DESIGN MANUAL

τεχνικό εγχειρίδιο σχεδιασμού για ιμάντες

χρονισμού timing



αυξομείωσης οδοντωτοί



ριγωτοί poly-v





Αυτό το εγχειρίδιο παρέχει πληροφορίες σχετικά με τους τύπους ιμάντων καθώς και οδηγίες σχετικά με το σχεδιασμό τους. Κατά τον υπολογισμό και σχεδιασμό ενός ιμάντα μετάδοσης κίνησης συχνά υπάρχουν αρκετές επιλογές όσον αφορά την επιλογή του τύπου. Αυτή η επιλογή ιμάντα είναι καθοριστική για το σχεδιασμό παρέχει δε τη βέλτιστη λειτουργία και ζωή, εξασφαλίζοντας το χαμηλότερο δυνατό κόστος συντήρησης.

DESIGN OF V-BELT DRIVES

You can calculate industrial drives with ROFLEX belt types by the following procedure.

If the drives are for agricultural machinery or special drives and drives for mass production, we recommend that you contact ROULUNDS technical department which has experts ready to assist you with advice on how to achieve the optimum solution for your belt drive tasks, for example by running ROFLEX calculation programs but also on the basis of many years' practical experience.



DESIGNATIONS AND UNITS APPLIED

| а | Number of pulleys in the drive | |
|-----------------|--|------|
| В | Width of pulley | [mm] |
| Β _F | Width of flat pulley | [mm] |
| b _d | Correction supplement to datum-diameter for V-belt pulley | [mm] |
| b _e | Correction reduction of effective- diameter for V-belt pulley | [mm] |
| С | Centre distance | [mm] |
| с ₁ | Service factor | |
| c ₂ | Belt length correction factor | |
| c ₃ | Arc of contact correction factor on smaller V-belt pulley | |
| c ₄ | Correction factor for tension idler | |
| с ₅ | Arc of contact correction factor in a V-flat drive | |
| D _F | Diameter of flat pulley | [mm] |
| D _{FD} | Calculated datum-diameter of flat pulley | [mm] |
| D _{FP} | Calculated pitch-diameter of flat pulley | [mm] |
| D _{FE} | Calculated effective-diameter of flat pulley | [mm] |
| D _t | Supplement for belt height | [mm] |
| D _e | Effective-diameter of larger V-belt pulley | [mm] |
| D _d | Datum-diameter of larger V-belt pulley | [mm] |
| D _p | Pitch-diameter of larger V-belt pulley | [mm] |
| d _e | Effective-diameter of smaller V-belt pulley | [mm] |
| d _d | Datum-diameter of smaller V-belt pulley | [mm] |
| d _p | Pitch-diameter of smaller V-belt pulley | [mm] |

| f | Deflection frequency | [Hz] |
|-------------------|---|---------------|
| h | Height difference between shaft turned drives | ts in [mm] |
| i | Speed ratio | |
| K | Deflection force per belt | [N] |
| k ₁ | Tensioning factor for belt tension | n |
| k ₂ | Factor for centrifugal force | [kg/m] |
| I | Span length of belt | [mm] |
| L _a | Outside V-belt length | [mm] |
| L _d | Datum V-belt length | [mm] |
| L _e | Effective V-belt length [mm or] | 1/10 inch] |
| L _i | Inside V-belt length | [mm] |
| L _m | Mean V-belt length | [mm] |
| P _M | Power consumption of driven un or motor output | nit [kW] |
| P _N | Power rating per V-belt | [kW] |
| P _D | Design power | [kW] |
| n ₁ | Revolutions of smaller V-belt pulley | [rev/min] |
| n ₂ | Revolutions of larger V-belt pulley | [rev/min] |
| S _{dyn} | Shaft load, dynamic | [N] |
| S _{stat} | Shaft load, static | [N] |
| T _{stat} | Belt tension per belt, static | [N] |
| Т | Section height of V-belt | [mm] |
| v | Belt speed | [m/s] |
| z | Number of V-belts | [pieces] |
| х | Adjustment of centre distance for take-up | [mm] |

| у | Adjustment of centre distance for installation | [mm] |
|------|--|----------|
| β | Arc of contact on smaller V-belt pul | lley [°] |
| σ | Deflection of span length | [mm] |
| φ | Angle between pulleys in drives with nonparallel shafts | [°] |
| π | 3.1416 | |
| hp | 0.736 kW | |
| kp | 9.815 N | |
| inch | 25.4 mm | |

CALCULATION PROCEDURE

1. Service factor c₁

Table 1, page 15. Choose from the table the operating conditions which best correspond to the actual operating conditions for the drive.

2. Belt section

is selected on the basis of diagrams 1 - 5, page 16 - 18. As a principal rule, narrow V-belts should be

used for new drives. This gives the most economical and least space demanding design.

For high-speed drives, or where small pulley diameters are required, ROFLEX RE-X programmes 10 and 17 and ROFLEX-X programmes 12 and 16 will usually provide the optimum solution.

When selecting belt type and section, the recommended maximum belt speed v [m/s] must be taken into consideration. This speed is listed on the data sheet for the belt type in question, in the PROGRAMME KEY and in the DIMENSION TABLES, page 41 - 43.

3. Speed ratio i

is the ratio of the rev/min of the smaller to that of the larger V-belt pulley

 $i = \frac{n_1}{n_2}$

or the ratio of the pitch-diameter of the larger to that of the smaller pulley.

$$i = \frac{D_p}{d_p}$$

For calculation of pitch-diameter, see point 4.

Having selected the V-belt pulley diameters, check that the speed ratio is as desired.

4. V-belt pulley diameters d_d/d_p and D_d/D_p [mm]

Tables 2 and 3 on page 19 - 20 indicate the standard datum- and effective-diameters.

We recommend selecting as large diameters as practically possible in order to obtain better power transmission at higher belt speeds.

The diameter of the smaller V-belt pulley is selected from the table. The diameter of the larger V-belt pulley is calculated as follows:

 $D_d = d_d \times i \text{ [mm]}$

Standard diameters should always be selected if at all possible.

The PITCH-diameter is used for an exact calculation of the speed ratio i, point 3, and the belt speed v, point 8.

These are calculated from the datum-diameter or the effective-diameter:

 $d_p = d_d + 2b_d \text{ [mm]}$ $d_p = d_e - 2b_e \text{ [mm]}$

 $D_p = D_d + 2b_d \text{ [mm]}$ $D_p = D_e - 2b_e \text{ [mm]}$

Correction supplement/reduction $2b_d$ and $2b_e$, see tables 2a and 3a on page 20.

For most drives it is sufficiently accurate to use datum-diameters when calculating the speed ratio and belt speed.

V-belt pulley groove dimensions are shown in tables 21 - 25 on page 43 - 46.

5. Centre distance C [mm]

The centre distance should be selected within this range:

$$C > 0,7 (d_d + D_d) [mm]$$

 $C < 2 (d_d + D_d) [mm]$

Deviations from this may occur due to the practical conditions of space or other technical requirements.

Actual centre distance, see point 7.

6. Belt length, datum L_d [mm]

$$L_d = 2C + 1,57 (D_d + d_d) + \frac{(D_d - d_d)^2}{4C}$$
[mm]

- C = Centre distance, point 5
- D_d = Datum-diameter of larger V-belt pulley [mm].
- d_d = Datum-diameter of smaller V-belt pulley [mm].

Find the closest standard belt length in the selected belt programme.

7. Centre distance C [mm]

The actual centre distance is calculated by adjusting the selected C with half of the difference between the belt length calculated in point 6 and the selected standard belt length.

For necessary installation and take-up allowance, see tables 4 - 5, page 21 - 22, which indicate the recommended minimum.

8. Belt speed v [m/s]

$$v = \frac{d_p \times n_1}{19100} [m/s]$$

 d_p = V-belt pulley pitch-diameter [mm] For calculation of pitch diameter, see point 4.

In practice it will usually be sufficiently accurate to use the datum-diameter d_d [mm].

n₁ = Number of revolutions [rev/min] of same V-belt pulley.

Check that the belt speed is not higher than the recommended maximum speed v, which is listed in the PROGRAMME KEY and in the DIMENSION TABELS, page 41 - 43.

9. Deflection frequency f [Hz]

$$f = \frac{a \times v \times 1000}{L_d} \quad [Hz]$$

- a = Number of pulleys in the drive
- v = Belt speed [m/s]
- $L_d =$ Datum belt length [mm]

"f" is to be checked in proportion to the maximum deflection frequency, which is listed in the selected belt programme.

10. Power rating per belt P_N [kW] can be found in the power ratings table for the selected belt programme and section.

11. Belt length correction factor c₂ See table 6, page 23.

12. Arc of contact correction factor c₃

The ratio
$$\frac{D_d - d_d}{C}$$

is calculated and factor c_3 is found in table 7, page 24, for wrapped or raw-edge belt types.

Table 7 also contains the arc of contact β [°] on the smaller V-belt pulley. This is used for calculating the shaft load, point 15, for example.

14.

Number of V-belts z 13.

> The required number of V-belts z is calculated according to the following formula and the result then rounded up to the nearest whole number above it.

$$z = \frac{P_{M} \times c_{1}}{P_{N} \times c_{2} \times c_{3}}$$

 P_{M} = Power consumption of driven unit or the motor's rated output [kW].

 P_N = Power rating per V-belt, point 10.

 c_1 = Service factor, point 1.

 c_2 = Belt length correction factor, point 11.

 c_3 = Arc of contact correction factor, point 12.

Calculation of drive with tension idler, see point 16.

Belt tension T_{stat} [N]

Correct belt tension is one of the preconditions for achieving satisfactory operation of the V-belt drive. For calculation, see page 25.

Belt tension checking, page 26.

Instructions on procedure for installation and maintenance of drive, see page 34

15. Shaft load S_{stat} and S_{dyn} [N]

Based on the prescribed belt tension, the shaft load is calculated according to the formulas on page 27.

The dynamic shaft load S_{dyn} is used for dimensioning bearings and shafts.

16. Drives with tensioning idler

Installation of an extra idler in the drive may be required for technical reasons. Instructions on

- placing and design
- dimensioning

see page 28.

17. Drives with nonparallel shafts

For conditions, see page 29.

18. **Fully turned drives**

For conditions, see page 30.

19. **V-Flat drives** Page 31.



CALCULATION EXAMPLE

According to the information given in the questionnaire, select in the PROGRAMME KEY. Programme 11 Narrow V-belts, wrapped

| 1. | Service factor c₁ Table 1, page 15. Look for centrifugal pump or the closest sim- ilar unit under driven unit. Look for motor type and operating time over | Rotary pump | | | | | |
|----|--|---|--|--|--|--|--|
| | 16 hours under driving machine/motor and read the value c_1 . | c ₁ = 1.4 | | | | | |
| 2. | Belt section for programme 11 Diagram 2, page 17 | | | | | | |
| | $P_{\rm D} = P_{\rm M} \times c_1 [\rm kW]$ | $P_{D} = 35 \times 1.4 = 49 \text{ kW}$ | | | | | |
| | The point of intersection of P_D and the 1470 rev/min of the smaller V-belt pulley is in the borderland between sections SPA and SPB. In such cases we recommend selecting the | | | | | | |
| | smaller section. | Belt section SPA | | | | | |
| 3. | Speed ratio i | | | | | | |
| | $i = -\frac{n_1}{n_2}$ | $i = \frac{1470}{1000} = 1.47$ | | | | | |
| 4. | Pulley diameter | | | | | | |
| | The diameter of the smaller pulley is selec- ted from table 2, page 19, under section SPA. | d _d = 150 mm | | | | | |
| | The datum-diameter of the larger pulley is calculated as follows: $D_d = d_d \times i$ [mm] | D _d = 150 × 1.47 = 220.5 mm | | | | | |
| | Closest standard according to table 2: | D _d = 224 mm | | | | | |
| | | | | | | | |

The pitch-diameter of the pulleys is calculated and the speed ratio checked:

 $i = \frac{D_d + 2 b_d}{d_d + 2b_d} = \frac{D_p}{d_p}$

2 $\rm b_{\rm d}$ according to table 2a, page 20, under belt section SPA and programme 11.

5. Centre distance C [mm]

Should be selected within this area: $C > 0.7 (d_d + D_d) [mm]$ $C < 2 (d_d + D_d) [mm]$

C min. according to questionnaire 450 mm. C max. according to questionnaire 1000 mm. $\begin{array}{lll} C > 0,7(150+224) & C > 262 \mbox{ mm} \\ C < & 2(150+224) & C < 748 \mbox{ mm} \end{array}$

= 1.47 is acceptable for this drive.

The deviation from the desired speed ratio i

 $i = \frac{224 + 0}{150 + 0} = 1.49$

C is initially selected as = 550 mm

| 6. | Belt length L _d [mm] | | | | | | | |
|-----|--|---|--|--|--|--|--|--|
| | $L_{d} = 2 \times C + 1.57 \times (D_{d} + d_{d}) + \frac{(D_{d} - d_{d})^{2}}{4 \times C} \text{ [mm]}$ | $L_{d} = 2 \times 550 + 1.57 \times (224 + 150) + \frac{(224 - 150)^{2}}{4 \times 550} $ [mm] | | | | | | |
| | Closest standard L _d according to pro- gramme 11, section SPA, STANDRAD PRO- | L _d = 1690 mm | | | | | | |
| | GRAMME | L _d = 1682 mm | | | | | | |
| 7. | Centre distance C [mm] | | | | | | | |
| | With proper correction for belt length, the actual centre distance will be C [mm]. | $C = 550 - \frac{1690 - 1682}{2} = 546 \text{ mm}$ | | | | | | |
| | Adjustment of C, table 4, page 21. | | | | | | | |
| | C min. = C – y [mm] C max. = C + x [mm] | C min. = 546 - 27 = 519 mm C max. = 546 + 22 = 568 mm | | | | | | |
| | | which is within the limits specified in the questionnaire. | | | | | | |
| 8. | Belt speed v [m/s] | | | | | | | |
| | Calculation of pitch-diameter $d_p = d_d + 2b_d$ | $d_p = 150 + 0 = 150 \text{ mm}$ | | | | | | |
| | 2b _d according to table 2a, page 20. | | | | | | | |
| | $v = \frac{d_p \times n_1}{19100}$ [m/s] | $v = \frac{150 \times 1470}{19100}$ = 11.5 m/s | | | | | | |
| | Recommended maximum belt speed v for programme 11. | 42 m/s | | | | | | |
| 9. | Deflection frequency f [Hz] | | | | | | | |
| | $f = \frac{a \times v \times 1000}{L_d}$ [Hz] | $f = \frac{2 \times 11.5 \times 1000}{1682} = 13.7 \text{ Hz}$ | | | | | | |
| | Recommended maximum f for programme 11 | 100 Hz | | | | | | |
| 10. | Power rating per belt P _N [kW] | | | | | | | |
| | According to programme 11, section SPA, POWER RATING TABLES. $n_1 = 1470$ rev/min and i = 1.5 Smaller V-belt pulley d_d is 150 mm. With interpolation for d_d = 140 mm and | | | | | | | |
| | d _d = 160 mm. | P _N = 6.7 kW | | | | | | |

11. Belt length correction factor c₂

For L_d 1682 mm under section SPA narrow V-belts in table 6, page 23.

12

12. Arc of contact correction factor c_3

For wrapped V-belts Table 7, page 24.

Arc of contact ß and factor c_3 is calculated by interpolation between $\beta = 174^\circ$ and $\beta = 169^\circ$.

Correction factor

13. Number of V-belts z

 $z = -\frac{P_{M} \times c_{1}}{P_{N} \times c_{2} \times c_{3}}$

Number of V-belts

Checking of pulley width B [mm].

According to table 21, page 43, Section SPA.

 $B = (z-1) \times e + 2 \times f [mm]$

Maximum permissible B according to questionnaire

Proposal for drive design Belt type Datum-diameter of smaller pulley Datum-diameter of larger pulley Pulley width Speed ratio Centre distance Installation and take-up allowance Belt set

The above is one of several possible solutions. We therefore recommend making more calculations in order to optimize the solution both technically and economically.

If a different programme is selected, e.g. programme 10, together with larger pulley diameters, the drive design could have the technical data shown in example 2. This proposal gives a solution that is technically and economically superior.

| Example 2 |
|------------------------------------|
| Belt type |
| Datum-diameter of smaller pulley |
| Datum-diameter of larger pulley |
| Pulley width |
| Speed ratio |
| Centre distance |
| Installation and take-up allowance |
| Belt set |

 $c_3 = 0.99$

$$z = -\frac{35 \times 1.4}{6.7 \times 0.95 \times 0.99} = 7.8 \text{ pcs.}$$

z = 8 pcs.

 $B = (8-1) \times 15 + 2 \times 10 = 125 \text{ mm}$

125 mm.

ROFLEX narrow V-belts, programme 11 $d_d = 150 \text{ mm}$ $D_d = 224 \text{ mm}$ B = 125 mm i = 1.49 C = 546 mm - 27/+ 22 mm $8 \text{ pcs. ROFLEX SPA 1682 L}_d$

ROFLEX RE-X narrow V-belt, programme 10 $d_d = 224 \text{ mm}$ $D_d = 315 \text{ mm}$ B = 65 mm i = 1.4 C = 541 mm - 27/+ 22 mm $4 \text{ pcs. ROFLEX RE-X XPA 1932 L_d}$

14. Belt tension T_{stat} [N] per belt

Static tension T_{stat} [N], see page 25.

In table 8, look for k_1 under programme 11, mean load and arc of contact $\beta = 172^{\circ}$.

In table 9, look for ${\rm k_2}$ under programme 11, section SPA.

$$T_{\text{stat}} = 500 \times k_1 \times \frac{P_M}{z \times v} + k_2 \times v^2 [N]$$

$$k_2 = 0.115$$

 $T_{stat} = 500 \times 1.75 \times \frac{35}{8 \times 11.5} + 0.115 \times 11.5^2$ [N]
 $T_{stat} \approx 348$ N per belt
 $T_{stat} = 500 \times 1.74 \times \frac{35}{8} + 0.105 \times 17.2^2$ [N]

T_{stat} = 500 × 1.74 ×
$$\frac{35}{4 \times 17.2}$$
 + 0.105 × 17.2² [N]
T_{stat} ≈ 474 N per belt

For example 2, the belt tension will be

Checking the belt tension. Calculation of deflection force K [N], page 26.

 $K = 0.06 \times T_{stat} [N]$

Span length of belt I = c × sin $\frac{\beta}{2}$ [mm] Deflection $\sigma = \frac{I \times 15}{1000}$ [mm]

For example 2, K will be

Span length

Deflection

$$I = 546 \times \sin \frac{172}{2} = 545 \text{ mm}$$

$$\sigma = \frac{545 \times 15}{1000} = 8.2 \text{ mm} \approx 8 \text{ mm}$$

$$K = 0.06 \times 474 = 28.4 \text{ N}$$

$$I = 541 \times \sin \frac{171}{2} = 539 \text{ mm}$$

$$\sigma = \frac{539 \times 15}{2} = 8.1 \text{ mm} \approx 8 \text{ mm}$$

 $K = 0.06 \times 348 \approx 20.9 \text{ N}$

k₁ = 1.75

15. Shaft load, page 27

Static shaft load S_{stat} [N].
S_{stat} = 2 × z × T_{stat} × sin
$$\frac{\beta}{2}$$
 [N]

Example 2

Dynamic shaft load

$$S_{dyn} = 707 \times \frac{P_{M}}{v} \sqrt{k_{1}^{2} + 1 - (k_{1}^{2} - 1)\cos\beta} [N]$$

$$S_{stat} = 2 \times 8 \times 348 \times \sin \frac{172}{2} [N]$$

$$S_{stat} = 5554 N$$

$$S_{stat} = 2 \times 4 \times 474 \times \sin \frac{171}{2} [N]$$

$$S_{stat} = 3780 N$$

$$\begin{split} & S_{dyn} = 707 \times \frac{35}{11.5} \sqrt{1,75^2 + 1 \cdot (1,75^2 - 1)\cos 172} \quad [N] \\ & S_{dyn} = 5317 \text{ N} \\ & S_{dyn} = 707 \times \frac{35}{17.2} \sqrt{1,74^2 + 1 \cdot (1,74^2 - 1)\cos 171} \quad [N] \\ & S_{dyn} = 3533 \text{ N} \end{split}$$

SERVICE FACTOR c₁, POINT 1

With the c_1 factor, allowance is made for the load conditions which are characteristic of the listed driving unit types and driven units as well as of the number of operating hours.

If the driving unit or driven unit in question is not listed, we recommend selecting a listed unit which is as close to the applicable load con-ditions as possible.

Under extreme operating conditions with e.g. sharp dust, high temperatures, high starting tor-que and heavy shock loads, the c1 factor should be increased.

Our technical department is ready to help you with advice within this area, too.

| | Driving unit / Motor | | | | | | | | | |
|---|---|--|---------------------------------------|---|------------------|--------------|--|--|--|--|
| Driven unit | AC motors, s with star-delt DC shunt-wo der internal o | single- and thre a start. bund motors. A combustion eng | ee-phase Aultiple cylin- gines. | AC motors, single- and three-phase, series wound, slip-ring motors with direct start. DC motors, series and compound wound. Single cylinder internal com- bustion engines. | | | | | | |
| | Number of o | perating hours | per 24 hours | Number of o | perating hours | per 24 hours | | | | |
| | Up to 10 | Over 10 to 16 | Over 16 | Up to 10 | Over 10 to 16 | Over 16 | | | | |
| Agitators for liquids. Small centrifugal blowers. Fans up to 7.5 kW. Light-duty conveyors. | 1.0 | 1.1 | 1.2 | 1.1 | 1.2 | 1.3 | | | | |
| Belt conveyors for sand, grain, etc. Dough mixers. Fans over 7.5 kW. Generators. Washing machines. Machine tools. Punching, pressing and shearing machines. Printing machines. Positive displacement rotary pumps. Vibrating and rotary screens. | 1.1 | 1.2 | 1.3 | 1.2 | 1.3 | 1.4 | | | | |
| Brick-making machinery. Bucket elevator. Piston compressors. Screw conveyors. Hammer mills. Hollanders. Piston pumps. Positive displacement blowers. Crushers. Woodworking machinery. Textile machinery. | 1.2 | 1.3 | 1.4 | 1.4 | 1.5 | 1.6 | | | | |
| Gyratory and jaw-roll crushers. Mills (ball/rod). Hoists (heavy loads). Rolling mills, calenders etc. for the rubber and plastics industries. | 1.3 | 1.4 | 1.5 | 1.5 | 1.6 | 1.8 | | | | |

Table 1, Service factor c₁

SELECTION OF BELT SECTION, POINT 2

Diagrams 1-5 provide guidelines for selection of belt section within the selected programme. Consequently, it is often appropriate to make calculations with a different section and programme.

In marginal cases we recommend selecting the closest smaller section, since it is our experience that this gives the best solution, economically as well as technically.

From an overall point of view, we further recommend selecting the largest possible pulley diameter within the limits of the recommended maxi-mum belt speed and the space available. The diagrams are a function of the design power P_D [kW] and the number of revolutions n_1 [rev/min] of the smaller pulley.

Design power $P_D = P_M \times c_1$ [kW]

- P_M = Power consumption of the driven unit in kW or the rated kW of the driving unit.
- c_1 = Service factor, table 1, page 15.

The belt section is found in the intersection of lines drawn from the design power P_D in the left-hand side of the diagrams and the number of re-volutions n_1 on the bottom line. The pulley dia-meter d_d [mm] corresponding to the recom-mended maximum belt speed is shown here, too.

Diagram 1, Programme 10, ROFLEX RE-X narrow V-belts Programme 12, ROFLEX-X narrow V-belts



Diagramme 2, Program 11, ROFLEX narrow V-belts







n₁ [rev/min.] x 100 d_d [mm] x 100



Diagram 4, Programme 16, ROFLEX-X classical V-belts





18

PULLEY DIAMETERS, STANDARD, POINT 4

For further information, please refer to the standards ISO 4183, BS 3790, DIN 2211/1, DIN 2217/1.

The datum designation has not been introduced in some standards.

For further reference, please see the summary on page 57.

The recommended minimum pulley diameter is listed in power rating tables for belt programmes 10, 11, 12, 15, 16 and 17.

As regards the other programmes, this information is listed on the applicable programme in the PRODUCT SPECIFICATIONS

| Classical V-belt sections | Z ZX 10 10X | A AX 13 13X | B BX 17 17X | | 20 | C CX 22 22X | 25 | D 32 | E 40 |
|---------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Narrow V-belt sections | SPZ XPZ | SPA XPA | SPB XPB | S19 | | SPC XPC | | | |
| | 40 50 56 | 50 | | | | | | | |
| | 63 71 80 | 63 71 80 | 80 | | | | | | |
| | 90 100 112 | 90 100 112 | 100 112 | | | | | | |
| | 125 132 | 118 125 132 | 125 | | | | | | |
| | 140 150 160 | 140 150 160 | 140 150 160 | | 140 160 | 140 160 | | | |
| | 180 200 | 180 190 200 | 180 190 200 | 180 190 200 | 180 200 | 180 190 200 | | | |
| | 224 | 224 236 | 224 236 | 212 224 | 224 | 212 224 236 | 224 | | |
| Datum- diameter [mm] | 250 280 300 | 250 280 300 | 250 280 300 | 250 280 | 250 280 | 250 280 300 | 250 280 | 280 | |
| | 315 355 400 | |
| | 450 500 560 |
| | 630 | 630 | 600 630 | 630 | 630 | 600 630 | 630 | 600 630 | 600 630 670 |
| | 800 | 710 800 | 710 750 800 | 710 800 | 710 800 | 710 750 800 | 710 800 | 710 750 800 | 710 800 |
| | | 1000 | 900 1000 1120 |
| | | | 1250 | 1250 1400 | 1250 1400 | 1250 1400 | 1250 1400 | 1250 1400 1500 | 1250 1400 1500 |
| | | | | 1600 1800 2000 | 1600 1800 2000 | 1600 1800 2000 | 1600 1800 2000 | 1600 1800 2000 | 1600 1800 2000 |

Table 2, Standard diameters [mm]

For calculation of PITCH-DIAMETER, see table 2a, page 20.

Table 2a Correction supplement 2b_d [mm]

Pitch-diameter calculation:

Pitch-diameter d_p = datum-diameter d_d + 2 b_d [mm]

| | V-belt section | | | | | | | | | | | | |
|----------------|------------------------------------|------------------------------------|------------------------------------|-----|-----|------------------------------------|-----|---------|---------|--|--|--|--|
| Programme | Z ZX 10 10X SPZ XPZ | A AX 13 13X SPA XPA | B BX 17 17X SPB XPB | S19 | 20 | C CX 22 22X SPC XPC | 25 | D 32 | E 40 | | | | |
| 10, 12, 16, 17 | 0 | 1.7 | 3.2 | | | 5.5 | | | | | | | |
| 11 | -1.4 | 0 | 0 | 1.8 | | 2.5 | | | | | | | |
| 15 | 1.2 | 2.8 | 1.2 | | 2.4 | 4.8 | 3.4 | 4.8 | 3.2 | | | | |

Pulley groove dimensions, see tables 21-22, page 46 - 47.

PULLEY DIAMETERS, standard

The recommended minimum pulley diameter is listed in the power rating table for belt programmes 10, 11 and 12.

When converting the belt section according to the RMA/MPTA standard into SP and XP, then:

 $3V/9N \approx SPZ$ $5V/15N \approx SPB$ $3VX \approx XPZ$ $5VX \approx XPB$ For further information, please refer to the US standard RMA/MPTA IP-22.

| V-belt section | | Effective-diameter d _e [mm] | | | | | | | | | | | | |
|----------------|--------------------|--|--------------------|--------------------|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|------------|--|
| 3V/9N 3VX | 67 140 630 | 71 150 800 | 75 160 850 | 80 165 | 85 175 | 90 200 | 92,5 250 | 100 265 | 103 315 | 112 355 | 118 400 | 125 475 | 132 500 | |
| 5V/15N 5VX | 180 315 1000 | 190 335 1120 | 200 355 1250 | 212 375 1600 | 224 400 1800 | 236 475 | 243 500 | 250 530 | 258 600 | 265 630 | 272 710 | 280 800 | 300 950 | |
| 8V/25N | 315 250 | 335 800 | 355 900 | 375 1000 | 400 1120 | 425 1250 | 450 1320 | 475 1600 | 500 1800 | 530 2000 | 560 2500 | 600 | 630 | |

Table 3 Standard diameters [mm]

Table 3a, Correction reduction 2b_e [mm]

Pitch-diameter calculation:

Pitch-diameter $d_p = effective diameter d_e - 2b_e [mm]$

| Brogramma | V-belt section | | | | | | | | | | | |
|------------|----------------|-----|-----|------|------|------|-----------|--|--|--|--|--|
| Frogramme | 3V | 5V | 8V | HA/A | HB/B | HC/C | HC/C HD/D | | | | | |
| 10, 11, 12 | 3,0 | 4,3 | 9,2 | | | | | | | | | |
| 23*) | -0,8 | 1,5 | 4,1 | -2,4 | 1,4 | 2,3 | 5,9 | | | | | |

*) See programme 23, PRODUCT SPECIFICATION, regarding standards for pulleys.

As regards pulley groove dimensions, see tables 23-25, page 48 - 49.

INSTALLATION AND TAKE-UP ALLOWANCE, POINT 7

To install the belts without damaging them and to maintain the proper belt tension, it must be possible to adjust the centre distance as specified in table 4.

As regards joined V-belts, see table 5, page 22.

The adjustments are guidelines, and they can be used for most drives.

If a specific calculation of x and y is required, these formulas have to be used:

If the centre distance is fixed, an adjustment facility can be established by means of a tension idler, see page 28.



 L_d = Datum belt length [mm] T = Section height [mm] β = Arc of contact [°] π = 3.1416

| | | | | Minimum take-up x [mm] | | | | | | | | | |
|---|--|---------------------------------------|----------------|---------------------------|------------------------|-------------------|----------------------|-----------------------|------------------------|------------------------|-------------------------|----------------|--------------------------|
| Datum belt length L _d [mm] | | SPZ XPZ 3V A/13 AX 13X | SPA XPA | SPB XPB 5V 20 | SPC XPC | Z/10 ZX 10X | B/17 BX 17X | C/22 CX 22X | 25 S19 | D/32 | E/40 | 8V | All sections |
| > > | ≤ 670 670 - 1000 1000 - 1320 | 16 18 19 | 19 21 22 | 27 | | 13 14 16 | 20 21 23 | 27 29 | | | | 43 | 10 10 13 |
| > > > | 1320 - 1662 1662 - 2240 2240 - 3000 | 21 24 28 | 24 27 31 | 29 32 35 | 39 43 | 18 21 24 | 25 28 31 | 30 33 37 | 36 40 | 41 45 | | 44 47 51 | 17 22 30 |
| > > > | 3000 - 3550 3550 - 4500 4500 - 5600 | 30 35 41 | 33 38 44 | 38 43 48 | 46 51 56 | 27 32 37 | 34 39 44 | 40 44 50 | 43 48 53 | 48 52 58 | 62 67 | 54 59 64 | 36 45 56 |
| > > > | 5600 - 6700 6700 - 8500 8500 - 10000 | 46 55 | | 54 63 70 | 62 71 78 | | 50 59 66 | 55 64 72 | 59 68 75 | 63 72 80 | 73 82 89 | 70 79 86 | 67 85 100 |
| > > > > | 10000 - 11800 11800 - 13500 13500 - 15000 15000 - 16100 | | | 79 88 95 101 | 87 96 103 109 | | 75 84 91 97 | 81 89 97 102 | 84 93 103 106 | 89 97 105 110 | 98 107 114 120 | 95 | 118 135 150 160 |

Table 4 ROFLEX V-belts programmes 10, 11, 12, 15, 16, 17.

Table 5 ROFLEX joined V-belts, programme 23.

| Effective belt length L _e [mm] | | | Μ | Minimum take-up x [mm] | | | | | |
|---|--|----------|----------------------|---------------------------|-------------------|----------------|----------------|-------------------|-------------------|
| | | HA/A | HB/B HC/C HD/D 3V/9J | | 5V/15J | 8V/25J | All sections | | |
| > > | 1100 ≤ 2240 2240 - 3550 3550 - 4500 | 36 43 | 46 53 58 | 55 62 67 | | 36 43 48 | 59 64 | | 22 36 45 |
| > | 4500 - 5600 5600 - 6700 6700 - 8500 | | 63 69 78 | 72 78 87 | 88 94 103 | 53 | 69 75 84 | 100 106 115 | 56 67 85 |
| > > > | 8500 - 10000 10000 - 11800 11800 - 13500 | | | | 110 119 128 | | | 122 131 140 | 100 118 135 |
| > | 13500 - 15000 15000 - 16000 | | | | 135 140 | | | 147 152 | 150 160 |

The adjustments in table 5 are guidelines. If a specific calculation of x and y is required, use these formulas:

$$x = \frac{0.01 \times L_e}{\sin \frac{\beta}{2}} \quad [mm]$$

$$y = \frac{0,005 \times L_{e} + \pi \times T}{\sin \frac{\beta}{2}} \quad [mm]$$

 L_e = Effective belt length [mm] T = Section height [mm]

$$\beta$$
 = Arc of contact [°]

 $\pi = 3,1416$



BELT LENGTH CORRECTION FACTOR c_2 , POINT 11

The length factor c_2 expresses the deflection frequency which the V-belt is subjected to when passing over the pulleys.

The table values for power rating P_N [kW] per belt are based on a reference or basic belt length.

Where belt lengths differ from that length, the deflection frequency and thus also the factor c_2 are changed.

The reference length is listed against $c_2 = 1.00$.

| | Narrow V-belts | | | | | | | Classical V-belts | | | | | | | | |
|----------------------|-------------------------|------------|----------------------------|----------------------------|-------|----------------------------|-------------------------|-------------------------|-------------------------|-------------------------|----------------------------|----------------------------|----------------------------|----------------------------|--|--|
| с ₂ | SPZ XPZ 3V 3VX | SPA XPA | SPB XPB 5V 5VX | SPC XPC | S19 | 8V | Z/10 ZX 10X | A/13 AX 13X | B/17 BX 17X | 20 | C/22 CX 22X | 25 | D/32 | E/40 | | |
| 0.80 | 465 | 551 | 915 | 1.453 | 1.622 | 1.653 | 297 | 666 | 875 | 1.216 | 1.448 | 1.735 | 2.320 | 2.578 | | |
| 0.81 | 496 | 695 | 977 | 1.551 | 1.241 | 1.765 | 312 | 700 | 920 | 1.279 | 1.523 | 1.824 | 2.440 | 2.712 | | |
| 0.82 | 529 | 741 | 1.042 | 1.655 | 1.324 | 1.883 | 328 | 736 | 967 | 1.345 | 1.601 | 1.918 | 2.565 | 2.851 | | |
| 0.83 | 565 | 791 | 1.112 | 1.765 | 1.412 | 2.008 | 345 | 774 | 1.017 | 1.414 | 1.683 | 2.016 | 2.697 | 2.997 | | |
| 0.84 | 602 | 843 | 1.185 | 1.881 | 1.505 | 2.141 | 362 | 813 | 1.069 | 1.486 | 1.769 | 2.119 | 2.834 | 3.150 | | |
| 0.85 | 642 | 898 | 1.263 | 2.005 | 1.604 | 2.282 | 381 | 854 | 1.123 | 1.561 | 1.859 | 2.227 | 2.978 | 3.310 | | |
| 0.86 | 684 | 957 | 1.346 | 2.136 | 1.709 | 2.431 | 400 | 897 | 1.179 | 1.640 | 1.953 | 2.339 | 3.128 | 3.477 | | |
| 0.87 | 728 | 1.019 | 1.433 | 2.275 | 1.820 | 2.589 | 420 | 943 | 1.239 | 1.722 | 2.051 | 2.457 | 3.286 | 3.652 | | |
| 0.88 | 775 | 1.085 | 1.526 | 2.422 | 1.938 | 2.756 | 441 | 990 | 1.301 | 1.809 | 2.154 | 2.580 | 3.450 | 3.835 | | |
| 0.89 | 825 | 1.155 | 1.624 | 2.577 | 2.062 | 2.933 | 463 | 1.039 | 1.366 | 1.899 | 2.261 | 2.708 | 3.622 | 4.026 | | |
| 0.90 | 877 | 1.228 | 1.727 | 2.742 | 2.194 | 3.120 | 486 | 1.091 | 1.433 | 1.993 | 2.373 | 2.842 | 3.802 | 4.225 | | |
| 0.91 | 933 | 1.306 | 1.837 | 2.916 | 2.333 | 3.319 | 510 | 1.144 | 1.504 | 2.091 | 2.490 | 2.983 | 3.989 | 4.434 | | |
| 0.92 | 992 | 1.389 | 1.953 | 3.100 | 2.480 | 3.528 | 535 | 1.201 | 1.578 | 2.194 | 2.613 | 3.129 | 4.185 | 4.652 | | |
| 0.93 | 1.054 | 1.476 | 2.075 | 3.295 | 2.636 | 3.749 | 561 | 1.260 | 1.655 | 2.302 | 2.741 | 3.283 | 4.390 | 4.880 | | |
| 0.94 | 1.120 | 1.568 | 2.205 | 3.500 | 2.800 | 3.984 | 589 | 1.321 | 1.735 | 2.414 | 2.874 | 3.443 | 4.604 | 5.118 | | |
| 0.95 | 1.190 | 1.666 | 2.342 | 3.718 | 2.974 | 4.231 | 617 | 1.385 | 1.820 | 2.581 | 3.014 | 3.610 | 4.828 | 5.366 | | |
| 0.96 | 1.263 | 1.768 | 2.487 | 3.947 | 3.158 | 4.492 | 647 | 1.452 | 1.908 | 2.653 | 3.159 | 3.784 | 5.061 | 5.625 | | |
| 0.97 | 1.341 | 1.877 | 2.639 | 4.190 | 3.352 | 4.768 | 678 | 1.522 | 2.000 | 2.781 | 3.311 | 3.966 | 5.304 | 5.895 | | |
| 0.98 | 1.423 | 1.992 | 2.801 | 4.445 | 3.555 | 5.069 | 711 | 1.595 | 2.095 | 2.914 | 3.470 | 4.156 | 5.558 | 6.178 | | |
| 0.99 | 1.509 | 2.112 | 2.971 | 4.715 | 3.772 | 5.366 | 745 | 1.671 | 2.195 | 3.053 | 3.635 | 4.354 | 5.823 | 6.473 | | |
| 1.00 | 1.600 | 2.240 | 3.150 | 5.000 | 4.000 | 5.690 | 780 | 1.750 | 2.300 | 3.198 | 3.808 | 4.561 | 6.100 | 6.780 | | |
| 1.01 | 1.695 | 2.375 | 3.339 | 5.300 | 4.240 | 6.032 | 817 | 1.833 | 2.409 | 3.349 | 3.956 | 4.777 | 6.368 | 7.101 | | |
| 1.02 | 1.797 | 2.516 | 3.539 | 5.617 | 4.494 | 6.392 | 855 | 1.919 | 2.522 | 3.507 | 4.176 | 5.002 | 6.689 | 7.435 | | |
| 1.03 | 1.904 | 2.666 | 3.749 | 5.951 | 4.761 | 6.772 | 895 | 2.009 | 2.640 | 3.671 | 4.372 | 5.236 | 7.003 | 7.783 | | |
| 1.04 | 2.017 | 2.823 | 3.971 | 6.302 | 5.042 | 7.172 | 937 | 2.103 | 2.764 | 3.843 | 4.576 | 5.481 | 7.330 | 8.147 | | |
| 1.05 | 2.135 | 2.989 | 4.204 | 6.673 | 5.338 | 7.594 | 981 | 2.201 | 2.892 | 4.021 | 4.788 | 5.735 | 7.671 | 8.526 | | |
| 1.06 | 2.260 | 3.164 | 4.450 | 7.063 | 5.651 | 8.038 | 1.026 | 2.302 | 3.026 | 4.208 | 5.010 | 6.001 | 8.026 | 8.920 | | |
| 1.07 | 2.392 | 3.348 | 4.709 | 7.474 | 5.979 | 8.505 | 1.074 | 2.409 | 3.166 | 4.402 | 5.241 | 6.278 | 8.396 | 9.332 | | |
| 1.08 | 2.530 | 3.542 | 4.981 | 7.907 | 6.325 | 8.998 | 1.123 | 2.519 | 3.311 | 4.604 | 5.482 | 6.566 | 8.781 | 9.760 | | |
| 1.09 | 2.676 | 3.746 | 5.268 | 8.362 | 6.689 | 9.516 | 1.174 | 2.634 | 3.452 | 4.814 | 5.732 | 6.866 | 9.183 | 10.206 | | |
| 1.10 | 2.829 | 3.961 | 5.570 | 8.841 | 7.073 | 10.061 | 1.228 | 2.754 | 3.620 | 5.033 | 5.994 | 7.179 | 9.601 | 10.671 | | |
| 1.11 | 2.990 | 4.186 | 5.887 | 9.344 | | 10.634 | 1.283 | 2.879 | 3.784 | 5.262 | 6.265 | 7.504 | 10.036 | 11.155 | | |
| 1.12 | 3.160 | 4.424 | 6.221 | 9.874 | | 11.237 | 1.341 | 3.009 | 3.955 | 5.499 | 6.548 | 7.843 | 10.490 | 11.659 | | |
| 1.13 | 3.338 | 4.673 | 6.572 | 10.431 | | 11.871 | 1.402 | 3.145 | 4.133 | 5.747 | 6.843 | 8.196 | 10.962 | 12.184 | | |
| 1.14 | 3.525 | 4.935 | 6.940 | 11.016 | | 12.537 | 1.464 | 3.286 | 4.318 | 6.004 | 7.150 | 8.563 | 11.483 | 12.730 | | |
| 1.15 | 3.722 | 5.211 | 7.328 | 11.632 | | 13.237 | 1.530 | 3.432 | 4.511 | 6.272 | 7.469 | 8.945 | 11.964 | 13.298 | | |
| 1.16 1.17 1.18 | 3.929 4.146 4.374 | 5.500 | 7.735 8.163 8.612 | 12.278 12.957 13.669 | | 13.972 14.745 15.556 | 1.598 1.669 1.742 | 3.585 3.744 3.909 | 4.711 4.920 5.137 | 6.551 6.841 7.143 | 7.801 8.146 8.505 | 9.343 9.757 10.187 | 12.496 13.049 13.624 | 13.889 14.504 15.143 | | |
| 1.19 1.20 1.21 | 4.614 4.865 5.129 | | 9.083 9.578 10.097 | 14.417 15.203 16.027 | | 16.407 | 1.819 1.898 1.981 | 4.080 4.259 4.444 | 5.363 5.597 5.841 | 7.456 7.783 8.122 | 8.879 9.267 9.671 | 10.634 11.100 11.583 | 14.223 14.845 15.492 | 15.808 16.500 | | |
| 1.22 1.23 1.24 | 5.405 5.695 6.000 | | 10.641 11.213 11.812 | 15.551 | | | 2.067 2.155 2.249 | 4.667 4.838 5.046 | 6.095 6.358 6.632 | 6.474 8.841 9.221 | 10.091 10.527 10.980 | 12.035 12.609 13.152 | 15.164 15.863 | | | |

Table 6 Belt length correction factor c_2

ARC OF CONTACT CORRECTION FACTOR c₃, POINT 12

The V-belt power rating P_N [kW/belt] is based on a 180° arc of contact. If the arc of contact is smaller, the power transmission capability is reduced and P_N is adjusted by multiplying the read table value by factor c_3 .

Correction factor c_3 is listed in table 7

- for wrapped V-belts, programmes 11, 15.
- for raw-edge V-belts, programmes 10, 12, 16, 17.



D_d = Datum-diameter of larger V-belt pulley [mm]

d_d = Datum-diameter of smaller V-belt pulley [mm]

 β = Arc of contact on smaller V-belt pulley [°]

For those drives in which effective-diameters $\rm D_e/\rm d_e$ [mm] are used, these values must be used in the calculations.

| $\frac{D_d - d_d}{C}$ | 0.00 | 0.10 | 0.20 | 0.30 | 0.40 | 0.50 | 0.60 | 0.70 | 0.80 | 0.90 | 1.00 | 1.10 | 1.20 | 1.30 | 1.40 | 1.50 |
|---------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Angle β [°] | 180 | 174 | 169 | 163 | 157 | 151 | 145 | 139 | 133 | 127 | 120 | 113 | 106 | 99 | 91 | 83 |
| c ₃ , wrapped | 1.00 | 0.99 | 0.99 | 0.98 | 0.98 | 0.97 | 0.96 | 0.95 | 0.94 | 0.92 | 0.91 | 0.89 | 0.87 | 0.85 | 0.82 | 0.78 |
| c ₃ , raw-edge | 1.00 | 1.00 | 0.99 | 0.99 | 0.99 | 0.98 | 0.98 | 0.97 | 0.97 | 0.96 | 0.95 | 0.94 | 0.92 | 0.90 | 0.88 | 0.85 |

Table 7, Arc of contact correction factor c_3 .

BELT TENSION, POINT 14

It is essential to the operation and life of V-belts that they are installed with the necessary tension and that this tension is maintained.

Excessive belt tension results in poorer efficiency and an increased, unnecessary load on the belt. This means shorter belt life and extra load on shaft bearings etc.

Insufficient belt tension reduces the power transmission capability. Any slip between belt profile and pulley groove causes extra wear of the belt edges and increased heat build-up in the belts. This means faster destruction of the belts and thus too short life. We therefore recommend calculating the necessary static belt tension $\rm T_{stat}$ according to the following formula:

$$T_{stat} = 500 \times k_1 \times \frac{P_M}{z \times v} + k_2 \times v^2$$
 [N/belt]

- k_1 = Tension factor, table 8.
- k₂ = Factor for centrifugal force [kg/m], table 9, page 23.
- P_M = Power consumption or rated output of the motor [kW]
- z = Number of V-belts
- v = Belt speed [m/s]

When installing new belts, we recommend a belt tension of $1.3 \times T_{stat}$ in order to compensate for the initial belt tension drop which occurs during the first hours of operation.

The belt tension should then be checked periodically, see the section on installation and maintenance, page 34 - 38.

| | Progra | ammes 10, 12, | 16, 17 | Programmes 11, 15, 20, 23 Operating conditions | | | | | |
|-------|---|-----------------------------|--|---|-----------------------------|--|--|--|--|
| | Оре | erating conditi | ons | | | | | | |
| β [°] | Light drives Constant load k ₁ | Mean load k ₁ | Heavy drives Shock load k ₁ | Light drives Constant load k ₁ | Mean load k ₁ | Heavy drives Shock load k ₁ | | | |
| 180 | 1.50 | 1.73 | 2.03 | 1.50 | 1.73 | 2.03 | | | |
| 175 | 1.51 | 1.73 | 2.03 | 1.51 | 1.74 | 2.04 | | | |
| 170 | 1.51 | 1.74 | 2.04 | 1.52 | 1.75 | 2.06 | | | |
| 165 | 1.52 | 1.75 | 2.05 | 1.54 | 1.77 | 2.08 | | | |
| 160 | 1.53 | 1.75 | 2.06 | 1.55 | 1.79 | 2.10 | | | |
| 155 | 1.53 | 1.76 | 2.07 | 1.57 | 1.80 | 2.12 | | | |
| 150 | 1.54 | 1.77 | 2.08 | 1.59 | 1.83 | 2.14 | | | |
| 145 | 1.55 | 1.79 | 2.10 | 1.61 | 1.85 | 2.17 | | | |
| 140 | 1.57 | 1.80 | 2.12 | 1.63 | 1.88 | 2.20 | | | |
| 135 | 1.58 | 1.82 | 2.13 | 1.66 | 1.90 | 2.24 | | | |
| 130 | 1.60 | 1.84 | 2.16 | 1.68 | 1.94 | 2.27 | | | |
| 125 | 1.62 | 1.86 | 2.18 | 1.72 | 1.97 | 2.32 | | | |
| 120 | 1.64 | 1.88 | 2.21 | 1.75 | 2.01 | 2.36 | | | |
| 115 | 1.66 | 1.91 | 2.24 | 1.79 | 2.06 | 2.42 | | | |
| 110 | 1.69 | 1.94 | 2.28 | 1.83 | 2.11 | 2.48 | | | |
| 105 | 1.72 | 1.98 | 2.32 | 1.88 | 2.17 | 2.54 | | | |
| 100 | 1.75 | 2.02 | 2.37 | 1.94 | 2.23 | 2.62 | | | |
| 95 | 1.80 | 2.07 | 2.43 | 2.00 | 2.30 | 2.70 | | | |
| 90 | 1.85 | 2.12 | 2.49 | 2.08 | 2.39 | 2.80 | | | |

Table 8 Tension factor k₁

| D | Belt section | | | | | | | | | | | | |
|-----------|--------------|--------|--------|--------|-------|--------|--------|-------|-------|-------|--|--|--|
| Programme | XPZ | XPA | ХРВ | XPC | SPZ | SPA | SPB | S19 | SPC | 8V | | | |
| 10 | 0.065 | 0.105 | 0.190 | 0.325 | | | | | | | | | |
| 11 | | | | | 0.065 | 0.115 | 0.200 | 0.275 | 0.350 | 0.520 | | | |
| 12 | 0.060 | 0.100 | 0.180 | 0.320 | | | | | | | | | |
| | ZX/10X | AX/13X | BX/17X | CX/22X | | | | | | | | | |
| 16 | 0.055 | 0.080 | 0.165 | 0.250 | | | | | | | | | |
| 17 | 0.060 | 0.090 | 0.180 | 0.255 | | | | | | | | | |
| | Z/10 | A/13 | B/17 | 20 | C/22 | 25 | 32 | D/32 | E/40 | | | | |
| 15 | 0.058 | 0.104 | 0.172 | 0.239 | 0.282 | 0.366 | | 0.591 | 0.958 | | | | |
| 20 | | 0.104 | 0.172 | 0.239 | 0.282 | 0.366 | 0.519 | 0.591 | | | | | |
| | HA/A | HB/B | HC/C | HD/D | 3V/9J | 5V/15J | 8V/25J | | | | | | |
| 23 | 0.154 | 0.237 | 0.406 | 0.750 | 0.095 | 0.250 | 0.637 | | | | | | |

Table 9 Factor for centrifugal force k₂ [kg/m]

CHECKING THE BELT TENSION

When the V-belt set has been installed, the belt tension can be checked in the following, simple way, which provides adequate security that the belt tension is correct.

Apply a calculated force K at the centre of the span I. This force shall be sufficient for deflecting the belt 15 mm per 1000 mm of span. K must be applied perpendicularly to the belt.

 $K = 0.06 \text{ x } T_{\text{stat}} [N]$

K = Deflection force per belt [N]

 T_{stat} = Static tension per belt [N], see page 25.



Span length of belt I [mm]

$$I = C \times \sin \frac{\beta}{2} \quad [mm]$$

C = Centre distance [mm]

Deflection σ [mm]

$$\sigma = \frac{I \times 15}{1000} [mm]$$

A practical procedure for checking the belt tension is shown in the section "Installation", page 34.

JOINED V-BELTS

The method with the deflection force and deflection of a belt cannot be used for checking the belt tension of joined V-belts.

We recommend using the following procedure which is based on an elastic belt extension corresponding to the static belt tension T_{stat} .

1. The joined V-belt is installed on the pulleys and stretched so slightly that in reality it has no tension.

2. The belt length L is measured with a tape measure placed on the outside of the belt. Then the necessary belt extension is calculated - length correction L_k - to achieve the proper belt tension.

The length correction L_k is calculated according to the following principle:

$$L_{k} = \frac{T_{stat} \times L}{C_{k}} \text{ [mm]}$$

 $T_{stat} = Static tension per belt [N], see page 25$

- L = Measured outside belt length [mm]
- c_k = Extension factor, see table 10

Tabel 10 Extension factor c_k

| Belt section | C _k |
|----------------|----------------|
| HA/A | 53.000 |
| HB/B | 75.000 |
| HC/C | 104.000 |
| HD/D | 161.000 |
| 3V/9J | 37.000 |
| 5V/15 | 75.000 |
| 8V/25 J | 127.000 |

The outside belt length L_a in tensioned condition is calculated as follows:

 $L_a = L + L_k [mm]$

4. Then tension the belt until it has reached the calculated outside length L_a [mm]

Subsequent periodic checking of the belt tension is carried out by slackening the belt until it is without tension, point 1. Then follow the procedure as described in points 2 - 4.

SHAFT LOAD, POINT 15

Based on the necessary belt tension, the static and dynamic shaft loads can be calculated according to the following formulas:

Static shaft load S_{stat} [N]

$$S_{\text{stat}} = 2 \times z \times T_{\text{stat}} \times \sin \frac{\beta}{2}$$
 [N]

z = Number of V-belts

T_{stat} = Static belt tension [N], see page 86

 β = Arc of contact [°] on smaller pulley Table 7, page 24.

Dynamic shaft load S_{dyn} [N]

$$S_{dyn} = 707 \times \frac{P_{M}}{V} \sqrt{k_{1}^{2} + 1 - (k_{1}^{2} - 1) \cos \beta} [N]$$

- P_M = Power consumption or rated output of the motor [kW]
- v = Belt speed [m/s]
- k_1 = Tension factor, table 8, page 25.
- β = Arc of contact [°] on smaller pulley Table 7, page 24.

The dynamic shaft load is used for dimensioning shafts and bearings.



 T_1 = Effective belt force in tight belt part [N]

T₂ = Effective belt force in slack belt part [N]

S_{dyn} = Dynamic shaft load [N]

DRIVES WITH TENSIONING IDLER, POINT 16

It may be necessary to install an additional idler or tensioning idler on V-belt drives for several reasons, for example where you have:

FIXED CENTRE DISTANCE

An adjustable tensioning idler has to provide the retensioning facility necessary for installing V-belts and securing the tension.

DESIGN DETAILS

The V-belts can be guided around fixed structural parts of the machine by means of an idler.

LARGE CENTRE DISTANCE

By applying a slight pressure an idler is able to damp any vibrations in the slack belt part which ensures that the V-belts do not keel over when entering the groove of the driven pulley.

SMALL ARC OF CONTACT

The arc of contact can be increased by means of an outside idler, thereby reducing the risk of slippage.

NONPARALLEL SHAFTS

Proper entry into the pulley groove can be ensured by means of a tensioning idler or guide idler.

COUPLING FEATURE

The drive can be engaged or disengaged by means of an idler system which establishes the belt tension with springs or hydraulics.

With extremely varying loads, such a system is also able to safeguard against overloading of the drive and machine parts.

An idler will apply additional load to the belts and should be omitted if technically possible.

The following principal rules are recommended for the placing of an idler system:

The idler should act on the "slack" part of the belt drive, if possible. This will reduce the load on the idler system and the belts to a minimum.

This means that tensioning idlers should not be used in reversible drives.



An inside idler for belt types within programmes 10, 11, 12, 16 and 17 should be constructed as a V-belt pulley. For programmes 15, 20, 21 and 23 it may be constructed as a flat pulley.

However, a V-belt pulley should always be used for drives with a large centre distance in order to achieve lateral control of the V-belts.

An inside idler reduces the arc of contact on the pulleys. We recommend that it be placed such that it produces the same arc of contact on both pulleys regardless of how it is set within its adjustment range.



An outside idler may be constructed as a flat pulley with a cylindrical face. It increases the arc of contact on the pulleys but the possibility of retensioning is often limited, and the take-up allowance should therefore be checked in relation to tables 4-5, page 21 - 22.

The idler should be placed with the greatest possible distance Ca from the pulley where the belts are running in. The reason for this is that a flat pulley does not control the V-belts laterally, which may result in sidewards tracking.

DIAMETER OF IDLERS

The diameter of an inside idler must as a minimum be equal to the diameter of the smaller pulley in the drive.

The diameter of an outside idler must as a minimum be $1.4 \times$ the diameter of the smaller pulley.

We recommend using a diameter larger than the stated minimum if that is technically possible. This will reduce the extra load always applied by the idlers to the V-belts.

IDLER CONSTRUCTION

Inside idlers with grooves should be made in accordance with the applicable standard for V-belt pulleys, see tables 21 - 25, page 46 - 49.

An outside or inside idler constructed as a flat pulley must have a cylindrical face, i.e. not convex.

From a technical point of view, the drive will often operate better if idlers with flanges are used. Any rounding between flanges and face must be avoided, since that may cause the belts to pull up the sides of the flanges and capsize.



Distance between flanges bs [mm]

 $b_s = 1.5 \times \text{top width of V-belt profile + width of pulley B [mm].}$

as regards the V-belt sections D/32 and E/40:

b_s = 1.3 x top width of V-belt profile + width of pulley B [mm].

CALCULATION OF DRIVE Belt length

It will usually be necessary to calculate the belt length according to a drawing of the drive.

Check that the idler movement provides the adjustment facility necessary for installation and take-up allowance, see tables 4 and 5 on page 21 - 22.

Correction factor for idler c₄

An idler will have a negative influence on V-belt life. To compensate for that, the correction factor c_4 is inserted into the formula for calculating the required number of belts.

Table 11 Correction factor for idler c₄

| Number | C4 | | | |
|-----------|------|--|--|--|
| of idlers | | | | |
| 1 | 0.91 | | | |
| 2 | 0.86 | | | |
| 3 | 0.81 | | | |

The number of V-belts is then calculated as follows:

$$z = \frac{P_{M} \times c_{1}}{P_{N} \times c_{2} \times c_{3} \times c_{4}}$$

For further information, see point 13, page 8.

DRIVES WITH NONPARALLEL SHAFTS, POINT 17

are also termed turned drives.

When the following guidelines are observed, this type of drive operates well but shorter belt life relative to a traditional drive must be expected.

Our technical department gives advice on design, dimensioning and, if necessary, selection of special belts which have been designed to absorb the extra loads.



Drives with 30 - 90° angle between the shafts.

1. Minimum centre distance C [mm] At $\varphi = 90^{\circ}$

 $C \text{ min.} = 5,5 (D_d + B) \text{ [mm]}$

 $\begin{array}{ll} At \ \phi & = 45^{\circ} \\ C \ min. \ = 4 \ (D_{d} + B) \ \ [mm] \end{array}$

At $\phi = 30^{\circ}$ C min. = 3 (D_d + B) [mm]

D_d = Datum-diameter of larger pulley [mm]

B = Width of pulley [mm]

2. The speed ratio i

should not exceed i = 2.5. If a greater speed ratio is required, the power has to be transmitted in two stages, e.g. first a traditional drive and then a turned.

3. Height difference h [mm]

The centre line of the horizontal shaft must be h [mm] higher than the centre line of the pulley on the vertical shaft.

The size of h is changed in relation to the centre distance C, see table 12.

Table 12

| Centre distance C [mm] | Classical V-belts h [mm] | Narrow V-belts h [mm] | | |
|---------------------------|--------------------------------|-----------------------------|--|--|
| - 1500 | 5 | 3 | | |
| 1501 - 2000 | 10 | 8 | | |
| 2001 - 2500 | 15 | 10 | | |
| 3001 - 3500 | 30 | 20 | | |
| 3501 - 4000 | 35 | 25 | | |
| 4001 - 4500 | 45 | 35 | | |
| 4501 - 5000 | 60 | 40 | | |
| 5001 - 5500 | 70 | 50 | | |
| 5501 - 6000 | 85 | 55 | | |

4. Direction of rotation

The direction of rotation is selected such that the tight belt part is at the bottom of the drive.

5. Pulleys

Both pulleys must be with grooves according to standard, see tables 21 - 25 on page 46 - 49.

For drives with a single V-belt, we recommend using deep groove pulleys, see table 22, page 47.

6. Calculation

The calculation of the drive follows the procedure described in points 1-15, page 5 - 8.

FULLY TURNED DRIVE, POINT 18

The shafts are parallel and the V-belt turned 180°, thereby producing a reversal of the direction of rotation of one of the shafts.



The following guidelines should be followed when establishing a fully turned V-belt drive.

1. Minimum length of belt part I [mm]

I min. = $6 \times (D_d + B)$ [mm]

- D_d = Datum-diameter of larger pulley [mm]
- B = Width of pulley [mm], tables 21 25, page 46 49.

2. Guide idler

To avoid mutual wear where the two belt parts are crossing each other, a guide idler can be installed on the slack belt part near the point of intersection.

Raw-edge belt types with inside cogging must be turned such that the belt top of the two belt parts are facing each other.

3. Calculation of drive

follows the procedure described on page 5 - 8, with the exception of point 6, belt length, which is calculated as follows:

$$L_d = 2 \times C + 1,57 (D_d + d_d) + \frac{(D_d + d_d)^2}{4 \times C} [mm]$$

V-FLAT DRIVES, POINT 19

This type of drive is used when it is desirable to change a flat belt drive into a V-belt drive, because it is often most economical to retain the flat pulley which is also serving as flywheel in many cases. Moreover, it could be advantageous to use this type of drive in new constructions, because of the cost of manufacturing large V-belt pulleys.

The following ROFLEX programmes can be used for V-FLAT drives:

15 Classical V-belts 20 - -21 Double V-belts 23 Joined V-belts.

As regards programmes 20 and 21, please contact our technical department.

Narrow V-belts should not be used because of the relatively small bottom width of the belt sections, which may result in the V-belts capsizing. However, this does not apply to joined V-belts in programme 23.

A V-FLAT drive does not exploit the power transmission capability of the belts as a drive with two V-belt pulleys. Special conditions and factors therefore need to be included in the calculations.

The following guidelines must be observed to ensure an efficient, functional drive.

- The smaller pulley must be a V-belt pulley with grooves according to standard, see tables 21, 24 and 25, page 46 and 49, or a deep-groove pulley, see table 22 on page 47.
- 2. The flat pulley must have a straight/cylindrical belt face.
- 3. The speed ratio must be at least i = 3.

$$i = \frac{n_1}{n_2} = \frac{D_{FP}}{d_p} \ge 3$$

- n₁ = Number of revolutions of smaller pulley [rev/min].
- n₂ = Number of revolutions of larger pulley [rev/min].



 D_{FP} = Calculated pitch-diameter of the flat pulley [mm], see page 32.

d_p = Pitch-diameter of V-belt pulley [mm].

4. Centre distance C to be selected within the following limits, as determined by the speed ratio.

at i \leq 5, C = 1,2 (D_F - d_d) [mm]

at i > 5, $C = D_F [mm]$

D_F = Diameter of flat pulley [mm]

d_d = Datum-diameter of V-belt pulley [mm]

5. At the same time ratio $\frac{D_{Fp} - d_p}{C}$ should be within 0,5 - 1,17.

As regards D_{Fp} and d_p , see point 3.

The optimal ratio is 0.85.

 The width of the flat pulley's belt face, B_F, should as a minimum be as specified in table 15, page 32.

> When the preconditions 1 - 6 have been satisfied, the V-FLAT drive is calculated as described on page 6 - 8, with the exception of:

- Point 4, As regards the flat pulley, D_F, the calculation diameter is determined as shown on page 32.
- Point 6, Belt length; see page 33.
- Point 12, As regards the arc of contact correction factor, use factor c_5 , table 16, page 33.

CALCULATION DIAMETRES OF FLAT PULLEY



Calculated diameters are determined with a supplement to D_F according to tables 13 - 14.

| Datum-diameter | $D_{FD} = D_F + D_{td} [mm]$ |
|--------------------|--------------------------------------|
| Pitch-diameter | $D_{FP} = D_F + D_{tp} [mm]$ |
| Effective-diameter | $D_{FE} = D_F + D_{te} \text{ [mm]}$ |

Table 13, Programme 15

| Belt section | Z/10 | A/13 | B/17 | 20 |
|-----------------|------|------|------|------|
| D_{td} | 7 | 10 | 14 | 16 |
| D_{tp} | 8 | 12 | 15 | 18 |
| Belt section | C/22 | 25 | D/32 | E/40 |
| D _{td} | 21 | 20 | 22 | 27 |
| lu | 21 | 20 | 22 | 21 |

Table 14, Programme 23

| Belt section | HA/A | HB/B | HC/C | HD/D |
|-----------------|-------|--------|--------|------|
| D _{tp} | 12 | 14 | 18 | 24 |
| D _{te} | 10 | 16 | 22 | 30 |
| Belt section | 3V/9J | 5V/15J | 8V/25J | |
| D _{tp} | 13 | 21 | 36 | |
| D _{te} | 12 | 23 | 40 | |

Example, Programme 15

 D_F = 1200 mm, belt section C/22 D_{FP} = 1200 + 26 = 1226 mm.

V-BELT PULLEY

Calculation of pitch-diameter, see table 2a and 3a, page 20.

Table 15 Flat pulley, minimum width of belt face B_F [mm]

| Programme | Belt section | | Supplement per extra | | | | | | | | | |
|-----------|--------------|-----|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|--------------|
| No. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | belt [mm] |
| 15 | Z/10 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 | 12 |
| 15 | A/13 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 160 | 165 | 180 | 15 |
| 15 | B/17 | 55 | 74 | 93 | 112 | 131 | 150 | 169 | 189 | 207 | 226 | 19 |
| 15 | 20 | 65 | 88 | 111 | 134 | 157 | 180 | 203 | 226 | 249 | 272 | 23 |
| 15 | C/22 | 74 | 99 | 126 | 151 | 177 | 202 | 228 | 253 | 279 | 304 | 25.5 |
| 15 | 25 | 83 | 112 | 141 | 170 | 199 | 228 | 257 | 286 | 315 | 344 | 29 |
| 15 | D/32 | 98 | 135 | 172 | 209 | 246 | 283 | 320 | 357 | 394 | 431 | 37 |
| 15 | E/40 | 118 | 162 | 207 | 251 | 296 | 340 | 385 | 429 | 474 | 508 | 44.5 |
| 23 | HA/A | | 60 | 76 | 92 | 108 | 124 | 139 | 155 | 171 | 187 | 15.88 |
| 23 | HB/B | | 72 | 91 | 110 | 129 | 148 | 167 | 186 | 205 | 224 | 19.05 |
| 23 | HC/C | | 97 | 123 | 148 | 174 | 199 | 224 | 250 | 275 | 301 | 25.4 |
| 23 | HD/D | | 133 | 169 | 206 | 242 | 279 | 315 | 352 | 388 | 425 | 36.53 |
| 23 | 3V/9J | | 53 | 64 | 74 | 84 | 95 | 105 | 115 | 125 | 136 | 10.3 |
| 23 | 5V/15J | | 79 | 96 | 114 | 131 | 149 | 166 | 184 | 201 | 218 | 17.5 |
| 23 | 8V/25J | | 117 | 145 | 174 | 202 | 231 | 260 | 288 | 317 | 345 | 28.6 |

ARC OF CONTACT CORRECTION FACTOR c5

The correction factor for the arc of contact on the smaller pulley differs from that used for drives with two V-belt pulleys.

The correction factor c_5 for a V-FLAT drive is listed in table 16 and has to be inserted into the formula in point 13 page 8 instead of factor c_3 .

The calculation diameter of the flat pulley is $D_{FD} = D_F + D_{td}$, see table 13.

The following formula is used for joined V-belts:

 $\frac{\mathsf{D}_{\mathsf{FE}}-\mathsf{d}_{\mathsf{e}}}{\mathsf{C}}$

 $D_{FE} = D_F + D_{te}$ [mm], see table 14. d_e = Effective-diameter of V-belt pulley [mm]



Table 16, Arc of contact correction factor c_5 .

| D _{FD} - d _d C | 0.00 | 0.10 | 0.20 | 0.30 | 0.40 | 0.50 | 0.60 | 0.70 | 0.80 | 0.90 | 1.00 | 1.10 | 1.20 | 1.30 | 1.40 |
|---------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Arc of contact β [°] | 180 | 174 | 169 | 163 | 157 | 151 | 145 | 139 | 133 | 127 | 120 | 113 | 105 | 99 | 91 |
| с ₅ | 0.75 | 0.76 | 0.78 | 0.79 | 0.80 | 0.81 | 0.83 | 0.84 | 0.85 | 0.85 | 0.82 | 0.80 | 0.77 | 0.73 | 0.70 |

CALCULATION OF BELT LENGTH

Datum belt length L_d [mm]

$$L_d = 2 \times C + 1,57 (d_d + D_F + D_{td}) + \frac{(D_F + D_{td} - d_d)^2}{4 \times C} [mm]$$

- C = Centre distance [mm]
- d_d = Datum-diameter of V-belt pulley [mm]
- $D_F = Diameter of flat pulley [mm]$
- D_{td} = Supplement to D_F , table 13, page 32

Effective belt length L_e [mm]

$$L_e = 2 \times C + 1,57 (d_e + D_F + D_{te}) + \frac{(D_F + D_{te} - d_e)^2}{4 \times C} [mm]$$

C = Centre distance [mm]

d_e = Effective-diameter of V-belt pulley [mm]

 D_F = Diameter of flat pulley [mm]

 D_{te} = Supplement to D_F , table 14 page 32

BELT TENSION

Proper belt tension is vital to the operation of the drive and the life of the V-belts.

To ensure optimum V-belt drive operation, we recommend calculating the belt tension and deflection force K [N] for the drive in question.

See the sections on belt tension, page 25, and checking of belt tension, page 26.



The belt tension in most drives can be checked with adequate reliability by means of ROULUNDS belt tension gauge; alternatively a spring balance can be used.

When checking the belt tension, follow this procedure:

- 1. When the V-belts have been installed into the grooves of the pulleys, increase the centre distance until the belts are taut.
- 2. Measure or calculate the span length of the belts I [mm] as shown on page 26.
- 3. The deflection is calculated as 15 mm per 1000 mm of span.

For example, the span I = 900 mm

Deflection = $\frac{900 \times 15}{1000}$ = 13,5 mm

- 4. Place the large O-ring on the scale of the belt tension gauge at the calculated deflection.
- 5. Place the small O-ring at 0 [mm].
- 6. Place a straightedge on the pulleys.
- Place the belt tension gauge at the centre of the span and perpendicularly to the straightedge.
- 8. Push down the belt tension gauge until the large O-ring is flush with the bottom edge of the straightedge.

- 9. Read the deflection force K [N] on the belt tension gauge scale by the small O-ring.
- Compare the K-value reading with the calculated value or the table value for the belt section of the belt type in question and with the datum-diameter of the smaller pulley, tables 17 20 page 36 37.

K must be within K_{min} and K_{max} in the table. For drives with a heavy, pulsating load, we recommend $K = K_{max}$.

When the belts are installed for the first time, we recommend multiplying the table values for K_{min} and K_{max} by 1.3.

- 11. If the K-value reading is too low or too high compared with the table or calculated value, adjust the centre distance until the correct K is achieved.
- 12. Start the drive. Let it run for 5 minutes. Check the belt tension, and adjust it if necessary.
- After approx. 24 hours of operation, check the belt tension. Check it regularly after that, and keep it at the recommended value.





Joined V-belts

The procedure for ordinary V-belts cannot be applied to checking the belt tension of joined V-belts.

We recommend following the procedure described on page 26.

| Datum-diameter of smaller pulley | | | F | Progra | mme 1 | 10 | | | | | F | Progra | mme 1 | 7 | | |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | XI | PZ | X | PA | X | PB | XI | PC | ZX/ | '10X | AX | /13X | BX | '17X | CX/ | 22X |
| d _d [mm] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] |
| 40 45 50 56 | 12 13 | 16 18 | | | | | | | 5 6 7 7 | 7 8 9 10 | 5 8 | 9 12 | | | | |
| 63 71 80 90 | 15 16 17 18 | 20 21 23 24 | 14 17 20 23 | 20 23 27 31 | | | | | 8 8 9 9 | 11 11 12 12 | 10 13 15 16 | 15 17 20 22 | 15 19 | 22 25 | | |
| 100 112 125 140 | 19 19 20 20 | 25 26 27 27 | 25 27 28 30 | 33 36 38 40 | 29 34 38 42 | 39 45 51 56 | | | 9 9 10 10 | 12 13 13 13 | 18 19 20 21 | 24 25 27 28 | 22 24 26 28 | 29 32 35 38 | 34 | 46 |
| 160 180 200 224 | 21 21 | 28 29 | 31 33 33 34 | 42 44 45 46 | 46 49 52 54 | 62 66 69 72 | 56 63 69 75 | 75 84 92 100 | | | 22 23 | 29 30 | 30 32 33 35 | 41 43 44 46 | 39 42 45 48 | 52 56 60 63 |
| 250 280 315 355 | | | | | 57 59 61 63 | 75 78 80 82 | 80 85 90 94 | 106 112 118 123 | | | | | 36 37 | 47 48 | 50 52 55 57 | 66 69 71 73 |
| 400 450 500 560 | | | | | | | 99 103 107 112 | 127 132 135 139 | | | | | | | 59 61 63 | 75 77 78 |

Table 17 Deflection force K [N]

Table 18 Deflection force K [N]

| Datum-diameter of smaller pulley | | | | | | Progra | mme 11 | | | | | |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|--------------------------|--------------------------|--------------------------|
| | S | PZ | S | PA | SI | ЪВ | S | 19 | SI | °C | 8V/: | 25N |
| d _d [mm] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] |
| 63 71 80 90 | 9 11 12 14 | 13 15 17 19 | 14 | 20 | | | | | | | | |
| 100 112 125 140 | 15 16 17 18 | 21 22 23 24 | 17 20 22 24 | 23 26 30 32 | 27 | 37 | | | | | | |
| 160 180 200 224 | 19 20 20 21 | 26 26 27 28 | 26 28 30 31 | 35 38 40 41 | 32 37 40 43 | 43 49 53 57 | 34 40 45 | 47 53 59 | 53 | 71 | | |
| 250 280 315 355 | | | 32 33 34 | 43 44 45 | 46 48 51 53 | 60 63 66 68 | 50 54 58 62 | 65 71 76 80 | 61 68 75 81 | 80 89 97 104 | 88 100 | 117 132 |
| 400 450 500 560 | | | | | 55 57 59 | 71 72 74 | 66 69 72 74 | 84 87 89 95 | 87 92 96 99 | 110 115 119 129 | 110 120 127 134 | 145 156 165 173 |
| 630 710 860 | | | | | | | 76 | 97 | 103 106 110 | 132 135 137 | 142 148 155 | 181 187 192 |

| Datum-diameter of smaller pulley | | | F | Progra | mme 1 | 12 | | | | | F | Progra | mme 1 | 6 | | |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | X | PZ | X | PA | X | РВ | X | PC | ZX/ | 10X | AX | /13X | BX/ | 17X | CX/ | 22X |
| a _d [mm] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] |
| 40 45 50 56 | 8 10 | 11 13 | | | | | | | 4 5 6 | 6 7 8 8 | 3 | 7 10 | | | | |
| 63 71 80 90 | 11 13 14 16 | 16 18 19 21 | 8 12 15 18 | 14 18 21 25 | | | | | 7 7 8 8 | 9 10 10 11 | 7 10 12 14 | 11 14 16 19 | 9 13 | 15 19 | | |
| 100 112 125 140 | 17 17 18 19 | 22 23 24 25 | 21 23 25 27 | 28 31 33 36 | 19 25 29 34 | 28 34 39 45 | | | 8 9 9 9 | 11 11 12 12 | 15 17 18 19 | 20 22 24 25 | 16 19 21 24 | 22 25 29 32 | 24 | 34 |
| 160 180 200 224 | 20 20 | 26 27 | 28 30 31 32 | 38 40 41 43 | 38 42 45 48 | 51 56 60 63 | 43 51 57 64 | 58 68 76 84 | | | 20 21 | 27 28 | 26 28 30 31 | 35 37 39 41 | 30 34 38 41 | 40 45 50 54 |
| 250 280 315 355 | | | | | 50 52 54 57 | 66 69 71 74 | 69 75 80 84 | 91 98 104 109 | | | | | 32 34 | 43 44 | 44 47 49 52 | 58 61 64 66 |
| 400 450 500 560 | | | | | | | 89 94 98 102 | 114 119 122 126 | | | | | | | 54 57 59 | 69 71 73 |

Table 19 Deflection force K [N]

Table 20 Deflection force K [N]

| Datum-diameter of smaller pulley | | | | | | | Pro | ogram | me 15 | , 20 | | | | | | |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|----------------------------|----------------------------|-------------------------------|---------------------------------|--------------------------------|---------------------------------|
| | Z/ | 10 | A | 13 | B/ | /17 | 2 | 20 | C | 22 | 2 | 25 | 32-1 | D/32 | E/ | 40 |
| a _d [mm] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] | K _{min} [N] | K _{max} [N] |
| 50 56 63 71 | 4 5 5 6 | 6 6 7 8 | 4 | 8 11 | | | | | | | | | | | | |
| 80 90 100 112 | 7 7 7 8 | 9 9 10 10 | 9 11 13 15 | 13 16 18 20 | 10 13 | 16 19 | | | | | | | | | | |
| 125 140 160 180 | 8 8 8 9 | 11 11 11 11 | 16 17 19 20 | 22 23 25 26 | 16 19 22 24 | 23 26 29 32 | 18 22 26 | 26 30 34 | 21 27 | 31 37 | | | | | | |
| 200 224 250 280 | | | 21 21 | 27 28 | 26 28 29 31 | 35 37 39 40 | 28 31 33 35 | 37 40 43 45 | 31 36 39 43 | 41 46 51 55 | 35 40 46 | 48 54 60 | 53 | 72 | | |
| 315 355 400 450 | | | | | 32 34 | 42 43 | 37 39 41 42 | 47 49 51 54 | 46 49 52 54 | 59 62 65 70 | 50 55 59 62 | 66 72 77 81 | 62 70 78 85 | 81 91 100 108 | 86 | 113 |
| 500 560 630 710 800 | | | | | | | 43 | 55 | 56 58 | 72 74 | 66 69 71 74 76 | 84 87 92 95 97 | 90 96 101 105 110 | 114 121 129 134 139 | 97 108 119 129 139 | 125 138 150 161 171 |

Maintenance

In addition to checking the belt tension, regular checks should be made to ensure that the drive is not soiled with oil or dirt and that the V-belts and pulleys are not damaged.

The V-belts can be cleaned with a mixture of glycerol and alcohol at the ratio of 1:10.

Never use strong degreasing agents such as petrol, turpentine, diluents etc.

Belt dressing, regardless of its nature, must not be used.

Replacement

If a V-belt in a belt set is damaged, the entire belt set must be replaced.

A belt set must not consist of different belt makes.

Influence of heat

High temperatures are damaging and will reduce belt life. Sealed shields and other objects which prevent free circulation of air should therefore be avoided.

If the driven unit radiates strong heat, the belts should be protected with shielding.

Storage of V-belts

If stored as per the instructions, V-belts can be stored for several years without any noticeable influence on their features.

Storage on shelves is the best and least space demanding method.

If suspended, the peg diameter must be at least $12 \times$ the belt height. Consequently, never use ordinary steel hooks, nails or similar objects.

Storage conditions

The temperature in the storage room should be $10 - 25^{\circ}$ C, and the relative humidity must not exceed 65%.

Direct sunlight on V-belts and sources of heat near the belts must be avoided.

V-belts should not be stored near chemicals, oil and grease, acids and other substances which degrade rubber and textiles.

TERMINOLOGY

Standardised terms are used for describing a drive with V-belts; the most common ones will be described in this section.

DATUM SYSTEM

The ISO 1081-1980 standard describes two systems for defining pulleys and V-belts: datum and effective.

This means that three concepts are now being used for describing drives with V-belts: datum and effective as well as the traditional term, pitch, but pitch is used only for calculating the speed ratio and the belt speed of the drive.

The DATUM/EFFECTIVE systems can be defined as systems that provide an unequivocal, unvarying identification, whereas PITCH is variable, depending on the design of the V-belt. For this very reason, the more recent belt designs have generated a need for an identification system other than pitch.

The grooves and diameters of pulleys as well as Vbelt lengths have been determined unequivocally with the introduction of the datum/effective systems.

DATUM SYSTEM

The groove of a pulley is identified by its datum width W_{d} , which is independent of the groove angle.



The pulley diameter is termed the datum-diameter d_d and is measured by the groove width W_d .

The V-belt length is defined as the datum length L_d and is measured as shown in the following point concerning V-belt length.

ISO has determined that the datum groove width W_d of pulleys shall be identical with the formerly standardised pitch groove widths.

In practice, this means that the pitch-diameter d_p of the pulleys is now termed datum-diameter d_d and that the pitch length L_p of the V-belts is changed into a datum belt length L_d .

EFFECTIVE SYSTEM

Under this system, a pulley groove width $\rm W_{e}$ is defined by the measurement shown in the illustration below.



The pulley diameter is termed effective outside diameter d_e, or just effective-diameter.

The V-belt length is defined as effective belt length L_e and is measured as shown in the following points concerning V-belt length.

PITCH SYSTEM

This definition is used for calculating the exact speed ratio and belt speed of a drive, since these values are determined by the placement of the Vbelt section pitch line in the pulley groove. See the following points concerning V-belt section.



The distance b_d is therefore variable and is included as a correction supplement when determining the pitch-diameter d_p of the pulley.

The calculation of the speed ratio i and the belt speed v is therefore as follows:

 $i = \frac{D_d + 2b_d}{d_d + 2b_d} = \frac{D_p}{d_p}$ see point 3, page 7

$$v = \frac{(d_d + 2b_d) \times n_1}{19100} = \frac{d_p \times n_1}{19100} \quad [m/s]$$

see point 8, page 7

Under the effective system, the pitch-diameter is calculated as follows: $d_p = d_p - 2b_p$ [mm]









Tensile and compressive stresses occur in the cross section of the profile during the bending of the belt in the pulley groove. These stresses will decrease to "0" (zero) in the line that is termed NEUTRAL AXIS. PITCH ZONE or PITCH.

W Top width As regards sections with bevelled corners, the top width is determined on the basis of the point of intersection of the extended lines.



- W_p Pitch width
- т Section height
- b Pitch placement is the distance from the top line of the profile to the pitch zone.
- Profile angle α For standard V-belts α = 38 - 40°

V-BELT LENGTH

The V-belt length is defined in different ways in the standards but it is measured according to specified methods in all cases.

The measuring machine consists of two pulleys with the same datum-diameter, effective-diameter or two plane pulleys. The measurement load on the moving pulley depends on the belt section.



P = Measurement load

e = Centre distance

Datum belt length L_d [mm]

is measured over pulleys with datum-diameter d_d [mm].

 $L_d = 2 \times e + d_d \times \pi$ [mm]

The ISO term datum length L_d [mm] is identical with the previously used pitch belt length L_p [mm].

Effective belt length L_e [mm]

The effective-diameter of the pulleys, d_e [mm], is used for calculating the belt length.

 $L_e = 2 \times e + d_e \times \pi$ [mm].

Outside belt length L_a [mm]

The physical outside length of the V-belt is measured with a measuring tape on the outside of the belt while the belt is installed in the measuring machine.

Inside belt length L_i [mm]

is measured over two plane pulleys with the diameter d [mm], centre distance e [mm], is calculated as follows:

 $L_i = 2 \times e + d \times \pi$ [mm]

Mean belt length L_m [mm]

occurs in connection with double V-belts, and for all practical purposes it may be said to be \approx effective belt length.

 $L_m \approx L_e$ [mm].

The programmes on ROFLEX V-belts and the dimension tables page 41 - 43 include informations regards the supplements and reductions to be applied when making an approximate calculation of a belt length specification other than the one listed, e.g. conversion from datum length L_d [mm] to inside length L_i [mm].

V-BELT IN PULLEY GROOVE

The placement of a V-belt section in the groove of the standard pulley designed for it is described with the term "Ride". This is the distance from the top of the section to the outside diameter d_e of the pulley.

The permissible maximum/minimum distance/ride is specified in standards.

RIDE OUT

Distance (1) from the top of the V-belt section to the outside diameter d_{a} of the pulley.



RIDE 0/RIDE FLUSH

The top of the V-belt section is flush with the outside diameter d_{e} of the pulley.



RIDE IN

Distance (2) from the top of the V-belt section to the outside diameter d_{e} of the pulley.



DIMENSION TABLES

In those programmes where several standards are listed, there may be minor differences in the dimension specification.

The designation "X" for V-belts of the raw-edge design has not been introduced in all standards. Summary of standards, see page 57.





| Get | ion designations | on ion dime | isionw ⁺ | T Innit | ni length atum bet | | rt, the start | r a hendi | inside parts | Innii Ito In Inninun F | ni ini ini ini ini ini ini ini ini ini | ini undane | set d & d & Immi diameter d & Immi diameter d & Immi at belt speed v Immi at belt speed v Immi hat denerion treat the weight of mi | |
|--------|------------------|----------------|---------------------|---------|--------------------------|-------|---------------|-----------|--------------|------------------------------|--|------------|--|---|
| ROFLEX | CLASSICA | AL V-BI | ELTSI | SO 41 | 84, BS | 3790, | DIN 2 | 215, A | NSI/RI | MA IP- | 20 | | PROGRAMME 1 | 5 |
| | | | | | | | | | | | | | | ٦ |

| 8 | 8×5 | 6,7 | 19 | 31 | 19 | 40 | | | 0,040 |
|-------|-----------|-----|----|-----|----|-----|----|----|-------|
| Z/ 10 | 10×6 | 8,5 | 22 | 38 | 22 | 50 | | | 0,058 |
| A/13 | 13×8 | 11 | 30 | 50 | 30 | 63 | | | 0,104 |
| B/17 | 17 × 11 | 14 | 43 | 66 | 43 | 100 | | | 0,172 |
| 20 | 20 × 12,5 | 17 | 48 | 79 | 48 | 140 | 30 | 70 | 0,239 |
| C/22 | 22 × 14 | 19 | 65 | 85 | 65 | 160 | | | 0,282 |
| 25 | 25 × 16 | 21 | 61 | 101 | 61 | 224 | | | 0,366 |
| D/32 | 32 × 20 | 27 | 69 | 126 | 69 | 280 | | | 0,591 |
| E/40 | 40 × 25 | 32 | 84 | 157 | 84 | 450 | | | 0,958 |

ROFLEX-X CLASSICAL V-BELTS ISO 4184, BS 3790, DIN 2215

| ZX/10X | 10×6 | 8,5 | 22 | 38 | 22 | 40 | | | 0,055 |
|--------|---------|-----|----|----|----|-----|----|-----|-------|
| AX/13X | 13×8 | 11 | 30 | 50 | 30 | 50 | 50 | 100 | 0,080 |
| BX/17X | 17 × 11 | 14 | 43 | 66 | 43 | 80 | 50 | 120 | 0,165 |
| CX/22X | 22 × 14 | 19 | 65 | 85 | 65 | 140 | | | 0,250 |

ROFLEX RE-X CLASSICAL V-BELTS ISO 4184, BS 3790, DIN 2215

| ZX/10X | 10×6 | 8,5 | 22 | 38 | 22 | 40 | | | 0,060 |
|--------|---------|-----|----|----|----|-----|----|-----|-------|
| AX/13X | 13×8 | 11 | 30 | 50 | 30 | 50 | 50 | 120 | 0,090 |
| BX/17X | 17 × 11 | 14 | 43 | 66 | 43 | 80 | 50 | 120 | 0,180 |
| CX/22X | 22 × 14 | 19 | 65 | 85 | 65 | 140 | | | 0,255 |

ROFLEX CLASSICAL V-BELTS ISO 4184, BS 3790, DIN 2215, ASAE S 211.4 PROGRAMME 20

PROGRAMME 17

PROGRAMME 16

| A/13 | 13×8 | 11 | 30 | 50 | 30 | 46 | 63 | | | 0,104 |
|------|-----------|----|----|-----|----|-----|-----|----|----|-------|
| B/17 | 17 × 11 | 14 | 43 | 66 | 43 | 65 | 100 | | | 0,172 |
| 20 | 20 × 12,5 | 17 | 48 | 79 | 48 | | 140 | | | 0,239 |
| C/22 | 22 × 14 | 19 | 65 | 85 | 65 | 99 | 160 | 30 | 60 | 0,282 |
| 25 | 25 × 16 | 21 | 61 | 101 | 61 | | 224 | | | 0,366 |
| 32 | 32 × 16 | 27 | 50 | 101 | 50 | 101 | 250 | | | 0,519 |
| D/32 | 32 × 20 | 27 | 69 | 126 | 69 | 120 | 280 | | | 0,591 |





ROFLEX DOUBLE V-BELTS DIN 7772, ASAE S 211.4

PROGRAMME 21

| ΗΑΑ/ΑΑ | 13×10 | 11 | 21 | 63 | 21 | 31 | 80 | | | 0,140 |
|--------|---------|----|----|-----|----|----|-----|----|----|-------|
| HBB/BB | 17 × 13 | 14 | 26 | 82 | 26 | 41 | 112 | | | 0,244 |
| HCC/CC | 22 × 17 | 19 | 36 | 107 | 36 | 53 | 200 | 30 | 60 | 0,409 |
| 25 | 25 × 22 | 21 | 40 | 138 | 40 | 69 | 280 | | | 0,590 |
| HDD/DD | 32 × 25 | 27 | 51 | 157 | 51 | 79 | 355 | | | 0,878 |





| ROFLEX JOINED | V-BELTS ANSI/RMA IF | -20. RMA/MPTA | IP-22, ASAE S 211.4 |
|----------------------|---------------------|---------------|---------------------|
|----------------------|---------------------|---------------|---------------------|

PROGRAMM 23

| HA/A | 13×8 | 10 | 15,88 | 9 | 64 | 32 | 32 | 80 | | | 0,154 |
|--------|---------|----|-------|----|-----|----|-----|-----|----|----|-------|
| HB/B | 17 × 11 | 13 | 19,05 | 13 | 80 | 29 | 51 | 130 | | | 0,237 |
| HC/C | 22 × 14 | 17 | 25,4 | 18 | 100 | 32 | 68 | 210 | | | 0,406 |
| HD/D | 32 × 19 | 22 | 36,53 | 28 | 130 | 36 | 94 | 370 | 30 | 60 | 0,750 |
| 3V/9J | 9×8 | 10 | 10,3 | | 66 | 28 | 38 | 67 | | | 0,095 |
| 5V/15J | 15 × 13 | 16 | 17,5 | | 100 | 29 | 71 | 180 | | | 0,250 |
| 8V/25J | 25 × 23 | 26 | 28,6 | | 157 | 32 | 125 | 315 | | | 0,637 |



ROFLEX-VARI VARIABLE SPEED V-BELTS, ISO 1604, DIN 7719

PROGRAMME 40

| Section designation | W16 | W20 | W25 | W31,5 | W40 | W50 | W63 | W71 | W80 | W100 | |
|---------------------|---------------------|-----|------|-------|------|------|-----|-----|------|------|-----|
| Top width | W [mm] ~ | 17 | 21 | 26 | 33 | 42 | 52 | 65 | 74 | 83 | 104 |
| Pitch width | W _p [mm] | 16 | 20 | 25 | 31.5 | 40 | 50 | 63 | 71 | 80 | 100 |
| Section height | T [mm] ~ | 6 | 7 | 8 | 10 | 13 | 16 | 20 | 23 | 26 | 32 |
| Pitch zone | B [mm] ~ | 1.5 | 1.75 | 2 | 2.5 | 3.25 | 4 | 5 | 5.75 | 6.5 | 8 |
| Section angle | α [°] ~ | 26 | 28 | 28 | 28 | 28 | 30 | 30 | 30 | 32 | 32 |



ROFLEX-VARI VARIABLE SPEED V-BELTS, RMA/MPTA IP-25

PROGRAMME 40

| | 1422V | 1922V | 2322V | 1926V | 2926V | 3226V | 2530V | 3230V | 4430V | 4036V | 4436V | 4836V |
|------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Section designation | 22V A22 | 30V A22 | 37V A22 | 30V A26 | 46V A26 | 51V A26 | 40V A30 | 51V A30 | 70V A30 | 64V A36 | 70V A36 | 76V A36 |
| Top width W [mm] ~ | 22 | 30 | 37 | 30 | 46 | 51 | 40 | 51 | 70 | 64 | 70 | 76 |
| Section height T [mm] ~ | 8 | 10 | 11 | 11 | 13 | 13 | 15 | 16 | 18 | 18 | 18 | 19 |
| Section angle α [°] ~ | 24 | 24 | 24 | 28 | 28 | 28 | 32 | 32 | 32 | 38 | 38 | 38 |

ROFLEX-VARI VARIABLE SPEED V-BELTS ISO 3410, ASAE S 211.4

PROGRAMME 41

| Section designation | | HG | нн | н | HJ | нк | HL | нм | HN | но |
|---------------------|---------------------|------|------|------|------|------|------|------|------|------|
| Top width | W [mm] ~ | 16.5 | 20.4 | 25.4 | 31.8 | 38.1 | 44.5 | 50.8 | 57.2 | 63.5 |
| Pitch width | W _p [mm] | 15.4 | 19 | 23.6 | 29.6 | 35.5 | 41.4 | 47.3 | 53.2 | 59.1 |
| Section height | T [mm] ~ | 8 | 10 | 12.7 | 15.1 | 17.5 | 19.8 | 22.2 | 23.9 | 25.4 |
| Pitch zone | B [mm] ~ | 2.5 | 3 | 3.8 | 4.7 | 5.7 | 6.6 | 7.6 | 8.5 | 9.5 |
| Section angle | α[°] ~ | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |



ROFLEX MULTI-RIB BELTS, DIN 7867, ASAE S 211.4

PROGRAMME 33

| Section designation | PH | PJ | PK | PL | РМ | | | |
|-------------------------|---------------------|------|------|------|------|------|--|--|
| Section designation | н | J | К | L | М | | | |
| Rib spacing | s [mm] | 1.60 | 2.34 | 3.56 | 4.70 | 9.40 | | |
| Belt height | h [mm] ~ | 3 | 4 | 6 | 10 | 17 | | |
| Minimum pulley diameter | d _e [mm] | 13 | 20 | 45 | 75 | 180 | | |



ROFLEX SYNCHRONOUS BELTS, ISO 5296

PROGRAMME 34

| Section designation | | MXL | XXL | XL | L | н | хн | ххн |
|---------------------|-----------------------|-------|-------|-------|-------|--------|--------|--------|
| Circular pitch | e [mm] | 2.032 | 3.175 | 5.080 | 9.525 | 12.700 | 22.225 | 31.750 |
| Tooth width | s [mm] | 1.14 | 1.73 | 2.57 | 4.65 | 6.12 | 12.57 | 19.05 |
| Tooth height | h _t [mm] | 0.51 | 0.76 | 1.27 | 1.91 | 2.29 | 6.35 | 9.53 |
| Tooth angle | 2β [°] | 40 | 50 | 50 | 40 | 40 | 40 | 40 |
| Belt height | h _s [mm] ~ | 1.14 | 1.52 | 2.3 | 3.6 | 4.3 | 11.2 | 15.7 |



ROFLEX SYNCHRONOUS BELTS

PROGRAMME 34

| Section designation | | 3M | 5M | 8M | 14 M | 20M | |
|---------------------|---------------------|-----|-----|-----|-------------|------|--|
| Circular pitch | e [mm] | 3.0 | 5.0 | 8.0 | 14.0 | 20.0 | |
| Tooth height | h _t [mm] | 1.2 | 2.1 | 3.4 | 6.1 | 8.4 | |
| Belt height | h [mm] ~ | 2.4 | 3.8 | 5.6 | 10.0 | 13.2 | |



PULLEYS - GROOVE DIMENSIONS

For further information, please refer to the standards ISO 4183, BS 3790, DIN 2211/1, DIN 2217/1. Summary of standards, see page 57.

Narrow V-belts: Programmes 10, 11 and 12

Classical V-belts: Programmes 15, 16, 17, 20, 21 and 30

| Table 21 |
|----------|
|----------|

| Cl V-b | assical elts sec- | Y | | Z ZX | A AX | B BX | | | C CX | | D | E |
|---------------------------|----------------------|-------|--------|------------|--------------------------------------|--------------------|--|--------------------------------------|--|--------------------------------------|----------------------------|----------------------------|
| | tions | | 8 | 10 | 13 | 17 | | 20 | 22 | 25 | 32 | 40 |
| Narrow V-belt sections | | | | SPZ XPZ | SPA XPA | SPB XPB | S19 | | SPC XPC | | | |
| | W _d | 5,3 | 6,7 | 8,5 | 11 | 14 | 16 | 17 | 19 | 21 | 27 | 32 |
| | W _e | 6,3 | 8 | 9,7 | 12,7 | 16,3 | 18,6 | 20 | 22 | 25 | 32 | 40 |
| | o min. | 1,6 | 2 | 2 | 2,75 | 3,5 | 4 | 5,1 | 4,8 | 6,3 | 8,1 | 9,6 |
| | n min. | 4,7 | 7 | 9 | 11 | 14 | 16 | 13 | 19 | 16 | 19,9 | 23,4 |
| | е | 8±0,3 | 10±0,3 | 12±0,3 | 15±0,3 | 19±0,4 | 22±0,4 | 23±0,4 | 25,5±0,5 | 29±0,5 | 37±0,6 | 44,5±0,7 |
| | f | 7±1 | 7±1 | 8±1 | 10 <mark>+ 2</mark> 10 <u>- 1</u> | 12,5 ⁺² | 14,5 <mark>+</mark> 2 14,5 <u>-</u> 1 | 15 <mark>+</mark> 2 15 <u>-</u> 1 | 17 <mark>+ 2</mark> 17 <mark>- 1</mark> | 19 <mark>+</mark> 2 19 <u>-</u> 1 | 24 <mark>+ 3</mark> - 1 | 29 <mark>+ 4</mark> - 1 |
| 32° | | ≤ 63 | ≤ 71 | | | | | | | | | |
| ູ 34° | At datum- | | | ≤ 80 | ≤ 118 | ≤ 190 | ≤ 250 | ≤ 250 | ≤ 315 | ≤ 355 | | |
| 36° | [mm] | > 63 | > 71 | | | | | | | | ≤ 500 | ≤ 600 |
| 38° | | | | > 80 | > 118 | > 190 | > 250 | > 250 | > 315 | > 355 | > 500 | > 600 |

Total width B [mm] of pulley with \times number of grooves: B = (x-1)e + 2f [mm]



DEEP - GROOVE PULLEYS - GROOVE DIMENSIONS

Table 22 lists the groove dimensions which are commonly used.

For further information, please refer to ANSI/RMA IP-20 and ASAE S 211.4

Narrow V-belts: Programmes 10, 11 and 12

Classical V-belts: Programmes 15, 16, 17, 20, 21 and 30

Table 22

| | Cla | assical V-belt sec | ctions | Z ZX | A AX | B BX | | C CX |
|---|-------------------------------|--------------------|-----------------------|------------|------------|------------|----------|------------|
| | | | | 10 | 13 | 17 | | 22 |
| | N | arrow V-belt sect | tions | SPZ XPZ | SPA XPA | SPB XPB | S19 | SPC XPC |
| | | W _d | | 8.5 | 11 | 14 | 16 | 19 |
| | | a | $\alpha = 34^{\circ}$ | | 15 | 18.9 | 22.1 | 26.3 |
| | | y ~ | $\alpha = 38^{\circ}$ | 11.3 | 15.4 | 19.5 | 22.9 | 27.3 |
| | | b min. | | 4 | 6.5 | 8 | 10 | 12 |
| | | h min. | | 9 | 11.5 | 14.5 | 16 | 19.5 |
| | e | | 14 ± 0.3 | 18 ± 0.3 | 23 ± 0.4 | 27 ± 0.5 | 31 ± 0.5 | |
| | | f | | 9 ± 0.6 | 11.5 ± 0.6 | 14.5 ± 0.8 | 17 ± 1 | 20 ± 1 |
| | 34° At datum diamator d. [mm] | | | 80 | 118 | 190 | 250 | 315 |
| α | 38° | | d fuund | > 80 | > 118 | > 190 | > 250 | > 315 |

Total width B [mm] of pulley with \times number of grooves: B = (x-1)e + 2f [mm]



PULLEYS - GROOVE DIMENSIONS

For further information, please refer to the standards RMA/MPTA IP-22 and ASAE S 211.4 $\,$

Narrow V-belts: Programmes 10, 11 and 12

| 3V ≈ SPZ | $3VX \approx XPZ$ |
|------------------|-------------------|
| $5V \approx SPB$ | $5VX \approx XPB$ |

Table 23

| Groove profile | d _e [mm] | α° | b _e | h _g min. | S _g | S _e min. | Groove profile ISO |
|-------------------|--|----------------------|----------------|------------------------|----------------|------------------------|--------------------------|
| 3V | ≤90 >90 - ≤150 >150 - ≤305 >305 | 36 38 40 42 | 8,89 | 8,6 | 10,3 | 9,0 | 9N |
| 5V | ≤ 255 > 255 – ≤ 405 > 405 | 38 40 42 | 15,24 | 15,0 | 17,5 | 13,0 | 15N |
| 8V | ≤ 405 > 405 – ≤ 570 > 570 | 38 40 42 | 25,4 | 25,1 | 28,6 | 19,0 | 25N |

Total width B [mm] of pulley with \times number of grooves: B = (x-1) S_g + 2 S_e [mm]



JOINED V-BELT PULLEYS - GROOVE DIMENSIONS

For further information, see the standards ISO 5290, ISO 5291, ASAE S 211.4, ANSI/RMA IP-20 and RMA/MPTA IP-22

Joined V-belts: Programme 23

Table 24 Standard ISO 5291

| Groove profile | d _e [mm] | α° | w _e | h _g min. | е | f min. | Groove profile ISO |
|-------------------|------------------------|----------|----------------|------------------------|-------|-----------|--------------------------|
| HA/A | ≤ 125 > 125 | 34 38 | 13 | 12 | 15,88 | 9 | AJ |
| HB/B | ≤ 195 > 195 | 34 38 | 16,5 | 14 | 19,05 | 11,5 | BJ |
| HC/C | ≤ 325 > 325 | 34 38 | 22,4 | 19 | 25,40 | 16 | CJ |
| HD/D | ≤ 490 > 490 | 36 38 | 32,8 | 26 | 36,53 | 23 | DJ |

Table 25 Standard ISO 5290

| Groove profile | d _e [mm] | α° | W _e | h _g min. | e | f min. | Groove profile ISO |
|-------------------|--|----------------------|----------------|------------------------|------|-----------|--------------------------|
| 3V | ≤90 >90 - ≤150 >150 - ≤300 >300 | 36 38 40 42 | 8,9 | 8,9 | 10,3 | 9,0 | 9J |
| 5V | ≤ 250 > 250 - ≤ 400 > 400 | 38 40 42 | 15,2 | 15,2 | 17,5 | 13,0 | 15J |
| 8V | ≤ 400 > 400 - ≤ 560 > 560 | 38 40 42 | 25,4 | 25,4 | 28,6 | 19,0 | 25J |

Total width of pulley with \times number of grooves: B = (x-1)e + 2 \times f [mm]



DRIVES WITH FLAT BELTS

ROULUNDS standard flat belt types are described in programme 50, PRODUCT SPECIFICATIONS, and in the following calculation procedure their power rating is listed in tables 3 and 4, page 52. The belt type to be used for the drive in question is selected on the basis of this.

CALCULATION

Terms and units used.

| В | Width of pulley | [mm] |
|----------------|---|-----------|
| b | Belt width | [mm] |
| С | Centre distance | [mm] |
| C ₁ | Service factor | |
| c ₂ | Arc of contact correction factor | |
| D | Diameter of larger pulley | [mm] |
| d | Diameter of smaller pulley | [mm] |
| h | Crown of camber on pulley face | [mm] |
| i | Speed ratio | |
| L _i | Inside belt length | [mm] |
| n ₁ | Number of revolutions of smaller pulley | [rev/min] |
| n ₂ | Number of revolutions of larger pulley | [rev/min] |
| P _M | Power consumption | [kW] |
| P _N | Power rating per 10 mm belt width | [kW] |
| v | Belt speed | [m/s] |
| x | Adjustment of centre distance for take-up allowance | [mm] |
| у | Adjustment of centre distance for installation | [mm] |
| β | Arc of contact on smaller pulley | [°] |
| | | |

1.

Service factor c1 Table 1, page 51.

The power rating tables are based on the maximum permissible tension in the applicable belt types at the stated pulley diameter and rev/min. It is therefore important that calculation is carried out with a service factor that makes allowance for the operating conditions of the driven unit, e.g. overloading when started, shock loads etc.

2. Belt type

To be selected according to application, see programme 50.

3. Speed ratio i

is the ratio of the rev/min of the smaller to that of the larger pulley

$$i = \frac{n_1}{n_2}$$

or the ratio of the diameter of the larger to that of the smaller pulley.

$$i = \frac{D}{d}$$

4. **Pulley diameter**

The diameter of the smaller pulley d [mm] is selected from the power rating table for the selected belt type, tables 3-4 page 52.

The diameter of the larger pulley D [mm] is calculated as follows: $D = d \times i [mm]$

Tension idlers, see point 13, page 53.

5. Centre distance C [mm]

C may be determined on the basis of the applicable conditions or it may be chosen to be $2 \times$ the diameter of the larger pulley D [mm].

For installation and take-up allowance, see point 11, page 53.

6. Belt length L_i [mm]

The inside belt length is calculated as follows:

$$L_i = 2 \times C + 1,57 (D + d) + \frac{(D - d)^2}{4 \times C}$$
 [mm]

C = Centre distance [mm]

D = Diameter of larger pulley [mm]

d = Diameter of smaller pulley [mm]

7. Belt speed v [m/s]

$$v = \frac{d \times n_1}{19100} \quad [m/s]$$

- d = Diameter of smaller pulley [mm]
- $n_1 = \text{Rev/min of smaller pulley}$

The recommended maximum belt speed is listed in the power rating table for the selected belt type.

 Arc of contact correction factor c₂ Table 2, page 52

In drives with more than two pulleys, the arc of contact is calculated according to drawing.

 Power rating P_N [kW] The power rating per 10 mm belt width is determined from the table for the selected belt type, tables 3-4, page 52.

For further detail, see point 14 for fully- and semiturned drives.

10. Necessary belt width b [mm]

$$b = \frac{P_{M} \times c_{1} \times 10}{P_{N} \times c_{2}} \quad [mm]$$

- P_M = Power consumption of driven unit in kW or rated kW of motor.
- P_N = Power rating [kW] per 10 mm belt width, tables 3-4.
- $c_1 =$ Service factor, table 1

 $c_2 =$ Arc of contact correction factor, table 2.

The belt width b [mm] is rounded up to the closest standard width, see table 5, page 53.

Table 1 Service factor c₁

| | | | Driving u | nit/motor | | | |
|---|---|--|------------------------------------|---|-----------------|--------------|--|
| Driven unit | AC motors, s with star-delt DC shunt-wo cylinder inter | single- and thre a start. Jund motors. M mal combustion | ee-phase lultiple n engines. | AC motors, single- and three-phase, series wound, slip-ring motors with direct start. DC motors, series and compound wound. Single cylinder internal combustion engines. | | | |
| | Number of o | perating hours | per 24 hours | Number of o | perating hours | per 24 hours | |
| | Up to 10 | Over 10 to16 | Over 16 | Up to 10 | Over 10 to16 | Over 16 | |
| Agitators for liquids. Small centrifugal blowers. Fans up to 7.5 kW. Light-duty conveyors. | 1.0 | 1.1 | 1.2 | 1.1 | 1.2 | 1.3 | |
| Belt conveyors for sand, grain, etc. Dough mixers. Fans over 7.5 kW. Generators. Washing machines. Machine tools. Punching, pressing and shearing machines. Printing machines. Positive displacement rotary pumps. Vibrating and rotary screens. | 1.1 | 1.2 | 1.3 | 1.2 | 1.3 | 1.4 | |
| Brick-making machinery. Bucket elevator. Piston compressors. Screw conveyors. Hammer mills. Hollanders. Piston pumps. Positive displacement blowers. Crushers. Woodworking machinery. Textile machinery. | 1.2 | 1.3 | 1.4 | 1.4 | 1.5 | 1.6 | |

Table 2 Arc of contact correction factor c₂

| D-d C | 0.00 | 0.10 | 0.20 | 0.30 | 0.40 | 0.50 | 0.60 | 0.70 |
|----------------------|------|------|------|------|------|------|------|------|
| Arc of contact β [°] | 180 | 174 | 169 | 163 | 157 | 151 | 145 | 139 |
| C ₂ | 1.00 | 0.98 | 0.96 | 0.93 | 0.91 | 0.88 | 0.86 | 0.82 |
| D-d C | 0.80 | 0.90 | 1.00 | 1.10 | 1.20 | 1.30 | 1.40 | 1.50 |
| Arc of contact β [°] | 133 | 127 | 120 | 113 | 106 | 99 | 91 | 83 |
| C ₂ | 0.80 | 0.78 | 0.74 | 0.71 | 0.66 | 0.64 | 0.59 | 0.54 |

Table 3 Power rating P_N [kW] per 10 mm belt width

DANCORD

| | d | | | | | | Numb | per of r | evolut | ions o | f small | er pull | ley [rev | /min] | | | | | |
|-----------|---|--|--|--|--|--|--|--|--|--|--|--|--|---|--------------------------------------|--------------------------------------|-------------------------------------|----------------------|----------------------|
| | [mm] | 200 | 400 | 720 | 800 | 920 | 1200 | 1450 | 1600 | 2000 | 2400 | 2800 | 3200 | 3600 | 4000 | 4500 | 5000 | 5500 | 6000 |
| DANCORD M | 80 100 125 160 200 250 315 400 | 0.07 0.11 0.18 0.29 0.44 0.53 0.71 0.89 | 0.18 0.26 0.44 0.60 0.82 1.01 1.37 1.71 | 0.26 0.49 0.78 1.07 1.43 1.95 2.36 2.94 | 0.29 0.57 0.89 1.21 1.58 2.13 2.54 3.17 | 0.35 0.73 0.98 1.38 1.87 2.40 2.90 3.51 | 0.49 0.82 1.18 1.60 2.14 2.76 3.36 2.92 | 0.56 0.96 1.34 1.82 2.45 3.10 3.68 4.16 | 0.60 1.01 1.43 1.94 2.60 3.23 3.83 4.16 | 0.74 1.23 1.67 2.23 2.94 3.56 3.96 3.71 | 0.88 1.38 1.89 2.46 3.18 3.74 3.71 | 0.95 1.51 2.03 2.63 3.35 3.57 2.99 | 1.01 1.60 2.16 2.69 3.23 3.21 | 1.10 1.72 2.60 2.71 <u>3.03</u> 2.57 | 1.18 1.80 2.29 2.57 2.71 | 1.19 1.80 2.29 2.27 2.02 | 1.23 1.78 <u>2.21</u> 1.96 | 1.23 1.76 2.03 | 1.12 1.71 1.93 |
| DANCORD G | 160 200 250 315 400 630 | 0.37 0.55 0.74 0.92 1.18 1.79 | 0.66 1.03 1.40 1.76 2.27 3.49 | 1.18 1.66 2.28 2.93 3.75 5.16 | 1.26 1.81 2.46 3.20 4.04 5.38 | 1.43 2.08 2.76 3.55 4.50 5.67 | 1.71 2.43 3.24 4.10 5.07 5.49 | 1.95 2.76 3.69 4.49 5.38 4.49 | 2.06 2.93 3.85 4.66 5.38 | 2.36 3.31 4.23 4.90 4.96 | 2.61 3.53 4.40 4.67 | 2.71 3.68 4.19 4.45 | 2.78 3.59 3.71 | 2.80 3.21 2.93 | 2.61 2.82 | 2.21 2.02 | 1.64 | | |
| DANCORD H | 250 400 500 630 700 800 900 | 0.26 1.01 1.45 2.09 2.40 2.74 3.07 | 1.20 1.91 2.78 3.74 4.32 4.96 5.59 | 1.88 3.01 4.32 5.46 6.13 6.62 6.79 | 2.03 3.24 4.54 5.68 6.30 6.82 6.53 | 2.28 3.65 4.94 5.77 6.25 6.32 5.30 | 2.43 3.88 4.90 4.95 4.61 | 2.29 3.68 | 2.04 | 1.89 | | | | | | | | | |
| | | | | | | v > a | pprox. | 40 m/s | | | | | | • | | | | | |

Recommended maximum belt speed 40 m/s

Table 4 Power rating P_N [kW] per 10 mm belt width

STARKODDER

| | d | | | | | | Numb | per of I | revolut | ions o | f small | er pull | ey [rev | /min] | | |
|---------|--|--|--|--|---|--|--|--|--|--|--|--|------------------------------|------------------------------|----------------------|------|
| | [mm] | 200 | 400 | 720 | 800 | 920 | 1200 | 1450 | 1600 | 2000 | 2400 | 2800 | 3200 | 3600 | 4000 | 4500 |
| 3 plies | 80 100 125 160 200 250 | 0.04 0.06 0.12 0.16 0.19 0.29 | 0.09 0.15 0.22 0.31 0.41 0.55 | 0.21 0.28 0.37 0.54 0.74 0.94 | 0.23 0.31 0.43 0.62 0.87 1.06 | 0.26 0.37 0.51 0.74 0.97 1.17 | 0.32 0.44 0.65 0.88 1.17 1.29 | 0.38 0.56 0.78 1.07 1.43 1.51 | 0.41 0.60 0.87 1.18 1.52 1.76 | 0.52 0.76 1.04 1.47 1.79 1.90 | 0.63 0.90 1.22 1.62 1.95 2.13 | 0.71 1.00 1.41 1.74 2.13 2.26 | 0.78 1.13 1.50 1.87 | 0.85 1.21 1.59 1.99 | 0.91 1.31 1.69 | 1.02 |
| 4 plies | 125 160 200 250 315 400 | 0.13 0.18 0.26 0.35 0.46 0.61 | 0.18 0.33 0.48 0.53 0.85 1.14 | 0.40 0.59 0.81 1.19 1.51 1.97 | 0.53 0.68 0.92 1.26 1.67 2.15 | 0.57 0.81 1.10 1.47 1.97 2.43 | 0.65 0.96 1.36 1.64 2.32 2.82 | 0.87 1.20 1.58 2.06 2.57 3.01 | 0.99 1.31 1.69 2.19 2.72 | 1.25 <u>1.54</u> 1.97 2.49 | 1.31 <u>1.71</u> 2.24 | 1.38 1.91 | 1.45 | 1.57 | | |
| 5 plies | 160 200 250 315 400 500 | 0.18 0.26 0.39 0.51 0.74 0.96 | 0.37 0.53 0.71 0.98 1.38 1.76 | 0.62 0.93 1.31 1.74 2.32 2.90 | 0.74 1.02 1.45 1.93 2.51 3.14 | 0.84 1.25 1.67 2.23 2.90 3.51 | 0.96 1.50 2.02 2.69 3.29 3.83 | 1.07 1.76 2.36 2.97 3.54 | 1.18 1.91 2.49 3.17 | 1.46 2.18 2.80 | 1.63 2.40 | 1.87 | | | | |
| 6 plies | 200 250 315 400 500 630 | 0.29 0.41 0.56 0.79 1.06 1.38 | 0.56 0.74 1.12 1.54 1.96 2.62 | 0.96 1.38 1.88 2.59 3.28 4.07 | 1.06 1.49 2.09 <u>2.84</u> 3.53 4.38 | 1.24 1.74 2.44 3.24 3.82 | 1.50 2.14 2.90 3.71 | 1.74 2.47 3.31 3.97 | 1.89 2.65 3.41 | 2.16 2.88 | | | | | | |
| | | | | v>a | pprox. | 20 m/s | | | | | | | | | | |

Recommended maximum belt speed 20 m/s for belts with endless joint.

| Belt width b [mm] | 25 | 32 | 40 | 50 | 63 | 71 | 80 | 90 | 100 | 112 | 125 | |
|--------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Corresponding pulley width B [mm] | 32 | 40 | 50 | 63 | 71 | 80 | 90 | 100 | 112 | 125 | 140 | |
| Belt width b [mm] | 140 | 160 | 180 | 200 | 224 | 250 | 280 | 315 | 355 | 400 | 450 | 500 |
| Corresponding pulley width B [mm] | 160 | 180 | 200 | 224 | 250 | 280 | 315 | 355 | 400 | 450 | 500 | 560 |

Table 5 Recommended belt and pulley widths

11. Installation and take-up allowance.



12. Pulley crown, camber h [mm]

To achieve optimum exploitation of the drive, the belt must be assured an even run on the pulleys. This can be achieved by giving the pulleys a smooth, crowned face with a camber h [mm] according to the sketch below.



The pulleys must never be equipped with side edges/flanges.

13. Tension idlers

If a tension idler is used, it should have at least the same diameter as that of the smaller pulley, and it must provide the same possibilities with regard to installation and takeup allowance as those mentioned in point 11.

The tension idler should be installed against the slack part of the belt, as illustrated in the sketches below.



14. Fully- and semiturned transmissions



Belt length L_i [mm] L_i = 2 × C + 1,57 (D + d) + $\frac{(D + d)^2}{4 \times C}$ [mm]

Power transmission $P_N = Table value \times 0.75 [kW]$

Semiturned transmission - 90°



Belt lenght L_i [mm]

$$L_i = 2 \times C + 1,57 (D + d) + \frac{(D + \frac{d}{2})^2}{4 \times C} [mm]$$

Power transmission $P_N = Table value \times 0,75$ [kW]

 $P_N = kW$ per 10 mm belt width.

BELT CONSTRUCTIONS

The following is a description of the basic designs used for the belt types listed in the PROGRAMME KEY.

The technical features, fields of application and data of the individual belt types, which are intended for use in the design of the drive, are listed in the DIMENSION TABLES, pages 41 - 43.

WRAPPED V-BELTS

The term "wrapped" indicates that the V-belt core is protected by one or more plies of fabric called fabric cover.

The fabric cover is of cotton or polyester, it is wear resistant and coated with rubber.



The power transmitting element in the cord zone is ordinarily polyester cord or several plies of special cord fabric. Kevlar cord is used in certain special belts.

Tension, cushion and compression are rubber compounds with specific properties.

The cushion bonds the cord to the other rubber elements and absorbs shock loads.

The compression gives the belt cross section form stability and supports the cord zone against deflection while under load.

This design is used for both classical and narrow V-belts.

Classical V-belts

are defined in terms of dimensions in standards such as ISO 4184, DIN 2215, BS 3790, ANSI/RMA IP-20 etc., see standards summary on page 57.



The ratio of the top width to the height of the sections is approx. 1.6.

Narrow V-belts

Dimensions according to the standards ISO 4184, DIN 7753/1, BS 3790, RMA/MPTA IP-22 etc., see summary on page 57.

The top width of the section is often bevelled to facilitate adaptation to minor deviations from the standard for pulley groove dimension.



The ratio of the top width to the height of the sections is approx. 1.2. Hence the term narrow Vbelts, as seen in relation to classical V-belts.

Joined V-belts

are often termed JV-belts. These consist of 2-5 standard V-belts which are joined into one unit by means of an overlaying band.



This design reduces vibrations in drives subjected to shock loads. This belt type is also used as a coupling belt, for example on combine harvesters.

Dimensions are defined in the standards ANSI/RMA IP-20, RMA/MPTA IP-22 and ASAE S 211.4, see summary on page 57.

Double V-belts

are also termed HEXAGONAL belts. The section width corresponds to the top width of the corresponding V-belt section.



This belt type has been designed for the so-called serpentine drives with more than two pulleys and in which the direction of rotation of at least one shaft is reversed.

Standards: ISO 5289, DIN 7722, ASAE S 211.4, see summary on page 57.

RAW-EDGE V-BELTS

have no fabric cover on the sides of the belt profile. A special rubber compound ensures this belt type a greater resistance to wear than wrapped V-belts. Also, it is characteristic of raw-edge belts that they keep a constant friction level for the remainder of their life after running in.



The compression in ROFLEX raw-edge V-belts is a special rubber compound - STIFLEX - with textile fibres oriented across the belt length. This safe-guards the form stability of the cross section and provides effective support for the power transmitting polyester cord.

The inside moulded cog gives the belts high flexibility and a good fit in the pulley grooves as well as a low operating temperature.

This design is used for both classical and narrow V-belts.

Classical V-belts

in the raw-edge design are designated with an "X" after the ordinary section designation, for example BX.

This designation has not yet been introduced by all standards but as far as dimensions are concerned reference can be made to ISO 4184, DIN 2215, BS 3790, ANSI/RMA IP-20 etc., see summary on page 57.



Narrow V-belts

of the raw-edge type are designated by changing the SP before the section designation to XP, for example XPA.



As far as dimensions are concerned reference can be made to ISO 4184, DIN 7753/1, BS 3790, RMA/MPTA IP-22, see summary on page 57. Some standards have not yet been updated with the new section designations.

Variable speed V-belts

for infinitely variable gears have been specially designed to achieve minimum transverse deflection of the cross section while under load and at the same time a large degree of flexibility. The belts have an inside moulded cog or double cog, i.e. both inside and outside cog.

This belt type is also termed a V/S (Variable Speed) belt. It is built up of components as those described in the section on raw-edge.



As regards V/S-belts, the ratio of the top width to the height of the sections is as follows:

- Minimum 3 for industrial V/S-belts

- 2-2.5 for V/S-belts for agricultural machinery, increasing in relation to larger top widths.

The dimensions for industrial V/S-belts are defined in standards ISO 1604, DIN 7714/1, RMA/MPTA IP-25.

Belts for agricultural machinery are defined in standards ISO 3410, ASAE S 211.4. See summary on page 57.

Multi-rib belts

are generally designed like a raw-edge V-belt in which the compression zone has V-profiles running along the length of the belt.

The relatively low belt height permits the use of small pulley diameters and high belt speed. The characteristic V-profiles with the large contact surface engaging the pulleys give a high power rating and permit high speed ratios.



See the section on raw-edge, page 116, in which the individual components are described.

A number of profile dimensions etc. are defined in standards RMA/MPTA IP-26, DIN 7867, ASAE S211.4, see summary on page 57.

SYNCHRONOUS BELTS

This belt type is primarily used for drives demanding a fixed speed ratio and is therefore also termed "Timing Belts".

A number of tooth profiles have been designed for a varying and diverse range of applications.

The protective fabric is ordinarily of nylon, and the tensile cords which give the belt its carrying power are often of glass or Aramid fibre, Kevlar.



Synchronous belts with both inside and outside teeth are used for drives with more than two shafts and where the direction of rotation has to be reversed.

Synchronous belts are defined in standards ISO 5296, ANSI/RMA IP-24, see summary on page 57.

FLAT BELTS

include two basic types:

- cord belts
- multi-ply textile/rubber belts.

Cord belts

are endless belts with power transmitting rayon or polyester cord in a core of a special rubber compound. The core is protected by a wear resistant fabric cover with one or two plies against the pulleys.



Textile/rubber belts

are built up of 2-6 plies of gummed cotton fabric. The special rubber compound between the individual plies ensures the adhesion ply/ply and high flexibility.



The belts are available as endless belts in specific lengths, or they can be connected at the installation site with mechanical belt connectors.

STANDARDS

| No. | Subject |
|----------------|--|
| ASAE S 211.4 | V-Belt and V-Ribbed Belt Drive for agricultural machines |
| BS 3733 | Endless V-Belt drives for agricultural purposes |
| BS 3790 | Endless wedge belt drives and endless V-belt drives |
| DIN 109/2 | Antriebselemente. Achsabstand für Riementriebe mit Keilriemen |
| DIN 111 | Antriebselemente. Flachriemenscheiben. Masse Nenndrehmomente |
| DIN 2211/1 | Schmalkeilriemenscheiben |
| DIN 2211/2 | Schmalkeilriemenscheiben. Prüfung der Rillen |
| DIN 2215 | Endlose Keilriemen |
| DIN 2216 | Endliche Keilriemen |
| DIN 2217 | Keilriemenscheiben |
| DIN 2217/2 | Keilriemenscheiben. Prüfung der Rillen |
| DIN 2218 | Endlose Keilriemen für den Maschinenbau. Berechnung der Antriebe. Leistungswerte |
| DIN 7719 | Endlose Breitkeilriemen für industrielle Drehzahlwandler. Riemen und Rillenprofile der zugehörigen Scheiben |
| DIN 7721/1 | Synchronriemenantriebe, metrische Teilung. Synchronriemen |
| DIN 7722 | Endlose Hexagonalriemen für Landmaschinen und Rillenprofile der zugehörigen Scheiben |
| DIN 7753/1 | Endlose Schmalkeilriemen für den Maschinenbau |
| DIN 7753/2 | Endlose Schmalkeilriemen für den Maschinenbau. Berechnung der Antriebe. Leistungswerte |
| DIN 7867 | Keilrippenriemen und -scheiben |
| DIN/ISO 5290 | Rillenscheiben für Verbund-Schmalkeilriemen, Rillenprofile 9J, 15J, 20J, 25J |
| DIN/ISO 5294 | Synchronriementriebe. Scheiben |
| DIN/ISO 5296/1 | Synchronriementriebe. Riemen |
| DIN/ISO 5296/2 | Synchronriementriebe. Riemen |
| DIN/ISO 7721/2 | Synchronriementriebe, metrische Teilung. Zahnluckenprofil für Synchronscheiben |
| DS 974 | Fladremstræk. Dimensioner på remme og remskiver. Justering af centerafstand |
| DS 2104 | Geometrisk kontrol af sporene i kileremsskiver |
| DS 2107 | Kileremsskiver til remprofilerne Y, Z, A, B, C, D, og E |
| DS 2108 | Kileremstræk - Monteringsanvisninger |
| DS/ISO 254 | Remtræk. Kileremsskiver. Kvalitet, bearbejdning og afbalancering |
| DS/ISO 3410 | Landbrugsmaskiner. Kileremme til variabel hastighed og sammenhørende remskivespor |
| DS/ISO 4183 | Remtræk. Kileremsskiver til remprofilerne Y, Z, A, B, C, D, E, SPZ, SPA,SPB og SPC. Middeldiametre og spordimensioner |
| DS/ISO 4184 | Remtræk. Kileremme. Længder |
| DS/ISO 5289 | Remtræk. Endeløse sekskant-kileremme til landbrugsmaskiner og kilespor i de tilsvarende skiver |
| DS/ISO 5294 | Remtræk. Remskiver til synkrone remtræk |
| DS/ISO 5296 | Remtræk. Synkrone remtræk |
| ISO 22 | Belt drives - Flat transmission belt and corresponding pulleys - Dimensions and toler- ances |
| ISO 155 | Belt drives - Pullevs - Limiting values for adjustment of centres |
| ISO 254 | Belt drives - Pulleys - Quality, finish and balance |
| ISO 255 | Belt drives - Pulleys for V-belts (system based on datum with) - Geometrical inspection |
| | of grooves |
| ISO 1081 | Drives using V-Belts and grooved pulleys - Terminology |
| ISO 1604 | Belt drives - Endless wide V-belts for industrial speed-changers and groove profiles for corresponding pulleys. |

| ISO 1813 | Anti-static endless V-Belts - Electric conductivity |
|----------------|--|
| ISO 3410 | Agricultural machinery - Endless variable-speed V-belts and groove sections of corresponding pulleys |
| ISO 4183 | Grooved pulleys for classical and narrow V-belts. |
| ISO 4184 | Classical and narrow V-belts - Lengths |
| ISO 5289 | Agricultural machinery - Endless hexagonal belts and groove sections of corresponding pulleys. |
| ISO 5290 | Grooved pulleys for joined narrow V-belts. Groove sections 9J, 15J, 20J, and 25J |
| ISO 5291 | Grooved pulleys for joined classical V-belts. Groove sections AJ, BJ, CJ and DJ (effective system). |
| ISO 5292 | Industrial V-Belt transmissions - Calculation of power ratings. |
| ISO 5294 | Synchronous belt drives - Pulleys |
| ISO 5295 | Synchronous belt - Calculation of power rating and drive centre distance |
| ISO 5296-1 | Synchronous belt drives - Belts |
| ISO 5296-2 | Synchronous belt drives - Belts |
| ISO 8370 | V- and ribbed V-belts - Dynamic test to determine pitch zone location |
| ISO 8419 | Narrow joined V-belts - Lengths in effective system |
| ISO 9653 | Belt drives - Electrical conductivity of antistatic endless synchronous belts - Characteristics and test method |
| ISO 9980 | Belt drives - Grooved pulleys for V-belts (system based in effective with) - Geometrical inspection of grooves |
| ISO 9982 | Belt drives - Pulleys and V-ribbed belts for industrial applications |
| ANSI/RMA IP-20 | Classical V-Belt and Sheaves |
| ANSI/RMA IP-21 | Double-V (Hexagonal) Belts |
| RMA/MPTA IP-22 | Narrow Multiple V-Belts |
| RMA/MPTA IP-23 | Light-Duty Single V-belts |
| RMA/MPTA IP-24 | Synchronous Belts |
| RMA/MPTA IP-25 | Variable Speed V-Belts |

RMA/MPTA IP-26 V-Ribbed Belts



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