

 <b>Řetězárna a.s.<sup>®</sup></b>	<b>High-strength link chains for mining applications</b>	<b>DIN, PN, PN-G</b>	
<b>MANUFACTURER</b>	Řetězárna a.s. Polská 48 790 81 Česká Ves	<b>ISSUE</b> 1/2017 <b>REPLACES</b> 11/2014	<b>PHONE</b> 584 488 111 <b>FAX</b> 584 428 194 <b>E-mail:</b> <a href="mailto:info@retezarna.cz">info@retezarna.cz</a> <a href="http://www.retezarna.cz">www.retezarna.cz</a>

## OPERATING AND MAINTENANCE

### 1. INTRODUCTION

High-strength link chains for mining applications have special properties. They are intended primarily for continuous conveyors and excavating machines in mines. These chains must not be used in chain slings or in devices for gripping and handling loads.

These operating and maintenance instructions refer to mining chains of class “B”, “C”, “RCV 9”, “D” and “DH” (according to PN), or “1” and “2” (according to DIN), or according to other equivalent standards.

Their dimensions and designs are given by the aforementioned standards and by the technical conditions.

These operating and maintenance instructions contain the most important information about our chains. Secure operation and specified service life of the chains require observance of these instructions. All operating and maintenance personnel as well as personnel responsible for inspections and storage of the chains must be familiar with these operating and maintenance instructions.

### 2. CHAIN QUALITY GRADE

The quality grade is a set of properties that characterize the utility value of the chain. Currently, Řetězárna a.s. manufactures chains of 4 quality grades, i.e.

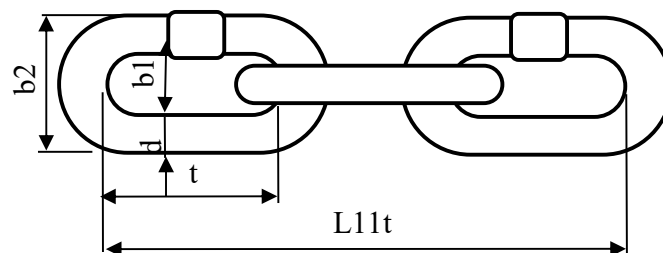
- Chain of “B” quality grade (1), min. breaking strength 630 MPa,
- Chain of “C” quality grade (2) - min. breaking strength 800 MPa,
- Chain of RCV 9 quality grade - min. breaking strength 900 MPa
- Chain of “D” quality grade (“DH”) - min. breaking strength 1000 MPa

The properties of the chain are also influenced by other parameters, such as the magnitude of the test load, elongation during test loading and during break loading and the operating force.

These parameters are specified in the standards and in the technical conditions for individual chain grades and dimensions.

Each quality grade has its advantages, but also disadvantages. In order to select the most suitable chain for the given operation and machine, along with the operating force or the breaking force, it is also necessary to consider the type of the conveyor, operating conditions, the type of loading, the environment, the type of material to be extracted, etc.

### 3. DIMENSIONS AND DESIGNATION OF CHAINS



Specific dimensions are given in the individual standards and technical conditions.

3.1. Nominal thickness “ $d$ ” - Nominal diameter of the round-steel bar from which the chain is made

3.2. Pitch “ $t$ ” (“ $p$ ”) - Internal length of the chain link

3.3. Nominal size “ $d \times t$ ” (“ $d \times p$ ”) - Designation of a round-steel bar chain. Indicates the nominal thickness and pitch of the chain.

3.4. Inner width “ $b_1$ ” (“ $a$ ”) - Inner diameter of the chain link measured away from the weld (DIN - at the weld).

3.5. Outer width “ $b_2$ ” (“ $b$ ”) - Width of the chain link measured away from the weld.

3.6. Length of the chain section “ $L = n \times t$ ” (“ $L = n \times p$ ”) - Inside length of the chain segment, specifying the permissible length tolerance of a calibrated chain.

To achieve dimensional accuracy, mining chains are calibrated during the production process. Moreover, short chain sections (5 to 15 links) are inspected for their total lengths, which must not be outside the tolerance limits specified in the standard for the given number of links in the segment.

When using the chains in conveyors with continual chains (e.g. in conveyors with central double chain), matched-up chains must be used to provide uniform distribution of forces into the individual chains.

The difference in the lengths of the matched-up chains shall be checked. The length difference must not exceed the value specified in the standard. Length measurement is performed with a prescribed basic load.

#### 4. MECHANICAL PROPERTIES OF CHAINS

4.1. Operating force - Maximum pulling force which can be applied on the chain during operation in optimum conditions. This force must not exceed the limit specified in the standard. If the chain is to be used under harsh conditions, the manufacturer of the equipment where the chain is used shall reduce the operating force or service life of the chain.

4.2. Production test load - Force applied along the whole length of the chain after heat treatment. This force must be within the limits specified in the standard.

4.3. Breaking strength - The largest force achieved on the test sample during the tension test before the sample broke.

4.4. Elongation at break - The value of total elongation at break is determined from the diagram "Load - elongation", and it is expressed in %.

4.5. Elongation at test force - The ratio of the total elongation of the sample at the test force to the measured length at the force acting during the measurement.

4.6. Hardness - abrasion-resistant properties of the chain measured in HV10 or HBW10.

#### 4.7. TEST CERTIFICATE

The mining chains are certified by the Test Certificate according to ČSN EN 10 204 - 3.1., which contains information about the manufacturer, test certificate number, order number, designation, size and mechanical parameters, and other specified properties of the chain.

**The chain manufacturer guarantees compliance with the standard according to which the chain is manufactured and supplied.**

#### 4.8. SURFACE FINISH

The chains can also be supplied with corrosion protection. In case of surface treatment, the following can be reduced in DIN 22252, for example:

- Breaking strength by 10% of the braking force
- Elongation at break by 20%

These parameters are decreased due to the changed friction at the joints of the links. This phenomenon occurs during the laboratory tests and initial operation before the protective coating is removed. When selecting a chain, this phenomenon must also be taken into account.

#### 5. CHAIN IDENTIFICATION

The chains are identified according to the applicable standards, e.g. DIN 22 252:2012-07 - Chain sections are marked with the manufacturer's mark, quality grade, month and year of manufacture. The links of chain sections longer than 10 m shall be identified at max. 10 m intervals. The first and last markings of the links must always be close to the end of the given section. Short sections are always marked in the middle of the chain section.

Colour markings must be requested in advance by the customer.

## 6. USE OF TESTED CHAINS

### 6.1. TRANSPORTATION AND STORAGE

The chains must be transported and stored in such a way as to exclude any negative weather effects and the presence of corrosive substances. Improper chain storage may result in intergranular corrosion cracks, which significantly reduce the service life of a new chain. In the case of a complaint, the degree of corrosion resulting from improper storage and transport will be assessed. The chain must be used in machinery within 12 months after its dispatch by the manufacturer.

### 6.2. GENERAL INSTRUCTIONS

The chains must be handled as machine elements. It is forbidden to subject them to corrosive effects, overload them, perform non-professional repairs, expose them to heat and drag them along the ground. The total life of the chain depends on the conditions under which it is operated (for example corrosive environment, type and structure of the material to be transported, condition of the conveyor's sprockets, conveyor deformation, regular tensioning of the chains in the conveyor, etc.). RCV 9 and "D" chains are also suitable for higher speeds. The chain with a homogeneous high link hardness ("DH") is only suitable for low speeds (max. 0.5m/s). It can also be used in mining with a high content of abrasives - stone.

Chains RCV 9, "D" and "DH" are not recommended for aggressive corrosive environments with acidic underground water which may cause increased stress corrosion and pitting corrosion.

Another major influence, which can significantly affect the life of the chain, is the fatigue life. Each quality grade has a prescribed minimum number of cycles the chain has to withstand. After this prescribed minimum number of cycles, individual links will break more frequently, the frequency increasing in time. The most important factor in fatigue fractures is frequent switching on and off the conveyor (forward and reverse run), excessive corrosion of the chain → cracks. Therefore, it is necessary to ensure electrical monitoring of the conveyor operation and regular inspection of the chain surface.

**Considering these effects, the user must specify limiting conditions for the operation of the machine, thus ensuring an adequate life of the chain. The guarantee does not cover common wear on the chain.**

### 6.3. CHAIN FITTING

The chain must be fitted and pre-loaded in accordance with the technical conditions and the manufacturer's operating instructions. The chain must be sufficiently pre-loaded, so that it does not

accumulate and form loops behind the drive sprocket wheel of the driving unit (in the direction of the rotation).

However, it must not exceed 25% of tension in the chain at the rated engine power.

In conveyors, matched-up chains must be used to provide uniform distribution of forces into the individual chains. These matched pairs must be fitted in the machinery as specified by the manufacturer. The fitting of the chains in the conveyor must provide for an equal load distribution on the chains, without impacts.

If a chain in the pair is damaged, the whole pair shall be replaced. It is not permissible to replace only a chain section as it might result in different chain lengths. The stress in the shorter chain would be higher than in the longer chain and thus the chains would be unevenly loaded. The shorter chain would be impaired, i.e. the operating force exceeded and, in the worst case, the chain broken. It is forbidden to use chains of different quality grades and chains by different manufacturers on a single conveyor.

The chain links must fit accurately onto the drive sprockets and pass accurately through the guides. No excessive wear of the chain must occur during operation. At the start of operation, the pocket wheels shall be lubricated for 30 hours.

If requested by the chain manufacturer, the manufacturer must be allowed to enter the workplace during assembly and testing and standard operation to check the correct handling, installation and maintenance, the environment and the chain operation in the machinery.

#### 6.4. PERMISSIBLE LOAD

The chain must not be overloaded (by extending the conveyor, by increasing the driving output) and it must not be subjected to impacts reducing its life. The machine must be fitted with elements protecting it from impact overload (flexible slip couplings, break pins for ploughs, etc.).

When connecting the chain to a shearer loader, the load applied by the shearer loader's engine must not be higher than 1/3 of the chain strength.

When towing the shearer loader using double chains with the drive unit(s) at the end of the scraper conveyor, the permissible torque of the drive sprocket wheel must not be exceeded (break pins, bypass valve, electronic limit, etc.), so that the resulting tension does not exceed the safety rating of the chain.

### 7. MAINTENANCE

#### 7.1. INSPECTING THE TECHNICAL CONDITION OF CHAINS

During operation, chains are exposed to conditions that may affect their reliability and safety. It is therefore necessary to check their technical condition on a regular basis. The frequency of inspections or chain replacement must be determined according to the parameters of the operation in which the chain is used and according to the instructions for the operation of the machine in which the chain is fitted.

Checks and expert inspections of the chains (by a qualified person who is properly trained by the chain manufacturer) focus on external defects of individual links (change in the shape and thickness of links, surface condition, wear, corrosion, cracks, etc.). Proper chain tensioning should be ensured under regular conditions. If the chain is not tensioned properly, the life of the chain as well as

sprockets, chain couplings, drives, etc. is reduced. The chain is tensioned properly, if the chain with the conveyor loaded on the main drive is slightly slack after the sprocket in the lower branch and has a slight clearance after the sprocket in the upper branch of the chain.

Each chain must be recorded. The record must include -

- Commissioning of the chain
- Length or number of chain sections
- Chain identification (KZS, quality)
- Place of operation (environment, mining, etc.)
- Type of machine where the chain is used
- Operational and technical data
- Inspections, checks, replacements of chain sections and couplings, etc.
- Type of wear, defects, failures - please specify
- Degree of corrosion
- Other information according to regulations and recommendations

If it is discovered during operation or in a regular inspection, that one of the chains in a pair or the entire pair is longer by more than 1%, the given chain section of the chain pair or the entire chain pair must be replaced with an adequate length of such chain or pair of chains. This is to avoid the problem of uneven chain loading. For better chain handling and alignment, it is recommended to sort out the chains in a range of 0.5% and mark them clearly to avoid confusion.

## 7.2. PUTTING CHAINS OUT OF OPERATION

A chain must be put out of operation in case of the following defects:

- Elongation of the chain by more than 2% \* (measured at 5 links) or insufficient play between the links, or visible difference in the lengths of the individual chains in a conveyor,
- Elongation of a link pitch by more than 2.5% \*,
- Excessive notches, dents, cracks, deep corrosion, or major pitting caused by sprockets,
- Only special connecting links may be used to connect the chain, corresponding to the size of the chain. It is forbidden to connect chains with wires or screws!
- The chain is thermally affected.

\* These chains can still be used in less demanding machines with less intensive operation. If a chain starts to show an excessive number of failures or extends by more than 4%, the chain must be discarded.

## 8. CHAIN DISPOSAL

Worn and discarded suspension chains are to be disposed of as normal metal waste at a waste collection facility (in accordance with Act no. 185/2001 Coll. on waste as "O" - Other).