[Technical Calculations]  
Designing of Chain Drive Mechanism 4

**Installation Way**

(A) Arrangement of Shafts

1. **Horizontal Arrangement**

- Even when the shafts are arranged horizontally, the following points should be taken into account in terms of the rotary direction of the shafts. In 2 and 3 shown, elongation of the chain may prevent the chain links from leaving the sprocket teeth smoothly, resulting in noise. In (2) shown, the load bottom and slack top sides of the chain may come in contact with each other to prevent this, use an idler or something equivalent.

Vertical Arrangement

In (3) shown, an elongated chain may sag below the bottom sprocket. In this case, when a small sprocket is arranged below a large sprocket, the elongated chain may drop away from the small sprocket. To prevent this, the shafts should be arranged so as to maintain the angle at a maximum of 60°. When the mechanism in question or the installation space requires a vertical arrangement, place the small sprocket above the large sprocket and an idler, etc. on the outside or inside as shown in (6).

(B) Deflection

- The deflection should normally be maintained at approximately 4% of the distance between the shafts, and approximately 2% in the following instances.

A. The shafts are arranged almost vertical transmission.

B. The distance between the shafts is 1 m or more.

C. The chain needs to be started and stopped frequently under heavy load.

D. The chain needs to be run in the reverse direction.

(C) Load Fluctuation

- When the load varies during operation, install an initial tension either on the load or loose side of the chain. This can remove vibration and reduce the noise of the chain.

**Lubrication**

The service life of roller chains depends heavily on lubrication. Therefore, correct lubrication is extremely important. Today, as chains are increasingly run at higher speeds, they need to be lubricated more efficiently.

**Benefits of Lubrication Oil**

- Oil applied into the space between pins, bushings and rollers forms an oil film. Which then helps reduce wear of parts as well as absorb impact. Oil also cools down heat generated in the chain. Use good quality mineral oil to lubricate roller chains.

**Recommended Lubricating Oil**

- Oil the chain in a manner such that the entire length of the chain is coated with oil, but not in a manner such that the chain is covered with a thick layer of oil.

- The lubrication method is mentioned in the power transmission efficiency tables (mentioned in the power transmission efficiency tables are based on the following):

- As shown in Figure 4, it is recommended that the oiling method be used in the following manner:

  - **Drop Lubrication**
  - **Inch Lubrication**
  - **Rotating Plate Lubrication**
  - **Forced Circulation Lubrication**

- It is necessary to adjust the oil quantity to prevent overheating.

**Allowable Stress for Tension Member**

- Check the belt that is selected for allowable stress, using the following procedures.

1. **Calculating the Effective Tension**

   The effective tension of a belt can be calculated using Formula 1.

   \[ T_{\text{effective}} = T_{\text{measured}} - \Delta T \]

   \[ T_{\text{measured}} = T_{\text{in}} + T_{\text{out}} \]

   \[ \Delta T = \frac{(F - F_0) \cdot L}{2} \]

   \[ F = \frac{P_{\text{max}}}{N} \]

   - **T** : Effective Tension
   - **F** : Effective Force
   - **P** : Maximum Power
   - **N** : Effective Number of Belts
   - **F_0** : Force of Gravity
   - **L** : Effective Length of Belt

2. **Using the Tension on the Loose Side to Calculate Maximum Tension**

   \[ F_{\text{max}} = \frac{P_{\text{max}}}{N} \]

   - **F** : Maximum Force
   - **P** : Maximum Power
   - **N** : Effective Number of Belts

3. **Using the Tension on the Tight Side to Calculate Maximum Tension**

   \[ F_{\text{min}} = \frac{P_{\text{max}}}{N} \]

   - **F** : Minimum Force
   - **P** : Maximum Power
   - **N** : Effective Number of Belts

4. **Using the Tension on the Loose Side to Calculate Maximum Tension**

   \[ F_{\text{max}} = \frac{P_{\text{max}}}{N} \]

   - **F** : Maximum Force
   - **P** : Maximum Power
   - **N** : Effective Number of Belts

5. **Using the Tension on the Tight Side to Calculate Maximum Tension**

   \[ F_{\text{min}} = \frac{P_{\text{max}}}{N} \]

   - **F** : Minimum Force
   - **P** : Maximum Power
   - **N** : Effective Number of Belts

6. **Using the Tension on the Loose Side to Calculate Maximum Tension**

   \[ F_{\text{max}} = \frac{P_{\text{max}}}{N} \]

   - **F** : Maximum Force
   - **P** : Maximum Power
   - **N** : Effective Number of Belts

Where the effective stress for the belt is used, it is to be equal to or higher than the maximum stress per cm width of the belt as expressed by Formula 1 above, the belt is suitable for use.