head uses the almost inaudible acoustic signal from the belt to detect vibration. The integral calculator within the meter determines the time base and performs the necessary calculations to support the results shown in the display window.

The meter may be used with all power transmission belts regardless of type or construction.

2.0 Limited Warranty

Limited Warranty Time of warranty is 12 months from date of original purchase provided that proper product registration has been completed. Product registration may be completed online
at; www.clavis.co.uk/registration

Warranty covers defects in materials and workmanship for the device only. Warranty does not cover accessory items such as batteries and applies only to parts that were not damaged as a result of inappropriate handling or use. The warranty expires immediately if the device itself is opened. Unit must be returned to Integrated Display Systems Ltd (IDS) for evaluation of all warranty claims. Any CLAVIS Belt Frequency Meter claimed to have a covered warranty condition involving material or workmanship shall, upon IDS's approval, be returned to IDS as designated, at the Customer's expense. Under no circumstances will liability exceed the original purchase price of the meter. IDS reserves the right to repair or replace the unit or to refund the original purchase price at their sole option.

Limitation of Warranty: IDS excludes any further liability for software, handbooks and information material. Furthermore, IDS does not accept liability for damages resulting from the use of the CLAVIS Belt Frequency Meter.

IDS's total responsibility and liability for any and all claims, losses and damages of any kind whatsoever arising out of any cause whatsoever (whether under any warranty or based contract, negligence, other tort, strict liability, breach of warranty, other theory or otherwise) shall not exceed the original purchase price of the CLAVIS Belt Frequency Meter in respect to which such cause arise, and in no event shall IDS be liable for special, incidental, consequential, exemplary, or punitive damages resulting from any such cause. No employee, agent and/or representative, promise or agreement, except as stated herein. IDS shall not be liable for, and customer assumes all liability for, all personal injury and property damage connected with the use of the product. There are no warranties which extend beyond the description on the face hereof, and IDS disclaims warranty of fitness for purpose or any other implied warranties.

Contact IDS Customer Service for warranty claims, product return procedure or technical information.

Integrated Display Systems Limited (IDS)
Tel: +44 (0) 191 262 7869
Fax: +44 (0) 191 262 0091
www.clavis.co.uk

3.0 Weights and tension values

The following tables are suggested tension values for power transmission belts manufactured by SKF® (SKF is a registered trademark of the SKF Group).

Timing belts

Belt type	Belt type	Belt Tension New belt	Run in belt	Mass
		N	N	kg/m
HiTD	5M 9	99	71	0,0369
	5M 15	174	124	0,0614
	5M 25	311	222	0,1024
	8M 20	372	266	0,1282
	8M 30	593	424	0,1922
	8M 50	1 037	741	0,3204
	8M 85	2 044	1 460	0,5447
	14M 40	1 297	926	0,4289
	14M 55	1 912	1 366	0,5897
	14M 85	3 142	2 244	0,9114
	14M 115	4 480	3 200	1,2331
	14M 170	7 139	5 099	1,8228
STPD	S8M20	390	279	0,1109
	S8M30	620	443	0,1673
	S8M50	1 110	793	0,2782
	S8M85	2 030	1 450	0,4732
	S14M40	1 340	957	0,4620
	S14M55	1 925	1 375	0,6343
	S14M85	3 165	2 261	0,9811
	S14M115	4 465	3 189	1,3268
	S14M170	6 975	4 982	1,9621
Timing belts	XL 025	13	11	0,0136
	XL 037	24	20	0,0203
	LO50	51	41	0,0433
	LO75	87	70	0,0650
	L 100	122	98	0,0867
	H075	220	176	0,0838
	H100	311	249	0,1117
	H150	485	388	0,1675
	H200	667	534	0,2233
	H300	1 045	836	0,3350
	XH 200	907	726	0,5718
	XH 300	1 428	1 142	0,8577
	XH 400	2 019	1 615	1,1436
	XXH 200	1 130	904	0,8087
	XXH 300	1 748	1 398	1,2130
	XXH 400	2 478	1 982	1,6173

Wrapped V, wedge and banded belts

Belt type	Smallest pulley diameter		Speed range		Belt tension per single belt*		Mass	
					New belt	Run in belt	Single belt	Belt in a band**
	over	incl.	over	incl.				
	mm		rpm		N	N	kg/m	
Z	40	60	1 000	2 500	104	69	0,0598	n/a
			2 500	4 000	121	81		
	60 over		1 000	2 500	174	116		
			2 500	4 000	174	116		
A	75	90	1 000	2 500	332	222	0,1083	0,1496
			2 500	4 000	254	169		
	90	120	1 000	2 500	391	261		
			2 500	4 000	332	222		
	120	175	1 000	2 500	469	313		
			2 500	4 000	411	274		
B	105	140	860	2 500	469	313	0,1867	0,2598
			2 500	4 000	391	261		
	140	220	860	2 500	567	378		
			2 500	4 000	528	352		
C	175	230	500	1 740	1 017	678	0,3099	0,4173
			1 740	3 000	841	561		
	230	400	500	1 740	1 251	834		
			1 740	3 000	1 115	743		
D	305	400	200	850	2 210	1 473	0,6347	0,8701
			850	1 500	1 877	1 251		
	400	510	200	850	2 698	1 799		
			850	1 500	2 268	1 512		
SPZ	56	79	1 000	2 500	338	226	0,0793	n/a
			2 500	4 000	262	175		
	79	95	1 000	2 500	383	255		
			2 500	4 000	415	276		
	95 over		1 000	2 500	477	318		
			2 500	4 000	438	292		
SPA	71	105	1 000	2 500	575	383	0,1341	0,1550
			2 500	4 000	524	349		
	105	140	1 000	2 500	696	464		
			2 500	4 000	628	418		
	140 over		1 000	2 500	872	581		
			2 500	4 000	876	584		
SPB	107	159	860	2 500	978	652	0,2083	0,2683
			2 500	4 000	941	627		
	159	250	860	2 500	1 255	837		
			2 500	4 000	1 116	744		
	250 over		860	2 500	1 496	997		
			2 500	4 000	1 275	850		

Wrapped V, wedge and banded belts

Belt type	Smallest pulley diameter		Speed range		Belt tension per single belt*		Mass	
					New belt	Run in belt	Single belt	Belt in a band**
	over	incl.	over	incl.				
	mm		rpm		N	N	kg/m	
SPC	200	355	500	1 740	2 026	1 350	0,3804	0,4398
			1 740	3 000	2 043	1 362		
	355 over		500	1 740	2 305	1 537		
			1 740	3 000	2 671	1 781		
3V	61	90	1 000	2 500	313	209	0,0762	0,1024
			2 500	4 000	274	182		
	90	175	1 000	2 500	430	287		
			2 500	4 000	391	261		
5V	171	275	500	1 740	1 134	756	0,2228	0,2717
			1 740	3 000	997	665		
	275	500	500	1 740	1 369	912		
			1 740	3 000	1 291	860		
8V	315	430	200	850	2 933	1 955	0,5450	0,6158
			850	1 500	2 386	1 590		
	430	570	200	850	3 520	2 346		
			850	1 500	3 129	2 086		

* Multiply the belt tension required for a single belt by the number of the belts in the banded belt unit to get total tension to apply.

** Multiply the mass of one belt in a band by the number of the belts in the banded belt unit to get total mass to apply.

Cogged raw edge V, wedge and banded belts

Belt type	Smallest pulley diameter		Speed range		Belt tension per single belt*		Mass	
					New belt	Run in belt	Single belt	Belt in a band**
	over	incl.	over	incl.				
	mm		rpm		N	N	kg/m	
ZX	40	60	1 000	2 500	119	80	0,0576	n/a
			2 500	4 000	139	93		
	60 over		1 000	2 500	199	133		
			2 500	4 000	199	133		
AX	75	90	1 000	2 500	372	248	0,1100	0,1530
			2 500	4 000	293	196		
	90	120	1 000	2 500	450	300		
			2 500	4 000	391	261		
	120	175	1 000	2 500	508	339		
			2 500	4 000	450	300		

Cogged raw edge V, wedge and banded belts

Belt type	Smallest pulley diameter		Speed range		Belt tension per single belt*		Mass	
	over	incl.	over	incl.	New belt	Run in belt	Single belt	Belt in a band**
	mm		rpm		N	N	kg/m	
BX	85	105	860	2 500	430	287	0,1804	0,2250
			2 500	4 000	372	248		
	105	140	860	2 500	626	417		
			2 500	4 000	547	365		
	140	220	860	2 500	763	508		
			2 500	4 000	645	430		
CX	175	230	500	1 740	1 310	873	0,3290	0,3980
			1 740	3 000	1 056	704		
	230	400	500	1 740	1 408	939		
			1 740	3 000	1 291	860		
XPZ	56	79	1 000	2 500	362	241	0,0683	n/a
			2 500	4 000	299	199		
	79	95	1 000	2 500	438	292		
			2 500	4 000	418	279		
	95 over		1 000	2 500	499	332		
			2 500	4 000	469	313		
XPA	71	105	1 000	2 500	657	438	0,1266	0,1560
			2 500	4 000	598	399		
	105	140	1 000	2 500	796	531		
			2 500	4 000	718	478		
	140 over		1 000	2 500	997	665		
			2 500	4 000	897	598		
XPB	107	159	860	2 500	1 116	744	0,2318	0,2785
			2 500	4 000	1 075	717		
	159	250	860	2 500	1 435	957		
			2 500	4 000	1 330	886		
	250 over		860	2 500	1 596	1 064		
			2 500	4 000	1 455	970		
XPC	200	355	500	1 740	2 313	1 542	0,3472	0,5480
			1 740	3 000	2 333	1 555		
	355 over		500	1 740	2 632	1 755		
			1 740	3 000	3 050	2 034		
3VX	55	60	1 000	2 500	293	196	0,0650	0,1020
			2 500	4 000	254	169		
	60	90	1 000	2 500	372	248		
			2 500	4 000	332	222		
	90	175	1 000	2 500	469	313		
			2 500	4 000	430	287		

Cogged raw edge V, wedge and banded belts

Belt type	Smallest pulley diameter		Speed range		Belt tension per single belt*		Mass	
	over	incl.	over	incl	New belt	Run in belt	Single belt	Belt in a band**
	mm		rpm		N	N	kg/m	
5VX	110	170	1 000	2 500	899	600	0,1830	0,2520
			2 500	4 000	489	326		
	170	275	500	1 740	1 310	873		
			1 740	3 001	1 212	808		
	275	400	500	1 740	1 525	1 017		
			1 740	3 001	1 486	991		

* Multiply the belt tension required for a single belt by the number of the belts in the banded belt unit to get total tension to apply.

** Multiply the mass of one belt in a band by the number of the belts in the banded belt unit to get total mass to apply.

Ribbed belts

Belt type	Smallest pulley diameter	Speed range	Belt tension per one rib* New belt	Run in belt	Mass** Single belt
	mm	rpm	N	N	kg/m
PJ	<80	n/a	67	45	0,0100
	>80		90	60	
PK	<95	n/a	139	93	0,0180
	>95		178	119	
PL	<150	n/a	216	144	0,0571
	>150		312	208	
PM	<250	n/a	672	448	0,1200
	>250		912	608	

* Multiply the belt tension required for one rib by the number of the ribs in the ribbed belt unit to get total tension to apply.

** Multiply the mass of one rib by the number of the ribs in the ribbed belt to get total mass to apply.

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Publication 9607 · January 2009

Printed in England.