

CHAIN MAINTENANCE GUIDE



Reprinted excerpts from the
Wippermann Catalogue 2015.

A TransDev Technical Report

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The information in this Technical Guide can also be found in the Wippermann Catalogue 2015. It forms part of a series designed to help you specify and identify the optimum Wippermann chain solution for your needs.

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General information

A chain drive needs relatively little maintenance, if the correct chain was selected, if it was installed correctly and if it is lubricated according to the recommended procedure.

However, the chain should be protected against dirt and adverse environmental influences. A chain protection box helps to prevent dirt, averts accidents and absorbs noise.

In case of protected drives maintenance comprises a regular (annual) cleaning of the oil container and a renewal of the oil filling.

Open running chain drives must be cleaned every 3 to 6 months.

Shorter periods may be necessary, if the chains are very dirty. When cleaning the chain drives, wheel alignment and chain tension should be checked as well.

Cleaning

First of all, in order to clean a chain drive properly, the external rough dirt must be removed by means of a hard or steel brush. Subsequently, the chain is rinsed in cleaning solvent, paraffin or diesel oil.

Furthermore, it is important to clean the inner parts of the chain. Therefore the chain is placed into paraffin, diesel oil or another solvent for approximately 24 hours in order to soak the dirt in the joints as well as the hardened lubrication remnants.

If the chain is moved several times back and forth in the solvent bath, joints will be thoroughly cleaned.

After the chain has been properly cleaned it should not make anymore scratching noises when the links are moved; if it does, the remaining dirt in the joints will form a grinding compound with the lubricating agent, which would destroy the chain very quickly.

Repair

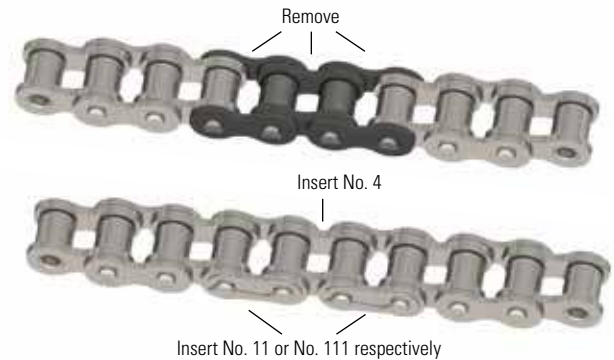
Subsequently the chain should be carefully examined for defective links, which must be replaced, if necessary.

A damaged outer link is replaced with a connecting link. Outer links are riveted into endless chains.



If an inner link or a roller is broken, the two adjoining links must also be removed; they must then be replaced by an inner link with two connecting links.

With endless chains outer links are to be used. However, if a chain looks really worn, it should be replaced by a new one.



Relubrication

Thorough relubrication is to be carried out immediately after cleaning and, if necessary, repair of the chain. It is important to ensure that quality and viscosity of the lubricant comply with the operating conditions of the chain drive, e.g. temperature and velocity (please refer to pages 105 ff. It is not recommended to add just a few drops from the oil can or simply douse the chain, since the oil will not reach the chain links, i.e. those parts which actually have to be lubricated. Even if the inner and outer plates are oiled, this will by no means guarantee a proper lubrication of the inner parts such as pins and bushings.

For perfect lubrication the chain is placed into a container with liquidised special chain lubricant heated up to 120° C. The chain is left in the lubricant bath until it has reached its temperature, before it is then taken out. Excess lubricant must be allowed to drip off since it will not aid the lubrication of the chains links if it sticks to the outer plates.

However, in practice, such perfect lubrication will rarely be possible. In this case an excellent engine lubricating oil should be used according to the recommendations on page 106 Please ensure that the lubricant will actually reach the links, which are to be lubricated.

Sprockets

The sprocket teeth must be thoroughly cleaned before the chain is finally put back on. It is particularly important to remove dirt sediments, which would stretch the chain, from the



bottom of the tooth gaps. Subsequently, the sprocket must be examined in order to determine, if the teeth are worn too much. In case of excessive wear or hooked-shaped teeth, sprockets should be replaced with new ones.

It is not recommended to simply turn a worn sprocket around so that it works in reverse run-

ning direction. New sprockets are to be checked according to the specifications on page 92.

Please note that a new chain should never be placed around a worn sprocket, because this will definitely reduce the lifecycle of the chain.

Shortening by 1 link

- a) Even number of links
up to a pitch of 19,05 mm



Pitch as of 25,4 mm



- b) Odd number of links
up to a pitch of 19,05 mm



Pitch as of 25,4 mm



Extending by 1 link

- a) Even number of links
up to a pitch of 19,05 mm



Pitch as of 25,4 mm



- b) Odd number of links
up to a pitch of 19,05 mm



Pitch as of 25,4 mm





The followings aspects should be considered when selecting a lubricant:

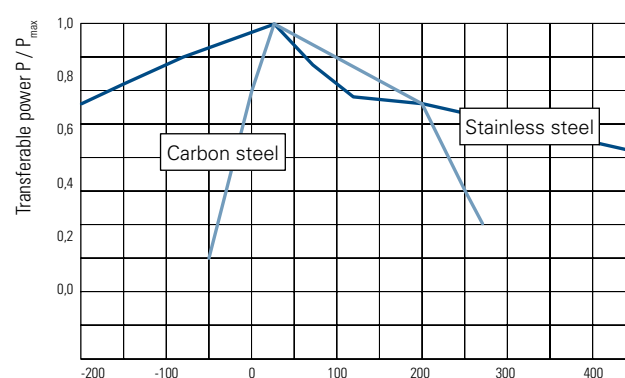
- **Oil or grease lubrication**
Oils are normally used for continuous relubrication. Grease is preferred, if the ambient air contains dust (lime, talcum, flour etc.).
- **Operating temperature**
This is one of the most significant aspects of lubricant selection. The decisive criterion is the temperature in the chain bearing during operation.
- **Viscosity**
Viscosity must be high enough so that all the chain parts are protected against wear and galling. However, despite high viscosity the oil must be sufficiently capable of flow.
The following rules of thumb apply:
 - Low bearing pressure, high chain speed
= low viscosity
 - High bearing pressure, low chain speed
= high viscosity
 - Low operating temperature = low viscosity
 - High operating temperature = high viscosity
- **Initial lubricant**
It must have excellent corrosion protection qualities and guarantee sufficient wear protection up to the first relubrication. The envisaged operating conditions should be taken into account.
- **Load-bearing properties**
Sufficient load-bearing properties of the lubricating oil film help to reduce wear.
- **Friction point wetting**
The chain lubricant must be able to permeate the lubrication gap autonomously.
- **Chain cooling**
In conjunction with appropriate lubrication procedures certain oils are suitable for cooling. The maximum service temperature of the lubricating oil must never be exceeded.
- **Applications in the food industry**
Lubricants must comply with specific food law requirements.
- **Applications in the textile industry**
Non-drip and non-adhesive oils should be used.
- **Corrosion protection**
This is particularly important for chains used in corrosive environments.
- **Applications in wet environments**
Lubricants must not be washed off by splash water. They must be capable of creep, and supply sufficient corrosion protection even as emulsions.
- **Muffling of chain noises**
Lubricants with higher viscosity ensure better muffling properties than low viscosity lubricants. However, the lubricants must always be sufficiently capable of flow.

- **Contact with elastomers and synthetic materials**
Compatibility with elastomers and synthetic materials must be guaranteed. Compatibility tests are always required.
- **Lifetime lubrication**
Lubrication has been designed in a way that the lubricant will be functioning during the entire lifetime of the chain.
- **Lifetime lubrication for chains is possible, if**
 - the chain load is low
 - the service temperature of the lubricant is considerably underrun
 - the overall operating time is low
 For lifetime lubrication special non-aging chain lubricants have been developed.
- **Ground water hazards**
Please refer to the appropriate safety data specifications.
- **General environmental compatibility**
Please use lubricants, which are biodegradable and particularly environmentally friendly.

Chain lubrication from production to operation

Chain manufacturers	Initial lubrication Corrosion and wear protection Selection of suitable lubrication method
Machine/engine manufacturers	Make already installed chains accessible for manual lubrication Plan chain protection boxes Provide oil pans Design lubrication facilities State reference values for lubrication schedules and lubricant dosage
Machine/engine operators	Inspection of lubrication state and, if necessary, evaluation of lubrication schedules and lubricant dosage Chain cleansing Chain conservation Relubrication

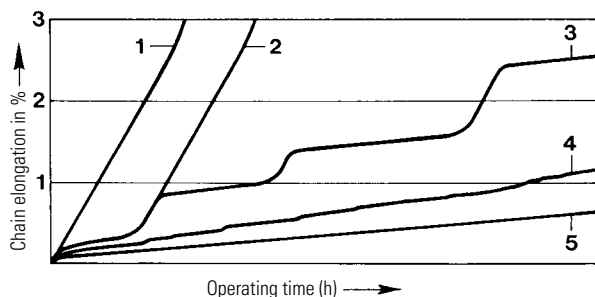
Performance of roller chains as a function of temperature



General information

Chains running on sprockets are subject to wear of the joints due to angle-sliding movements of the pins. Therefore efficient lubrication is of utmost importance. Even low-maintenance roller chains with plastic slide bearings should be relubricated occasionally.

Dry running condition (curve 1) causes excessive wear and destroys the chain within a very short time.



Chain elongation as a function of operating time with different lubrication states

One-time lubrication (curve 2) only delays the wear until the lubricant has been used up.

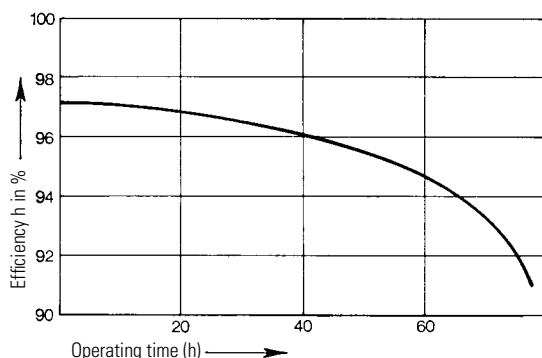
Intermittent dry running conditions (curve 3) frequently occur with manual lubrication, particularly if deadlines for relubrication have not been met.

Wrong lubrication (curve 4) results in uneven wear and may be caused by inferior, dirty, wrong (unsuitable viscosity) or too little lubricant.

Correct lubrication (curve 5) is crucial for chain drives according to performance diagrams.

Lubrication and degree of efficiency

The following graph shows the influence of lubrication on efficiency.



Degree of efficiency as a function of operating time with one-time lubrication (according to Worobjew)

Lubricants

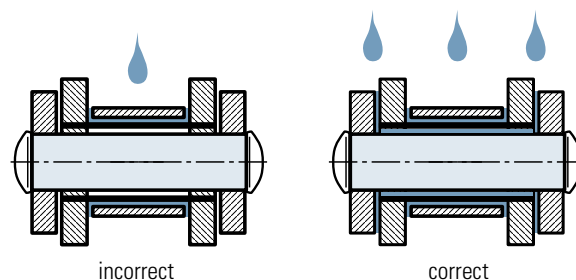
The selection of an appropriate lubricant depends first of all on the type of lubrication.

Low viscosity mineral oils are particularly suitable for chain drives

Ambient temperature °C	Viscosity group of lubricant
- 5 up to + 25	ISO VG 100 (SAE 30)
25 up to 45	ISO VG 150 (SAE 40)
45 up to 65	ISO VG 220 (SAE 50)

For higher temperatures (e.g. furnace chains) graphite or molybdenum disulfide (MoS_2) applied either as additive or spray will facilitate lubrication.

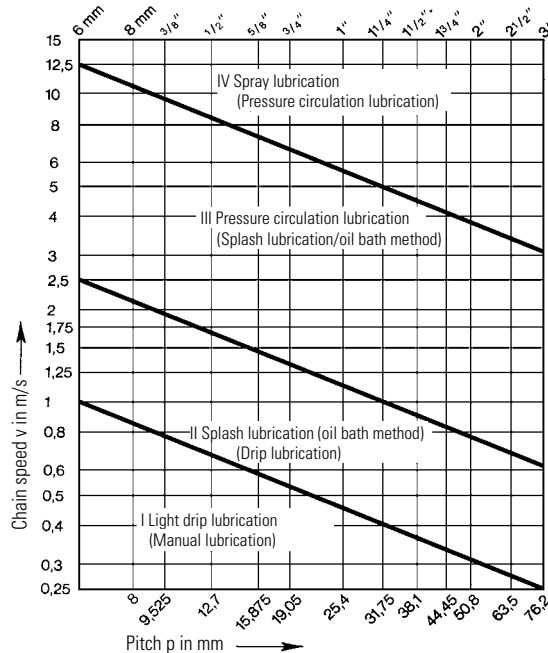
Low-viscosity or hardened grease products with a drop point of 70°C are also suitable for manual lubrication. In special cases liquidised grease may be sprayed on. Initial operation can start immediately after evaporation of the volatile carrier substance.



It is very important that the lubricant reaches the joints (pins, bushings), which are subject to wear.

Recommendations for lubrication

The type of lubrication depends on the chain pitch and the chain speed.



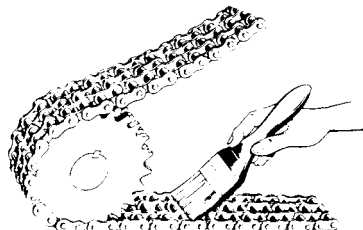
The lubrication types, which are not in brackets, are preferable to those in brackets (permitted).

In order to achieve a long wear life and high cost effectiveness for chain drives in lubrication range I (light drip lubrication or manual lubrication) relubrication schedules must be determined by tests

Manual lubrication

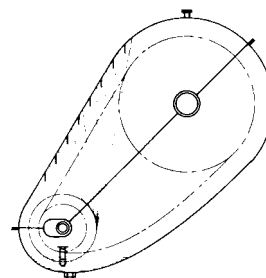
This type of lubrication by means of oil can and brush is not very safe and therefore only suitable for chains with occasional operation or for secondary drives and low chain speeds.

Sufficient lubrication should take place at least once a day (if possible every 8 operating hours). Lubricant colouration may not occur.



Spinning disk lubrication

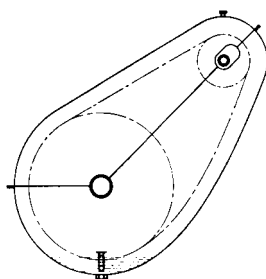
With this type of lubrication the chain operates above oil level. A disk submerging into the lower oil level (peripheral velocity between min. and max. 40 m/s) centrifuges oil against the casing walls from where it continuously runs down onto the chain via drip rails.



Splash lubrication (oil bath method)

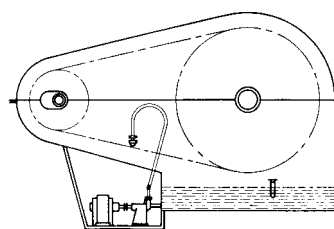
There is just enough oil in a sufficiently sized protection box (the worn and elongated chain must not be able to hit against the casing wall) to allow the chain plates to submerge into the bath up to the rollers or the bushings respectively.

Higher submerging depths cause the oil to heat up and lead to untimely oxidation of the oil.



Spray lubrication

Spray lubrication is very similar to pressure circulation lubrication. Instead of a lubrication shower, however, lubrication spray valves atomise the oil into aerosol form, and thus the fine oil mist can reach every single chain joint.



Drip lubrication

Drip lubrication by means of wick oilers, needle oilers or drip oilers is only suitable for low load bearing drives. Sufficient lubrication of the joint surfaces must be ensured. Lubricant colouration may not occur.

Pressure circulation lubrication

This type of lubrication is suitable for fast-running drives and high loads. The oil can be supplied via a connection to an existing pressure oil pipe or via an extra pump. By means of a lubrication shower situated near the large sprocket, oil is sprayed onto the inner side of the chain return strand in running direction over the whole width of the chain. High load-bearing drives need a second shower for cooling with the oil to be sprayed onto the pull strand. The oil quantity depends on the drive size and the amount of heat to be dissipated.

Lubrication overview

Lubrication range	Chain speed m/s	Lubrication a) favourable b) permitted	Transmissible power			
			correct lubrication (favourable/permitted)	insufficient lubrication without contamination	insufficient lubrication with contamination	without lubrication*
I	up to ≈ 1	a) Light drip lubrication b) Manual lubrication/grease lubrication	100 %	60 %	30 %	15 %
II	up to $\approx 2,5$	a) Splash lubrication (oil bath method) b) Drip lubrication		30 %	15 %	
III	up to $\approx 12,5$	a) Pressure circulation lubrication b) Splash lubrication (oil bath method), if possible with spinning disk		not permitted		
IV	above 12,5	a) Spray lubrication b) Pressure circulation lubrication (possibly with oil cooling system)				



WIPPERMANN Lubrication

Product	Oil	Grease	Spray	Application °C from to	Technical features
WKS-C				- 10 + 100	WIPPERMANN standard lubrication Mineral oil-based soap-free chain grease, with wax and product-specific additives, for extreme requirements as to corrosion and wear protection Water resistant
WKS-W				0 + 80	Lubrication wax for chains "Quasi dry" non-tacky lubrication film Wear protection High corrosion protection Good adhesive properties Excellent water resistance
WKS-Rapid				- 15 + 120	White chain lubricant Difficult to centrifuge off Protects against corrosion and wear It has absorbing and rinsing properties and provides effective lubrication Resistant to water and vapour Quite resistant to acids and bases
WKS-D				- 10 + 80	Corrosion protection oil Chlorine-free lubricant made with mineral oil raffinates and corrosion protection additives; thin, waxes and pressure-resistant lubrication with anti-wear additives Excellent corrosion protection
WKS-H1				- 10 + 140	Chain lubricant for hygienic and clean lubrication Fully synthetic high performance chain lubricant for the pharmaceutical, food and beverage, cosmetics, feeding stuff, and tobacco industries as well as their suppliers. Complies with U.S. requirements as to guidelines of sec. 21 CFR of FDA regulations Increased performance range achieved by a combination of high-quality, mineral oil free synthetic base oils with a high-capacity additives package. <u>Nonfood Compounds Program Listed H1, NSF Reg # 143954</u>
WKS-Plus				- 10 + 240	High-temperature lubricant Fully synthetic, temperature-stable high-performance oil especially developed for chain lubrication Improved protection against wear, ageing and corrosion due to a combination of synthetic ester oils and additives This product combines the special requirements of chain lubrication with demands on lacquer compatibility.
WKS-HT				- 10 + 250 (as of +300 °C dry lubrication)	High-temperature lubricant Polyalkylene glycol oil, containing solid lubricants, for chain lubrication at high temperatures Excellent wetting properties and creep behaviour High stability This product can be used at temperatures of up to 500°C; above 200°C there is a gradual transition to dry lubrication.
WKS-T				- 55 + 90	Lubricant for environments with low temperatures Fast biodegradable and low-temperature multi-purpose oil based on synthetic ester with excellent wear protection The product has a low evaporation rate and is characterised by its excellent viscosity-temperature behaviour; it is also highly age resistant
WKS-Spezial				- 10 + 80	Chain spray for relubrication Mineral oil-based chain spray with synthetic wax, corrosion protection and anti-wear additives (propellant: propane / butane pressure gas mixture) For relubrication of open drive chains, conveyor chains in conveying systems as well as for load chains

All lubricants supplied by WIPPERMANN are free from chlorine and silicone.



Conditions/Symptoms	Possible cause	What to do
One-sided wear on chains and sprockets	1. Shafts not parallel, sprocket and pinion not aligned	1. Realign
Wear on inner plates or on sides of sprocket teeth	1. Sprocket and pinion not aligned or shaft wobble	1. Realign sprockets
Wear on tooth heads	1. Chain elongation 2. Tooth error	1. Replace chain 2. Replace pinion and sprocket
Wear on tooth flanks, sprockets	1. Low material strength	1. Exchange for hardened sprockets
Wear on outer plates	1. Chain striking an obstruction	1. Make sure chain is not obstructed
Chain vibrates with high frequency	1. Eccentricity or sprocket wobble 2. Broken chain roller	1. Replace sprockets 2. Replace chain links or chain
Premature elongation	1. Insufficient lubrication or wrong chain size	1. Increase oil supply and check chain size
Rust-coloured discolouration of chain and pins	1. Insufficient lubrication	1. Improve lubrication
Chain jumps off sprocket	1. Excess chain slack 2. Chain riding too high on sprocket teeth due to chain wear	1. Adjust shaft centre distance or jockey sprocket 2. Replace chain
Broken chain parts	1. Drive overloaded 2. Excess chain slack and chain jumps off sprocket 3. Chain striking solid object 4. Chain speed too high 5. Imprecise toothing on the sprockets 6. Insufficient lubrication 7. Corrosion	1. Select another chain or avoid overload 2. Regular check and adjustment of shaft centre distance 3. Make sure chain is not obstructed 4. Check chain dimensioning 5. Change sprockets 6. Improve and increase lubrication 7. Avoid corrosion or use chains made of stainless material (please enquire)
Excessive noise	1. Chain striking an obstruction 2. Insufficient lubrication 3. Missing or broken rollers 4. Misalignment 5. Chain jumps off sprocket	1. Make sure chain is not obstructed 2. Improve lubrication 3. Replace chain or defective parts 4. Align shafts and sprockets 5. Re-adjust shaft centre distance



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