TECHNI/TIPS

A Publication of the Lubrication Engineers Technical Department

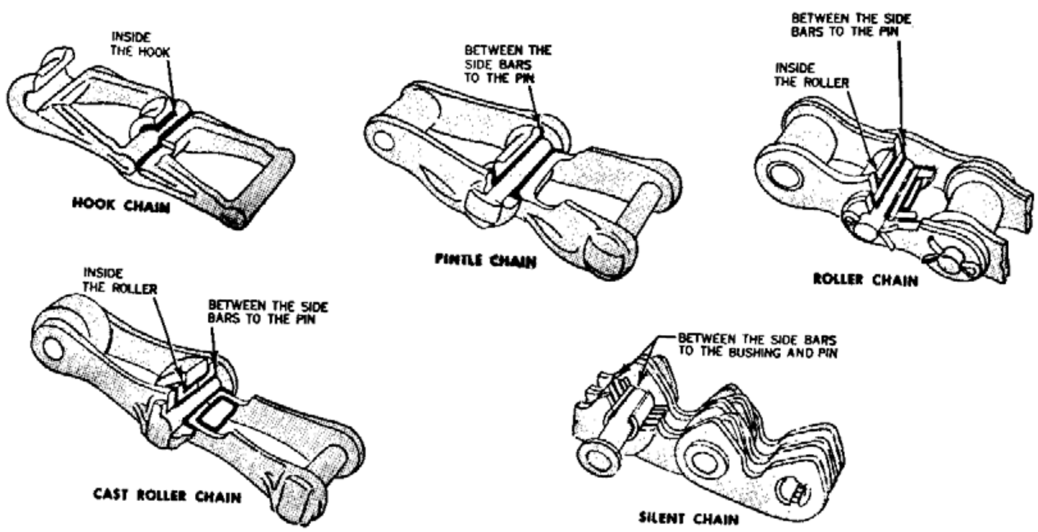
LEADERS IN LUBRICATIONS NUMBER 36

ROLLER CHAIN LUBRICATION

Roller chain drives are efficient, economical and versatile. In every phase of industry, chains will be found transmitting power and conveying raw materials or finished goods with efficiency and dependability.

The dependability of chain operation depends upon the basic principles of good installation, proper lubrication and maintenance.

Types of Roller Chains and Where They are to be Lubricated



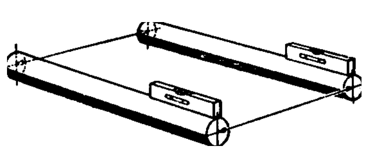
Installation

The shafts must be rigidly supported in properly designed bearings. Shaft displacement will change the initial alignment and shorten chain life. Drives should be carefully aligned before operation. Alignment procedure includes insuring that the shafts are parallel and in the same plane, and that the sprockets are in line and not offset on the shafts.

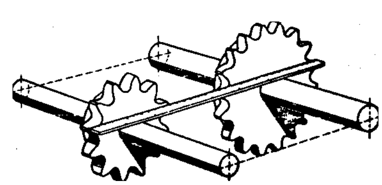
Misalignment, particularly in the multiple stand chains results in uneven loading across the width of the chain and can cause early failure. Care should be taken to avoid deflection under load which will result in sprocket misalignment. A drive can be perfectly aligned when standing idle and still have destructive misalignment during operations due to structural defects.

Contact between the drive and adjacent objects must not occur. Ample clearances should be provided to allow for chain pulsations and for possible end float of shafts. Where loose material (coal, gravel, dust, etc.) is present, sufficient clearance to prevent its accumulation around the drive is essential.

Carefully level each shaft, checking the adjustment with a machinist's spirit level applied directly to the shaft. If multiple width sprockets are used, the level may be applied across the teeth. Check the shafts for parallelism with a feeler bar. After adjustment, recheck the shaft levels; repeat the adjustments until both level and alignment are satisfactory.



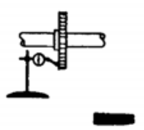
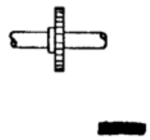
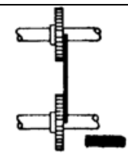
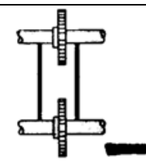
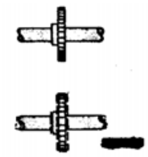
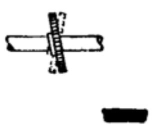
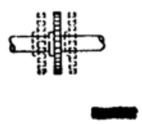
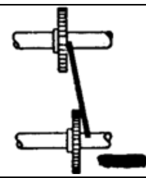
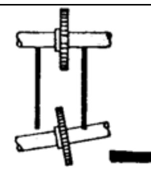
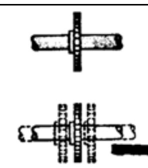
Aligning Shafts



Aligning Sprockets

Check the axial alignment of the sprockets with a straight edge applied to finished surfaces on the sides of the sprockets. A taut piano wire may be used if the center distance is too great for the available straightedge. If a shaft has axial float, block the shaft in its running position before alignment of the sprockets. Be sure to secure the sprockets against axial displacement using a set screw.

The performance of a chain drive or conveyor in terms of wear life and fatigue life is dependent to a great degree on the correct alignment of shafts and sprockets. Time taken to install shafts and sprockets properly is well spent. Check frequently, giving special attention to the points illustrated below.

RIGHT						
CHECK POINT	**Position of sprockets on shafts** -- axially square; check with dial indicator	**Lateral movement of sprockets on shafts** --none	**Alignment of sprockets on shafts** -- exactly opposite; check with straight edge	**Shafts parallel** -- check with vernier, calipers or feeler bars	**Shafts level** -- use machinist's level	**Shaft end float** -- minimum possible
WRONG						

Before installing the chain, recheck all the preceding adjustments, and correct any that have been disturbed.

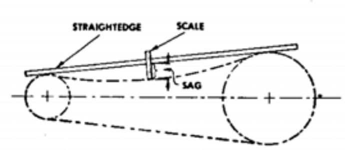
After removing the connecting link, wrap the chain around the sprockets, bringing the free ends together on one sprocket. (see figure to the right)

Insert the pins of the connecting link in the two end links of the chain; then install the free plate of the connecting link, and fasten the plate, using the cotters, spring clip or other fasteners supplied. After the fasteners have been inserted, it is important that the ends of the chain pins be tapped back so that the fasteners come up snugly against the outside of the connecting link plate. By doing this, three important things are accomplished:

1. Clearance between link plates across the chain are maintained. A connecting link plate driven down too far on the pins "squeezes" the chain joint so that no oil can get down between the link plates.
2. Proper assembly of the connector will assure smoother chain action with a minimum of whipping of the chain.
3. Maximum fastener life is achieved when it fits snugly against the link plate.

The use of offset link plates should be avoided wherever possible for the best performance. If an offset link is necessary, it should be assembled permanently into the chain with press-fit pins.

For a check of chain tension, turn one sprocket to tighten the lower strand of the chain; then measure the sag of the upper strand as shown at right. This sag, measured at the midpoint should be approximately two to three percent of the length of the tangent (straight-edge) to the sprockets.

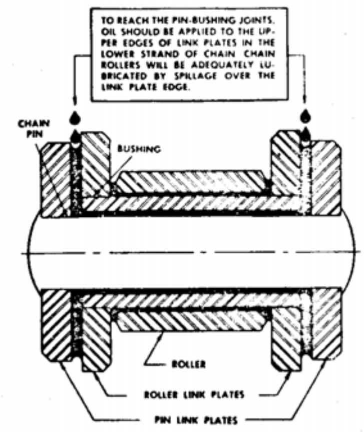


Chain Sag Measurement — Horizontal Drive

An inclined drive should have less slack than a horizontal drive. For a vertical drive, provision for adjustment of chain is desirable.

Lubrication

The figure at right is a cross section through a roller chain with the clearances greatly exaggerated to indicate the required flow of lubricant.



Most important is the lubrication of the pin and bushing surfaces which articulate with each other while the chain is under full load. Lubrication is also required between the rollers and bushings. To reach all of these surfaces, the lubricant is applied to the upper edges of the link plates on the lower strand of the chain shortly before the chain engages a sprocket. Then, as the chain travels around the sprocket, the lubricant is carried by centrifugal force into the clearances between the pins and the bushings. Spillage over the link plates supplies lubricant to the interior and the end surfaces of the rollers.

Chain lubricants should have the following characteristics:

- Sufficiently low viscosity to reach the internal surfaces
- Sufficient body to maintain the lubricating film under the bearing pressures.
- Freedom from corrosive ingredients.
- Ability to maintain lubricating qualities under different temperatures, moistures, etc.

The proper lubricant viscosity for various ambient temperatures are shown in the table below.

Chain Temperature °F (°C)	Recommended Lubricant			Oven Chain Temperature °F (°C) At Application	Recommended Lubricant
-20 (-29) to 20 (7)		4046	4010	less than 250[1]) (121°)	2700*
20 (7) to 40 (4)	6403	6803	9068	250° (121°) to 450° (232°)	2799`
40 (4) to 100 (38)	6404	6804	4030	*All open flames and pilot lights must be off before application.	
100 (38) to 120 (49)	6405	6805	9150		
120 (49) to 140 (65)	6406	6806	4090		
140 (65) to ---			9963		

Sprocket Chain Manufacturers Association recommends only oil for chain lubrication. LE's MONOLEC® R&O Compressor/Turbine Oils, LE's MULTILEC® Industrial Oils and 9963 SYNOLEC® Lubricant are appropriate for chain lubrication. They have high film strength, excellent oxidation resistance, outstanding rust protection and include specific anti-wear additives along with MONOLEC, LE's exclusive wear-reducing additive. These will result in long life for both the oil and the equipment. QUINPLEX® White Oil can also be used where HI products are desired. Occasionally, gear oils are used to lubricate chains in certain applications.

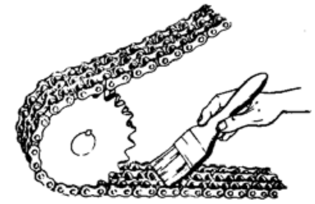
Many customers have found excellent results in using LE's 451/452 ALMASOL® Chain & Cable Lubricant. This is a light grease which penetrates well, has the body to prevent metal-to-metal contact and is tacky to stay in longer than oils. LE's 9102 SYNTEMP® Synthetic Lubricant and LE's 4025 QUINPLEX Food Machinery Lubricant (both in aerosol) are excellent chain lubricants. LE's 2001 MONOLEC Wire Rope Lubricant has been used successfully on chains where superior rust protection is needed.

There are four basic types of lubrication for chain drives:

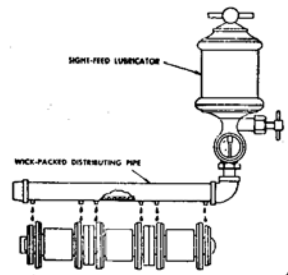
Manual Lubrication - Drip Lubrication - Bath or Disc Lubrication - Oil Stream Lubrication

The recommended types shown are influenced by chain speed and the amount of power transmitted. These are minimum lubrication requirements and the use of a better type is acceptable and may be beneficial. Chain life can vary appreciably depending upon the way the drive is lubricated. The better the lubrication, the longer the chain life. For this reason, it is important that the lubrication recommendations be followed.

In **manual lubrication**, oil is applied periodically with a brush or spout can. Volume and frequency should be sufficient to prevent discoloration of lubricant in chain joints.

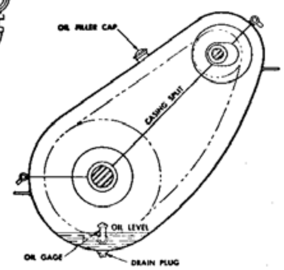

Manual Lubrication

In **drip feed lubrication**, oil drops are directed between the link plate edges from a drip lubricator. Volume and frequency should be sufficient to prevent discoloration of lubricant in the chain joints. Precaution must be taken against misdirection of the drops by windage.



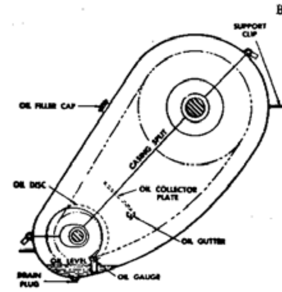
Drip Feed Lubrication

For multiple strand chains, a distribution pipe must be extended through a sump of oil in the drive housing. The oil level should reach the pitch line of the chain at its lowest point while operating, approximately halfway up the lowest tooth.



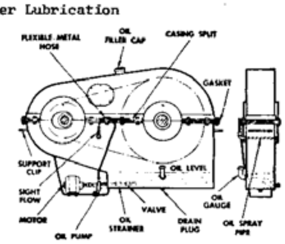
Bath Lubrication

On **disc lubrication**, the chain operates above the oil level. The disc picks up oil from the sump and deposits it onto the chain, usually by means of a trough or collector plate.



Disc or Slinger Lubrication

In **oil stream lubrication**, a pump driven from one of the main drive shafts, or by a separate motor, delivers oil under pressure to nozzles that direct an oil spray onto the chain. The oil should be applied inside the chain loop evenly across the chain width, and be directed at the lower strand. Excess oil collects in the bottom of the casing and is returned to the pump suction reservoir. A pres-sure-regulating valve bypasses to the reservoir any excess pump discharge. Cooling is accomplished by radiation from the external surfaces of the reservoir.



Oil Stream Lubrication

Cleaning and Storage

Clean a chain as follows: (1) Remove the chain from the sprockets. (2) Wash the chain with kerosene or LE's 2300 L-X Heavy-Duty Chemical Supplement. If the chain is badly gummed, soak it for several hours in the cleaning fluid and then rewash it in fresh fluid. (3) After draining off the cleaning fluid, soak the chain in oil to restore the internal lubrication. (4) Hang the chain over a rod to drain off the excess lubricant (5) Inspect the chain for wear or corrosion.

While the chain is off the sprockets, clean the sprockets with kerosene or LE's 2300 L-X Heavy-Duty Chemical Supplement, and inspect them for wear or corrosion. Unless properly protected, the components of a chain drive will deteriorate during long periods of idleness. If a chain is to be stored, remove it from the sprockets and cover it with heavy grease like LE's 2002 ALMASOL Wire Rope Lubricant or LE's 3752 ALMAGARD® Vari-Purpose Lubricant. Then wrap it in heavy, grease-resistant paper. Store the chain where it will be protected from moisture and mechanical injury. The sprockets may be left in place on the shafts. Before placing the drive in service again, thoroughly clean the chain and sprockets to remove the protective grease; then relubricate the chains.

Lubrication Engineers, Inc.®

300 Bailey Ave, Fort Worth, TX 76107 | 817-834-6321 | 800-537-7683
fax 817-834-2341 | http://www.le-inc.com

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