6.5 Lubricating oil for Gears

Purpose of using lubricating oil for longer life of gear is as follows,

1) Avoid metal contact (without oil film) to flank.

2) Reduce frictional heat from flank

In addition, better efficiency with less oscillation and noise can be expected.

Insufficient lubricating oil to flank can cause high oscillation and noise in a short time. Scuffing will occur with the increasing temperature, resulting in damage to the bearing. To prevent such problems, apply suitable lubricating oil to the gear is necessary. Proceed with proper method and amount to gear.

Method of lubricating oil

Classifications of lubricating oil to gears are as follows,

- 1) Grease lubricating method
- 2) Splash lubricating method (Oil bath or Splash lubrication)

3) Forced lubricating method

Selection of Method of lubricating oil can be by types of gears, Circumferential velocity, surface pressure (load applied to gear), finishing condition of flank, hardness of material and combination of materials. However, Circumferential velocity is usually used.

Table 8 indicates guide for selecting gear's lubricating method by circumferential velocity.

(1) For Spur, Helical and Bevel gears

Lubrication method	Circumferential velocity (m/s)					
	0	5	10	15	20	
Grease lubricating method	>	I			I	
Splash lubricating method	←		>			
Forced lubricating method			<			

(2) For Worm gear pair and Hypoid gears

Lubrication method	Circumferential velocity (m/s)					
	0	5	10	15	20	
Grease lubricating method	>		I		I	
Splash lubricating method	← ←		>			
Forced lubricating method		<				

Table 8. Guide for selecting gear lubricating method by circumferential velocity.

Proper level of lubricating oil

(1) Splash lubricating method (Oil bath or Splash lubricating)

Amount of lubricating oil for soaking each type of gear is different. The mixer resistance and windage are increased when large amount of lubricating oil are used for soaking the gear. Table 9 shows the proper level of lubricating oil for soaking the gear.



 $H=(1\sim3)\times$ Tooth depth



Line of centre of Worm gear

(d₁) Worm gear pair (Lower position of Worm gear)





(b) Spur and Helical gears (Perpendicular axis)

(a) Spur and Helical gears (Horizontal axis)



(c) Bevel and Hypoid gears



(2) Forced lubricating method

In general, temperature of lubricating oil should not exceed 8°C when lubricating oil flows onto working area of gear. Criterion for facewidth per cm is 0.5*1*/min for low speed and 1*1*/min for high speed. Lubricating oil for high speed, use following empirical formula.

Oil level(l/min) = 0.6 + 2×10⁻³ • mv

Hereby

- *m* : Module (mm)
- υ_{-} : Circumferential velocity (m/s) of Pitch circle

Spray before the starting area of gear engagement with lubricating oil perpendicular to flank. In rare instances for high speed, spray in the direction towards the end of the engagement.

To prevent temperature of oil from increasing, the collected oil should go through a cooling process using cooling equipment before being reused.

