With duty factor of 1.1, use "V-Belts" program with equiv. steady load of

$1.1 \times 24.7 = 27.2$ kW

First choice solution 3SPZ 2800 as shown: (Although life is unnecessary, there's little option here). Can now evaluate belt tensions in order to examine component lives in more detail.

```
**********************                               version 4b
V-BELT DRIVE SELECTOR                              by Doug Wright
**********************

title        : tutorial problem #10
design power          (kW) :   27.2
driving speed        (rpm) :   1470
driven speed limits  (rpm) :    650     750
drive life limits    (khr) :    2.0    25.0
```

belt & number		pulley diameters mm	mm	driven speed rpm	belt speed m/s	belt length mm	cent -res mm	belt life khr	eff'ness %
SPZ	2	315	630	735	24.2	3550	1021	2.8	85
SPZ	3	250	500	735	19.2	2800	801	15.7	82
A	3	315	630	735	24.2	3540	1016	2.3	81
A	4	250	500	735	19.2	2910	857	4.4	80
A	4	250	500	735	19.2	3080	943	4.9	80
SPA	1	400	800	735	30.8	4500	1292	3.4	79
A	5	200	400	735	15.4	2300	671	3.7	79
SPZ	4	180	400	662	13.9	2240	655	6.6	79
SPZ	4	200	400	735	15.4	2240	641	21.3	78
A	6	160	315	747	12.3	1940	592	2.1	78
A	6	180	400	662	13.9	2200	635	6.4	77

BELT TENSIONS, FULL-LOAD

From above output from "V-Belts"

$\gamma = \arcsin (500-250)/2\times 801 = 0.157 \text{ rad } (9^\circ)$

$F_c = z \rho v^2 = 3\times 0.07283 \times 19.2^2 = 81$ N

so at full load of 28 kW

$\hat{F} - \check{F} = P/v = 28\times 10^3/19.2 = 1458$ N

$(\hat{F} - 81)/(\check{F} - 81) = e^{\frac{1}{6}\operatorname{cosec} 19^\circ \times (\pi - 2\times 0.157)} = 4.25$

whence $\hat{F} = 1987$ N, $\check{F} = 529$ N.

Resolving these ∥ & ⊥ line of centres (sketch on previous page) gives resultant belt pull

$F'_R = 2495$ say 2500 N

This is the load experienced by motor bearings etc when demand is 28 kW. The pulley is only some 39 mm wide, so F_R is applied at about 20 mm from inboard end of shaft rather than at $x = e$ (see last problem). We don't have sufficient info to evaluate $F_R = f(x)$ so assume this 2500 N acts at end. This will be conservative, but see later

BELT TENSIONS, HALF-LOAD.

There is no info available which enables prediction of part-load tensions (because all current design is based on classical thin belt model). So assume the model examined above under "Traction Mechanics" applies also to practical V-belts — the tension variation predicted by this (eqn. (7) above) is not expected to be much in error, if indeed it is in error at all. See also last sketch in text.