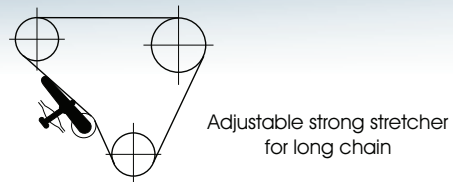


Driving gear with guiding lathes and a stretching wheel with a shock absorber



## CHAIN LUBRICATION

Every chain in ČZ Řetězy, Ltd. is lubricated and conserved in the last operation, but during the next usage periodic lubrication is necessary. Insufficient lubrication often causes excessive elongation or failure.

The lubrication type is already determined at the chain transmission project, and by this are also determined the lubricating intervals. Three types of lubrication are determined by standard CSN 014809 and by Diagrams 1 and 2. Recommended lubrication according to Diagrams 1 and 2 are the minimal conditions. It is recommended to use the closest efficient lubricating process according to your possibilities.

It is also efficient to follow the instructions of machine and transmission producers, and technical advances from ČZ Řetězy, Ltd.

Efficiency of different lubrication types is described in Diagram 4.

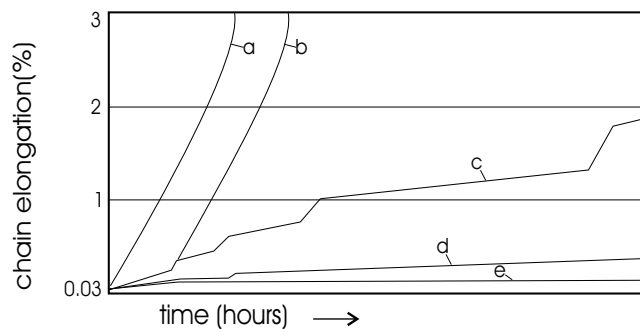


Diagram 4 Lubrication influence on the elongation

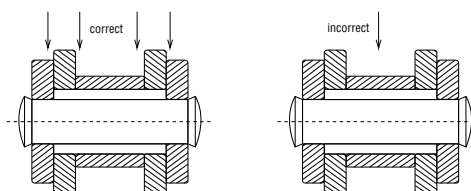
- Curve a** indicates the chain running without lubricating (dry conditions). These conditions lead to a strong joint wear, where corrosion elements owing to friction appears and slip surfaces are seizing. This can lead to a hard joint (seize) and in extreme cases even to chain breakage.
- Curve b** indicates the influence of lubricant efficiency, which is applied on the chain by producer. The wear process is slowing down, until the lubricating qualities of the lubricant coating are decreased. After this time, if the chain is not lubricated again, it works without lubrication (dry conditions). Then the wear course is the same as at curve a.
- Curve c** describes the wear ratio at irregular lubrication, when the chain works for some time without lubricant between lubricating intervals. Steep parts of the curve show the work without lubricant.
- Curve d** shows the effect of unsuitable bad-quality dirty lubricant, or its absence to the chain wear. In this case the uneven wear in the joints appears.
- Curve e** describes the optimal lubrication. The slip surfaces in the joints are uniformly polished, the wear is not almost not measurable. The lubricant is not contaminated by products from the wear. There is a minimum chain elongation according to the chain wear.

### **Manual lubrication**

Apply the lubricant by the oil can or brush it between the plates of inner and outer link on the inner side of the chain free section according to Layout 7. Clean the chain before lubricating, if it is dirty. Spray lubricant is possible to use for manual lubrication. It is especially suitable for secondary transmissions treatment of motorcycles and bicycles. Use the liquid and spray lubricants with sufficient penetration efficiency to ensure the lubricant penetration into the chain joint.

**Warning :**

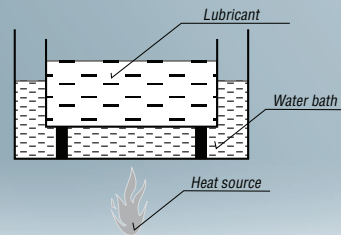
Lubricate the chain only when the device is shut down.



Layout 7 Manual lubrication

If you want to increase the lubricating interval, lubricate the chain by grease which is determined for chains. The best method is insertion of the cleaned chain into a hot grease (about 80 °C).

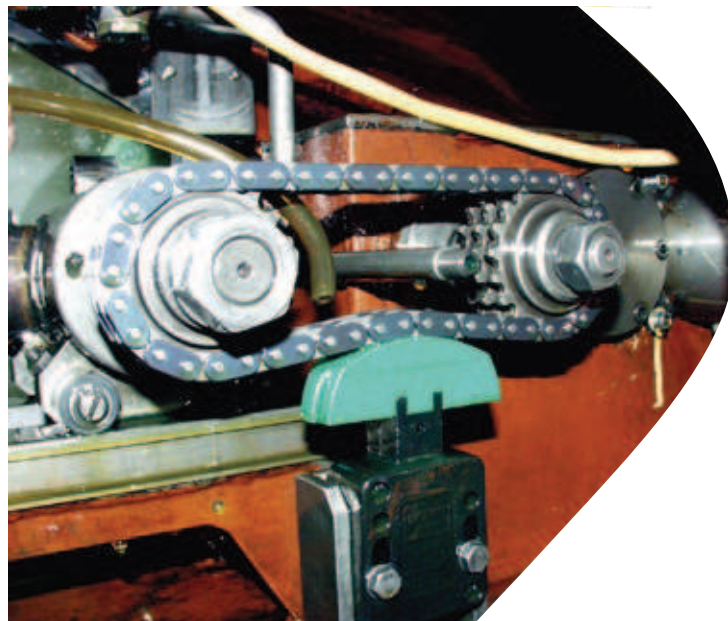
Before insertion into the grease fasten the chain on a string or wire for better manipulation. Warm up the grease slowly in a water bath, (see Layout 8) to prevent the grease overheating and losing the lubricating qualities. Leave the chain in the bath until it reaches the bath temperature, then move the chain in order to get the grease into the chain joints. No air bubbles should not leak from a well lubricated chain. Take the lubricated chain out of the bath, let it drip and cool down when hanging.



Layout 8 Water bath for warming up of grease

### **Drip lubrication**

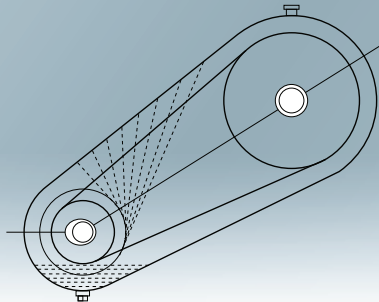
The drip lubrication is usually performed by drip lubricators or by a dosing device. Oil drops should fall between inner and outer plates. Necessary oil amount depend on the chain speed and it should be approximately 4 - 10 drops in a minute. At this dropping interval, the consumption is about 0,8 l in 24 hours. This brings a relatively high consumption of the lubricant. Beside this, some oil can disgorgel and pollute the cover and the machine. That is why you should equip the cover with a catcher of the excessive oil. It is necessary to check the function of the drip lubricator or the dosing device. This lubrication method is not too much environment-friendly.



Layout 9 Dripping equipment

### **Bath or disc lubrication**

The chains working in closed sealed covers (transmission boxes) can be lubricated by wadening in oil bath (see Layout 10). To avoid the oil over-heating, losing its qualities, decreasing the transmission efficiency, the chain should be dipped only to one half of its height. For improving the lubrication efficiency we recommend to use a splashing disc, which is mounted on the shaft and dipped in the oil so that the centrifugal force could splash the oil on other parts of the chain.

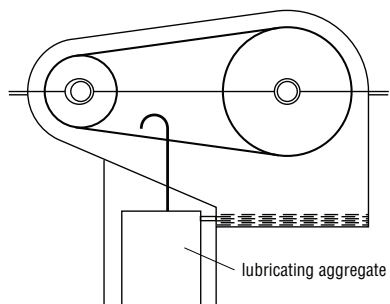


Layout 10 Bath or disc lubrication

### **Force-feed lubrication**

The force-feed lubrication is the most efficient type of lubrication. Uniform stream of the oil created by a pump is coated on the whole width of the free inner section of the chain in its direction of movement.

The oil quantity must be adjusted so that the oil from the chain should partially run down before it gets in contact with the chain wheel. Too big layer of oil carried by the chain will cause in contact with the chain wheel unnecessary oil overheating and decreasing of the transmission efficiency.



Layout 11 Force - feed lubrication

Oil viscosity recommendations are mentioned in the following table

Ambient temperature	-5 °C up to 25 °C	25 °C up to 45 °C	45 °C up to 65 °C
Viscosity class	SAE 30	SAE 40	SAE 50

## **CHAIN ASSEMBLY AND DISASSEMBLY**

### Assembly

Most of the transmissions are designed so that we could set the chain on the chain wheel teeth and then it is connected with a connecting link.

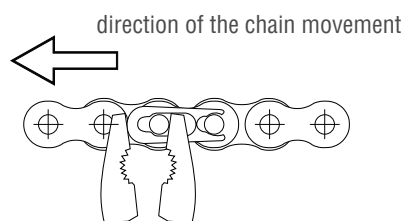
Chains with smaller pitches are connected by laying the ends of the chain on one of the wheels with the help of teeth spaces, which sets the distance corresponding with the pitch of the connecting link - see Layout 10.



Layout 10. Chain connecting on the chain wheel

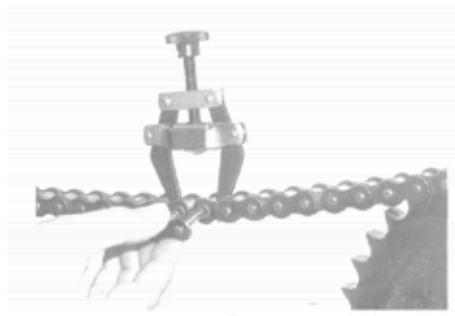
### **Warning :**

When using the connecting link with a flexible safety pin, it is necessary to assemble the closed part of the safety pin in the direction of chain movement - see Layout 11.



Layout 11. Correct assembling of the connecting link

At long pitch chains, which are heavier, a special puller is used which draws the free ends of the chain together, in order to put on the connecting link easily - see Layout 12.



Layout 12. Setting the ends of the chain by a puller

At some transmission types is from different reasons required that the chain must be connected as endless, it means to be without a disassembling connecting link. A riveting (outer) link is used for connecting in these chains. The chain connection is mostly made out of the transmission and then the connected chain is mounted on the chain wheels, which must be modified for this type of connection (for example wheel sliding on the shaft). Special tools must be used for this type of assembly.

**Disassembly**

If the chains are connected by removable connecting links, the disassembly is easy and proceeds in a reverse sequence than by the assembly of the chain, which was described in the chapter before. Chains connected as endless ones which have to be disassembled directly on the chain transmission must be disassembled by special tools. These make disassembling easier and do not damage the transmission. Disposed is only the outer link, by which is the chain disassembled, this one cannot be used anymore. Each disassembly of the endless chain is destructive.

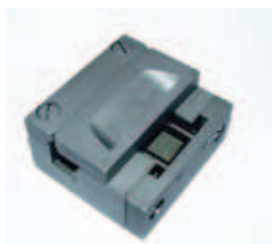
**Chain disassembly out of the equipment**

If we disassembly the chain out of the transmission, it is better to grind the unriveted pin heads, and then by the tool as shows Layout 13, knock out the pins from outer plate with the help of a mandrel and a hammer. All types of assembling and disassembling tools are available in CZ Retezy s.r.o., or at our distributors.



Layout13. Chain disassembly with the help of a mandrel and a hammer.

Tooling for hand disassembling of the chain



TYPE DP 1



TYPE DP 2

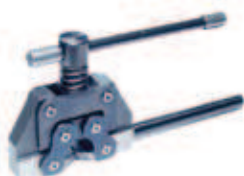
TYPE	using range
DP 1	pitch 9,525 - 19,05
DP 2	pitch 25,4

TYPE	using range
VZR 1	F 100, F 200, F 300, 082
VZR 2	pitch 9,525 - 15,875
VZR 3	pitch 25,4

Tooling for chain disassembling



TYPE VZR 1



TYPE VZR 2



TYPE VZR 3



Tooling for reparations of the chain with pitch 7,774 - 31,8 mm

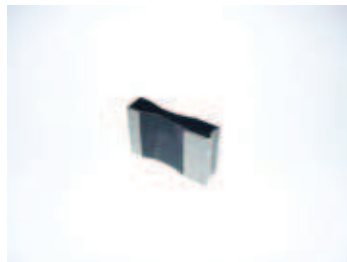


TYPE DO

Tooling for pin riveting



Tooling for roller punching



CHAIN TYPE	TOOLING CODE
219	6,48,275,000
05 B-1,2	6,48,206,000
06 B-1,2,3	6,48,183,000
06 C-1,2,3	
062 C	6,48,162,000
1/2"x3/16" MOFA	
1/2"x3/16" V.D.	
1/2"x1/4" MOFA	
O86	
08 B-1,2,3	
O81	6,48,175,000
O82	
1/2"x3/16" VELO	
08 A-1,2,3	6,48,255,000
10 B-1,2,3	6,48,200,000
10 A-1,2,3	
12 B-1,2,3	6,48,191,000
12 A-1,2,3	6,48,192,000
12 B ZP	
16 B-1,2,3	6,48,277,000
16 A-1,2,3	

CHAIN TYPE	TOOLING CODE
219	6,48,276,000
05 B-1,2	6,48,242,000
06 B-1,2,3	6,48,142,000
062 C	
1/2"x3/16" V.D.	
1/2"x3/16" MOFA	
1/2"x1/4" MOFA	
06 C-1,2,3	6,48,184,000
O81	6,48,158,000
O82	
1/2"x3/16" VELO	
08 A-1,2,3	6,48,256,000
O86	6,48,141,000
08 B-1,2,3	
10 B-1,2,3	
10 A-1,2,3	
12 B-1,2,3	6,48,143,000
12 B ZP	
12 A-1,2,3	
16 B-1,2,3	6,48,278,000
16 A-1,2,3	6,48,311,000

Tooling for pin punching-out



CHAIN TYPE	TOOLING CODE
219	6,29,620,000
O6 B-1	6,29,346,000
O6 C-1	
O5 B	
O6 B-2	6,29,347,000
O62 C	
O6 C-2	
O6 B-3	6,29,348,000
O6 C-3	
O81	6,29,040,004
O82	
1/2"x3/16" VELO	
1/2"x3/16" MOFA	6,29,563,000
1/2"x3/16" V.D.	
O8 A-1	
O86	6,29,349,000
O8 B-1	
10 B-1	
10 A-1	
1/2"x1/4" MOFA	
08 B-2	6,29,350,000
10 B-2	
10 A-2	
08 B-3	6,29,351,000
10 B-3	
10 A-3	
12 B-1	6,29,353,000
12 A-1	
12 B ZP	
12 B-2	6,29,354,000
12 A-2	
12 B-3	6,29,355,000
12 A-3	
16 B-1	6,29,622,000
16 A-1	
16 B-2	
16 A-2	
16 B-3	6,29,646,000
16 A-3	

## **METHODS OF CHAIN LENGTH ALTERNATIONS**

Chain transmission is favourable against other current transmissions (belt, gearwheels), because it is possible to change the axis distance easily by changing the chain length and shifting one of the wheels. Mainly it is preferable to use the chains with even number of links, in order to prevent mounting of the reducing link which decreases the static strength about 30 % .

At less difficult transmissions is also possible to shorten the chain, in operating wear reason, where is not possible to shift the chain wheels and where a big chain deflection can make problems in running.

### **Methods of chain elongation**

#### *1. Chain elongation from even number of links to even number of links :*

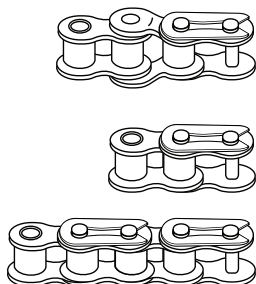
- We disassembly the chain in the connecting link position, or at any other position if the chain is connected as endless.
- After disassembly we insert the required number of links decreased about one into the chain.

Example : I require elongation about four links, I insert  $4 - 1 = 3$  links into the chain, i.e. two inner and one outer link.

- We perform the chain reconnection as follows :
  - a) two connecting links with a flexible safety pin
  - b) two outer links
  - c) one outer link and one connecting link with a flexible safety pin

#### *2. elongation of the chain with even number of links to odd number of links :*

- We disassembly the chain as in point 1.
- After disassembling we insert an offset link into the chain, or a double offset link. If we require longer elongation, we must also insert the required number of links.
- If we use the offset link, we decrease the number of inserted links about one.
- When the double offset link is used we decrease the number of inserted links about two.
- Chain reconnection is made as follows :
  - a) offset link in connection with connecting link with flexible safety pin, or with outer link,
  - b) offset double link between connecting links with flexible safety pin,
  - c) offset double link between two outer links,
  - d) offset double link between one connecting link with flexible safety pin and with one outer link.



Layout 35. Illustration of the chain elongation types



### **Methods of chain shortening**

Chain shortening is performed by the same method like elongation. We must disassembly the chain in two positions, in order to remove the excessive number of links.

### **CHAIN ATTENDANCE AND MAINTENANCE**

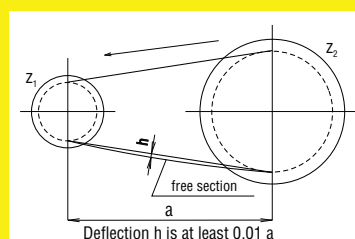
Chain failures, especially their fast wear, can only seldom be charged to the construction mistakes, or to mistakes in chain dimensioning. The reason is often incorrect lubrication and maintenance. Durability and effectiveness of transformed output depend on correct treatment of the chain transmission. Beside the correct mounting of the chain wheels, chain lubrication is very important, especially its plane lubricity (it is between the pin and the bush). The chain is created from many bearings (joints), where a small wear of one joint, invokes a big wear at the total sum. Therefore, it is necessary to pay attention to lubrication and treatment of these small chain bearings like to bearings in engineering.

It is necessary to respect the following chain transmission maintenance instructions:

- Lubricate the chain transmission in regular intervals or permanently (according to usage) see chapter - "Chain Lubrication".
- Ensure failure-free function of the lubricating equipment.
- Treat the chain by sufficient lubricant for the selected type of transmission and conditions under which it works.
- Check the wear conditions of the chain and the chain wheel.
- Connecting links and attachments of the chain are subject to increased wear, check them regularly and replace them if necessary.
- An open chain transmission must be provided with a suitable cover to prevent the dirt from getting into the chain.
- Never mount a new chain on extremely worn wheels.
- In case of longer season pauses treat the chain in order to prevent it against corrosion.
- Mount the chain to the wheels in the same position like before disassembly.
- Fix the deflection of the chain free section regularly.
- Check the guiding lathes of the chain regularly if there are any in the transmission. Replace the worn lathes immediately.

**Warning :**

Big or too small deflection of the chain free section is decreasing its durability, therefore it can cause a chain failure (bearing stress, chain fall from the chain wheel, jerking motion, etc...).



## **CHAIN DURABILITY**

Because the chain is a mechanical part assembled from many parts, it has its own technical durability. Chain durability is determined by the allowed operation elongation. The value of elongation is given by the standard and it is determined so that the chain transmission could ensure the quality force transfer, sufficient for safety operating. Chain elongation  $\Delta L$  is expressed by the length difference of the worn out chain  $L$  and basic chain length  $L_z$

$$\Delta L = L - L_z$$

Chain basic length  $L_z$  is calculated :  $L_z = x \cdot p$

$x$  = number of links

$p$  = chain pitch

Value of the allowed elongation  $\Delta L_{max}$  is not the same at all chains :

- a) roller and bush chains for general use  $\Delta L_{max} = 2\% L_z$  according to CSN,  $\Delta L_{max} = 3\% L_z$  according to DIN
- b) high speed chains are mostly used in car industry (timing, balancing...)  $\Delta L_{max} = 1\% L_z$  is recommended
- c) leaf chains (measured in the part, which is in contact with the return pulley)  $\Delta L_{max} = 3\% L_z$
- d) sport chains (motorcycles, bicycles) have their allowed specific elongation according to customer's usage.

Allowed chain elongation mentioned in per cent, relate to the over-all chain length.

The allowed maximum production tolerance of new chains from the basic dimension:

+ 0,15 % from over-all chain length - roller chain (according to CSN and DIN)

+ 0,10 % from over-all chain length - bush, high speed (only according to CSN).

## **How to measure the chain elongation**

1. Disassemble the chain from the transmission and clean it. It is important to avoid the dirt and rest of the lubricant between the pin and the bush, these can distort the measuring.  
Put the cleaned chain on a flat plate, stretch it, in order to take up the clearances between the parts, then measure the length with a measuring scale (outer holes pitch after connecting link). It is easier to measure 50 or 100 pitches. Subtract the basic length  $L_z$  from the measured length. The resulting value  $\Delta L = L - L_z$  the chain elongation.

For quick determination of the extension use the following table  $\Delta L_{max} =$  approximately 2 %.

Chain pitch		$\Delta L_{max}$ on 50 links [mm]	$\Delta L_{max}$ on 100 links [mm]
in inch	in mm		
	8,0	8,0	16,0
3/8"	9,525	9,5	19,0
1/2"	12,7	12,7	25,4
5/8"	15,875	16,0	32,0
3/4"	19,05	19,0	38,0
1"	25,4	25,5	51,0

2. Less exact method for the elongation evaluating is measuring directly on the transmission.  
You must measure the chain the stretched section. The procedure of the calculation is the same like in point 1. For better exactness we measure the length  $L$  on arbitrary number of links (as many as possible).