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- Conveyor and chain lubricators
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Lubricating Powder Coating Conveyor Systems

By Gordon Reeves

An automatic shot type conveyor lubricator is an essential component of every powder coating conveyor system. Manual application of lubricant to a moving conveyor is dangerous and impractical. Inexpensive brush lubricators don't have the necessary lubricant volume control and can only brush lubricant onto the outside of conveyor components and not into their bearings and wear areas. A dependable automatic shot type conveyor lubricator greatly extends the life of the conveyor by eliminating sliding friction and preventing seizing and also reduces drive power requirements. Lubrication also helps the conveyor run smoother to keep hanging parts from swaying.

The lubricator should be properly designed and engineered to be capable of dispensing all of the different types of lubricants commonly used. Because not all conveyor components require identical amounts of lubricant, it should have an adjustable lubricant output for each lubrication point. The lubricator should also have a microprocessor with programmable display screen to allow lubrication based on counting complete conveyor circuits. Lubricator nozzles should be sturdy and durable to consistently deposit lubricant onto or into the selected wear points. Each nozzle should have a check valve located as close to its tip as possible to eliminate dripping. The microprocessor should be programmed to recognize conveyor speed and to automatically adjust the lubricant ejection timing to match variations in conveyor speed. There are many important factors that must be carefully considered in the purchase, installation, operation, and maintenance of a conveyor lubricator.

1. The location of the lubricator on the conveyor is critical. Accessibility to the "front" of the lubricator (control panel, display screen, dispenser adjustment knobs, pressure adjustment knob, nozzles, and proximity sensors) is very important. The lubricator should be capable of operating in either conveyor travel direction so it can be installed with its "front" accessible at any desired location on the conveyor. Lubricators that include a direction of travel arrow and are not reversible will be more difficult to install in the most accessible location. The unload-load area of the conveyor is an ideal location for lubricator installation because the conveyor is usually closer to working height and the chain may be cooler. If the lubricator is installed too close to the spray washer, some lubricants may not penetrate the wear points before the conveyor enters the washer where poorly functioning conveyor shrouds may allow the lubricant to be washed off. If possible, the lubricator should be installed where there are no parts hanging from the conveyor but this may not be necessary for conveyors with sanitary hooks because they can be installed with a pan directly under the lubricator.

2. The lubricator should also be properly installed and adjusted. Install lubricator on a flat (horizontal) conveyor section and properly align the conveyor section included with the lubricator with the existing conveyor prior to welding. Welds must be ground so trolley or load wheels don't jump, twist, or lurch as they travel through lubricator. Aim nozzles per manufacturer's instructions. Sensors may also need slight adjustment.

3. Many different lubricants are available for use with powder coat conveyors, but you should use only lubricants that are compatible with your powder coating process. Full-synthetic, semi-synthetic, "dry-film" with either molybdenum disulfide (moly) or graphite, and water-soluble lubricants are a few of the many. Each lubricant has advantages and disadvantages. Some lubricants may be almost harmless when accidentally deposited on parts being powder coated but are expensive to use because they must be re-applied on almost every conveyor circuit. Other lubricants can be applied infrequently, but an error in application could cause a defect in your part finish. The lubricant selection should be based on protecting conveyor components, the powder coating system, parts being powder coated, and the environment. Temperature, time, load, conveyor speed, and atmosphere are also factors in choosing a lubricant. Choosing a lubricant will probably not be a "once and forever" decision.

Choose a lubricator that can handle "All Lubricants". Because new and better lubricants are constantly being developed, your customer should be able to choose a different lubricant at will. A lubricator that will function with a wide range of viscosities is preferable to one that will only handle thin "dry-film" type lubricants. The last thing you want to hear, after discovering a new and better lubricant, is that you can't use it in your lubricator.

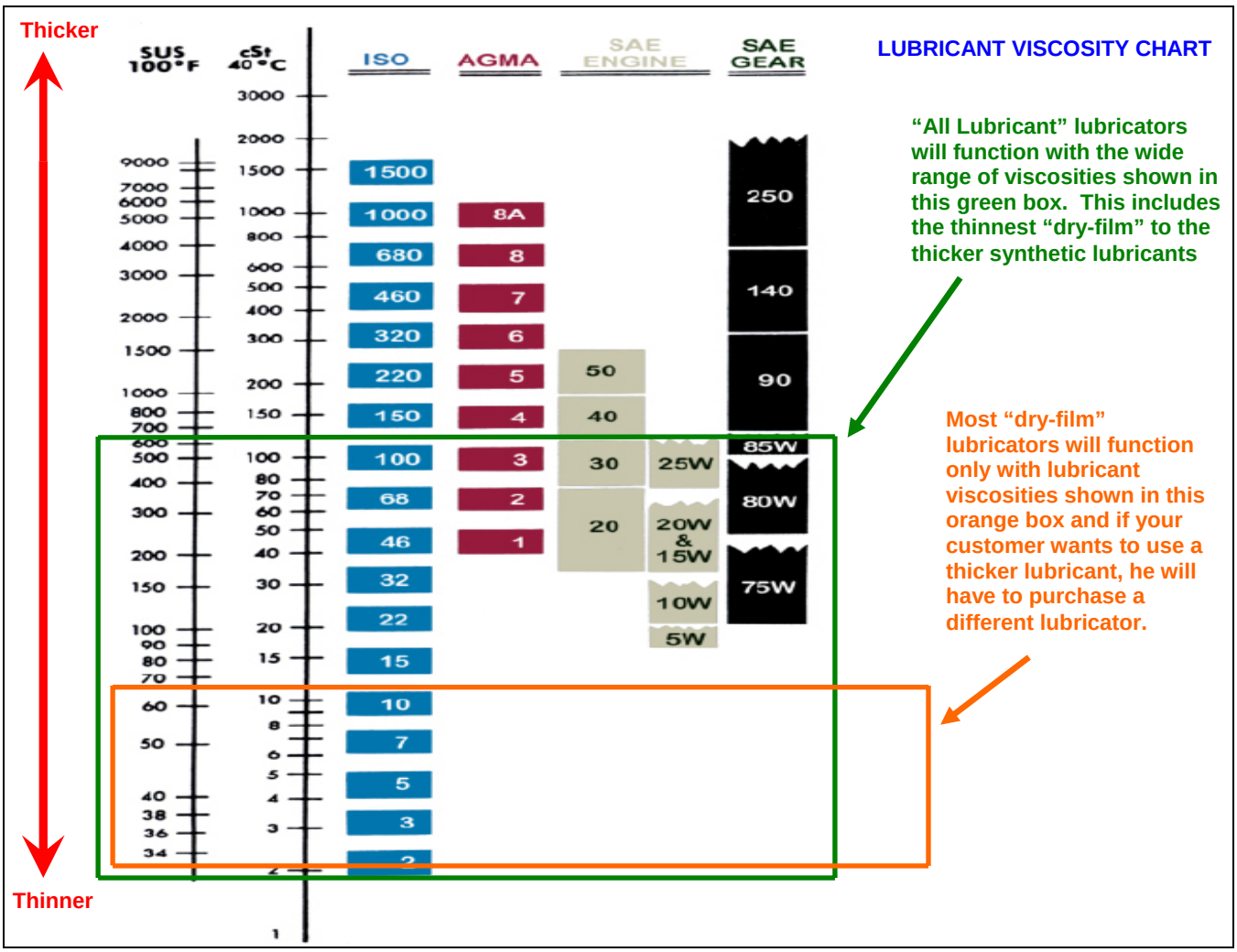
Viscosity is the measure of the lubricant's resistance to flow (shear stress) under certain conditions. Viscosity is important because it represents the measure for which the lubricant wants to stay put when pushed (sheared) by moving mechanical components. Viscosity also affects how lubricants are pumped, distributed, and squirted. A modern lubricator will handle "All Lubricants" that are within the viscosity range of 30 SUS to SAE 30 crankcase oil. In the ISO section of the viscosity chart below, 30 SUS is equivalent to ISO 2 and SAE 30 crankcase oil is equivalent to ISO 100.

Viscosity can be confusing. In a recent discussion about viscosity, a "dry-film" lubricator salesman claimed, "Our lubricator will handle 30 weight", but he meant 30 SUS, the viscosity of mineral spirits, not SAE 30, the viscosity of a crankcase oil. His customer asked about viscosity because his conveyor specifications called for lubrication with SAE 20 viscosity oil and he would have been very disappointed had he purchased a lubricator that would only handle 30 SUS lubricant. Although most of us understand that less viscous lubricants are identified as "thin" or "thinner" and more viscous lubricants are identified as "thick" or "thicker", there is still much confusion about viscosity and the different methods of measuring it. Many of us know how thick SAE 30 weight motor oil is, but few know that 30 SUS is the viscosity of mineral spirits and paint thinner.

There are six popular ways to designate viscosities of lubricants commonly used for conveyors and there are two measures of temperature (Fahrenheit and Celsius) and two temperatures 40°C (104°F.) or 100°C (212°F.) that can be applied.

1. SAE Engine (Society of Automotive Engineers) grades for crankcase oils
2. SAE Gear (Society of Automotive Engineers) grades for gear oils
3. SUS (Saybolt Universal Seconds)
4. cSt (kinematic viscosity in centistokes)
5. AGMA (American Gear Manufacturers Association) grades for gear oils
6. ISO (International Standards Organization)

The chart below shows the relations ship between these methods of measuring viscosity and also shows how different 30 SUS viscosity is from SAE 30 crankcase oil viscosity.



"Dry-film" lubricants with moly can be used to lubricate conveyors traveling through ovens with temperatures as high as 700°F. "Dry-film" lubricants are popular because they simultaneously clean and penetrate and will not attract dust. They consist of a blend of carrier (petroleum hydrocarbon based) and solids (usually moly) and the mixture is often 98% or more carrier with the remaining 2% moly and other additives. The preponderance of carrier causes the complete mixture to be extremely thin with a viscosity of from 30 to 60 SUS (ISO 2 to ISO 10).

The flash point of the carrier portion of a "dry-film" lubricant is an important consideration. Lower flash point carriers evaporate faster at lower temperatures. See FLASH POINT DEFINITION. If the conveyor components are not too hot when the lubricant is applied, the carrier will evaporate slowly to allow the moly to enter the bearings and wear areas of the conveyor. If the conveyor component temperature is too high, the carrier will evaporate quickly leaving the moly on the outside where it will eventually build up and flake off. Some "dry-film" lubricants have flash points around 115° F. which is so low that some trucking companies consider them too dangerous to ship. The lower flash point of the carrier is the magic that make the "dry-film" lubricants popular because the quick evaporation of 98% of everything that has been applied minimizes problems caused by applying too much lubricant, not aiming nozzles, and allowing nozzles to drip. The downside of this quick evaporation is that you will consume much more "dry-film" lubricant than you would of any other type.

FLASH POINT DEFINITION:
Flash point is the minimum temperature of a petroleum product or other combustible fluid at which vapor is produced at a rate sufficient to yield a combustible mixture. Specifically, it is the lowest sample temperature at which the air vapor mixture will "flash" in the presence of a small flame. Flash point may be determined by following ASTM Methods. Fire Point is the minimum sample temperature at which vapor is produced at a sufficient rate to maintain combustion. Specifically, it is the lowest sample temperature at which the ignited vapor persists in burning for at least 5 seconds. Since the fire point of commercial petroleum oils ordinarily runs about 30° C above the corresponding flash point, it is omitted from petroleum product data. Flash and fire points have obvious safety connotations – the higher the test temperature, the less the hazard of fire or explosion. Of comparable significance is their value in providing a simple indication of volatile material. The dilution of a crankcase oil with a fuel, for example, lowers the flash point. Flash and fire points should not be confused with Auto-Ignition Temperature, the temperature at which combustion occurs spontaneously without an external source of ignition.

Synthetic and semi-synthetic lubricants can be used to lubricate conveyors traveling through ovens with temperatures as high as 600°F. Synthetic and semi-synthetic lubricants are at the present time not as popular as "dry-film" types, but they are gaining in acceptance. The synthetic base components of these lubricants are often too viscous to be ejected from nozzles, but when blended with small amounts of lower viscosity materials (solvents) the resulting solution can be thinned to the optimum ISO 100 necessary for use in shot type conveyor lubricators. Adding more solvent would reduce the viscosity, but would also negate some of the beneficial properties of the high quality synthetic lubricant. The flash point of the thinner portion of these lubricants is of less significance for the penetration of the lubricant solution because 80% or more of the lubricant dispensed is the synthetic base product with the high 450 to 600° F. flash point. After the solvent evaporates, the synthetic lubricant remains to lubricate the conveyor components. The remaining synthetic lubricant is often of such high quality that 50% of it is still there after 48 hours of the highest claimed temperature. Users of synthetic and semi-synthetic lubricant sometimes lubricate once a week while users of "dry-film" lubricant sometimes lubricate continuously.

4. Conveyor lubricator maintenance is extremely important and can be performed by your own personnel, by an outside contractor, or by a combination of both. Nozzles must be aimed and re-aimed if bumped. Lubricant must be purchased to be available when needed. Reservoirs must be kept filled. Lubricator programs must be adjusted to match changing production and oven temperatures. Worn or damaged components must be replaced. Lubricators are not complex and any company that can maintain other components of a powder coating system should be able to maintain a conveyor lubricator. A well engineered conveyor lubricator doesn't need an outside contractor for maintenance.

If you use "dry-film" lubricants with a lubricator that is guaranteed to function with only one brand of lubricant, the cost of maintenance by an outside contractor (usually the lubricator and lubricant salesman) will often be buried in the cost of the lubricant. The high evaporation rate of "dry-film" lubricants requires the purchase of many pails of lubricant. This high sales volume combined with the high profit margin of mostly carrier (solvent) being sold as lubricant, allows the salesmen to combine lubricant sales and maintenance at an attractive price. The maintenance portion may appear to be free, but you will be using more lubricant.

If you use synthetic or semi-synthetic lubricant, maintenance is not as likely to be included at no cost with the purchase of lubricant. You will also be purchasing much less lubricant so the salesman can't bury the cost of maintenance in the cost of the lubricant. A lubricator that can handle the higher viscosity of these lubricants will be more rugged and may not require as much maintenance as a lubricator designed for only "dry-film". If low cost maintenance training is available, you should take advantage of it.

5. A lubricator should have a microprocessor that is capable of causing lubrication based on counting complete conveyor circuits. This can be accomplished by entering a number that represents a complete conveyor circuit into the lubricator program. See examples below.

Example #1. An enclosed track conveyor with load wheels on 6" centers (6" pitch) has 1,400 load wheels in a 700 ft long conveyor and the number "1,400" represents a complete conveyor circuit. The lubricator sensor will count load wheels.

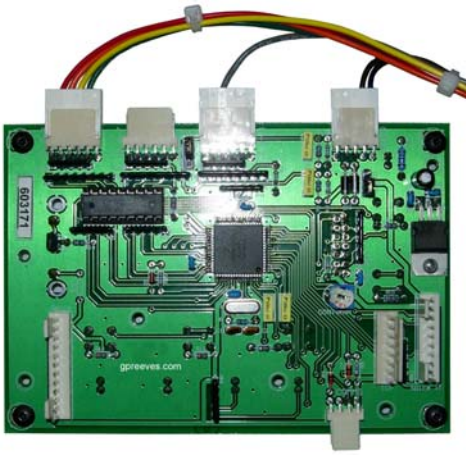
Example #2. An "I" beam conveyor has X458 (4") chain and the combination of a solid link and a connecting link results in the chain having an effective pitch of 8" and every solid link representing 8" of conveyor. Multiply conveyor length by 1.5 to obtain the number that represents a complete conveyor circuit. The lubricator sensor will count solid chain links.

Next, enter the number of complete circuits that are to be lubricated (usually one) followed by the number of complete circuits that are to be skipped or not lubricated. The number of skipped conveyor circuits depends on the conveyor length, time in oven, oven temperature, type of lubricant, conveyor load, etc. but the goal is to keep the conveyor system lubricated without applying excess lubricant because excess lubricant could drip from an already saturated conveyor. See photos of a microprocessor below and note the two-line backlit display, function buttons, and indicating lights.

HIGH QUALITY MICROPROCESSOR

Outside of enclosure

Inside of enclosure



Some lubricators still use clock-type timers to control their off-on lubrication cycles. The time on these clocks is often based on "time of day" even when they could have been wired to monitor actual conveyor run time. Stay away from lubricators with clock-type timers because microprocessors are much better at controlling lubricators. Be certain that any controller (timer or microprocessor) has full program and progress memory during power outages.

6. There is always a slight time delay between actuation of sensors and the squirting and subsequent arrival of a measured amount of lubricant onto the moving chain and trolleys. Older style lubricators calibrate for this delay by operating the conveyor at selected speed and then manually moving the sensor until the lubricant lands at the correct location. When the conveyor speed is reduced, lubricant will be deposited ahead of the correct location. When the conveyor speed is increased, lubricant will be deposited behind the correct lubrication location. Older style lubricators require manual repositioning of the sensor after conveyor speed changes.

Choose a lubricator that automatically places the lubricant in the correct locations regardless of conveyor speed. The Lube Logic lubricator uses its microprocessor to automatically recognize and display chain speed in "feet per minute" (fpm). The microprocessor uses this information to automatically control the "timing" of the lubricant ejections to cause the lubricant to land at the correct locations regardless of chain speed variations. This automatic ejection timing is especially important for "job shop" applications where extreme variations in conveyor speed are normal.

7. Because all lubrication points are not identical, (load wheel bearings require more lubricant than chain pivot points or chain pins) the lubricator should have one adjustable volume positive displacement piston dispenser for each lubrication point. The lubricant volume of adjustable positive displacement dispensers can be accurately preset to meet the different requirements of the various conveyor components. Stay away from lubricators that use multiple nozzles attached to one solenoid valve because they cannot be adjusted to intentionally dispense less lubricant from any of their nozzles. If the lubricant volume to each nozzle can't be adjusted, one or more nozzles will often dispense excess lubricant that will be wasted and could drip from the conveyor.

With lubricators that have positive displacement piston dispensers, the actual lubricant volume used for a complete conveyor circuit can be accurately calculated based on the adjusted outputs of the piston dispensers and the conveyor length. Claims of calculating lubricant usage for lubricators without piston dispensers are estimates or guesses because the actual lubricant volume will vary with pressure, viscosity, time, and resistance.

8. Compressed air is an awesome dependable source of energy for the reciprocating piston motions necessary to accurately dispense measured quantities of lubricant. Compressed air is ubiquitous in most modern production facilities. Lubricators that are controlled by electricity and powered by compressed air can use a common air pressure regulator for velocity control to function with thin "dry-film" and thicker synthetic and semi-synthetic lubricants. Be wary of lubricators that are "All Electric" because they usually can only dispense the viscosity of lubricant for which they have been originally designed and thicker or thinner lubricants will either drip or splash.

Conveyor powered lubricators don't use compressed air, but use the movement of the conveyor to cock a spring which is later released to move a piston to provide lubricant pressure. The conveyor powered mechanism is actuated by contacting the moving conveyor and is high maintenance even at slow conveyor speeds. Higher conveyor speeds intensify the problem. The conveyor powered lubricator may also include an arrow showing that it should only be operated in one direction. Before you purchase this type of lubricator, get it in writing that the lubricator (specifically the mechanical pump) will not be damaged by inadvertent operation in the wrong direction or without lubricant.

Some lubricators still use air valves with roller arms or cams that are actuated by the conveyor. Avoid these because they are not as dependable as lubricators that use non-contact electronic proximity or photo sensors.

9. Self-contained, remote fill, and central pump are three of the common methods of supplying lubricant to conveyor lubricators.

a. A self-contained lubricator has an integral gravity type reservoir that must be filled either manually or with an optional remote fill pump. Its reservoir should have a low level sensor and its controller should have a low level indicator light. Manual fill usually requires climbing a ladder with a lubricant container, but if reservoir is equipped with fill and return ports, an inexpensive hand-operated remote fill pump with tubing can be used.

b. Automatic pneumatic and electrical remote fill pumps can also be used with reservoirs that are equipped with fill and return ports and lubricators with integral reservoirs can continue operation during maintenance or container changes at these pumps.

c. Lubricators can also be purchased as "lubricating heads" and these will not include reservoirs because they are designed to be supplied with lubricant from a central pump. Many lubricator heads can be supplied by a single central pump, but it is recommended that the lubricant pressure from the central pump not be the pressure source used for dispensing lubricant. "Dry-film" lubricators that use this central pump pressure as the lubricant pressure source often can't be adjusted to dispense different (higher viscosity) lubricants when the user wants to change. Lubricating heads that use the central pump only as a source of lubricant and not as the lubricant pressure often can be adjusted to dispense the more viscous lubricants when desired because they use compressed air to operate one piston dispenser for each nozzle. Lubricator heads without reservoirs are vulnerable to the continued operation of the central pump. When the central pump is not operating, all lubricator heads will also not operate.

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