Jeremy Lui Ming Yuan
U1922313F
N174
CA3

Determine the Design Power

- using a 2 strands ⇒ multiple strand factor = 1.7 (From Table B-3)
- service factor (motor & agitator) = 1.0 (From Table B-2)

$$\text{Design power per strand} = \frac{(11\text{kW})(1.0)}{1.7}$$

$$= 6.47\text{kW}$$

Selecting chain size & number of teeth on the smaller sprocket

RPM of small sprocket : 900rpm
Design Power : 6.47kW

with reference to table B-4 → looking for manufacturer's power rating > (DP = 6.47kW)

@ NO.40 Maximum kilowatt ratings
$N_1 = 25$, manufacturer power rating: 6.73kW

@ NO.50 maximum kilowatt ratings
$N_1 = 13$, manufacturer power rating: 6.89kW
Pitch diameter $DP_1 = 66.34\text{mm}$ ✓ satisfy < max pitch diameter 400mm
[From ANSI standard sprocket]

[check if actual output speed is within 245–255RPM]
$N_1 = 13, N_2 = 45$
$n_2 = 900\left(\frac{13}{45}\right)$
$= 260\text{RPM}$ ✗ RPM too high

$N_1 = 13, N_2 = 54$
$n_2 = 900\left(\frac{13}{54}\right)$
$= 216.67\text{RPM}$ ✗ RPM too low

@ NO.50 Maximum kilowatt Ratings
$N_1 = 14$, manufacturer power rating: 7.46 kW
pitch diameter $DP_1 = 71.34\text{mm}$ ✓

[check if actual output speed is within 245–255 RPM]
$N_1 = 14, N_2 = 54$
$n_2 = 900\left(\frac{14}{54}\right)$
$= 233\text{RPM}$ ✗ RPM too low

$N_1 = 14, N_2 = 45$
$n_2 = 900\left(\frac{14}{45}\right)$
$= 280\text{ RPM}$ ✗ RPM too high

Determine number of teeth for larger sprocket

- average driven speed $= \frac{245+255}{2} = 250\text{rpm}$
- Speed ratio: $\frac{900}{250} = 3.6$

$N_2 = N_1(\text{speed ratio})$
$= 25(3.6)$
$= 90$ teeth [can't be used as not found in catalogue ANSI sprocket]

$N_2 = N_1(\text{speed ratio})$
$= 13(3.6)$
$= 46.8$ → satisfy < max pitch diameter 400mm
≈ 45 teeth, pitch diameter $DP_2 = 227.58\text{mm}$ ✓
[From ANSI standard sprocket]
or
≈ 54 teeth, pitch diameter $DP_2 = 273.02\text{mm}$ ✓
[From ANSI standard sprocket]

$N_2 = N_1(\text{speed ratio})$
$= 14(3.6)$
$= 50.4$
≈ 54 teeth, Pitch diameter $DP_2 = 273.02\text{mm}$ ✓
or
≈ 45 teeth, pitch diameter $DP_2 = 227.58\text{mm}$ ✓

@50 Maximum kilowatt Ratings

$N_1 = 15$, manufacturer power Rating: 8.04kW

Pitch diameter $DP_1 = 76.35mm$ ✓

[check if actual output speed is within 245-255 RPM]

$N_1 = 15$, $N_2 = 54$

$n_2 = 900\left(\frac{15}{54}\right)$

$= 250$ RPM ✓ within the range of 245-255RPM

$N_2 = N_1$ (Ratio speed)

$= 15(3.6)$ ✓

$= 54$ teeth, Pitch diameter $DP_2 = 273.02_{mm}$

Find Tentative centre length (TCL) & Actual centre Distance

$N_1 = 15$

$N_2 = 54$

@ ANSI NO 50,

Pitch, $P = 15.875$ [From table B-1]

$TCD = \frac{760}{P}$

$= \frac{760}{15.875}$

$= 47.9$ pitches

Find $TCL = 2TCD + \frac{N_2+N_1}{2} + \frac{(N_2-N_1)^2}{4\pi^2(TCD)}$

$TCL = 2(47.9) + \frac{54+15}{2} + \frac{(54-15)^2}{4\pi^2(47.9)}$

$= 130.150$ pitches

≈ 130 pitches [Round down to the closest even number]

↳ As centre distance cannot exceed 760mm & with an even number of pitches, we will not need to use offset Link

Find $C_1 = \frac{1}{4}\left[L - \frac{N_2+N_1}{2} + \sqrt{\left[L - \frac{(N_2+N_1)}{2}\right]^2 - \frac{8(N_2-N_1)^2}{4\pi^2}}\right]$

$C = \frac{1}{4}\left[130 - \frac{54+15}{2} + \sqrt{\left[130 - \frac{(54+15)}{2}\right]^2 - \frac{8(54-15)^2}{4\pi^2}}\right]$

$C = 47.34$ pitches

$C = 47.34(15.875)$

$= 751.57mm$ //

Previous design of chain drive	current design of chain drive
Single strand NO.50 roller chain	Double strand NO.50 Roller chain
Pitch = 15.875	Pitch = 15.875
$N_1 = 20$	$N_1 = 15$
$N_2 = 72$	$N_2 = 54$
$D_1 = 101.5mm$ [outside $\phi = 110mm$, from catalogue]	$D_1 = 76.35mm$ [outside $\phi = 83mm$, from catalogue]
$D_2 = 363.9mm$ [outside $\phi = 373.1mm$, from internet]	$D_2 = 273.02mm$ [outside $\phi = 283mm$, from catalogue]
$L = 142$ pitches	$L = 130$ pitches
$C = 750.4mm$	$C = 751.57mm$
Type B Lubrication	Type B Lubrication