www.lapua-ketjut.com

LAPUA CHAINS

Conveying **Power**

THE BEST CHAIN LASTS THE LONGEST!

Maintenance has become a significant aspect of company strategy. The focus has shifted from minimising costs to optimising utilisation rates and productivity. Industry has realised that saving doesn't make you rich. Competitive advantages and good results require the right investments to be made. The machines, the chains and the other components must be profitable.

The following pages offer information for people working in the sawmill, pulp and paper industries, as well as for those in the energy and processing industries. We offer help, guidance and hard facts – in the form of a manual – so that we can help you to create even more efficient processes.

During our history that now stretches back more than 60 years, one thing has always been true: all chains may look alike, but the best cannot be seen just by looking. Lapua chains have proven – and will continue to prove – their qualities as low life-cycle cost chains, and they will stand the comparison with any other chain.

Lapua Chains Ltd

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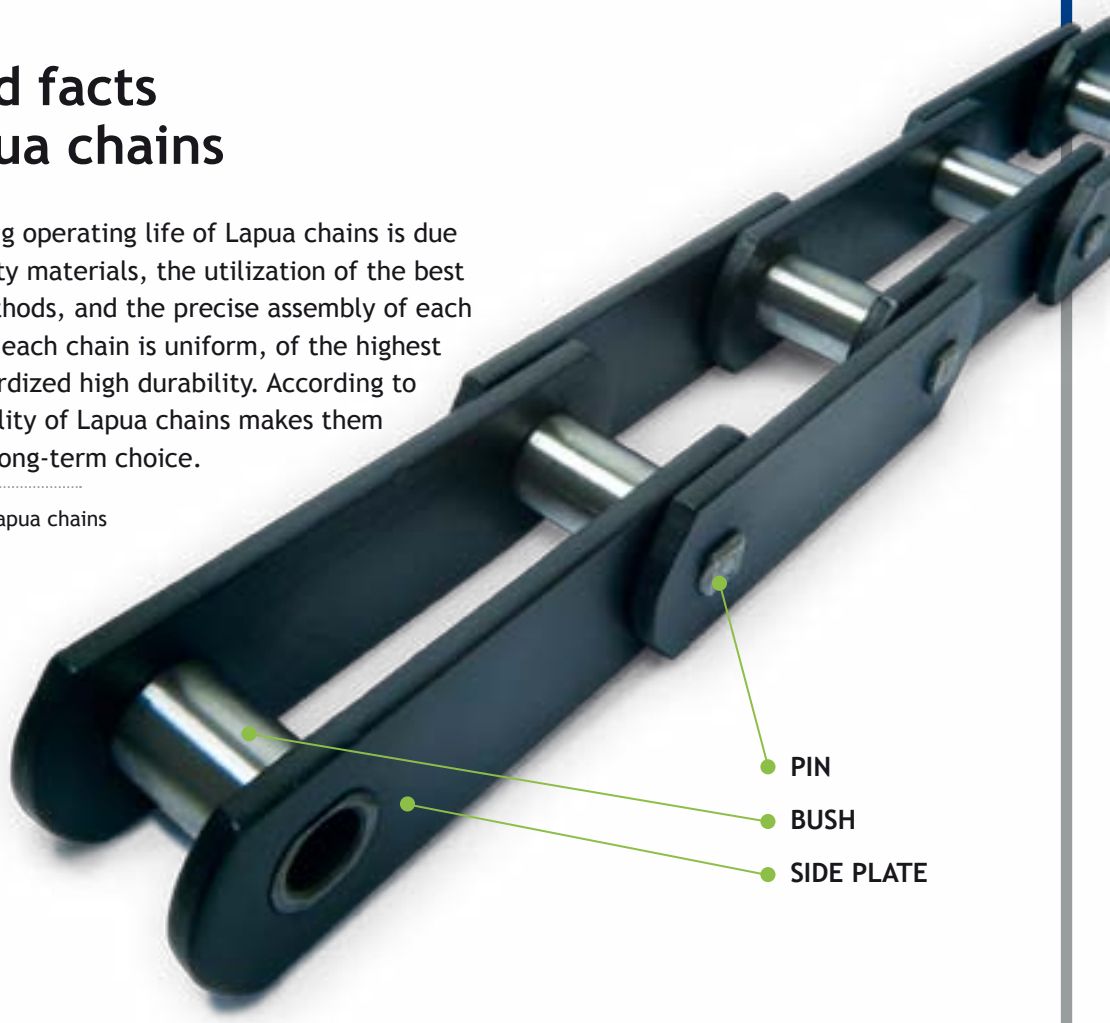
Contents

1. Why do Lapua chains last longer?

Three hard facts about Lapua chains

The exceptionally long operating life of Lapua chains is due to their highest quality materials, the utilization of the best known hardening methods, and the precise assembly of each product. Each link of each chain is uniform, of the highest quality and of standardized high durability. According to research*, the durability of Lapua chains makes them the most affordable long-term choice.

* Please refer to page 6: Lapua chains are cost-efficient.



1. The pin is hardened along its entire length

The pins of Lapua chains are thoroughly hardened — which is why these chains can sustain even the hardest impacts. Both the riveting point and the place where the pin meets the side plate are critical in terms of the chain's resistance to breaking. Hardening throughout the entire pin guarantees an unequalled shearing strength and an unequalled durability of the chain's riveting.

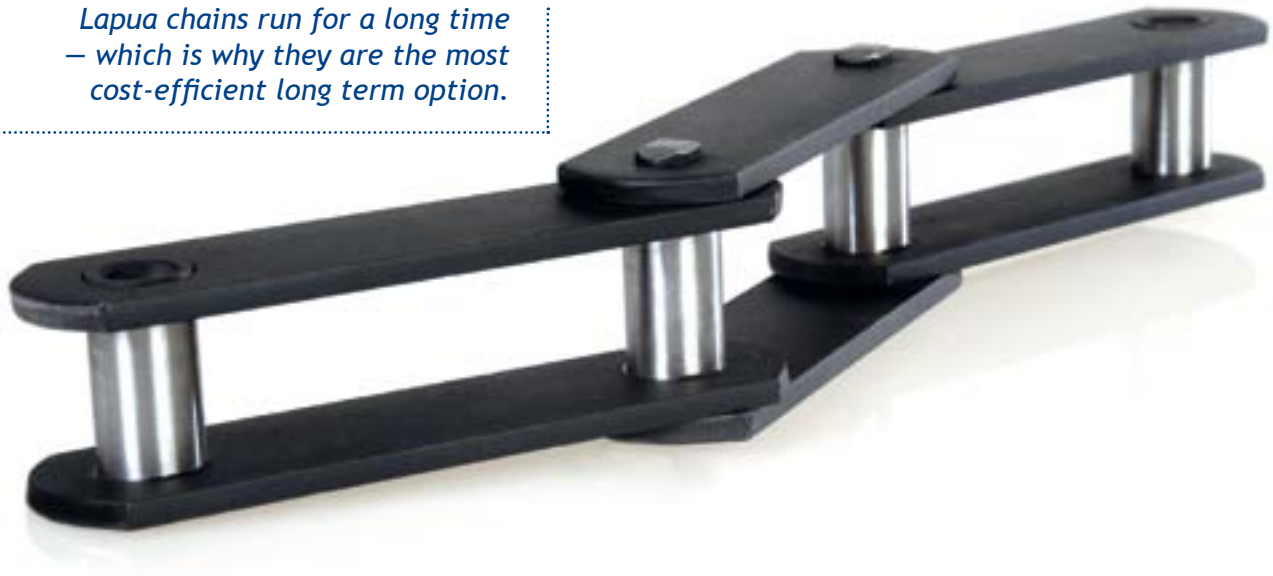
2. The internal surface of the bush is also hardened

The internal surfaces of the Lapua chain bushes are also hardened, making the chains extremely wear-proof. Hardening reduces wear on the internal surface of the bush, preventing the chain from elongating. The excellent durability of the chain's joints is the most significant factor contributing to the chain's increased operational life.

3. All materials are sourced from Western countries

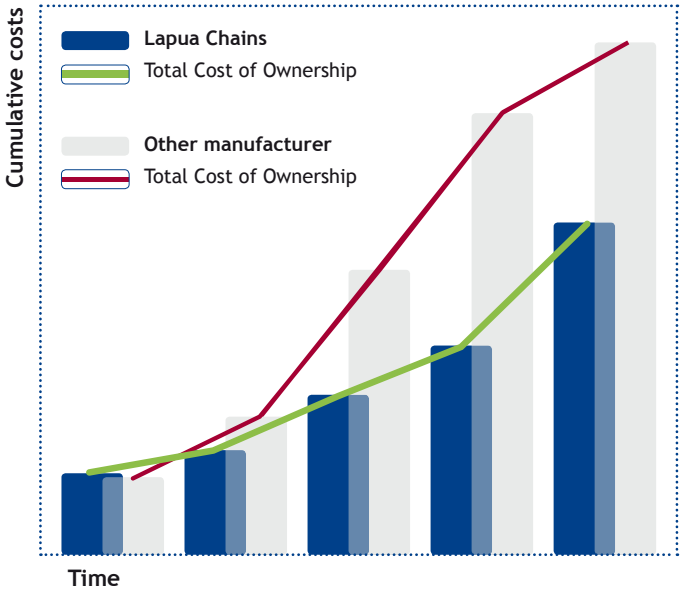
The long operational life of Lapua chains is ensured by raw materials of a uniformly high quality that have been sourced from Western countries, as well as via the application of hardening methods specifically selected for the chain's purpose. Immersion lubrication is one of the standard features of Lapua chains that enhance the chains' durability. Lapua Chains Ltd has manufactured conveyor chains for more than 60 years, utilizing completely different methods than its competitors. The production process is entirely Finnish.

Lapua chains run for a long time — which is why they are the most cost-efficient long term option.



LAPUA CHAINS ARE COST-EFFICIENT

The purchase price of any machine or component usually comprises only a part of its total costs. This is particularly true when it comes to conveyor chains. Other costs are accrued from installing the chain on the conveyor, maintenance work such as lubricating and tightening the chain, and from production losses caused by broken chains and maintenance shutdowns. The purchase price and costs accrued over the years comprise the total life cycle cost of a chain.



No compromises on quality

The share of purchase price in an item's total life cycle cost is usually lower than you think. If you compromise on the properties of a chain when purchasing it then you may, at first glance, seem to have made some savings. However, in time, such savings could backfire as the result of costly maintenance operations and subsequent production losses, and so the total life cycle costs of a chain then become significantly increased, particularly so in demanding conditions.

Each part of each Lapua chain is an example of high-quality Finnish craftsmanship. For more detailed information on these products' properties and manufacturing methods, please refer to section 2, Manufacturing.

The purchase price is usually only approximately half of a chain's total life cycle costs.

2. Manufacturing

Manufacturing

CERTIFIED BY inspecta

ISO 9001

A durable chain is made by utilizing the right materials and the right methods

A durable conveyor chain can only be created by making the right choices. Durable chains can only be made using carefully selected raw materials combined with the best manufacturing methods. Each link of each chain is of a standardized uniform quality because all the factors involved in the manufacturing process are carefully balanced.

The most affordable chain is the chain made to possess specific, selected properties.

Low life cycle costs =

Steel from Western Europe

The right hardening method

Properties specific and appropriate to the chain's application

A precise process of manufacture and assembly

WESTERN RAW MATERIALS

Lapua Chains Ltd uses only selected, reliable raw materials sourced directly from Western Europe. When chains are made from dimensionally precise raw materials of uniform quality, then each link becomes equally durable.

Pins

The pins are milled from round bars made from cold drawn steel satisfying extremely precise raw material and dimensional tolerances. Dimensionally accurate pins guarantee a uniform quality, wear-resisting end result.

Bushes

The bushes are made from precision milled steel tubes. These tubes have already been precisely dimensioned when they are delivered from the steel manufacturer into the chain production process, ensuring that the clearance between each pin and its bush will correspond exactly to its requirements.

Side plates

The side plates are made from hot-rolled flat bar. The low-carbon structural steel used as the side plates' raw material possesses excellent welding qualities. This ensures, for example, the easy and durable connection of attachments.

The first requirement for a wear-resistant chain: *Dimensionally accurate raw materials of a uniform quality.*

The precision-milled steel tubes used in each chain's bushes are custom-made for Lapua Chains Ltd.

UNIQUE HARDENING METHODS

The hardening methods used is what separates chain manufacturers from each other. Even if the sourcing of raw materials and processes of chain manufacture were otherwise successful, if the hardening method is poor or inaccurately executed then the end result will only be a chain of uneven quality that then breaks easily and wears out quickly. The selection of the hardening method to use is the single most significant factor in determining the life cycle cost of a chain.

***The second requirement for a wear-resistant chain:** The correct hardening of the pin and bush.*

Through hardening (quench and tempering)

1. The steel is heated in a furnace to its "austenizing" temperature (approx. 800 °C).
2. Directly quenched in water, oil or salt.
3. Tempering at from 450 to 650°C.
4. Controlled cooling to the normal room-temperature.

Benefits of through hardened steel

+ High-tensile all the way
+ Extremely durable
+ The chain pins are hard along their entire length
+ Also, the internal surfaces of the chain bushes are hard
+ The chain is suitable for both heavy and impact-type loads

Case hardening

1. The temperature of low carbon steel is increased to its carburizing temperature (900 to 950°C), at which temperature carbon from the carbon-rich atmosphere of the furnace is bound to the surface layer of the steel.
2. Directly quenched in water, oil or salt.
3. Tempering at a low temperature (180 to 200 °C).

Benefits of case hardened steel

+ An extremely hard and wear-resistant surface layer
+ The chain pins are hard along their entire length
+ Also, the internal surfaces of the chain bushes are hard
+ The chain is suitable for high-speed applications

Induction hardened bush

Case hardened bush

Induction hardening

Many chain manufacturers utilize an "induction" hardening method. The surface of the piece to be hardened is heated under a strong magnetic field, following which it is rapidly cooled down. Induction hardening is a fast - and therefore affordable - method, but it does have the disadvantages of uneven quality and bushes with soft internal surfaces.

A durable chain having the lowest life-cycle cost is made from the best materials manipulated via the correct and best technical processes.

DESIGN AND PRODUCTION — FINNISH EXPERTISE

Lapua chains are manufactured in Finland, all the way from their initial design through to the completion of the end product. All production processes are self-sufficient, ensuring that the manufacture of each link in each chain is controlled and that its origins are known. Each of our specialist sub-contractors are Finnish experts. This is how we can ensure that our chains are durable and that they compare well when it comes to evaluating life-cycle costs. To ensure high quality, our operations are certified in accordance with the requirements of the ISO 9001:2008 standard.

Life-cycle costs of a high-quality chain
= *purchase and installation*
\+ *maintenance*

Life-cycle costs of a chain of poor quality
= *purchase and installation*
\+ *frequent maintenance*
\+ *premature investment in a new chain*
\+ *installation of the new chain*
\+ *production losses*

Well-designed technical solutions

Lapua chains possess several special properties that separate them from their competitors. The majority of properties that improve chains' durability are standard characteristics in each of our chains. Certain further properties are optional. In addition, based on our clients' needs we are constantly developing new technical solutions.

Standard chains are rarely suitable for use just as they are. Usually various types of attachments and lug structures must be added. Specific applications may require the use of special materials or non-standard heat treatments.

Benefits gained from automation include dimensional accuracy, uniform quality of each part of each product and overall efficiency in production.

Hardening in an automatic controlled-atmosphere furnace provides each chain's parts with uniform quality properties.

1. The manufacture of pins and bushes

The chain pins and bushes are manufactured, using an automatic cut-off rotary transfer machine, from bars and precision-milled steel tubes. This machine performs several machining steps in one single cycle, ensuring an unparalleled productivity when compared to normal automatic lathes.

2. Hardening and grinding

Once the pins and bushes have been machined into their correct shape, they are hardened in fully automated controlled-atmosphere furnaces. As a result, the properties are of an equally high standard throughout each part of the piece, and each piece is of a uniform, high quality.

The third requirement for a wear-resistant chain: *The pitch of the outer plates has to have been shortened by the exact amount of the clearance required between the pin and the bush.*

The breaking load of Lapua Chains' welded chains is 40% better than that required by the appropriate standard. This is due to the fact that each chain's bushes are also welded.

All of the chain's sharp edges are removed from its side plates by a process of drumming.

Even though the production is highly automated, certain work phases are still carried out manually.

The fourth condition of a wear-resistant chain: The correct assembly methods.

3. Cutting and drumming the plates

The chain's side plates are cut from flat bar with precision-made punching tools. It is extremely important for the durability of the chain that the holes are perfectly cylindrical and that the pitch of the outer plates is shortened by the exact amount of the clearance required between the pin and the bush. The plates are finalised by drumming off any sharp edges.

4. Chain assembly

The chains are assembled on an assembly line where the pins and bushes are connected to the side plates. A durable connection is ensured by attaching the pins and bushes to the side plates with a press-on fit prior to riveting or welding.

In riveted chains, duplex milling of both ends of the bush and of the pin ensures that the bond is durable. Always, in welded chains (M224 and larger), the bush is also welded. Having a welded bush improves the breaking load of the chain by 40 per cent.

By installing the chain's attachments in the factory it can be guaranteed to work.

Each joint of the chain is thoroughly lubricated in an oil bath.

5. Installing the chain's attachments

Attachments are usually installed on the chain after it has been welded and assembled. Chains that have been equipped with attachments at the factory are ready for installation upon delivery.

6. Lubrication

All finished chains are completed by being passed through an oil bath. The chains are immersed in a lubricant, ensuring that each joint is thoroughly lubricated from the inside.

7. Packing the chain

All chains are packaged in such a way that at the installation site they can be put to use as easily as possible. All connecting links required to connect the chain are always delivered together with the chain. We deliver our chains, as much as possible, completely ready for installation. We will machine chains to the correct length if separately requested to do so.

Lapua chains, from the point of view of the mechanic, are always packaged in the best possible way.

3. Types of chains

Types of chains

1. Standard
M224 chain,
*breaking load **224 kN**.*

2. Lapua Chains'
M224 chain,
*breaking load **310 kN**.*

The breaking load of Lapua Chains Ltd's size M224 chain is approximately 40 per cent higher than that which the standard requires. This is due to the bushes being attached to the side plates by welding. The standard does not require the bushes to be welded.

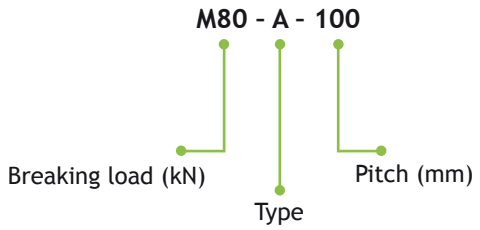
Lapua's chains exceed all standard requirements

Chains' external dimensions are specified in specific standards documents, which is why chains from the different manufacturers all look the same. However, the quality of a chain depend on the methods used by its manufacturer. Lapua Chains Ltd has developed a range of technical solutions that improve the durability of a chain at each of the chain's critical locations. These improvements clearly exceed the requirements set down in the standard, but they are, nevertheless, a standard feature in all Lapua chains.

	Chain no	Breaking load kN	Allowable load kN	Pitch (P)			
RIVETED CHAINS	M 40	40	5.7	63	80	100	125
	M 56	56	8.0	63	80	100	125
	M 80	80	11.4	80	100	125	160
	M 112	112	16.0	80	100	125	160
	M 160	160	22.8	100	125	160	200
WELDED CHAINS	M 224	(* 313	(* 44.8	125	160	200	250
	M 315	441	63.0	160	200	250	315
	M 450	630	89.6	200	250	315	400
	M 630	882	126.0	250	315	400	500
	M 900	1,260	179.2	250	315	400	500

(* Due to the welded bush, 40 per cent higher than that required by the standard.

Chain marking model



STRUCTURAL OPTIONS

Conveyor chains are divided into different size classes based on their nominal breaking load. Up to the size class M160 all chains are riveted, and from then on they are all welded. Depending on the requirements of the application, even smaller chains can be welded.

Riveted chains M40-M160

Lapua Chain Ltd's chains' riveting is ready for the heaviest use, because the pins have been thoroughly hardened along their entire length. The pins are riveted and the bushes are attached by being press-on fitted. Unlike many other manufacturers, the internal surface of each bush is also hardened so as to minimize elongation.

Welded chains M224-M900

The breaking load of the welded Lapua chains is approximately 40 per cent higher than required by the standard, due to the fact that the bushes are attached by welding. The pins are also always welded. Both the pins and the bushes are hardened along their entire length, and further, the internal surfaces of each bush is hardened.

The International standard ISO 1977:2006

The International standard ISO 1977:2006 mainly defines chains' external dimensions. The extent of chains' technical properties that lead to an improvement in their durability depend on the manufacturer.

The rivetings have a very high fatigue endurance, because the ends of the pins are hard.

All inner plates are chamfered before the bushes are welded.

TYPES OF CHAINS

The chains' size classes are divided into five types based on each chain's properties, and then into different pitches based on the length of the chain's links.

Type A

The side plates are straight and the chain is not equipped with rollers. On the conveyor the chain is supported by the side plates. This is the most commonly used type of chain.

Type B

Similar to type A, but has the additional feature of small rollers in order to reduce the wearing of the sprockets and bushes. The chain is supported by either its side plates or by its small rollers. When supported by its small rollers, only light loads may be used. Applications for these chains include high-speed conveyors.

Type C

On type C chains there are smooth, plain rollers that reach over the chain's side plates. The chain is supported by these plain rollers. This chain is particularly suited to long conveyors and large loads.

Type D

The chain's lateral guidance is implemented by the flange of the plain roller. This roller must be hardened. Other than this, the structure and applications of a type D chain are the same as for type C chains.

Type E

These chains' structure is similar to that of a type C chain, but its side plates have been raised higher than its plain rollers. The material to be conveyed can be loaded directly onto the chain.

A

B

C

D

E

In order to ease maintenance work, connection points can be marked with a safety colour.

CONNECTING LINKS

Chains are connected together by using "connecting links". Although all Lapua chains are delivered with the connecting links as required for their connections, in practice links, as spare parts, may be needed for various applications.

Several different types of connecting links are available. For more information on installing the connections, please see the Instructions section, page 101.

Connecting link

Connecting link

When the chains are delivered, a connecting link is included. The connecting link is usually connected by welding. However, in riveted chains, the connection can be riveted instead of being welded. At the site of installation, connecting the chain is best done by using a connecting link equipped with a cotter pin. As the connection is made with a cotter pin, no hot work is required. Cotter pins are available for size classes M40–M160.

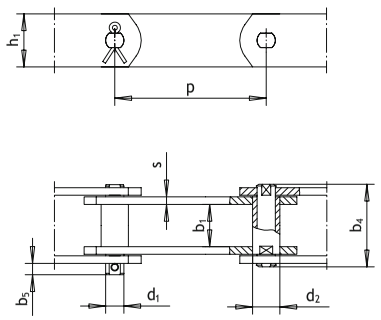
Connecting link with cotter pin

Cranked single links

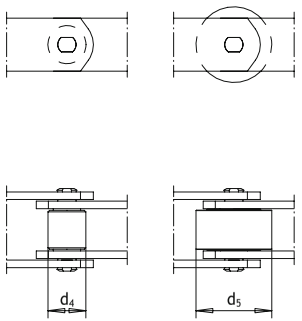
Usually, each chain must have an even number of links so that connections can be properly made. If the application, for any reason, requires an odd number of links, then the connection can be made with a cranked single link.

Cranked single links are also available with a cotter pin.

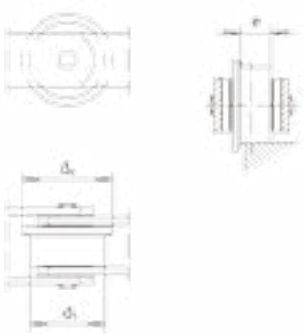
Cranked single links



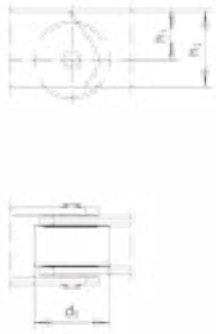
Type A



Type B Type C



Type D



Type E

	Chain no	load kN	Breaking load kN	Allowable load kN	Measuring Pitch (P)				width b_1 min	Internal Pin d_1	Bush d_2	roller d_4	Small roller d_5	Plain roller d_6 (**	e	External Flanged b_4 (** max	b_5 max	width s	Side plates h_1	h_2	h_3
RIVETED CHAINS	M 40	40	5.7	0.8	63	80	100	125	19	8.5	12.5	18	36	42	13.5	40	9	4 (**	25	35	22.5
	M 56	56	8.0	1.12	63	80	100	125	23	10	15	21	42	50	17	46	10	4	30	40 (**	25 (**
	M 80	80	11.4	1.6	80	100	125	160	27	12	18	25	50	60	20	59	12	5	35	50	32.5
	M 112	112	16.0	2.24	80	100	125	160	31	15	21	30	60	70	22	65	14	6	40	60	40
	M 160	160	22.8	3.2	100	125	160	200	36	18	25	36	70	85	25.5	77	16	7	50	70	45
WELDED CHAINS			(*																		
	M 224	313	44.8	4.5	125	160	200	250	42	21	30	42	85	100	30	89	-	8	60	90	60
	M 315	441	63.0	6.3	160	200	250	315	47	25	36	50	100	120	33	103	-	10	70	100	65
	M 450	630	89.6	9	200	250	315	400	55	30	42	60	120	140	37	121	-	12	80	120	80
	M 630	882	126.0	12,5	250	315	400	500	65	36	50	70	140	170	45	140	-	14	100	140	90
	M 900	1260	179.2	18	250	315	400	500	76	44	60	85	170	210	52	162	-	16	120	180	120

(* 40 per cent greater than that required by the standard, due to having welded bushes.
(** Differs from the standard.

4. Chains for the forestry and energy industries

Chains for sawmills

An integral part of sawmill equipment

Conveyor chains, sprockets and sliding guides are all essential components required for the operation of a sawmill because each piece of timber is carried on chains throughout the sawing process. A sawmill's chains must operate with as little maintenance as possible, and any sudden or unplanned production breakdowns must be eliminated. Lapua sawmill chains have been designed in cooperation with both machine manufacturers and with sawmills' operators to ensure that they suited to the challenges presented by sawmills.

All sawmill chains are designed in cooperation with machine manufacturers and sawmill operators.

Reliable chains are the most productive

Unplanned stops in production due to any sudden breaking of a chain will lead to significant costs, beyond the actual maintenance work. One significant cost item is that of having to replace a prematurely worn chain.

Long-term cost-efficiency is the starting point of Lapua chains' design. The total life cycle costs of a sawmill chain are kept low when there are no unnecessary maintenance costs, chain replacements or production breakdowns. For more information on the life-cycle costs of conveyor chains, please see page 6.

LOG PROCESSING CHAINS

Properties of Lapua chains

Log processing chains

- **A 40 per cent greater breaking load than that required by the standard for the M224 size class.**
- **Extremely durable pins and bushes are all thoroughly hardened. The internal surfaces of the bushes are also hardened.**
- **May also be manufactured in a case hardened form.**
- **Re-greasing holes and lubrication create significant savings in a chain's total life-cycle costs.**

In a sawmill, log processing is the activity that is the most demanding on the conveyor chains. The chains are constantly exposed to hard impacts and peak loads. In addition, varying weather conditions, such as frost and rain, stress the chains. Further, sand and other foreign materials carried by the timber can cause wearing.

Log chains consist of a conveyor chain with attachments affixed to it crosswise. Typical applications are log sorters and various kinds of feed conveyors.

Customer-specific solutions

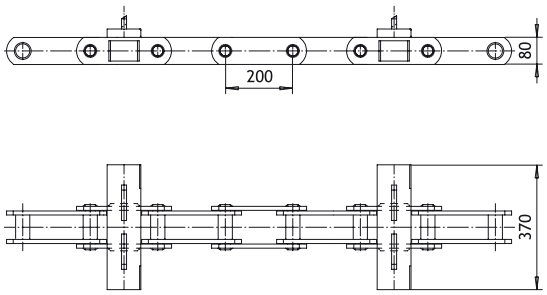
The role of the attachments is to bear the force of the load and to keep the load on the chain. Often, the attachments also support the chain, acting as the wearing, sliding surface against the sliding guide.

We offer several kinds of attachment solutions and we are constantly designing more. The attachments' dimensions can be adapted in any way and, upon request, the material from which they are made can be upgraded to an an even more wear-resistant alternative. Specifically, the model and the material of the tumblers that are fitted in an upright position in the attachment can often be adapted to the particular needs of a plant in order to achieve the best possible plant operation.

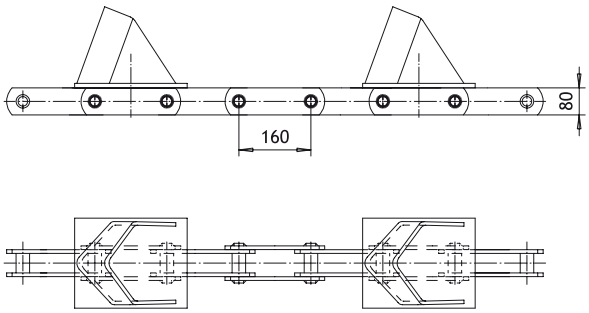
Re-greasing adds years to operating lives

With externally applied drop or brush type lubrication the grease cannot properly enter into the joint. This is why log chains should be equipped with re-greasing holes through which the grease is pressed directly into the joint itself. Re-greasing holes are typically used in the long and valuable chains of log sorters, but also increasingly on shorter conveyors.

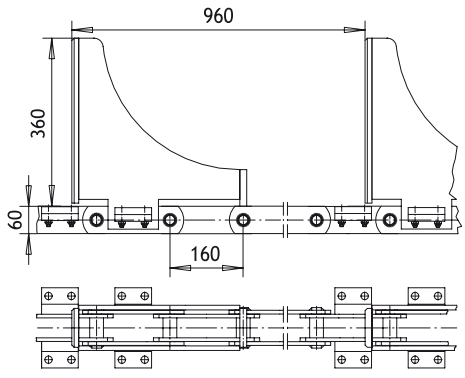
Examples of log processing chains



Log sorter



Log hoist

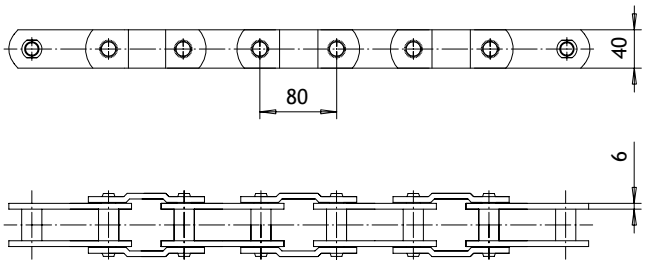


Log hoist

CURVE CHAINS

Curve chains are made with joints with a larger clearance than normal and they are equipped with side guiding structures.

Curves lead to certain special requirements for chains. Standard chains cannot bend in a sufficiently small radius. Therefore, most curve chains are special chains featuring more joints with a larger clearance than those of normal chains. In addition, such chains must usually be equipped with side guiding structure to prevent the pin ends from rubbing against the walls along the inner curve. The side guiding structure is easy to implement with bent side plates. Another option is to use a welded side guiding plate. The sizes of curve chains usually range from M80 to M160.

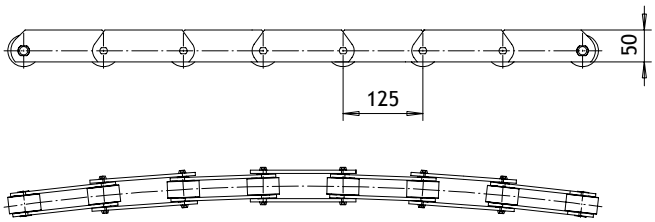


Minimum radius 3,500 mm

Properties of Lapua chains

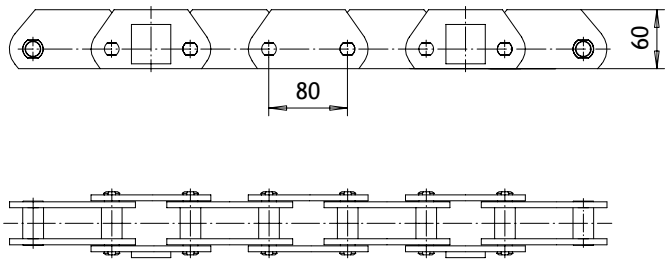
Curve chains

- + The internal surfaces of the bushes are also hardened.
- + The bent sideplate removes the need for toilsome welding of the guiding pieces.
- + Several structural and size options.



Minimum radius 3,380 mm

A chain's side guiding structure can be implemented with a bent side plate.



Minimum radius 3,500 mm

Properties of Lapua chains

Chains for bark and woodchip conveyors

- **Bolted attachments improve maintainability.**
- **In addition to the type A chains, type B and C chains can also be used.**
- **Bushes with hardened internal surfaces.**

CONVEYOR CHAINS FOR BARK AND WOODCHIP CONVEYORS

Bark and woodchip chains are usually used on the conveyors located on the lower floor of a sawmill, to transport the bark residue and woodchips into storage piles. The chains are usually installed as double chains, between which attachments are affixed that operate as scrapers.

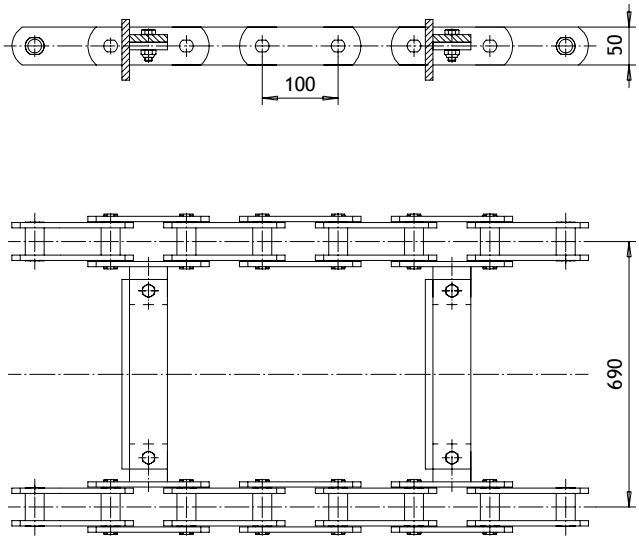
Bark and woodchip chains are typically between the sizes M112 and M224. The most common chain type is the roller-free type A. However, the smaller types, B and C, are also used as they generate less friction. In addition, the side plates of these chain types wear less as these chains are supported by rollers.

The attachments can be installed by either welding or by using screw joints. Attachments installed with screw joints are easier to maintain.

Did you find the right chain?

If you cannot find the chain type that you need, please do not hesitate to contact the Lapua Chains sales team on +358 6 435 1200, or just send us an email to post@lapuachains.com.

Attachments installed with screw joints are easier to maintain.



Bark chains

TOOTHED CHAINS

Toothed chains featuring toothed side plates are used in feeding the mill and in transporting the pre-cut timber. The dimensions of the toothed chain models produced by Lapua Chains are based on the roller chains designed for power transmission applications. These chains' mechanical structures have been developed so that they are the best, most suitable choice for use on such conveyors. Another significant improvement seen in these chains is the hardening of their components.

New models are constantly being developed

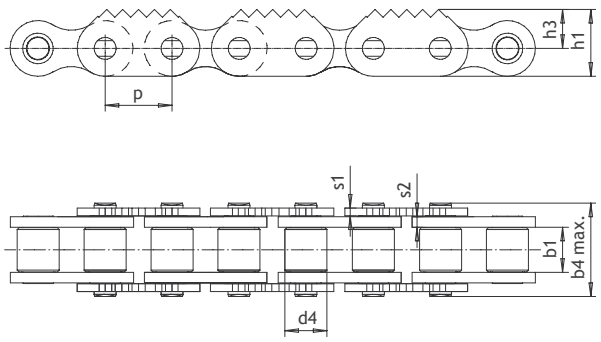
Our range includes chains with each of the following pitches: 1”(16 B), 1.5”(24 B), and 2”(32 B). The 1” and 1.5” chains are used in the processing of pre-cut timber. The 2” chains are used for feeding the logs. Toothed 2” chains in various dimensions and with various models of teeth are also available. In addition, we are constantly designing new versions that correspond to the needs of our clients. Lapua Chains Ltd also manufactures sliding guides for toothed chains.

Lapua Chains Ltd is the only manufacturer of toothed chains in all of the Nordic countries. *These toothed chains are manufactured in Lapua, Finland, from design all the way to the finished product.*

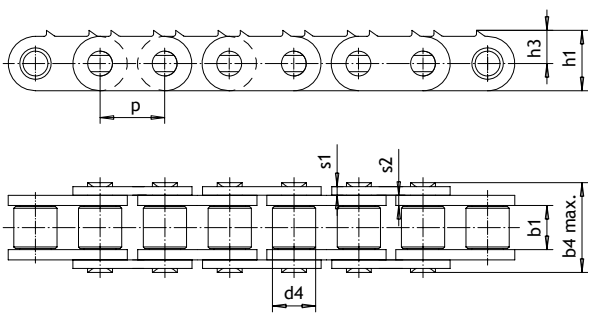
Properties of Lapua chains

Toothed chains

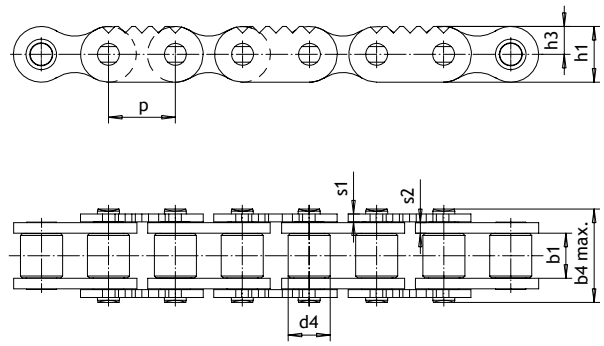
- **Unlike any of the competing products, these chains' entire manufacturing process takes place in Finland.**
- **Extremely high-quality raw materials and hardening methods.**
- **The bushes and rollers are manufactured, seamlessly, from tube.**
- **Extremely long operational lives.**
- **Several models of teeth.**



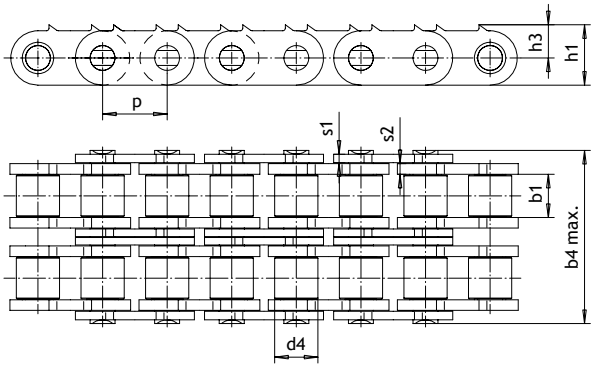
16B Model 21



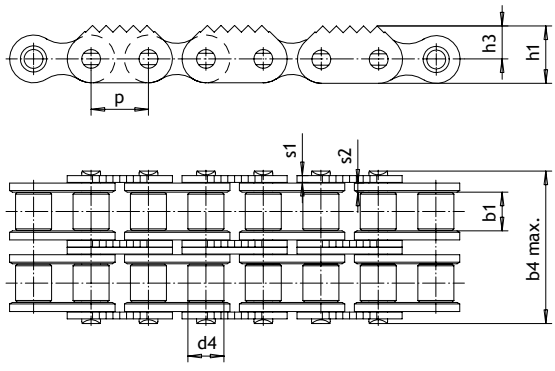
24B Model 9



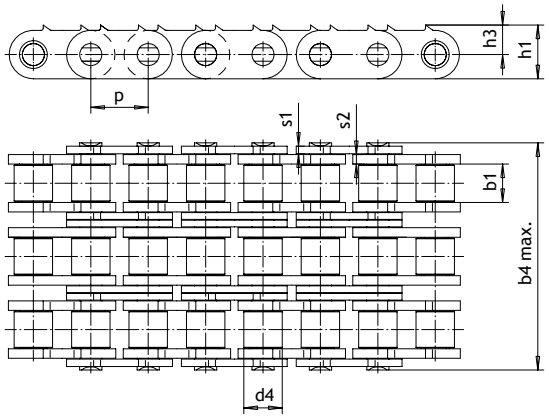
16B Model 27



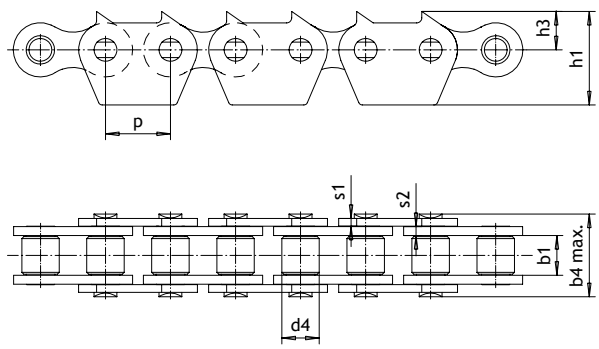
24B Model 2



16B Model 8



24B Model 1



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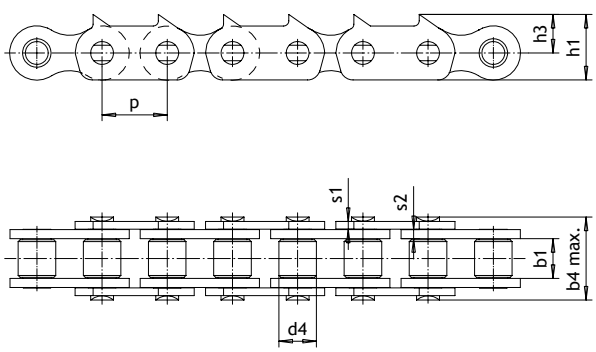

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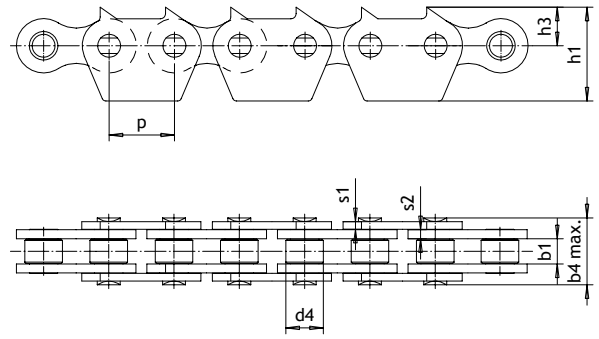
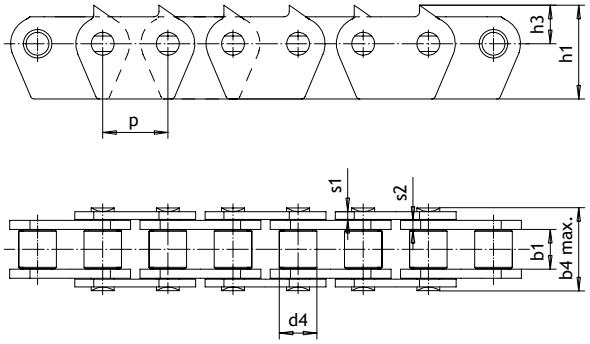


32B Model 9



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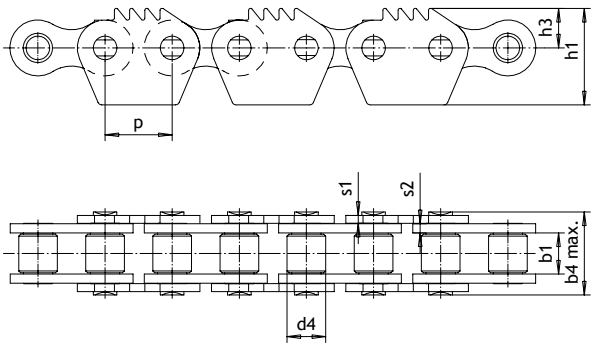

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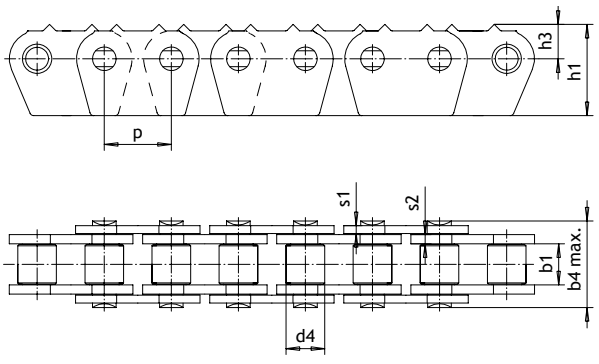
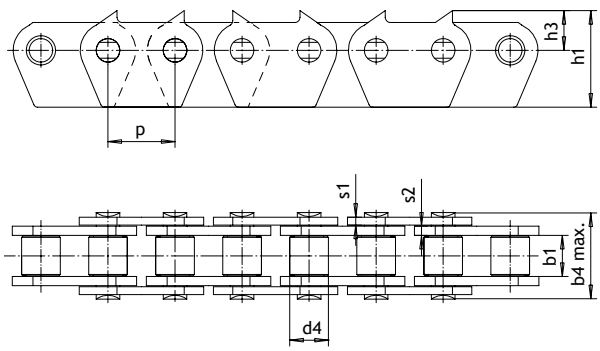


32B Model 15



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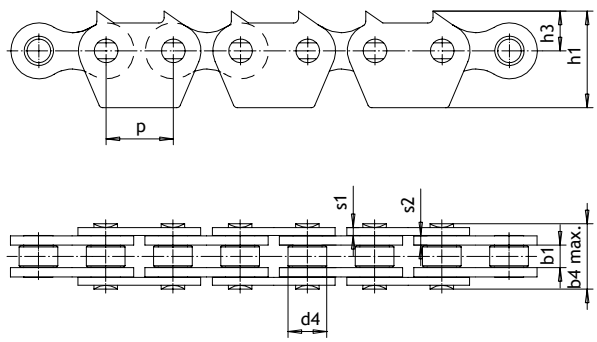
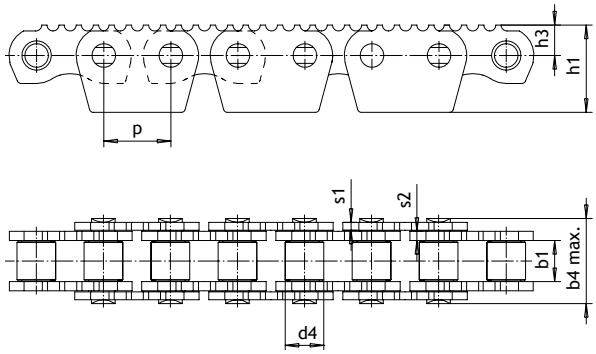


32B Model 17



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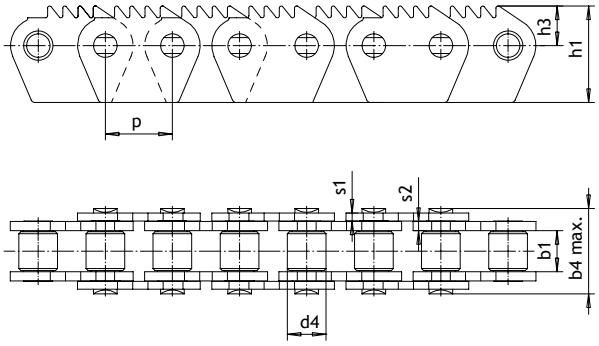

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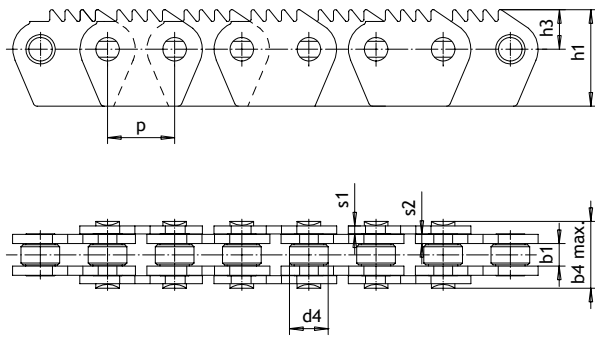

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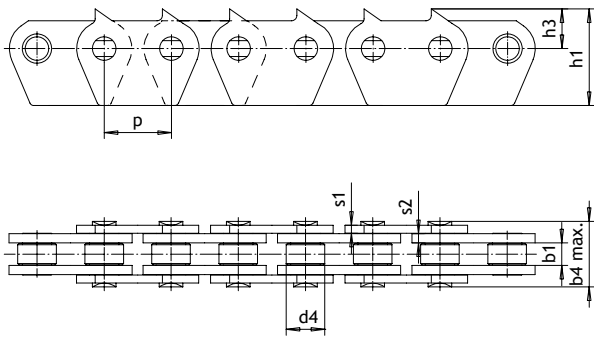

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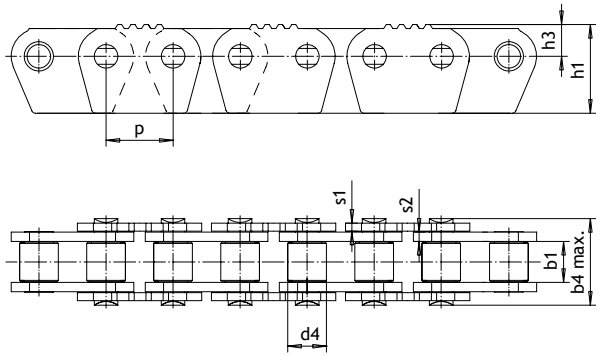

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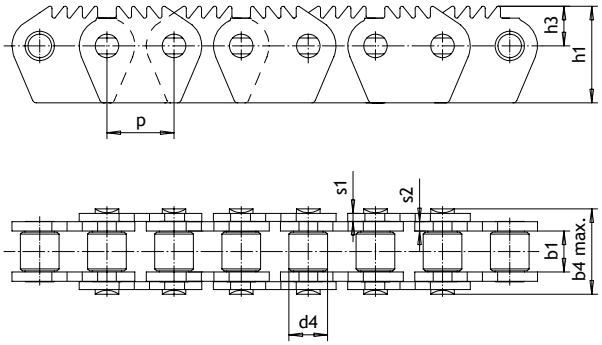

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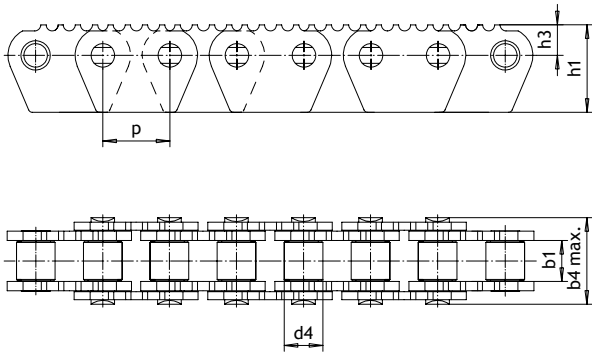

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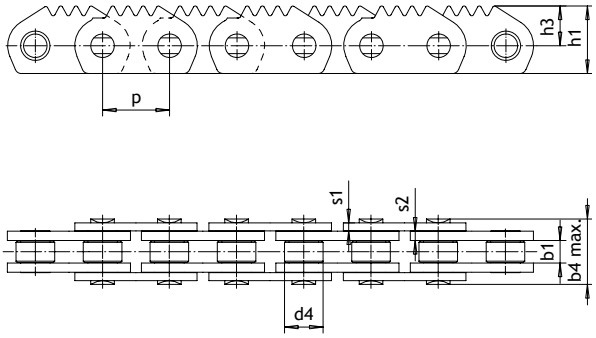

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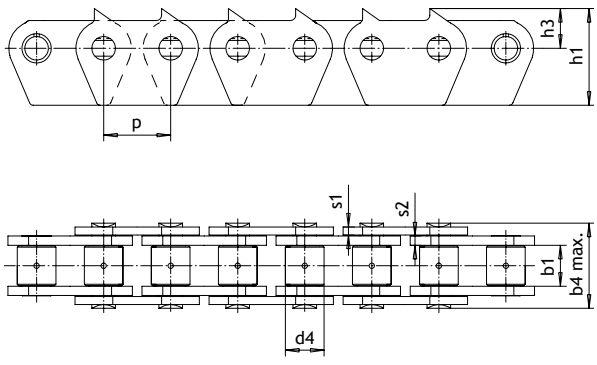

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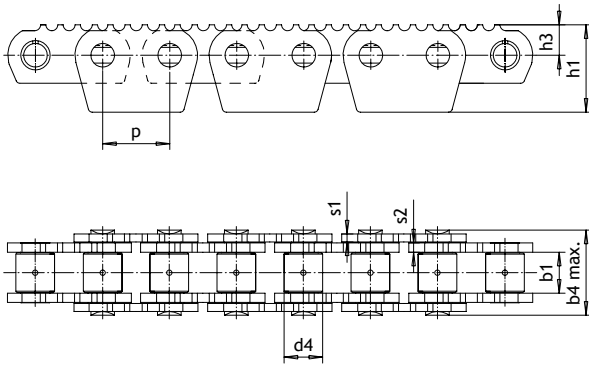
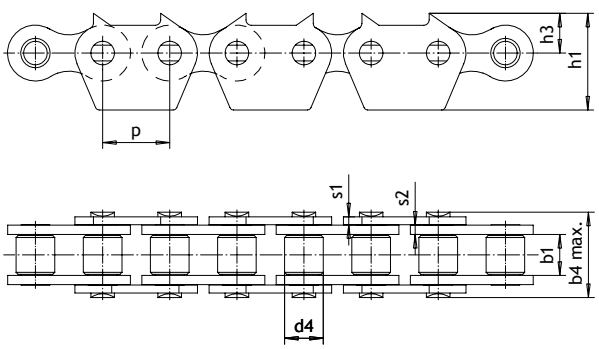
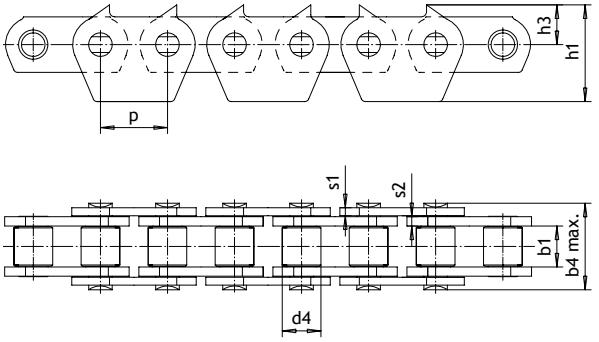


32B Model 28



32B Model 39



32B Model 40

We are always ready to design new tooth models to satisfy any needs of our clients.

Model no.	Pitch (P)	Internal width b1 min	Small roller d4	External width b4 max.	External plate s1	Internal plate s2	Plate height h1	Plate height from the pin h3
16B toothed chains								
21	25.4	17	15.88	35.25	3	4	25.3	14.75
27	25.4	17	15.88	35.25	3	4	21.1	10.55
8	25.4	17	15.88	67.35	3	4	25.3	14.75
24B toothed chains								
9	38.1	25.4	25.4	53.8	5	6	35.5	19.5
2	38.1	25.4	25.4	101.8	5	6	35.5	19.5
1	38.1	25.4	25.4	150.2	5	6	35.5	19.5
32B toothed chains								
4	50.8	30.99	29.2	64.8	6	7	73	30
8	50.8	30.99	29.2	64.8	6	7	51	30
9	50.8	19.6	29.2	52	6	7	73	30
11	50.8	30.99	29.2	64.8	6	7	73	30
13	50.8	30.99	29.2	64.8	6	7	73	30
15	50.8	30.99	29.2	64.8	6	7	69	26
16	50.8	30.99	29.2	64.8	6	7	73	30
17	50.8	17.02	29.2	49.5	6	7	73	30
18	50.8	30.99	29.2	64.8	6	7	66	23
19	50.8	30.99	29.2	64.8	6	7	73	30
20	50.8	17.02	29.2	49.5	6	7	73	30
21	50.8	17.02	29.2	49.5	6	7	73	30
22	50.8	30.99	29.2	64.8	6	7	67	24
23	50.8	30.99	29.2	64.8	6	7	73	30
24	50.8	30.99	29.2	64.8	6	7	66	23
25	50.8	17.02	29.2	49.5	6	7	51	30
27	50.8	30.99	29.2	64.8	6	7	73	30
28	50.8	30.99	29.2	64.8	6	7	66	23
39	50.8	30.99	29.2	64.8	6	7	73	30
40	50.8	30.99	29.2	64.8	6	7	73	30

Properties of Lapua chains

Processing chains for sawn goods

- **High-quality hardening methods specifically for high chain speeds.**
- **Re-greasing holes and lubrication create significant savings in a chain's total life-cycle costs.**
- **A wide selection of models and special characteristics.**
- **Developed in cooperation with both equipment manufacturers and end-users.**

We have an extensive selection of chains for processing sawn timber.

PROCESSING CHAINS FOR SAWN TIMBER

The conveyor chains used for processing sawn goods are significantly smaller but structurally more complex than the chains used in the earlier stages of the sawing process. These chains incorporate several different kinds of mechanisms, and the selection of chain types is extensive.

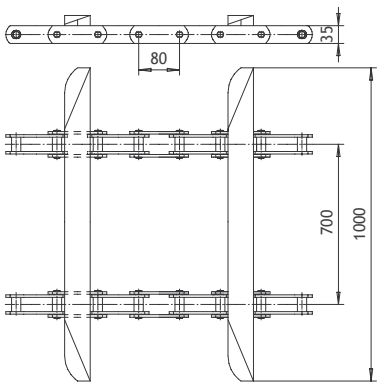
The need to boost production is creating a constant pressure to increase the operating speed of equipment. This is why chains used in processing sawn goods must be extremely reliable and be able to operate at high speeds.

Stainless lubrication

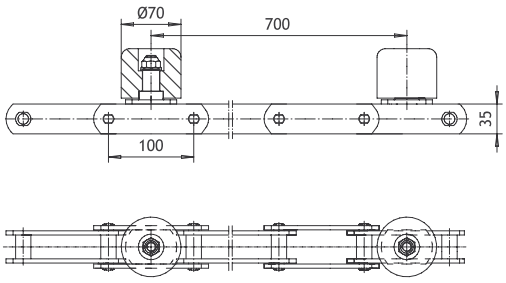
With the chains used to process sawn goods, lubricating these chains in the traditional way can be particularly challenging. The greases and lubricants applied must not stain the products, which often leads to insufficient lubrication being applied, or even not used at all. Due to these chains' re-greasing holes, the chains can be greased with exactly the right amount of lubricant, preventing the extra grease from staining the transported product. Re-greasing is particularly widely used in the chains of dimension sorters, for example.

Re-greasing prolongs the operational life of a chain by several years, reducing its total life-cycle costs. For information on re-greasing, please read the Instructions section on page 100.

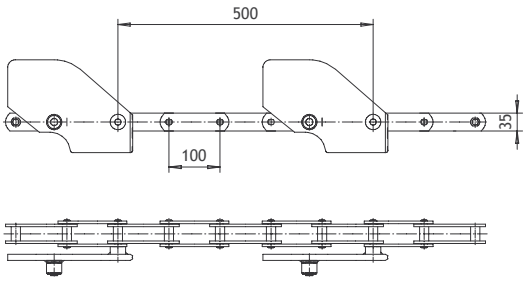
Applications of sawn goods processing chains



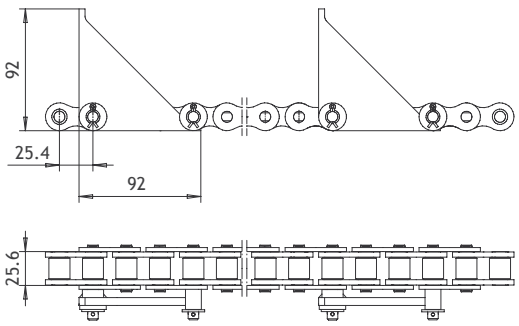
Lumber elevators



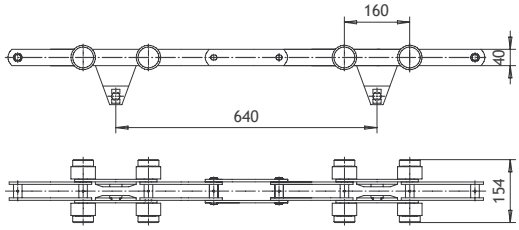
Chains with roller attachments



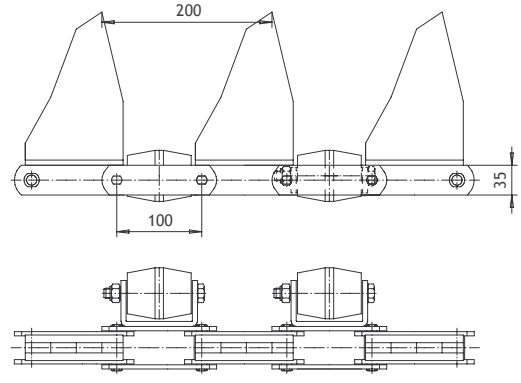
Chains for trimming tables



Chains for feeding conveyors



Sorting conveyor chains



Grading conveyor chains

ROOF-TOP CHAINS

The roof-top chain is a chain type originally developed by Lapua Chains Ltd. Today, it is an extremely popular chain for processing pre-cut timber, especially for packing such timber.

The chain's cap protects the product, preventing the sideplates from leaving marks on the product. The chain is suitable for transporting even the heaviest loads while, at the same time, ensuring that the products at the bottom of the pile are not damaged by the weight of the load. Correct cap design prevents transported goods from pushing in between the chain links.

Typically, roof-top chains come in sizes from M80 and M112. The plain rollers reduce friction, ensuring a minimal level of wear and allowing for even the longest conveyors to be run by small-scale operational machinery.

Properties of Lapua chains

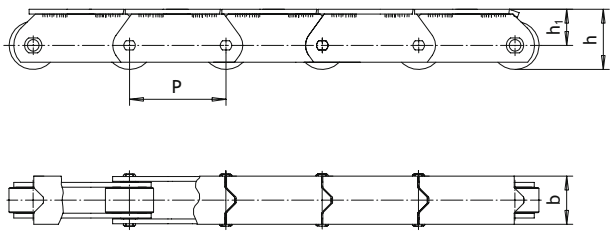
Roof-top chains

- **+ Excellent protection for transported products.**
- **+ The bent design of the lamella guarantees flawless chain operation.**
- **+ These can also be manufactured without plain rollers.**

Roof-top chains can be used to transport large loads without worrying about damaging the products at the bottom of the pile.

Dimensional table for roof-top chains

Chain no.	Pitch (P)				Width b	Height h	Height h_1
M80	80	100	125	160	50	63	37.5
M112	80	100	125	160	60	76	46
M160	100	125	160	200	70	87.5	52



Roof-top chains

4. Chains for the forestry and energy industries

Chains for pulp factories

One of the most valuable components of the factory

In a pulp factory, the conveyor chain is one of the most important components of the production equipment. They are wearing parts, which means that their having the correct properties is very significant. The chains made from the highest-quality raw materials and processed with the best hardening methods last the longest.

Sprockets, heavy loads and process water all strain the joints of a chain

Stress from impacts, loads and process water

Chains in pulp factories are constantly exposed to the combined effects of heavy, impact-like loads together with the pressure from sprockets. In addition, the process water used in the manufacture of pulp can rust the chains. This is why the chain is at risk of wearing, elongating and breaking.

The reliability of the chains in a pulp factory is vital: a sudden hardware failure and the subsequent stoppage of any production line is costly.

LAPUA CHAINS HAVE RISEN TO THIS CHALLENGE

Lapua Chains Ltd has designed chains for the pulp industry that can handle the industry's peaked loads. These chains' extreme durability is due to the technical solutions utilized in the production of Lapua chains: the bush of the joint has been thoroughly hardened, instead of being only surface hardened.

A non-welded bush.

A welded bush provides the chain with 40 per cent more durability.

The bush will not crack

Surface-hardened bushes are prone to hairline cracks. Hairline cracks are caused in surface-hardened bushes by having the hardened surface and its soft interior reacting differently under an applied load.

The through-hardened bushes that are a feature of Lapua chains are also hardened on the internal surface, which means that they will not crack under even the heaviest pressures. From size class M112 upward, all chain bushes in every Lapua chain are through-hardened as a standard feature.

Wear resistance

As the bush wears down as it is used, the chain will elongate. Another good reason for through hardening bushes is the fact that this minimises the bushes' wear, preventing the elongating of the chain. From size class M224 upward, all Lapua chains feature welded bushes, which exceeds the specifications of the standard. This results in the breaking load of Lapua chains being 40 per cent higher than that required by the standard.

All components are manufactured by Lapua Chains Ltd, which ensures that all the joints are equally durable.

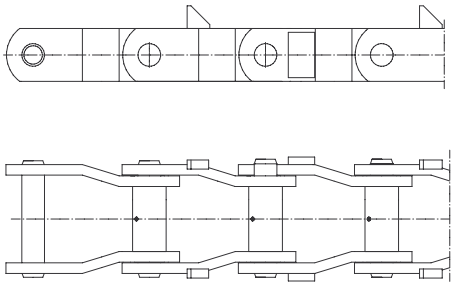
Pulp factory chain models

The selection of Lapua chains includes all of the chains most typically used in pulp factories. The majority of the chains are based on the M and Y type conveyor chains.

Usually, chains are equipped with various attachments, brackets and re-greasing holes. In some conveyors, standard chains are used without any special equipment.

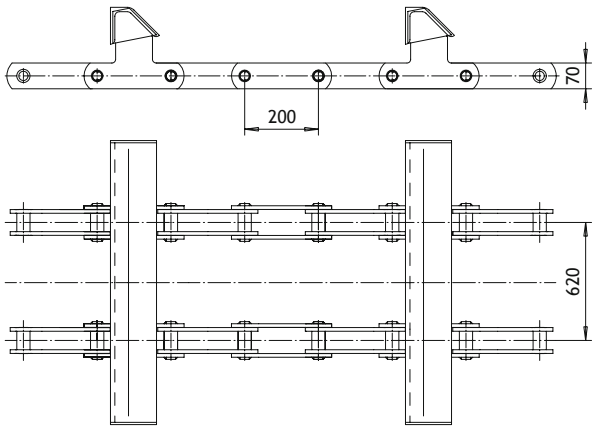
Examples of pulp factory chains

De-icing conveyor



Drum unloading chain

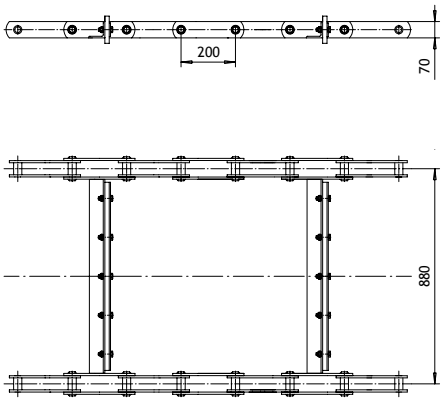
In-feeding chain for chipper



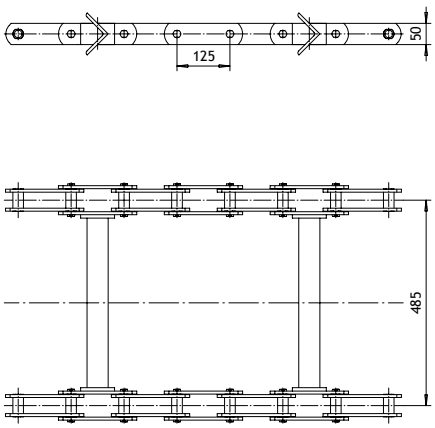
The chains in the pictures are examples of our pulp factory chains. For more chain options or for further information about our chains, please contact our sales team at Lapua Chains on +358 6 435 1200. You can also send us an e-mail at post@lapuachains.com. If required, we will gladly come over to your premises to present to you the various solutions available.

Chain for slasher

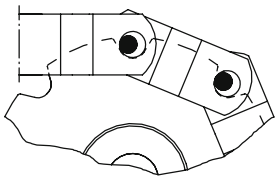
Examples of the chains used for processing bark and woodchips



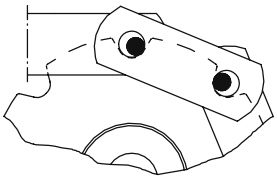
Double chain for a bark conveyor



Double chain for a woodchip conveyor



Y type chain



Bush chain

In a Y chain, the pin of the chain always supports the wall of the bush whenever it is under pressure by the sprocket. This ensures that the bush will not crack even under the heaviest load peaks.

Y CHAINS FOR HEAVY DUTY APPLICATIONS

In pulp factories, the Y type chains have gained ground over the traditional bush chains such as the M type chain. New plants are often equipped with Y type chains. Even several older factories have replaced their bush chains with Y type chains, which is an easy task and one that does not required any extensive adjustment work. The Y type chains offer several benefits during heavy duty applications.

Less stress on the joints

The Y type chains do not contain separate inner and outer links, as the bush chains do. All links are of the same type, which means that all chain joints perform similarly on the sprocket: the pin supports the wall of the bush at all times. As a result, even under pressure from the heaviest loads the bush will not be damaged.

There is plenty of strain on the joints in a bush-type chain

In this M type bush chain, the bushes are under an extreme level of strain. When going onto the sprocket, the pin of the first joint of the inner chain link sets in such a way that it does not support the wall of the bush. The weight of the load hits the bush; at peak loads the bush may give in and break.

This risk is particularly high if the bush is only surface-hardened by either induction hardening or by case hardening. In these cases, the difference in the hardness of the surface and the internal surface of the bush can lead to hairline cracks forming on the bush.

In addition, every alternate bush in the bush chain will then slide in the tooth gap of the sprocket, which significantly wears down both the sprocket and the bush.

Heavy-duty equipment is required in any pulp factory Y chains, stainless chains, and chains equipped with hardened side plates endure both heavy duty use and corrosion.

CHAINS FOR EXTREME CONDITIONS

Lapua Chains Ltd has developed a range of special chain properties that improve the durability of chains used in extreme conditions. These improvements have been designed without compromising any one of the other qualities of the chain.

The process waters throughout any pulp factory will quickly rust a normal chain. When a chain is regularly lubricated through its re-greasing holes, its rusting decreases.

Extremely durable side plates

Under certain conditions, a chain's side plates will be exposed to even more wear than usual. This problem can be solved with hardened side plates. The hardened side plates of Lapua chains are manufactured without compromising the high breaking load of the chains.

Stainless chains

The process water throughout a pulp factory may quickly rust a normal chain and render it unusable. In each stainless Lapua chain, the chain's critical parts – the pin and the bush – are both made from non-rusting raw materials. If necessary, the entire chain can be made from non-rusting raw materials.

For more information on wear-resistant side plates and non-rusting materials, please refer to the Other special chains section from page 55 onward.

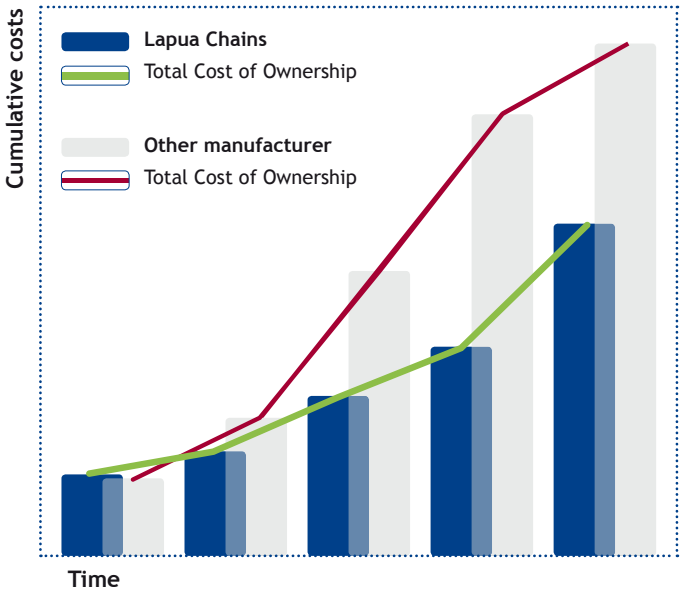
The durable side plates of Lapua chains are thoroughly hardened, making them uniformly hard over their entirety.

RE-GREASABLE CHAINS

Greasing and corrosion protection are the most important maintenance activities that affect the operational life of a chain. Regular greasing prevents the chain's joints from wearing, preventing the elongating of the chain while, at the same time, the corrosion protection provided prevents rusting.

Grease making it to the correct locations

The biggest problem with lubricating a chain is getting the grease into the right place: inside the chain's joint. In addition, the lubricant washes away quickly, and particularly so on the chains used in pulp factories because the chains are regularly in contact with water.



The bushes of Lapua chains can be made with re-greasing holes during their manufacturing process. Through these holes, the grease and corrosion protection agents can be pressed directly into the chain's joints. This will efficiently prevent the wearing and rusting of the chain's joints.

Increasing the replacement time of the chain

Using the correct lubrication agents helps to maintain the excellent properties of the chain while ensuring a high level of protection against corrosion. The replacement time of a chain may be increased by several years. Re-greasing reduces the life-cycle costs of all log conveyors, from de-icing conveyors to the feeding conveyors for chippers. For more information on re-greasing, please read the Instructions section on page 100.

4. Chains for the forestry and energy industries

Chains for paper mills

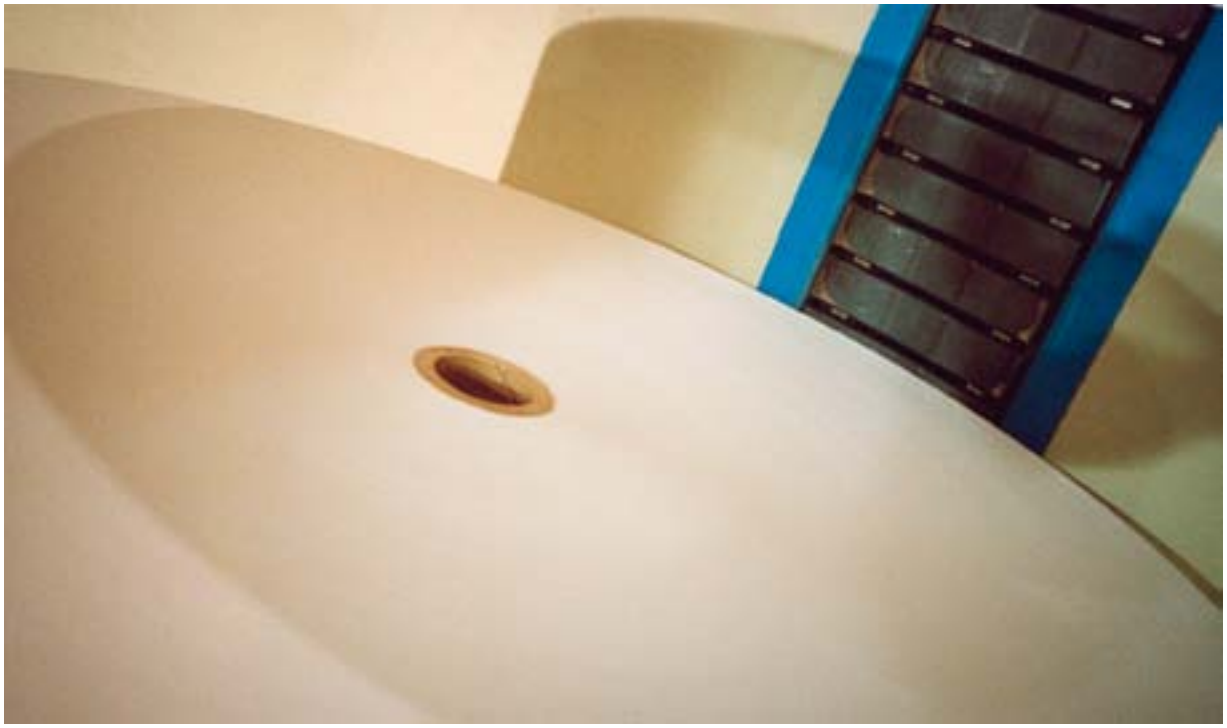
Durable components

A paper mill's chains should operate as durable components. That is, you only notice their importance when they malfunction. When a problem does occur, the chain cannot always be replaced with any other solution. The conveyor will stop for the duration of the maintenance, which means that sudden hardware failures will always lead to extra costs and other problems.

High stresses on the bearings

The lamella chain of a paper mill is a significant investment, and as such, it should be expected to last. Usually lamella chains require little maintenance, which means that their operation has to be extremely reliable.

The most significant feature of a paper mill chain should be its ability to bear great loads. With heavy loads, such as paper reels, starting the chains usually causes great starting friction. Due to this friction, the pressure from the sprocket starts to strain the bearings, particularly those in plain rollers.



All chains are stove enamelled during their manufacture. Upon request, chains can also be painted in a range of safety colours.

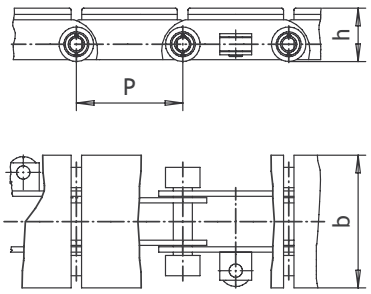
Western quality

Lapua Chains Ltd manufactures chains that operate flawlessly, even under the most demanding conditions. The objective of our product development is the care-free use and maintenance of our chains.

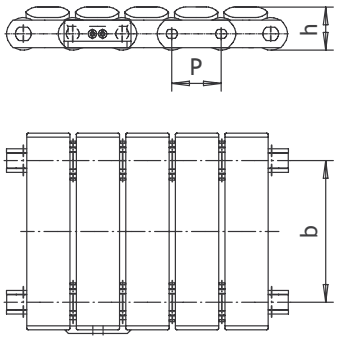
All types of lamella chains are manufactured by Lapua Chains Ltd. Excluding the bearings, every single one of the chain's components is Finnish. We use bearings from renowned, high-quality manufacturers.

Lamella chain models

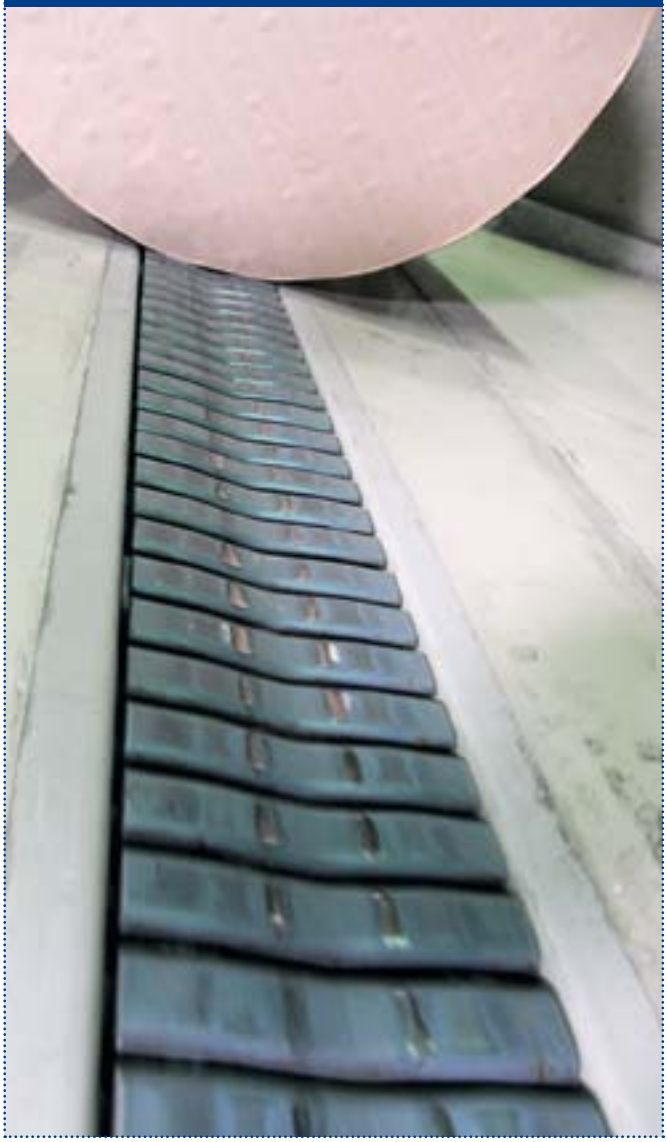
Thanks to our extensive experience and our cooperation with expert equipment manufacturers, the Lapua Chains' lamella chain selection is extensive. Here are some examples from our selection. For more information regarding the type of chain that you need, please contact the Lapua Chains sales team on +358 6 435 1200 or send an e-mail to post@lapuachains.com.

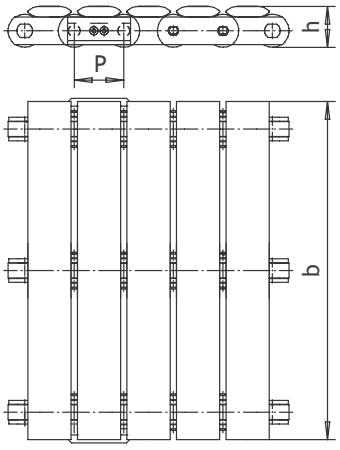


V lamella chain with outside rollers

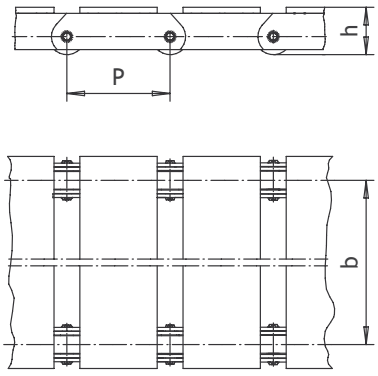


V lamella chain with a 63 mm pitch





Chain for vertically placed reels with a 63 mm pitch



Chain for vertically placed reels with a 200 mm pitch

4. Chains for the forestry and energy industries

Chains for heating plants

The chains must be reliable

Heating plants are often operated with very low numbers of staff, without any site-specific maintenance staff and around the clock, 24 hours a day. This is why its conveyor chains must be exceptionally durable and reliable. Sudden chain failures will always mean problems and extra costs.

The conveyor chains in heating plants must be exceptionally reliable.

Ready for installation

The replacing of chains in heating plants must be quick in order to minimise the duration of the production break down. Due to these plants' tight schedules and their limited numbers of staff, these chains must be easy to install.

Lapua Chains Ltd delivers all its products to heating plants completely ready for installation. Every package includes special chains with attachments, chain wheels, shafts and, if necessary, chain sliding guides.

The majority of the conveyor chains used in heating plants are based on M type chains. Due to the requirements resulting from these plants' operating conditions, certain chains equipped with special structures have become standard equipment on certain types of conveyors. These special chains are also available from Lapua Chains Ltd.

THE RIGHT PROPERTIES

Elongating is the most common reason for replacing a chain. Elongating of a chain is caused by a joint wearing down and its clearance increasing, lengthening the pitch of the chain link. With good lubrication, elongating can be inhibited. However, lubrication is not possible in all circumstances.

The single most important factor affecting the rate at which a chain elongates is the hardening method used during the manufacture of the chain bush and its pin. The wear resistance of Lapua chain joints has been maximised by hardening the pin thoroughly while also hardening the internal surface of the bush. This significantly slows down the wear on the chain, even if the chain is used without greasing.

Lapua chains provide durable solutions, even in the wearing conditions of heating plants. The secret to durability is in the bush.

From the size class M224 upwards, the breaking load of Lapua chains is approximately 40 per cent greater than that of standard chains. The higher breaking load is due to the bush being attached by welding, in addition to its press-on fit.

Rust, ash, and heavy loads threaten the conveyor chains at heating plants. Chains possessing the right properties will endure heavy wear.

ADDITIONAL FEATURES

The chain's operational life is increased by the hardened properties of its joints, as well as by its welded bush which, from the size class M224 upward, is included as a standard feature for all Lapua chains. In addition to these standard features, Lapua chains can be equipped with various additional features that improve the durability of the chain even further.

Stainless joints

Peat, in particular, poses a special challenge to the corrosion resistance of a chain. The acidity of peat will rapidly corrode normal steel. The joints of Lapua chains can be made from stainless steel. Chains equipped with stainless steel joints are used, for instance, in the large-scale floor conveyors at heating plant loading stations.

Joints with a larger clearance

Peat and ash may block a chain's joints. This blocking can be markedly reduced by using a chain with joints that have a larger clearance than normal.

Extremely durable side plates

Some chains move by sliding along a steel sliding guide. In these environments, side plates support the chain and are they are therefore exposed to heavy wear. This wear can be significantly reduced by hardening the chain's side plates. With through-hardening, the plates become highly durable.

Chains equipped with attachment holes

During manufacture, chains can be equipped with holes for attachments. Changing and maintaining attachments becomes easier if they have been attached with bolts instead of by welding.

For more information on these additional features just described, please read the section Other special chains from page 55 onward.

Acquiring the chains, the attachments, and the chain wheels all together in one package is easy and it saves money.

How is rust formed?

Rust is a mixture of iron oxides and hydroxides, formed when iron atoms are oxidised as a result of exposure to water and oxygen. Corrosion, or rusting, is a form of slow combustion, as is putrefaction. Rusting is caused by acidic substances. Peat, with a pH of approximately 4, is acidic, which means that it can easily corrode untreated steel.

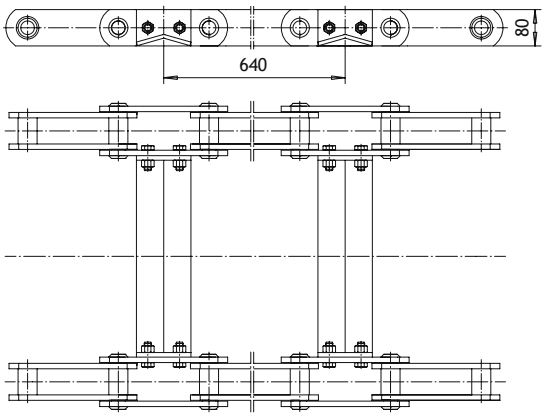
The wear of the joints in all Lapua chains is strongly retarded by the hardening of the internal surfaces of the chain's bushes.

CHAINS' OPERATING LIVES

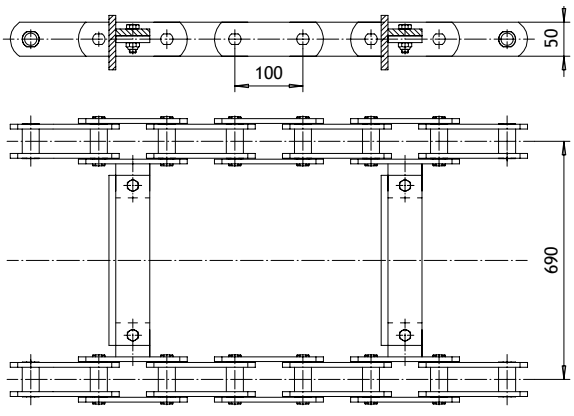
Usually, chains wear the most at their joints, causing the chain to elongate. If the chain runs along a sliding guide, then most wear is directed at the side plates.

The wearing of the chain should be monitored regularly, right from the installation of any new chain. The remaining operational life of a chain can be estimated by a few simple calculations. The replacement interval of a chain becomes longer when a chain does not have to be replaced "just in case".

For more information on monitoring the condition of chains, please read the Instructions section on page 102.



Chain at a reception station



Feed chain

5. Other special chains

Other special chains

For example, wear resistant side plates are often used on the in-feed chains of pulp factories.

DURABLE SIDE PLATES

Under certain applications, the side plates of a chain wear faster than its joints. Heavy loads and the running of a chain by sliding it along a sliding guide both expose a chain's side plates to heavy wear.

The best way to decrease the wearing of a chain's side plates is to select a chain equipped with plain rollers. However, this is not possible in all situations. Another option is to manufacture the chain with more durable and wear-resistant side plates.

Raw material pairs

Wear-resistant side plates are made by hardening. Extreme wear resistance is based on the high hardness of the material, meaning that wear resistant side plates can lead to significant wear of the sliding guide. You should always consider which component you would rather save: the side plates or the sliding guides. The best end result is born from the right combination of raw materials.

For more information on the right raw material combinations and on wear-resistant side plates, please contact our sales team on +358 6 435 1200 or sending us an e-mail to post@lapuachains.com.

REINFORCED SIDE PLATES

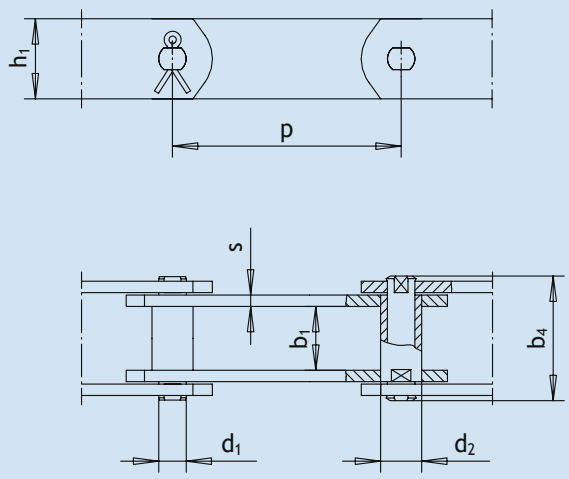
If great masses will be placed on the chain, and the chain is to run along a sliding guide, then the chain can be equipped with thicker side plates than normal. This reduces the surface pressure incident on the sliding guides and the side plates which, in turn, reduces wear. Another benefit of using reinforced side plates is the improved breaking strength of the side plates.

Reinforced side plates are mainly used in A type welded conveyor chains. Typical applications include the log desks installed in sawmills, and for the various receiving conveyors onto which great loads are placed on to a chain running along a sliding guides.

Due to the chain's reinforced side plates, the total width of the chain is slightly greater than usual. The greater width should be taken into account when considering sliding guide solutions and particularly when designing the side guiding structure.

Dimension table for reinforced side plates

Chain no	Pitch (P)				Internal width b_1 min	Pin d_1	Bush d_2	External width b_4 max	Side plates s	Side plates h_1
M 112	80	100	125	160	31	15	21	76	8	40
M 160	100	125	160	200	36	18	25	81	10	50
M 224	125	160	200	250	42	21	30	97	10	60
M 315	160	200	250	315	47	25	36	111	12	70
M 450	200	250	315	400	55	30	42	129	14	80



STAINLESS CHAINS

Under conditions where chains are exposed to corrosion, chains partially or entirely made from stainless steel can be used. For the most demanding of applications, chains can even be made from acid-resistant steel.

It is in the chain's joints that corrosion causes the most problems. If a joint gets rusty then it will wear quickly and get blocked easily.

The affordable choice – chainless joints

For many applications, a chain with corrosion-resistant joints and side plates made from normal structural steel is recommended. With this combination, the rusting of the joints can be prevented while keeping the purchase cost of the chain to a reasonable level.

Please note

Using corrosion-resistant materials leads to certain restrictions on the structure of the chain, depending on the weldability and hardening properties of the materials used. By conforming to these restrictions, a chain can then be manufactured to bear stress and corrosion to the greatest extent possible.

The table below presents the most common material types utilized for the manufacture of corrosion-resistant chains, and the restrictions that are associated with each of them. Upon request, raw materials with even greater durability can be used. For more information, please contact the Lapua Chains sales team on +358 6 435 1200 or by sending an e-mail to post@lapuachains.com.

Stainless joints are a good choice for the conveyors installed in heating plants' reception stations.

Chainless and acid-resistant chains come in size classes from M56 to M900

Feature	Chain component	Hardening	Weldability
Stainless	Pins and bushes	Through-hardened (*	Only M224 and greater
Stainless	Side plates	Not hardened	All size classes
Acid-resistant	Pins and bushes	Not hardened	All size classes
Acid-resistant	Side plates	Not hardened	All size classes

(* Stainless qualities are achieved following hardening.

The joints are thoroughly greased via their lubrication channels, which significantly slows down the process of wearing.

RE-GREASABLE CHAINS

Re-greasing can even triple the normal operational lifetime of a chain.

One common cause of having to replace a chain is elongation. The chain elongates by the joints wearing through use, and the clearance of the joints then increases. Proper lubrication of joints significantly slows down the elongation process.

Lubrication challenges

Getting the lubrication agent applied properly inside a normal chain joint is, actually, very difficult. Most chains are lubricated by "external oil lubrication" in which the oil is applied to the top of the chain with a drop or brush dosing feeder.

The problem with external lubrication methods is that the lubrication agent cannot properly enter into the inside of the chain's joints. This can lead to chains being covered with lubricant on their outside, and elongating almost as rapidly as non-lubricated chains.

Re-greasing is the solution

Elongating can be prevented by fitting the chain with re-greasable joints. During manufacture, the joints are equipped with lubrication channels through which the lubrication grease can be forced into the inside of the joints. Subsequently, the grease can now efficiently lubricate the joint and, in many applications, external lubrication can be abandoned entirely.

Precise lubrication

Re-greasing is also referred to as "precision lubrication": through the lubrication channels, it is ensured that the the grease now ends up in precisely the correct location, that is, inside the joint.

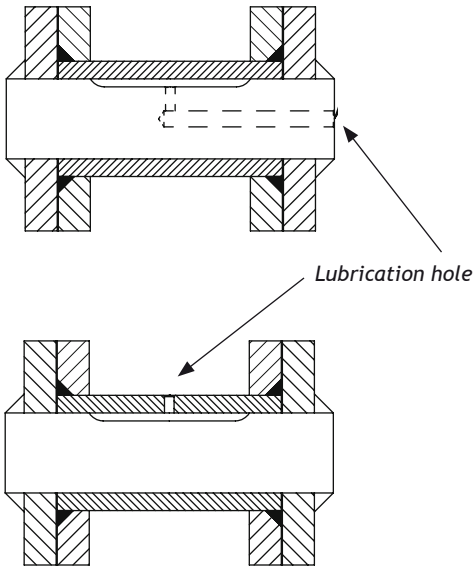
Increasing the operational life of the chain

Re-greasing is performed one to four times per year, depending on the chain's application. The more frequently the chain is lubricated, the more its operational life will be increased.

Before lubrication, all lubrication channels are cleaned with a small drill, following which a pneumatic lubrication device presses the grease into the channel. Use plenty of grease to ensure a thorough lubrication, including between the side plates.

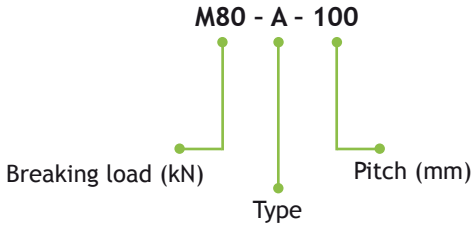
The initial lubrication is performed during manufacture. Upon request, Lapua Chains can also undertake the re-greasing work at your site.

Re-greasable chains are ideal for applications in which normal chains will elongate so that they have to be replaced in maybe only a few years. Typical applications include log and dimensional sorters in sawmills and the in-feed chains used in pulp factories.

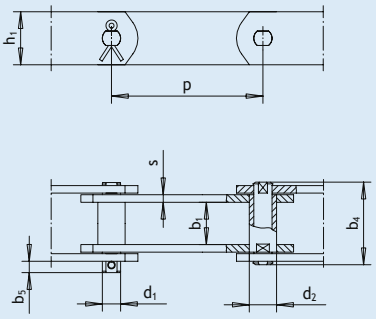


Lubrication can be applied through the hole at the end of the pin or in the bush.

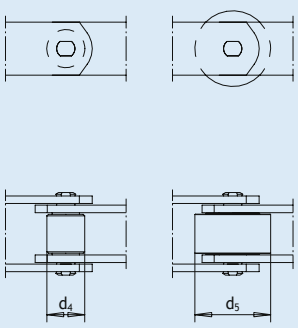
Chain marking model



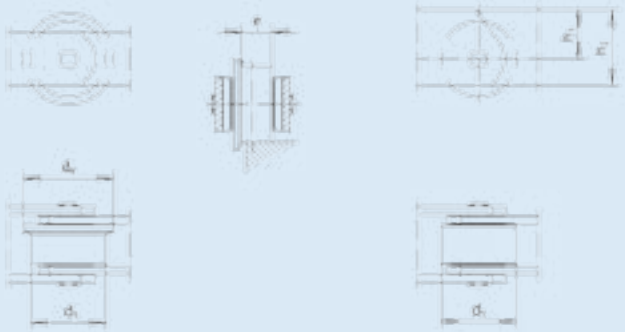
CHAINS ACCORDING TO ISO 1977:2006



Type A



Type B Type C



Type D Type E

	Chain no.	Breaking load kN	Allowable load kN	Measured load kN	Pitch (P)				Inner width b_1 min	Pin d_1	Bush d_2	Small roller d_4	Plain roller d_5	Flanged roller d_6 (**	Flanged roller e	Outer width b_4 max (**	b_5 max	Side plates s	Side plates h_1	Side plates h_2	Side plates h_3
RIVETED CHAINS	M 40	40	5.7	0.8	63	80	100	125	19	8.5	12.5	18	36	42	13.5	40	9	4 (**	25	35	22.5
	M 56	56	8.0	1.12	63	80	100	125	23	10	15	21	42	50	17	46	10	4	30	40 (**	25 (**
	M 80	80	11.4	1.6	80	100	125	160	27	12	18	25	50	60	20	59	12	5	35	50	32.5
	M 112	112	16.0	2.24	80	100	125	160	31	15	21	30	60	70	22	65	14	6	40	60	40
	M 160	160	22.8	3.2	100	125	160	200	36	18	25	36	70	85	25.5	77	16	7	50	70	45
WELDED CHAINS		(*																			
	M 224	313	44.8	4.5	125	160	200	250	42	21	30	42	85	100	30	89	-	8	60	90	60
	M 315	441	63.0	6.3	160	200	250	315	47	25	36	50	100	120	33	103	-	10	70	100	65
	M 450	630	89.6	9	200	250	315	400	55	30	42	60	120	140	37	121	-	12	80	120	80
	M 630	882	126.0	12.5	250	315	400	500	65	36	50	70	140	170	45	140	-	14	100	140	90
	M 900	1260	179.2	18	250	315	400	500	76	44	60	85	170	210	52	162	-	16	120	180	120

(* 40 per cent greater than that required by the standard, due to having welded bushes.
(** Differs from the standard.

Typical applications of attachment chains include wood processing and general processing industries' plants.

AFFIXING THE ATTACHMENTS

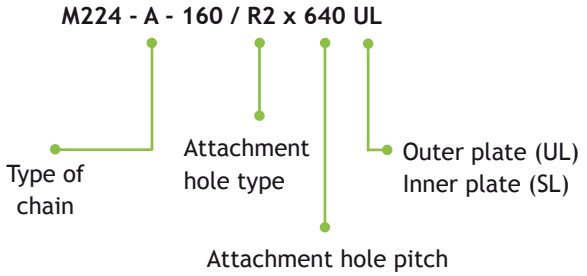
Often, several attachment structures have to be affixed to a chain. Instead of welding, the attachments can be affixed to the chain with bolts, either directly onto the side plates or by using attachment brackets. Maintaining the attachments in the condition in which they were installed is easy, and the same attachments can be reused in any new chain.

Benefits of attachments with bolts

+ Bolts greatly improve the maintainability of attachments because removing and affixing the attachments does not require any hot work.
+ Installing the attachment this way is more flexible and it prevents, for instance, uneven tightening and the extra strain caused by worn sprockets.
+ Worn chains are easy to replace as the old attachments can be reused.
+ The space required to transport a chain is significantly reduced when wide double chains can be delivered with their attachments removed.

The most typical standard attachment, hole and bracket types are presented on the following pages. These standard models can be easily changed to accommodate any special requirements of your application.

Chain marking model



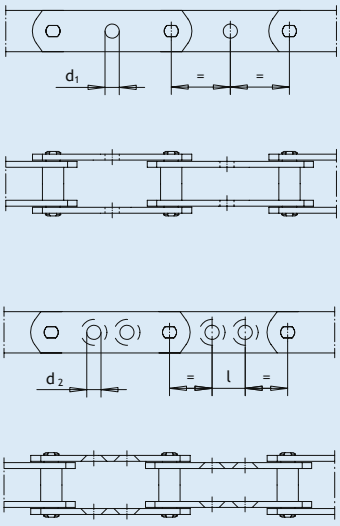
The dimensions of attachment holes and bracket models have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.

ATTCHMENT HOLES R1 AND R2

Attachment hole types

R1	an R1 hole on one side of the chain
R11	R1 holes on both sides of the chain
R2	Hole pair R2 on one side of the chain
R22	Hole pairs R2 on both sides of the chain

Please note. As a standard feature, all attachment holes are countersunk. In practice, from size class M224 upwards, a normal hexagonal screw can be used instead of a countersunk screw if the holes are located on the outer plates.



Chain no.	R1, R11 d_1	R2, R22 d_2	R2, R22 l	P_{min}
M40	8.5	6.6	25	80
M56	10	9	30	80
M80	12	9	30	100
M112	15	11	35	100
M160	18	11	40	125
M224	21	14	50	160
M315	25	14	60	200
M450	30	18	70	200
M630	30	18	100	315 (*
M900	30	24	100	315

(* If P = 250 then l = 80.

Chain marking model

M224 - A - 160 / K11K x 640 UL

- Type of chain
- Bracket type
- Bracket pitch
- Outer plate (UL)
  Inner plate (SL)

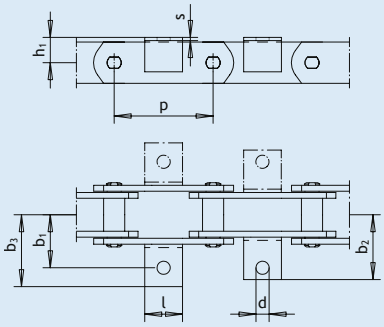
The dimensions of attachment holes and bracket models have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.

ATTACHMENT BRACKETS K1

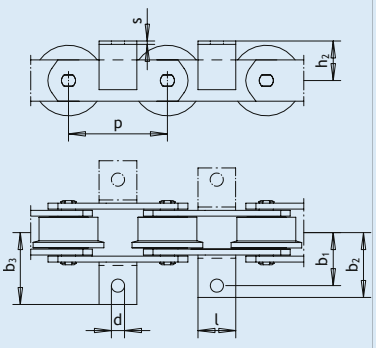
Bracket types

K1M	Low bracket on one side of the chain
K1K	High bracket on one side of the chain
K11M	Low brackets on both sides of the chain
K11K	High brackets on both sides of the chain

In the type D chains that are equipped with plain rollers, the brackets are installed on the flange-side of the roller.



K1M, K11M



K1K,K11K

Chain no.	d	l	h_1	h_2	b_1	b_2	b_3	s
M40	9	25	16	25	35	44	48	3
M56	11	30	19	30	44	56	61	4
M80	11	35	22	35	48	59	65	4
M112	14	40	25	40	55	72	79	5
M160	14	50	30	45	62	76	84	6
M224	18	60	35	55	70	90	99	8
M315	18	70	41	65	80	99	111	9
M450	18	80	46	75	90	110	124	10
M630	24	80	58	90	115	147	163	12
M900	28	80	70	110	140	175	193	14

Chain marking model

M224 - A - 160 / K2M x 640 UL

- Type of chain
- Bracket type
- Bracket pitch (mm)
- Outer plate (UL) / Inner plate (SL)

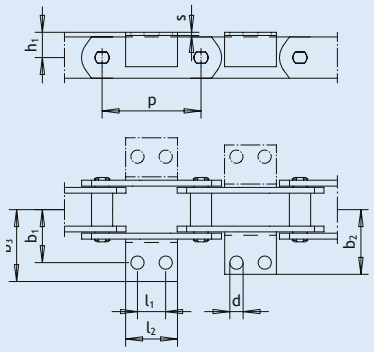
The dimensions of attachment holes and bracket models have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.

ATTACHMENT BRACKETS K2

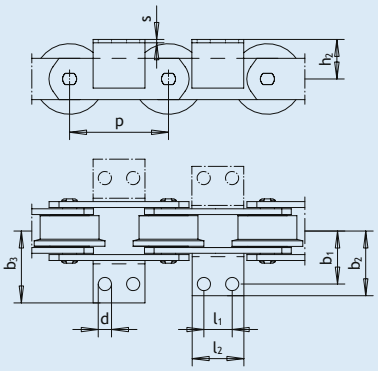
Bracket types

K2M	A low bracket on one side of the chain
K2K	A high bracket on one side of the chain
K22M	Low brackets on both sides of the chain
K22K	High brackets on both sides of the chain

In the type D chains that are equipped with plain rollers, the brackets are installed on the flange-side of the roller.



K2M, K22M



K2K,K22K

Chain no.	d	l_1	l_2	P_{min}	h_1	h_2	b_1	b_2	b_3	s
M40	9	20	45	80	16	25	35	44	48	3
M56	11	25	50	100	19	30	44	56	61	4
M80	11	50	75	125	22	35	48	59	65	4
M112	14	35	60	125	25	40	55	72	79	5
M160	14	50	80	160	30	45	62	76	84	6
M224	18	65	105	200	35	55	70	90	99	8
M315	18	50	90	200	41	65	80	99	111	9
M450	18	85	130	250	46	75	90	110	124	10
M630	24	100	150	315	58	90	115	147	163	12
M900	28	65	130	315	70	110	140	175	193	14

Chain marking model

M224 - A - 160 / J11 x 640 UL

- Type of chain
- Bracket type
- Bracket pitch (mm)
- Outer plate (UL)
- Inner plate (SL)

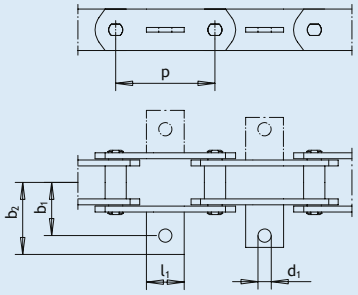
The dimensions of attachment holes and bracket models have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.

ATTACHMENT BRACKETS J1, J2

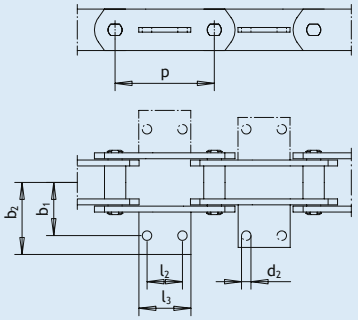
Bracket types

J1, J2 Brackets on one side of the chain
J11, J22 Brackets on both sides of the chain

In the type D chains that are equipped with plain rollers, the brackets are installed on the flange-side of the roller.



J1, J11



J2, J22

Chain no.	J1, J11 d_1	J1, J11 l_1	J2, J22 d_2	J2, J22 l_2	J2, J22 l_3	P_{min}	b_1	b_2	s
M40	9	25	6,6	25	45	80	35	44	3
M56	11	30	9	30	50	80	40	52	4
M80	11	35	9	30	50	100	45	60	5
M112	14	40	11	35	60	100	53	68	6
M160	14	50	11	40	70	125	60	76	8
M224	18	60	14	50	85	160	70	90	8
M315	18	70	14	60	100	200	80	100	10
M450	18	80	18	80	125	250	90	114	12
M630	24	80	18	100	150	315	115	150	15
M900	28	80	24	100	160	315	140	178	15

Chain marking model

M224 - A - 160 / F1 x 640 UL

- Type of chain
- Bracket type
- Bracket pitch (mm)
- Outer plate (UL) / Inner plate (SL)

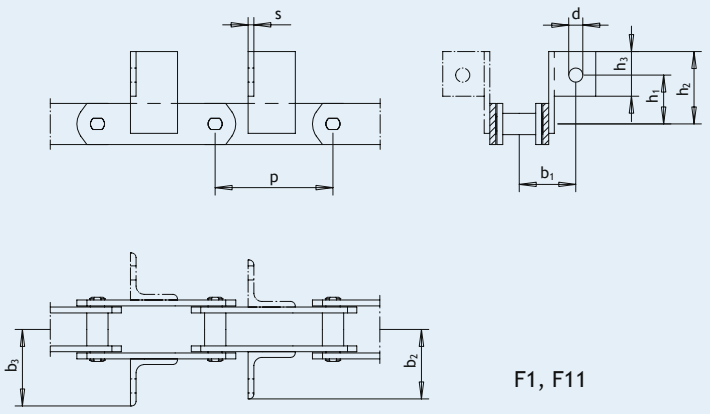
The dimensions of attachment holes and bracket models have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.

ATTACHMENT BRACKETS F1

Structure options

F1 Brackets on one side of the chain
F11 Brackets on both sides of the chain

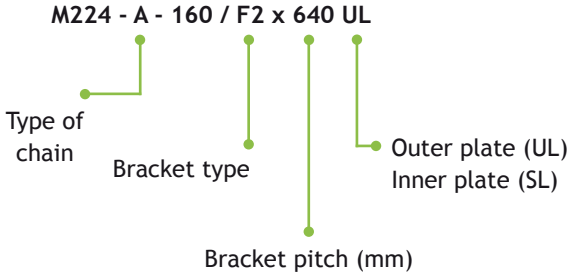
In the type D chains that are equipped with plain rollers, the brackets are installed on the flange-side of the roller.



F1, F11

Chain no.	d	b_1	b_2	b_3	h_1	h_2	h_3	s
M40	9	35	44	48	30	42	24	3
M56	11	40	52	56	36	50	30	4
M80	11	45	60	65	42	60	35	4
M112	14	53	68	75	50	70	40	5
M160	14	60	76	85	60	82	45	6
M224	18	70	90	100	72	100	55	8
M315	18	80	100	114	85	118	65	9
M450	18	90	114	125	95	130	70	10
M630	24	115	158	165	120	165	90	12
M900	28	140	178	195	130	180	100	14

Chain marking model



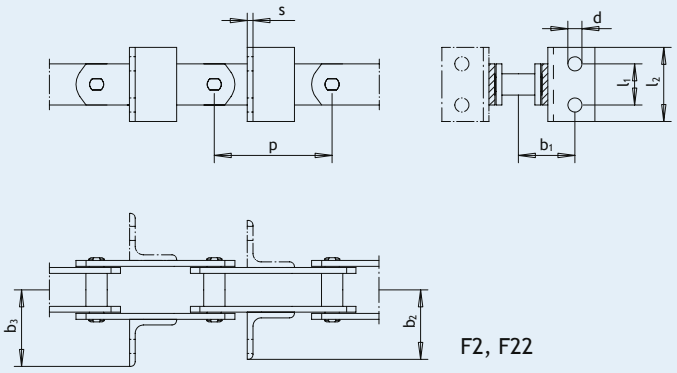
The dimensions of attachment holes and bracket models have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.

ATTACHMENT BRACKETS F2

Structure options

F2 Brackets on one side of the chain
F22 Brackets on both sides of the chain

In the type D chains that are equipped with plain rollers, the brackets are installed on the flange-side of the roller.



F2, F22

Chain no.	d	l_1	l_2	b_1	b_2	b_3	s
M40	6.6	25	45	35	44	48	3
M56	9	30	50	40	52	56	4
M80	9	30	50	45	60	65	4
M112	11	35	60	53	68	75	5
M160	11	40	70	60	76	85	6
M224	14	50	85	70	90	100	8
M315	14	60	100	80	100	114	9
M450	18	80	125	90	114	125	10
M630	18	100	150	115	150	165	12
M900	24	100	160	140	178	195	14

Chain marking model

M224 - A - 160 / L11 x 640 UL

- Type of chain
- Bracket type
- Bracket pitch (mm)
- Outer plate (UL)
  Inner plate (SL)

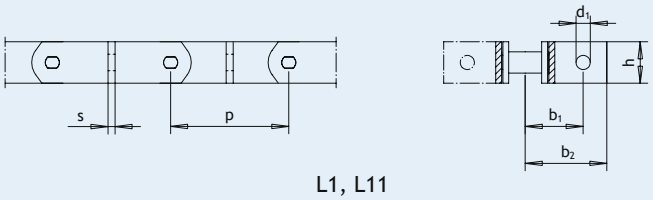
The dimensions of attachment holes and bracket models have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.

ATTACHMENT BRACKETS L1, L2

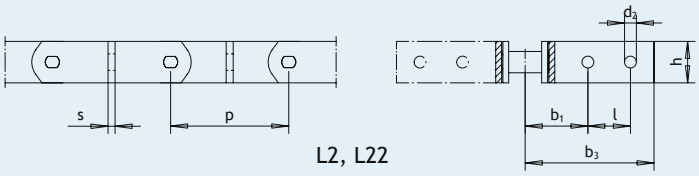
Structure options

L1, L2 Brackets on one side of the chain
L11, L22 Brackets on both sides of the chain

In the type D chains that are equipped with plain rollers, the brackets are installed on the flange-side of the roller.



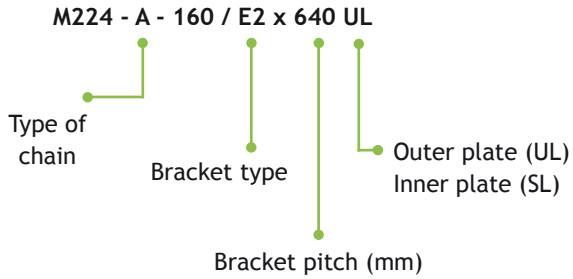
L1, L11



L2, L22

Chain no.	L1, L11 d_1	L1, L11 b_2	L2, L22 d_2	L2, L22 l	L2, L22 b_3	L2, L22 b_1	h	s
M40	9	44	6.6	25	70	35	25	3
M56	11	52	9	30	82	40	30	4
M80	11	60	9	30	90	45	35	5
M112	14	68	11	35	103	52	40	6
M160	14	76	11	40	116	60	50	8
M224	18	90	14	50	140	70	60	8
M315	18	100	14	60	160	80	70	10
M450	18	114	18	70	185	90	80	12
M630	24	150	18	80	230	115	100	15
M900	28	178	24	90	270	140	120	15

Chain marking model



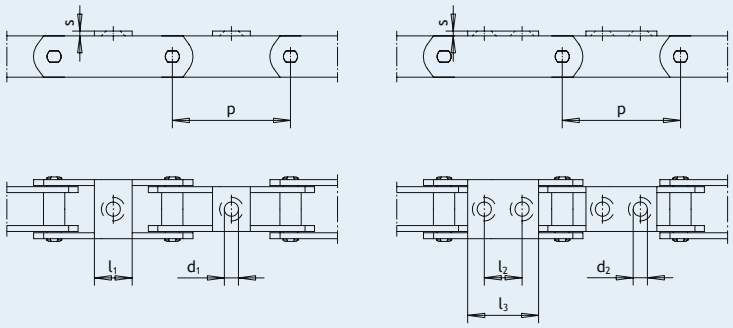
The dimensions of attachment holes and bracket models have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.

ATTACHMENT BRACKETS E1, E2

Structure options

Structure options are bracket with one or two holes.

Please note. The E1 and E2 brackets cannot be used for chains of types C and D.



E1 E2

Chain no.	E1 d_1	E1 l_1	E2 d_2	E2 l_2	E2 l_3	E2 P_{min}	s
M40	9	25	6.6	25	45	80	3
M56	11	30	9	30	50	80	4
M80	11	35	9	30	50	100	5
M112	14	40	11	35	60	100	6
M160	14	50	11	40	70	125	8
M224	18	60	14	50	85	160	8
M315	18	70	14	60	100	200	10
M450	18	80	18	80	125	250	12
M630	24	80	18	100	150	315	15
M900	28	80	24	100	160	315	15

Chain marking model

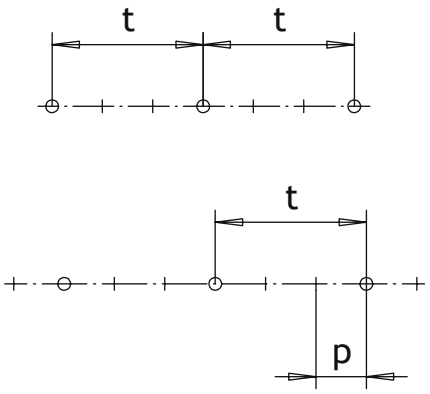
M112 - A - 125 / 750 x 3

Type of chain

Number of rollers (pieces)

Distance between the roller groups t (mm)

The dimensions of outside rollers have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.



CHAINS WITH OUTSIDE ROLLERS

Instead of plain rollers, chains can be equipped with "outside rollers". Here, the desired attachment or bracket structures can be affixed to the chain's links, while supporting the chain remains simple.

For more information regarding supporting chains, please read page 85 of the Instructions section.

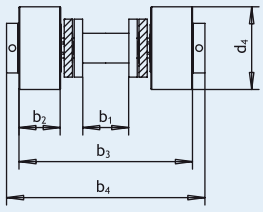
Typical applications include long chain lines equipped with attachments, such as the conveyors used by sawmills' dimension sorters and the lamella conveyors used in papermills.

The rollers can be manufactured from either steel or plastic. Steel rollers can also be equipped with bearings.

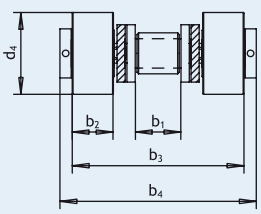
The chain joints can be equipped with type B small rollers, and the side plates can be manufactured as raised type E plates.

Type C plain rollers

Chain no.	b_1	b_2	b_3	b_4	d_4
M40	20	19	75.3	85.3	36
M56	24	23	89.3	101.3	42
M80	28	27	105.5	119.5	50
M112	32	31	121.7	137.7	60
M160	37	36	141	157	70
M224	43	42	163.4	183	85
M315	48	47	187	207	100



AC
Chain type A

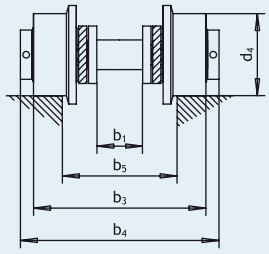


BC
Chain type B

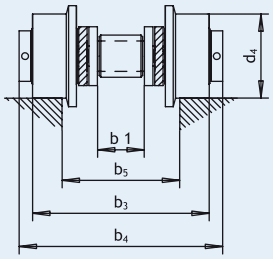
Type D plain roller

Chain no.	b_1	b_5	b_3	b_4	d_4
M40	20	48.3	75.3	85.3	36
M56	24	56.3	89.3	101.3	42
M80	28	67.5	105.5	119.5	50
M112	32	79.7	121.7	137.7	60
M160	37	93	141	157	70
M224	43	106.4	163.4	183	85
M315	48	124	187	207	100

b_5 = between the sliding guides



AD
Chain type A

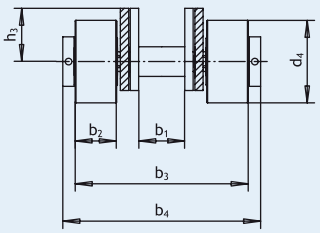


BD
Chain type B

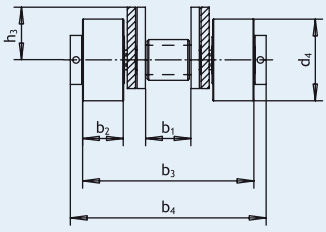
With a type E side plate

Chain no.	b_1	b_2	b_3	b_4	d_4	h_3
M40	20	19	75.3	85.3	36	22.5
M56	24	23	89.3	101.3	42	30
M80	28	27	105.5	119.5	50	32.5
M112	32	31	121.7	137.7	60	40
M160	37	36	141	157	70	45
M224	43	42	163.4	183	85	60
M315	48	47	187	207	100	65

h_3 = height of the side plates



AEC



BEC

Chain marking model

M112 - A - 125 / U3 x 250

- Type of chain
- Extended pin type
- Extended pin pitch (mm)

The dimensions of extended pins have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.

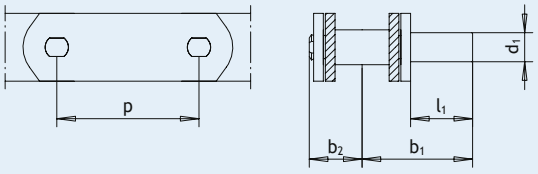
CHAINS WITH EXTENDED PINS

Conveyor chains can be equipped with "extended pins" which are used to affix various attachment and guide-support structures. In this case, pivoting must be done coaxially, in relation to the chain joint. Applications include many kinds of elevators and the trimming table chains used in sawmills.

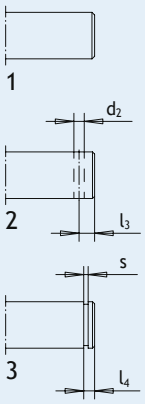
The end of an extended pin can be formed in three different ways, depending on the type of the attachment structure that will be affixed. On all Lapua chains, the extended pins are always hardened.

An extended pin can also be affixed to the chain's side plate. For more information, please contact our sales team on +358 6 435 1200 or just send an e-mail to post@lapuachains.com.

Extended pin on the chain joint:

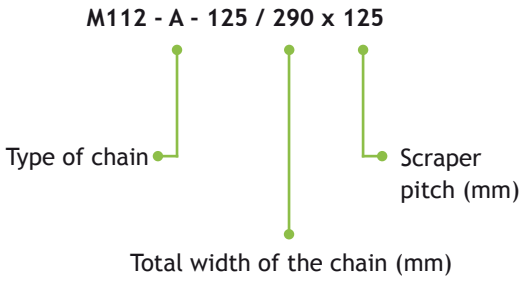


Type:



Chain no.	d_1	l_1	b_1	b_2	d_2	l_3	l_4	s
M40	10	22	40	21	3	4	1.7	1.1
M56	12	28	49	24	4	5	1.9	1.1
M80	15	32	57	29	4	5	2.2	1.1
M112	18	38	67	33	5	6.5	2.8	1.3
M160	22	45	79	38	5	6.5	2.8	1.3
M224	25	55	94	44	6	8	3	1.3
M315	30	65	111	51	6	8	3.7	1.6
M450	35	75	129	60	8	10	4.6	1.6

Chain marking model



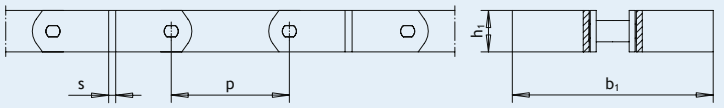
Scrapers' dimensions have become standardised across all manufacturers. However, there may be small differences, so it is best to first check the measurements before placing an order.

SCRAPER CHAINS

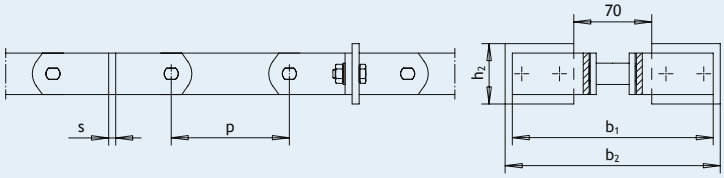
Scraper chains are ideal for transporting fine materials. If the materials are sticky, then some of the scrapers can be replaced with special cleaning scrapers.

The cleaning scrapers can be made from either wear-resistant plastic or from rubber. The cleaning scrapers are attached to the scrapers by bolts.

Cleaning scrapers should be installed at sufficiently frequent intervals, approximately on every fourth scraper.



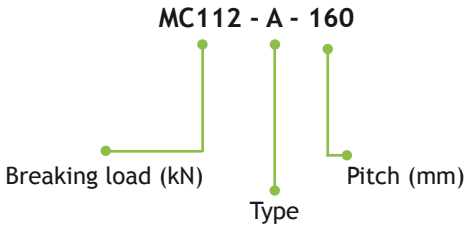
Without cleaning scrapers



With cleaning scrapers

Chain no.	h_1	h_2	s	b_1			Inner width of the conveyor b_2		
M40	25	40	4	120	155	190	125	160	200
M56	30	45	5	120	155	190	125	160	200
M80	35	50	6	190	240	290	200	250	300
M112	40	56	8	240	290	340	250	300	350
M160	50	66	10	290	340	385	300	350	400
M224	60	76	10	340	385	485	350	400	500
M315	70	86	15	385	485	585	400	500	600

Chain marking model

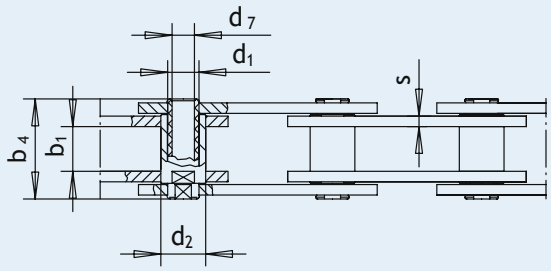


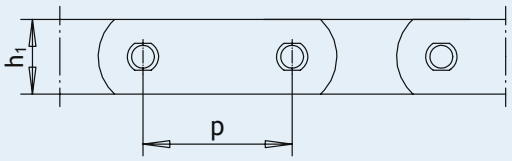
HOLLOW PIN CHAINS

Various attachment and special structures can be attached to chains with hollow pins by using mechanisms that penetrate the chain's pin.

Hollow pins can be used, for instance, for bolt attachments or for pivoting shaft structures that roll between two chains.

Typical applications include paternoster lifts and elevators.





	Breaking load kN	Allowable load kN	Measured load kN	Pitch (P)					Inner width b_1 min	Outer width b_4 max	Pin d_1	Bush d_2	Pin hole d_7	Side plates s	Side plates h_1
MC 56	56	8	1.12	80	100	125	160	200	22	51 (*	15 (*	21	10.2	5 (*	35
MC 112	112	16	2.24	125	160	200	250	315	30	67	21 (*	30 (*	15.1 (*	7 (*	50
MC 224	224	32	4.5	160	200	315	400	500	40	97 (*	30 (*	42 (*	21.3 (*	10 (*	70

(* Differs from the standard.

6. Sprockets

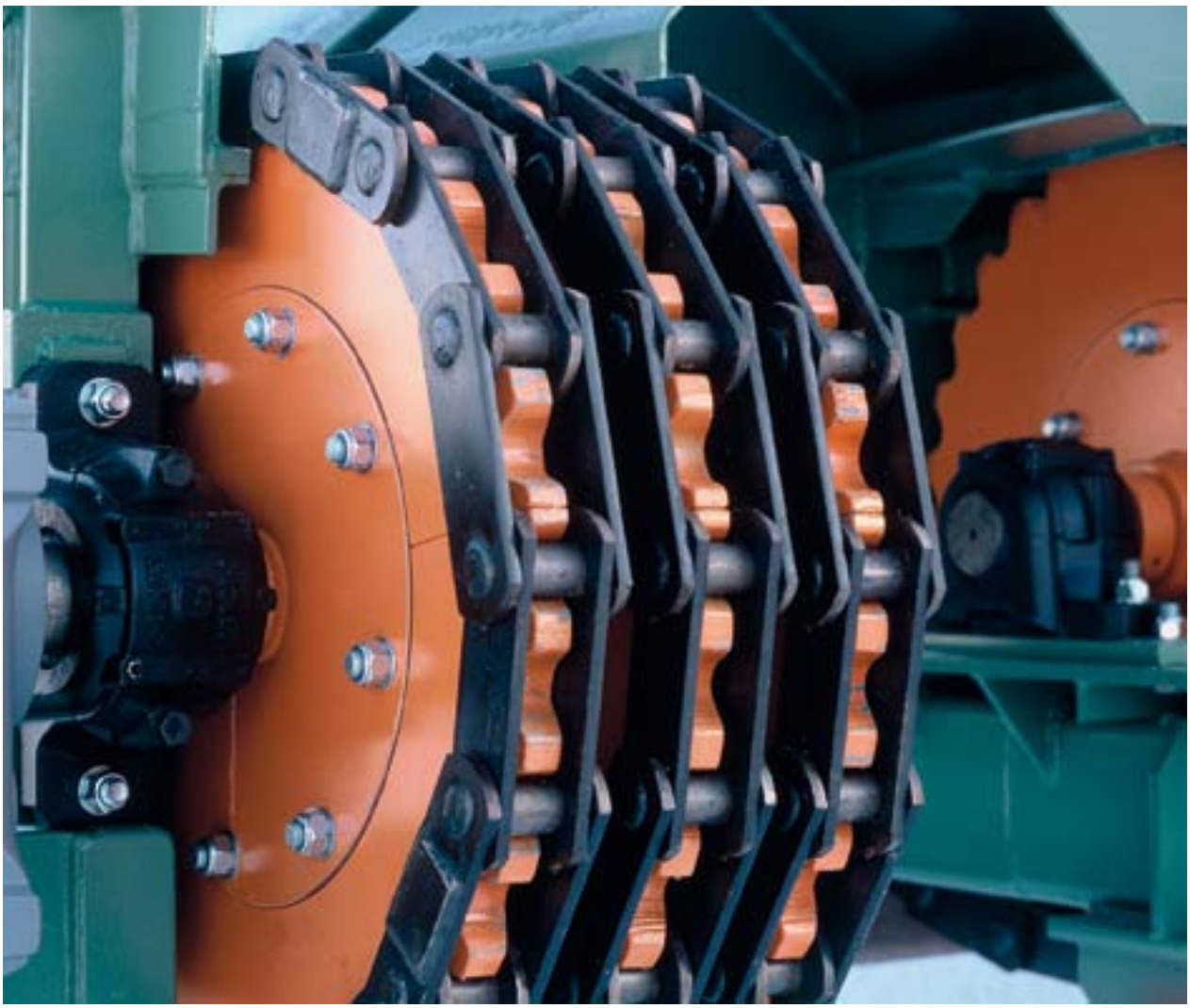
Sprockets

THE SPROCKET TRANSMITS POWER TO THE CHAIN

A high-quality sprocket prevents the chain from wearing.

The sprockets and the return sprockets are among the most significant components in a conveyor. The sprocket transmit the power produced by the operating equipment so that it can move the chain.

In addition to chains and sliding guides, Lapua Chains Ltd also manufactures and delivers sprockets. Acquiring all components from the same manufacturer is both easy and cost-efficient, and the full compatibility of all components is guaranteed.



The syncronization of the sprockets is very important in systems with several parallel chains.

The bush and the tooth must fit together

The properties of the sprocket significantly affect the durability of the entire chain. Incorrect or low-quality sprockets greatly reduce the operational life of the chain.

The sprocket transmits the operating equipment's power, via the chain bushes, to the chain. This is why the compatibility of the sprocket's teeth and the chain's bushes is crucial for the flawless operation and durability of a conveyor.

The bushes are usually exposed to higher levels of stress than any other part of the chain. In most types of chains, the bushes wear down the fastest, which means that the operational life of the bushes defines the operational life of the entire chain.

The compatibility of the sprockets' teeth and the chain's bushes is vital for the durability of the chain.

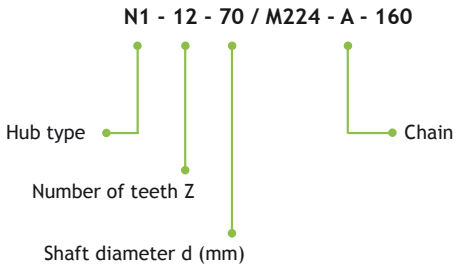
SELECTING A SPROCKET

The manufacturing methods used, the raw materials, and the number of teeth are the most important selection criteria for sprockets.

The number of teeth should never be less than eight. A sufficient number of teeth prevents the polygon effect that causes the chain to jerk and twitch. The faster the conveyor, the greater the number of teeth should be. In lines having several parallel chainss, and for conveyors with double chains, the sprockets must be syncronized.

Return sprockets can usually turn freely in relation to each other. The number of teeth on a return sprocket may be two less than the number of teeth on the drive sprockets, but never less than eight.

Sprocket marking model



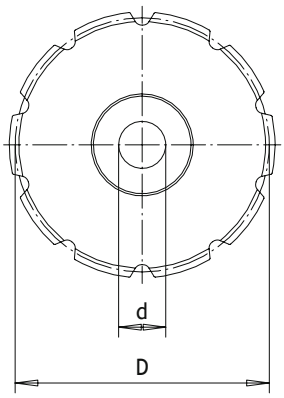
One-piece sprockets

The benefits of a one-piece sprocket are its low purchase price and its simple structure. However, one-piece sprockets are somewhat difficult to replace. During replacement, the shafts have to be removed from their bearings. The sprocket is installed by leading it onto the shaft and locking it into place.

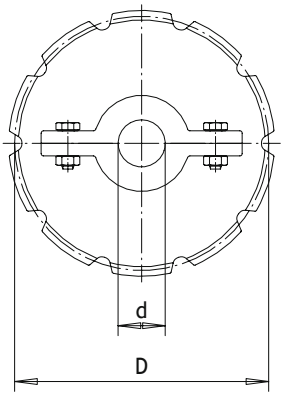
Splittable sprockets

The splittable sprocket is easier to install. As the sprocket consists of two separate halves, the shaft does not have to be removed for its installation. The halves are joined together by a bolt joint in the sprocket.

A splittable sprocket is ideal for demanding applications, in which the installation does not require removing the shaft.

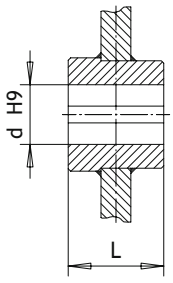


One-piece YN

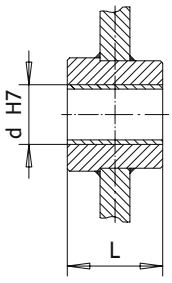


Splittable XN

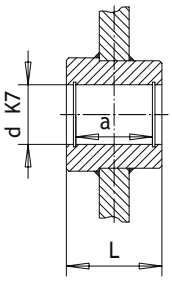
Hub types



N 1
Keyway

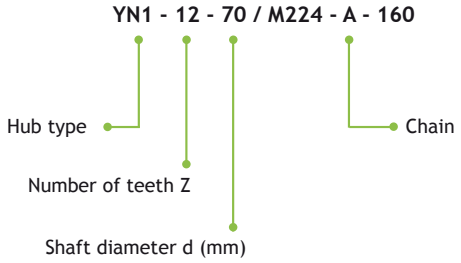


N 2
Bearing bush



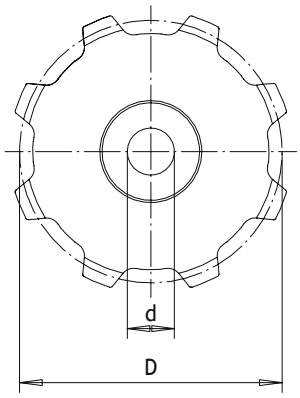
N 4
With ball bearings

Sprocket marking model

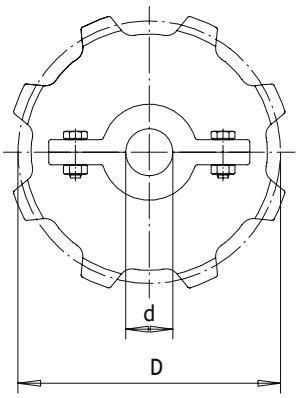


Sprockets with longer tooth gap

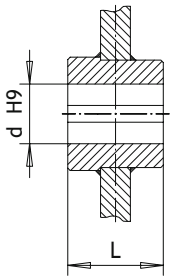
If the chain is to be used to transport materials that could cause blockages, the best option is a sprocket featuring longer tooth gaps than normal. The longer tooth gap will not get blocked and cause the chain to tighten. The disadvantage is that the sprocket may run less precisely. The reference diameters can be seen on the same table as that used for normal sprockets.



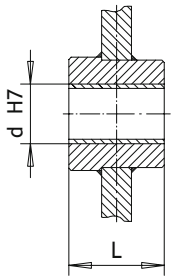
One-piece YN



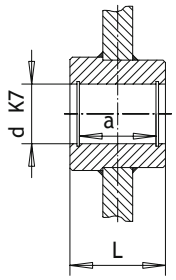
Splittable XN



YN 1
Keyway



YN 2
Bearing bush



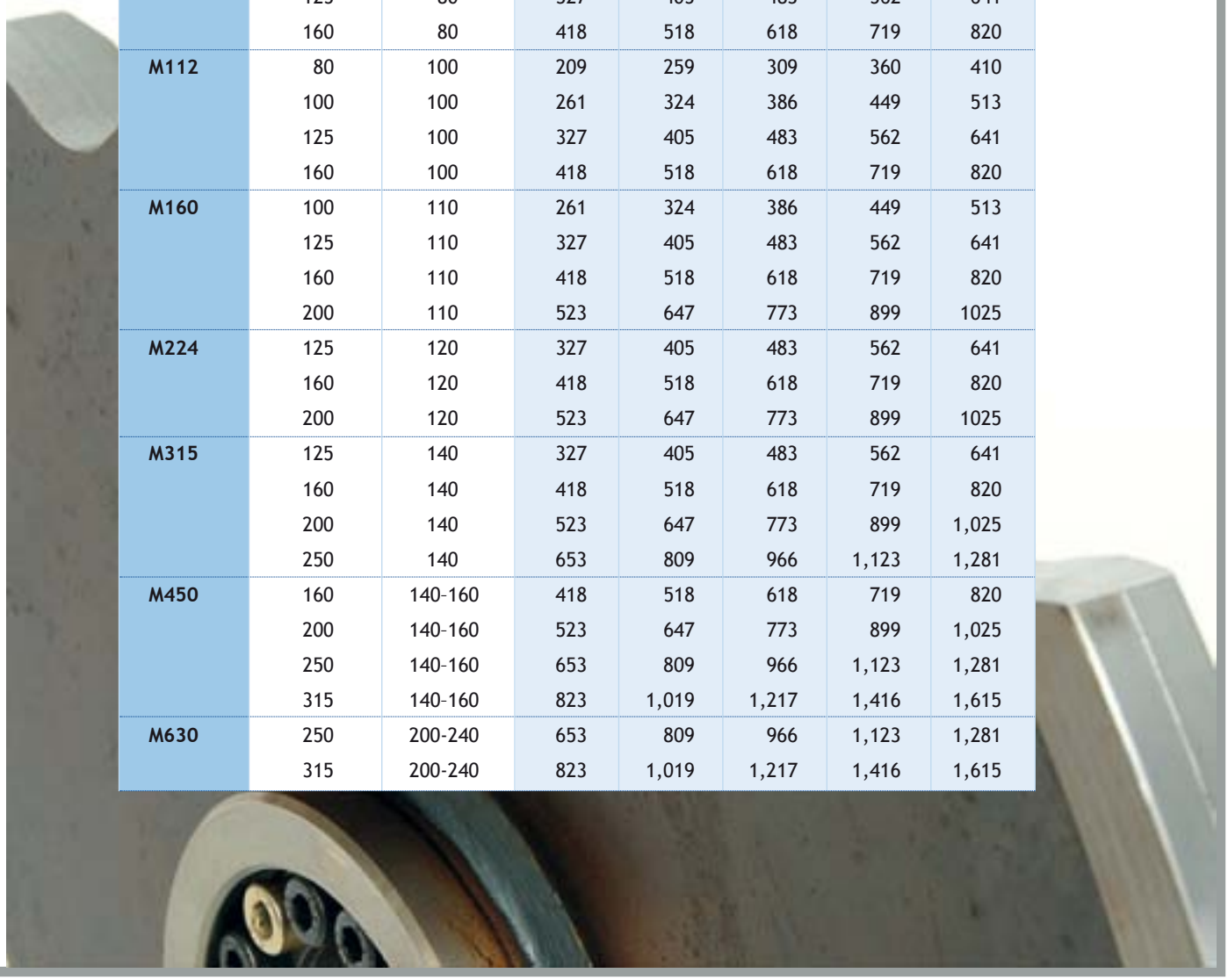
YN 4
With ball bearings

Hub types

SPROCKET REFERENCE DIAMETERS

Reference diameter D in different size classes

Chain no.	Pitch	Length of hub	8	10	12	14	16
M40	63	60	165	204	243	283	323
	80	60	209	259	309	360	410
	100	60	261	324	386	449	513
M56	63	70	165	204	243	283	323
	80	70	209	259	309	360	410
	100	70	261	324	386	449	513
	125	70	327	405	483	562	641
M80	63	80	165	204	243	283	323
	80	80	209	259	309	360	410
	100	80	261	324	386	449	513
	125	80	327	405	483	562	641
	160	80	418	518	618	719	820
M112	80	100	209	259	309	360	410
	100	100	261	324	386	449	513
	125	100	327	405	483	562	641
	160	100	418	518	618	719	820
M160	100	110	261	324	386	449	513
	125	110	327	405	483	562	641
	160	110	418	518	618	719	820
	200	110	523	647	773	899	1025
M224	125	120	327	405	483	562	641
	160	120	418	518	618	719	820
	200	120	523	647	773	899	1025
M315	125	140	327	405	483	562	641
	160	140	418	518	618	719	820
	200	140	523	647	773	899	1,025
	250	140	653	809	966	1,123	1,281
M450	160	140-160	418	518	618	719	820
	200	140-160	523	647	773	899	1,025
	250	140-160	653	809	966	1,123	1,281
	315	140-160	823	1,019	1,217	1,416	1,615
M630	250	200-240	653	809	966	1,123	1,281
	315	200-240	823	1,019	1,217	1,416	1,615

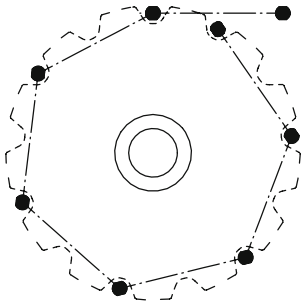


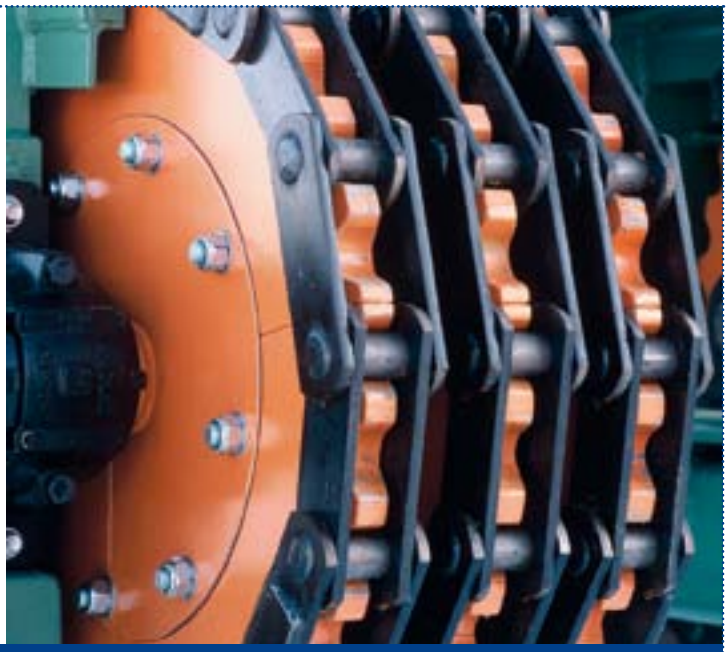
The same hub types are available for use with half-tooth sprockets as for normal sprockets, in both one-piece and splittable configurations.

Half-tooth sprockets

Sprockets wear mostly in their tooth gaps, where the chain bush rubs against the gap. However, this wearing can be halved by using a sprocket with "half tooth" gaps. In practice, extra tooth gaps are made between the existing tooth gaps, making a 10-tooth sprocket into a 21-tooth sprocket. The tooth gaps are spaced such that each gap is only used on every alternate rotation. Wear is significantly reduced, while the sprocket's diameter remains nearly the same as it was before.

The use of sprockets with half-tooth gaps is mainly restricted by the pitch of the chain used. Half-tooth sprockets cannot be used in combination with chains having very short pitches.





Half-tooth sprockets

REFERENCE DIAMETERS AND THE MINIMUM NUMBER OF TEETH FOR HALF-TOOTH SPROCKETS

Reference diameters for half-tooth sprockets (D)

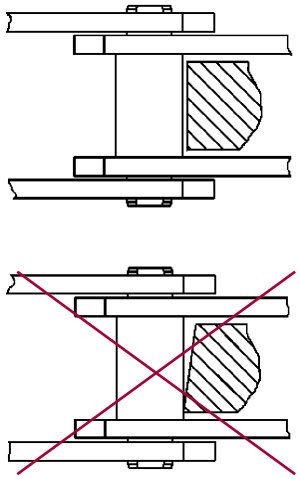
z \ p	63	80	100	125	160	200	250	315
6.5	136	172	215	269	344	430	538	678
7.5	155	197	246	307	393	492	615	774
8.5	174	221	277	346	443	554	692	872
9.5	194	246	308	385	493	616	770	970
10.5	214	271	339	424	543	679	848	1069
11.5	234	297	371	463	593	741	924	1168
12.5	253	322	402	503	643	804	1005	1267
13.5	273	347	434	542	694	867	1084	1366
14.5	293	372	465	581	744	930	1163	1465
15.5	313	397	497	621	795	994	1242	1565
16.5	333	423	528	661	845	1057	1321	
17.5	353	448	560	700	896	1120	1400	
18.5	373	473	592	740	947	1183	1479	
19.5	393	499	623	779	997	1247	1558	
20.5	413	524	655	819	1048	1310		

The minimum number of teeth (z_{min})

The table presents the smallest available pitches and numbers of teeth for chains usable with the various size classes.

Chain	z_{min}	Chain	z_{min}	Chain	z_{min}	Chain	z_{min}
M56-A-63	7.5	M112-A-80	6.5	M224-A-125	6.5	M450-A-200	6.5
M56-A-80	6.5	M112-A-100	6.5	M224-A-160	6.5	M450-A-250	6.5
M56-A-100	6.5	M112-A-125	6.5	M224-A-200	6.5	M450-A-315	6.5
M56-A-125	6.5	M112-A-160	6.5	M224-A-250	6.5	M450-A-400	6.5
M80-A-63	7.5	M160-A-100	6.5	M315-A-160	6.5	M630-A-250	6.5
M80-A-80	6.5	M160-A-125	6.5	M315-A-200	6.5	M630-A-315	6.5
M80-A-100	6.5	M160-A-160	6.5	M315-A-250	6.5	M630-A-400	6.5
M80-A-125	6.5	M160-A-200	6.5	M315-A-315	6.5	M630-A-500	6.5

A machined sprocket saves the chain.



Load peaks stress chains

If the toothing of a sprocket does not match its chain and a tooth touches a chain bush only at its point or corner, then peak loads are applied to the wall of the bush. These peak loads wear down the bush and may cause it to crack.

FLAME-CUT OR MACHINED SPROCKETS?

Sprockets are manufactured by two methods: by flame-cutting and by machining. It is good to know the differences between these two alternatives because the manufacturing method used affects both the price and the operational life of a chain.

Machined sprockets save the chain

A machined sprocket is produced by machining the teeth from a slab by milling. This results in extremely dimensionally accurate teeth and tooth gaps. The perpendicularity of the teeth and the quality of their surfaces are both excellent.

Machined sprockets save the chain. The tooth will always come into contact with the chain bush along its entire width, saving the bush from experiencing any extremely wearing localised loads. When the chains force or speed is very high, a machined, dimensionally accurate sprocket is the best choice.

A flame-cut sprocket is the budget option

The less expensive option is to flame, laser or plasma cut the sprocket into the desired shape from a steel plate. The teeth can be made to size without separate machining.

The dimensional accuracy of the teeth of a flame-cut sprocket is lower than that of a machined sprocket, which means that the tooth system may not, necessarily, be as exactly perpendicular as that of a machined sprocket. If the tooth only touches the chain bush with its point or corner, then a significantly peaked load may be directed at the bush wall. Peaked loads cause significant wear on the bush, even leading to breakage of the chain.

Machined sprockets repay their investment

As a general rule, flame-cut sprockets are best suited for slow, lightly loaded and less critical conveyors. In all other applications, we recommend using a machined sprocket.

When used in any inappropriate application, a flame-cut sprocket will rapidly damage a valuable chain. Even though the purchase costs of a flame-cut sprocket are low, these savings will quickly disappear in the subsequent operating costs.

For more information on selecting the correct sprocket, please contact the Lapua Chains sales team on +358 6 435 1200, or just send us an e-mail to posti@lapua-ketjut.fi.

SPROCKETS' ATTACHMENT METHODS

The type of conveyor, installation conditions and the size of the shaft etc. must all be considered in the selection of the sprocket attachment method and the hub type. One of the most important qualities in a sprocket is that it is easy to replace.

Welding

The simplest way to attach a sprocket on the shaft is to weld it, which means that no other attachment parts are required. However, a welded sprocket cannot be replaced without damaging the shaft, which is why it is poorly suited to demanding applications.

Keyway

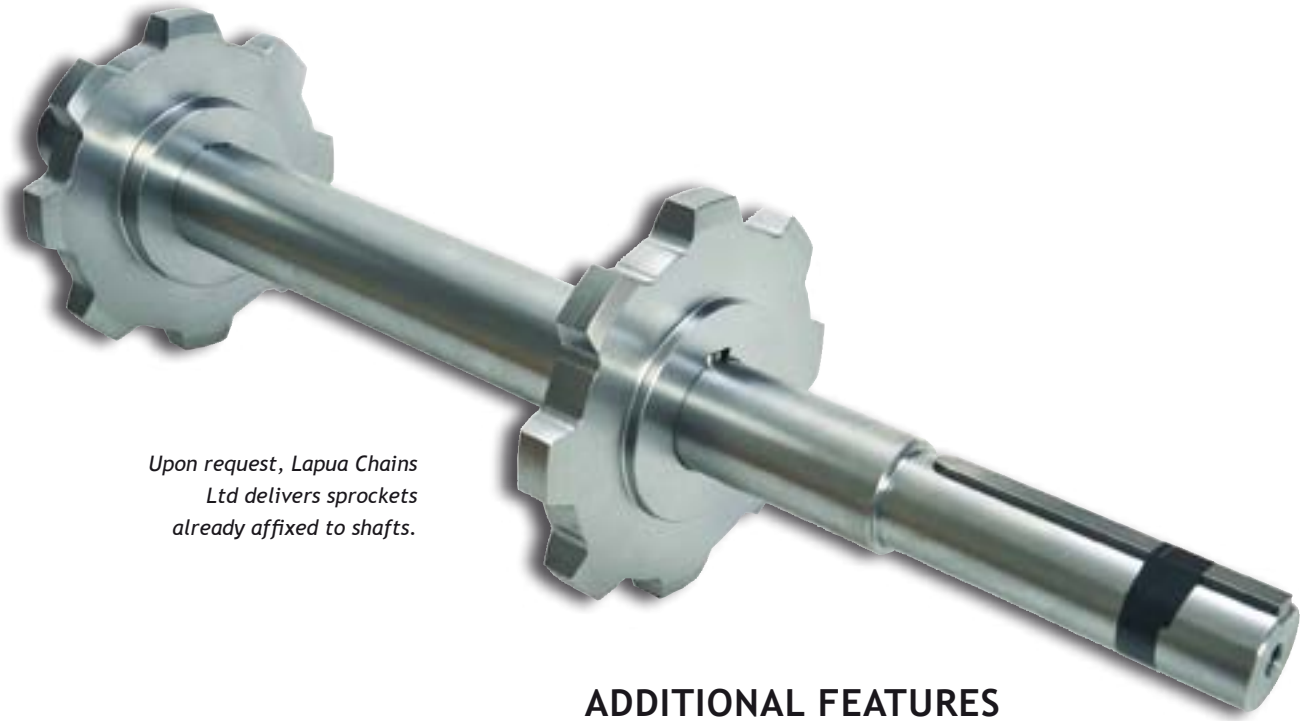
Keyway locking is the most common method of attaching a sprocket. Keyways are machined into the sprocket hub and the shaft, and a separate key piece is then affixed to them. The key piece locks the sprocket onto the shaft with a "shape-closed joint". Longitudinal sliding of the sprocket on the shaft is prevented by separate lock screws.

Keyway milling requires grooves to be machined, but it makes for a very quick installation of the sprocket.

A sprocket equipped with a clamping bush hub is easy to install.

Clamping bush

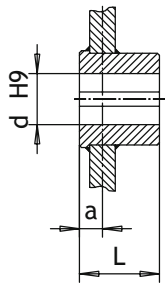
A clamping bush hub is the easiest hub type to affix to a shaft. The hub is made from clamping bushes that can be tightened so that they attach the sprocket to the shaft with friction. The clamping bush is tightened directly onto the shaft, which is why the shaft does not have to be machined.



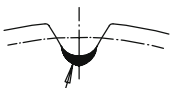
Upon request, Lapua Chains Ltd delivers sprockets already affixed to shafts.

ADDITIONAL FEATURES

Lapua chains offer plenty of practical solutions that improve the operation of sprockets under various applications.



Single-sided hubs



Refuse bevel

Single-sided hubs

When the chains have to be as far apart as possible, but without any increase in the width of the conveyor, then the sprocket can be equipped with a single-sided hub.

Refuse bevel

If the transported material is likely to cause blockages, but a sprocket with a longer tooth gap than normal cannot be fitted, then the chain can be equipped with a refuse bevel. The tooth gap will be cleaned by the bevel in the bottom of the gap.

Lowered teeth

Using teeth of a lower than normal height is a good solution when structures and attachments affixed to the chain limit the space available for the teeth attached to the chain.

Special materials

Most sprockets are made from S355 (Fe52) grade structural steel. If the application requires even better durability, then various wear-resistant, stainless, and acid-resistant steels can be considered.

7. Instructions

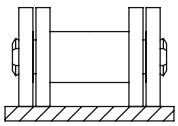
Design instructions

SUPPORTING THE CHAIN

A conveyor chain can be supported in various ways, depending on the type of chain and the requirements of the conveyor. In addition to being supported on the driving side of the chain's path, a chain often has to be supported on its return side. Depending on the chain type, the support methods used on the driving and the return side may have to be manufactured quite differently. The most common solutions are presented in the following section.

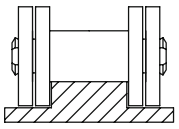
Log chains are usually supported by attachments.

SOLUTIONS FOR THE DRIVING SIDE



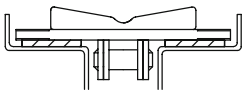
Supporting the side plates or plain rollers on a sliding guide

+ Simple and affordable
+ Reliable
+ Even running
- Higher friction with chains without plain rollers
- Wears the chain's side plates and sliding guides



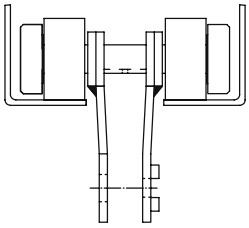
The chain is supported by the small roller on a sliding guide

+ Small friction
+ Even running
+ The sliding guide also operates as the side guiding structure
- Only for type B chains (that cannot take large vertical loads)



The chain is supported by the attachments on a sliding guide

+ Saves the chain, as it is the attachments that actually carry the load
+ The chain's side plates will not wear
- A very high chain force is required for long conveyors



Outside rollers

+ Little chain force is required
+ Side guiding is easy
+ Simple sliding guide solutions, those on the the driving and the return sides are similar
+ Enables the use of special attachment structures
- Greater purchase costs than for normal chains

On the return side, the chain can be supported by its attachments, but this will wear the attachments down.

SOLUTIONS FOR THE RETURN SIDE

When designing supports for the return side, the chain sag, the attachment structures and the tightening mechanism must all be taken into account.

The same support solutions that were used on the driving side can also be applied to the return side. The benefits gained are in many aspects similar.

Sliding guides

- The chain runs smoothly and more quietly when using support rollers or curved sliders because there is no sag.

Support by using attachments

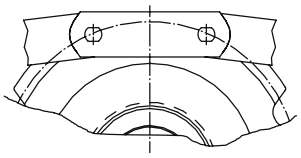
- If the chain is to be supported by its attachments, this must be taken into account in the design of the attachment structures, as the attachments will slide up and down.

Outside rollers

- These stress the rollers more because the rotation direction of the rollers change as the chain moves to its return side.

Supporting rollers and curved sliders

- The supporting points must be sufficiently frequent to prevent the chain's sag from drifting. On long conveyors, the suitable interval is 2.5–3 m. In addition, either the first or the last interval must be longer than this.



Please note

The chain's sag and any attachment structures affixed to it lead to certain requirements for the return side's supports. The chain's tightening mechanism must also be considered when planning supports. For instance, when using automatic tighteners there must be no sag.

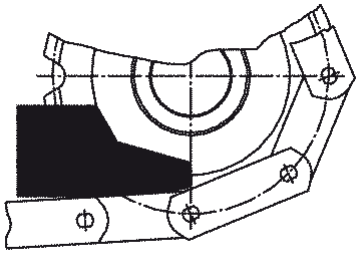
Supports are not always required on the return side

In some cases, the supports can be left out on the return side. In these cases, the chain sag is used to tighten the chain. However, this often requires more space and it is only suitable for slower conveyors.

Solutions that save the chain

In high-speed conveyors in particular, the supports must operate reliably. We recommend attaching a special device on the return side of a high-speed conveyor in order to make the chain run smoothly, thus saving the chain.

Another chain-saving solution is to support the chain on the chain's return sprocket. This will also decrease the noise generated by the operation of the chain.



A special device installed on the return side of the conveyor saves the chain and provides for easier maintenance.

When using outside rollers, both the driving and the return side can be supported in the same way.

The selection and design of sliding guides

The shape, attachments and materials used in a chain are the most important factors to consider when selecting and designing sliding guides. The materials transported, the forces used and the speed of the chain all naturally affect these.

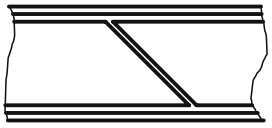
A sliding guide is the most common supporting method for a conveyor chain. Its benefits include the simplicity of its structure and use, and its low purchase costs.

When using a sliding guide, either the chain or its attachments can be used for support. For more information on the differences between the various support solutions, please read the section Supporting the chain on page 85.

THE SHAPE OF THE SLIDING GUIDE

The structure of the sliding guide is mainly determined by the chain type, the support solutions and the side guiding structures. The requirements for precision in guiding the chain may also be significant. For example, in measuring conveyors and in-feed conveyors in sawmills, the transported material must remain motionless on the chain.

If possible, select the simplest possible structure. It may be difficult to find ready-made sliding guide materials for many profiles, which means that sliding guides have to be machined from raw bars or plates. Particularly when using hard, wear-resistant steel (such as Hardox®), the costs may end up being many times that of sliding guides made from standard-sized flat bar.



Bevel edge cutting is the most common way of producing sliding guide extensions.

Please note

The rod lengths supplied from raw material suppliers usually have a maximum length of six metres, which is why sliding guides often have to be assembled from multiple parts. The extensions must be designed so that when the chain is sliding on the sliding guide it will pass the extensions smoothly. In designing shapes and structures, the changes in length caused by thermal expansion must be taken into account.

The extensions are usually made by bevel edge cutting. This way, the chains will cross the seams smoothly and thermal expansion can occur without problems.

Sliding guide material

The most significant choice made when designing a sliding guide is its raw material. The most common options are steel and plastic. There are also several special materials available, such as various composites and polyurethane.

The most significant decisions determining the life of a sliding guide are made in its design stage. In addition to a sliding guide's purchase costs, its life cycle costs will include all other costs incurred during the life cycle of the sliding guide and the chain, including maintenance costs.

The significance of the load on the selection of material

The type and size of the load that will be placed on the chain both affect the selection of raw materials for the sliding guide. The best material for vertically transporting large loads is steel due to its wear-resistant qualities. If particularly good sliding qualities are required from the sliding guide, the right choice is then plastic. Plastic is ideal for use on log sorters in sawmills and on other long conveyors.

Instead of fixed attachment structures, the attachments can be made of replaceable wearing plates. These can be made from plastic or steel.

For more information on designing sliding guides, please contact the Lapua Chains sales team on +358 6 435 1200 or just send us an e-mail to post@lapuachains.com.

Selecting the correct material pair for the sliding guide and the chain helps to achieve a longer operational life.

For heavy-duty conveyors, such as those for log handling at pulp factories, wear-resistant steel is usually selected as the material for the sliding guides.

The selection of the raw material pair affects which part will wear down faster; the chain side plates or the sliding guide. With the right material selections, minimal wearing and a long operational life for the chain can be achieved, while keeping operational costs low.

STEEL SLIDING GUIDES

Steel is the most common sliding guide material. If the chain and its attachments are made from steel, a steel sliding guide is often the best choice.

Due to its low operating costs and its wear-resistance, steel is an unequalled material choice for sliding guides. In addition, it has excellent sliding properties, provided that it is regularly lubricated.

A wide selection of grades of steel are available. If unusual grades of steel are used in the chain, then the selection of the raw material pair must be carefully considered.

Please note

The disadvantages of steel include poor machineability and its high weight. Manufacturing sliding guides from harder steel grades, such as wear-resistant steels (Hardox®, for example) is many times more difficult, and therefore more expensive, than manufacturing sliding guides from structural steel or from plastic.

One option is to use hardened steel that is hardened only after the sliding guide has been manufactured. In this case, there are fewer options of raw materials, and the hardening methods also set certain restrictions on the lengths of the pieces that can be used in the sliding guides.

If the sliding guides are made from long flat bars, then the standard dimensions of the available flat bars must be considered. When seeking to utilize the more unusual materials, we recommend first investigating the delivery times and minimum batch sizes of the materials in advance.

THE PROPERTIES AND APPLICATIONS OF VARIOUS STEEL GRADES

1. Weldable structural steel grades

Applications: Slow, non-critical conveyors

+ Good machineability
+ Reasonably priced
+ Easily available
+ Several shapes and profiles
- Poor wearing resistance

2. Key steel

+ Better wearing resistance than for structural steel
+ A small friction coefficient
- Limited bar profile options
- Poor weldability

3. Steel grades hardened after machining

+ Good machineability
+ The steel's hardness can be precisely determined
- Only suitable for short pieces
- Dimensional changes during hardening

4. Wear-resistant steel grades (Hardox®)

+ Extremely high wearing resistance
- Extremely difficult to machine

5. Unhardened spring steel

+ Better wearing resistance than for structural steel
+ Easy to machine
+ Reasonably priced
- Only flat bars are available

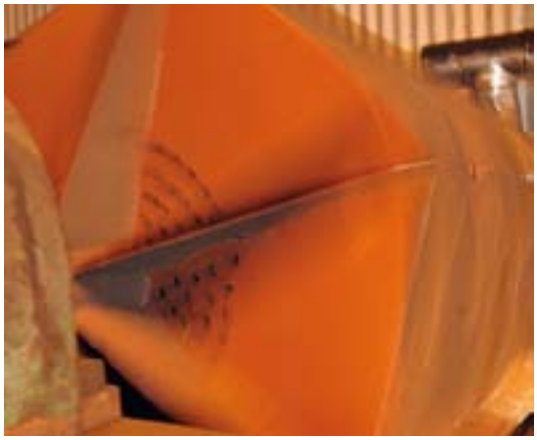
6. Stainless and acid-resistant steel grades

+ Corrosion resistance
- Poor machineability

The machineability of the sliding guide material significantly affects the manufacturing costs of the sliding guide.

Using flat bars is easy, and the selection is extensive.

PLASTIC SLIDING GUIDES



All Lapua chains are suitable for use with plastic sliding guides because their side plates are drummed before assembly.

Plastic is a common sliding guide material for certain applications. It is easy to machine, and the sliding qualities of even the most common plastics are excellent. Special plastics, such as PTFE (Teflon®), lead to the creation of particularly low friction sliding guides. Due to its elasticity, a plastic sliding guide also runs more quietly than steel sliding guides.

A simple choice

Even though several qualities of plastic are available, choosing the right kind of plastic is usually not as complicated as selecting the right grade of steel. Furthermore, several different varieties of plastic can be tested for the same application without dramatically altering the chains or any other structures.

The most common plastics are various polyamides, of which Nylon® is the best known. Polyamides have excellent sliding properties and high wear resistance.

Please note

Changing the type of plastic may not require extensive changes to the chain or to the other conveyor structures

The biggest restriction on using plastic is its weak wear resistance in comparison to steel. If the component that will slide over the sliding guide includes a steel chain or a steel attachment, then all the structures must be carefully considered. The sliding surfaces touching the plastic must be rounded. For this reason, the side plates of Lapua chains are always drummed before assembly.

The sliding guide supporting the chain will often cause uneven wear due to the increased surface pressure. The wear of the plastic sliding guide can be reduced by supporting the chain with the attachment.

Polyamide has excellent sliding qualities, making it ideal for log handling conveyors, for example.

CHAIN SAG AND TIGHTENING

Keeping the chain sufficiently tight is essential for the operation and durability of the equipment. The chain sag must be considered when selecting the tightening mechanism and working out the length of the chain.

Chain sag can be used to tighten the chain, but only on slow conveyors. Chains equipped with automatic tighteners will automatically remain at the desired tightness.

An unevenly tightened sprocket may break the chain.

Calculating the tightening clearance

The length of the chain required by the conveyor can be calculated by multiplying the shaft centre distance by two and adding to this figure the number of links required for the drive and return sprockets. Usually, the length of one link pair is sufficient for the installation clearance. When using automatic tighteners, remember that beyond the tightening clearance, the chain should not sag.

The fact that the chain is always shortened by multiples of pairs of the link length must be considered in the design of the tightening method and in establishing the tightening clearance. As the chain is made up of inner and outer links, it is usually very difficult to shorten the chain by only one link.

The synchronisation of conveyors in lumber processing systems is extremely important.

Please note

Special attention must be paid when designing conveyors with several chains in which the attachment pitch and the running of the chain have been synchronised with other chains or other pieces of equipment.

It is important for the durability of the chain and the sprocket that the sprockets and return sprockets are aligned with the chain. If the sprocket is tightened unevenly it will wear unevenly and it will quickly break the chain.

In double chains (such as woodchip chains) made from two parallel chains, the lines and tightening of the chains must be identical. Uneven tightening or the sprocket teeth moving out of phase will rapidly wear the chain, resulting in the chain breaking and the conveyor stopping.

Especially after installing a new chain or new operating equipment, the tightening and alignment must be regularly monitored. New equipment will take time for settling in and it will require initial adjustments.

Chain selection instructions

When designing a new conveyor, it is a good idea to thoroughly examine the qualities of different chains. Once the chain is installed, replacing it with a new chain type is usually very difficult. In addition to changing the chain, other components, such as the sprockets and sliding guides, usually have to be replaced also.

The transported material and the stress it delivers to the chain also affect the chain selection. Other issues to be considered are the desired speed, capacity and noise levels.

Future needs must often be already considered even during the conveyor's planning phase. If necessary, the conveyor's speed must be able to be significantly increased without any significant changes.

First the size

The force directed onto the chain should be the starting point of the design process. Once the force is known, you can choose the right chain size, taking into account any future needs.

Sometimes there are other factors, besides force, affecting the selection of the chain size. For example, hard materials falling on the chain may stress the chain. At times, the general structure of the conveyor restricts the selection of the chain size.

When the chain must run evenly and quietly, select a chain with a very short pitch.

Then the pitch

After selecting the chain size, the chain's pitch is chosen. The shorter the pitch, the more evenly and quietly the conveyor runs. Another benefit offered by a short pitch is that the sprockets have a smaller diameter. The disadvantage is the higher purchase price and the chain's greater mass. As a general rule, the shorter the pitch, the better.

Based on experience

It is difficult to give any universally applicable instructions for selecting the chain size and pitch. The best choices are often made based on experience. If necessary, Lapua Chains is glad to offer you its experience. For more information, please contact our sales team on +358 6 435 1200, or just send an e-mail to post@lapuachains.com.

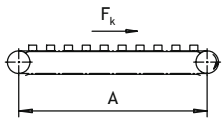
Calculation instructions

The selection of conveyor chains and the overall design of a conveyor can be made easier by making some calculations concerning the various loads and structural alternatives. These calculations will provide suggestive values upon which choices can then be made. The following section contains some typical formulas used for such calculations.

Safety factor

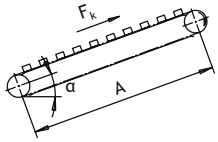
When making calculations for conveyor chains, the safety factor changes depending on the application. For conveyors that run slowly and evenly (< 0.5 m/s), the safety factor can be 7. However, the standard recommendation for a safety factor is 10.

When making calculations for welded Lapua chains, 1.4 times (i.e. use 40 per cent greater values) for the breaking strength should be used from size class M224 upward. The higher breaking strengths of Lapua chains is due to their welded bushes.



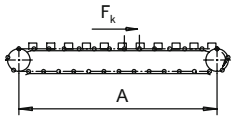
Sliding friction without rollers (horizontal)

$F_s = 1.1\ (Q+2 \cdot G_1 \cdot A)\ \mu_1 \cdot 10$



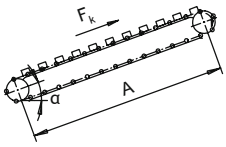
Sliding friction without rollers (slanted)

$F_s = 1.1\ [\cos \alpha\ (Q+2 \cdot G_1 \cdot A)\ \mu_1 + Q \sin \alpha] \cdot 10$



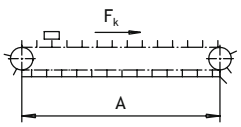
Rolling friction (types C, D, and E)

$F_s = 1.1\ (Q+2 \cdot G_1 \cdot A)\ \mu_2 \cdot 10$



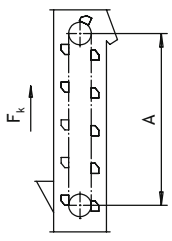
Rolling friction, slanted (types C, D, and E)

$F_s = 1.1\ [\cos \alpha\ (Q+2 \cdot G_1 \cdot A)\ \mu_2 + Q \sin \alpha] \cdot 10$



Scraper chains

$F_s = 1.1 \cdot A\ (2 \cdot G_1 \cdot \mu_1 + G_2 \cdot \mu_3) \cdot 10$



Elevators $F_s = 1.15 \cdot A\ (1.5 \cdot G_1 + G_2) \cdot 10$

Elevators $F_s = 1.15 \cdot A\ (1.5 \cdot G_1 + \frac{Q_h}{3.6 \cdot v}) \cdot 10$

Lapua Chains Ltd is not responsible for any misprints in the calculation instructions and formulae.

Abbreviations and units

Marking	Explanation	Unit
F_s	Static chain force	N
F_d	Dynamic chain force	N
F_{tot}	The conveyor's total chain force	N
n	The number of parallel chains	pieces
F	$\frac{F_k}{n}$ chain force per chain	N
G_1	Weight of parallel chains, including attachments	kg/m
G_2	Weight of transported goods	kg/m
Q	Total weight of the goods on the conveyor	kg
Q_h	Transport power	t/h
A	Centre distance	m
v	The chain's speed	m/s

Friction coefficients

μ_1 The sliding friction coefficient	Dry	Lubricated
On a steel surface	0.3...0.4	0.25
On a plastic surface	0.20	0.20

μ_2 Rolling resistance with plain rollers	μ_2
Steel rollers	0.15
Plastic rollers	0.10
Rollers with ball bearings	0.05

μ_3 Friction coefficient between the transported material and the steel base	μ_3
Woodchip and sawdust	0.40
Grain	0.35
Cement	0.65
Clay and sand, dry	0.60
Ash, dry	0.50

Lapua Chains Ltd is not responsible for any misprints in the calculation instructions and formulae.

The polygon effect and dynamic loads

The results yielded by the formula for the chain force are the values of the static chain force. In practice, the force transmitted by the sprocket to the chain is not static but dynamic, due to the "polygon effect". The polygon effect is caused by the chain setting on the sprocket like a polygon.

The smaller the number of teeth on the sprocket, the greater the dynamic load caused by the polygon effect. At its strongest, the polygon effect is visible as a jerking and twitching movement of the chain.

The total chain force (F_{tot}) caused by the dynamic and static loads due to the polygon effect is easiest to calculate with the following formula:

$$F_{tot} = F_s + F_d = F_s + (k_1 \cdot F_s)$$

1. From the table, select the number of teeth on the drive sprocket and the speed of the chain.
2. The coefficient given by the table is then used in the formula.
3. Any combination of the number of teeth and speed that yields a coefficient greater than k_1=0.3 should not be used.

The values in the table are for a chain pitch of 200 mm. The chain force coefficients of other pitches can be calculated by multiplying the value in the table with the following equivalence coefficient.

Chain pitchcoefficient	Equivalence
80	2.50
100	2.00
125	1.60
160	1.25
200	1.00
250	0.80
315	0,64

Coefficient of the dynamic chain force k_1

Speed m/s	Number of teeth on the drive sprocket (Z) 6	7	8	9	10	12	14	16	18	20	22
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.4	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
0.6	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0
0.8	0.7	0.5	0.4	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1
1.0		0.8	0.6	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1
1.2			0.9	0.7	0.6	0.4	0.3	0.2	0.2	0.1	0.1
1.4				1.0	0.8	0.5	0.4	0.3	0.2	0.2	0.2
1.6					1.0	0.7	0.5	0.4	0.3	0.3	0.2
1.8						0.9	0.7	0.5	0.4	0.3	0.3
2.0							0.8	0.6	0.5	0.4	0.3
2.2								0.8	0.6	0.5	0.4
2.4									0.7	0.6	0.5
2.6										0.7	0.6
2.8											0.7

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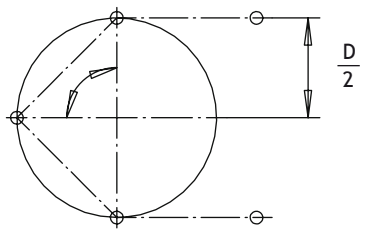
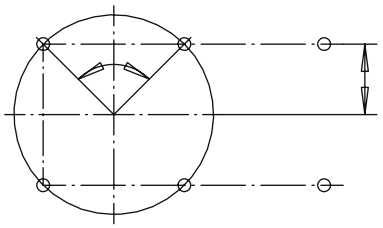


$v_{max} = \pi \cdot n \cdot D$



$v_{min} = \pi \cdot n \cdot D \cdot \cos \frac{\alpha}{2} = \pi \cdot n \cdot D \cdot \cos \frac{180^\circ}{z}$

The dynamic load (F_d) can also be calculated without the coefficient and used in the formula on the previous page. In this case, the calculation is not limited to the combinations of the number of teeth and the speed given in the table.

The acceleration caused by the speed change can be calculated using the following formula:

$$a = \frac{2\pi^2 \cdot v^2}{z^2 \cdot p}$$

The dynamic chain force caused by the speed changes (F_d) is calculated using the following formula:

$$F_d = 3 \cdot a \cdot A \cdot (2G_1 + G_2)$$

The total force on the chain is calculated by utilizing the dynamic chain force (F_d) in the following formula:

$$F_{tot} = F_s + F_d$$

Abbreviations and units

Marking	Explanation	Unit
n	rotational speed	1 rpm
Z	number of teeth on the sprocket	pieces
a	acceleration caused by the speed change	m/s^2
v	average speed of the chain	m/s
p	pitch of the chain	m
D	reference diameter of the sprocket	mm

Please note

In the design phase, the selection of the conveyor chains is mainly based upon the experience of the designer. For various factors, rough coefficients and limiting values can be determined that at least partially replace the knowledge gained from experience. Usually the conditions experienced vary greatly, and thus the coefficient cannot take all factors into consideration.

For more information or guidance in chain selection, please contact our sales department. With our vast experience we can help you find the right chain that will serve you as long as possible.

Lapua Chains Ltd is not responsible for any misprints in the calculation instructions and formulae.

Weights of the conveyor chains kg/m

Chain	Pitch	Chain type						
		A	B	C		D	E	
				with steel rollers	with plastic rollers		with steel rollers	with plastic rollers
M 40	63	2.2	2.5	4.2	2.4	4.3	4.8	3
	80	2	2.2	3.6	2.2	3.7	4.2	2.8
	100	1.9	2.1	3.1	2	3.2	3.7	2.6
	125	1.8	1.9	2.8	1.9	2.9	3.4	2.5
M56	63	3.2	3.6	6.5	3.6	6.8	7.2	4.3
	80	2.9	3.3	5.5	3.3	5.8	6.2	3.9
	100	2.7	3	4.8	3	5	5.5	3.6
	125	2.6	2.8	4.2	2.8	4.4	4.9	3.4
M 80	80	4.5	5.2	9	5.1	9.5	10.3	6.4
	100	4.2	4.7	7.8	4.7	8.1	9.1	6
	125	3.9	4.3	6.8	4.3	7.1	8	5.5
	160	3.7	4	5.9	3.9	6.1	7.1	5.2
M 112	80	6.7	7.7	14	7.6	14.6	16	9.7
	100	6.1	6.9	11.9	6.8	12.4	14	8.9
	125	5.6	6.3	10.3	6.2	10.7	12.3	8.2
	160	5.2	5.8	8.9	5.7	9.2	10.9	7.7
M 160	100	9.5	10.9	18.7	10.4	19.4	19.7	13.1
	125	8.7	9.9	16.1	9.4	16.6	17.3	12
	160	8	8.9	13.8	8.6	14.2	16.1	11.1
	200	7.5	8.2	12.1	8	12.5	14.4	10.4
M 224	125	12.8	14.5	25.6		26.8		
	160	11.6	13	21.6		22.6		
	200	10.8	11.9	18.8		19.6		
	250	10.2	11	16.6		17.2		
M 315	160	17.8	19.9	33.2		35.1		
	200	16.4	18.1	28.8		30.3		
	250	15.4	16.7	25.2		26.4		
	315	14.5	15.5	22.3		23.2		
M 450	200	23.8	26.8	44.9		46.9		
	250	22.1	24.5	38.9		40.6		
	315	20.6	22.6	34		35.3		
	400	19.5	21	30		31		
M 630	250	34.2	38	57.4		60.8		
	315	31.7	34.7	50.1		52.8		
	400	29.6	32	44.1		46.3		
	500	28.1	30	39.7		41.4		

Chain maintenance instructions

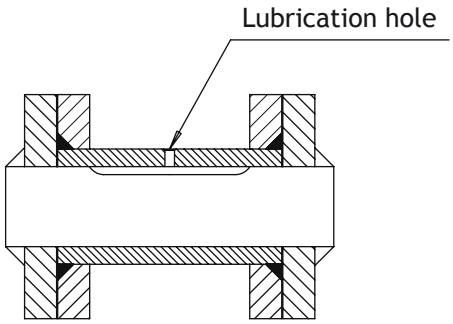
Chain joints elongate when wear of the joint's pins and bushes increases the joint's clearances. The faster the chain elongates, the more often it has to be replaced.

The chain is worn by:

- Conditions: temperature, humidity
- The properties of the transported material: acidity, abrasiveness (such as sand)
- The mass and friction of the transported material: the heavier the load, the more it stresses the chain
- Speed of the conveyor
- Foreign matter on the conveyor

LUBRICATION PREVENTS WEARING

The most important maintenance procedure for the conveyor chain is lubrication. Proper lubrication of joints significantly reduces wear. If the chain runs on sliding guides then the sliding guides also have to be lubricated.



Re-greasing holes ensure that the lubricant gets inside the joints.

The best form of lubrication is through lubrication holes

There are several ways to lubricate chain joints. Typical methods include a range of drop or brush lubricating devices. The problem with these is that the lubricant cannot penetrate inside the joint, instead remaining on the joint's exterior.

Re-greasing holes, on the other hand, are a very secure lubrication method. The "re-greasable chains" manufactured by Lapua Chains Ltd are maintained by lubrication applied through separate re-greasing holes. This way, lubricant gets to the right place: inside the joints.

CONNECTION INSTRUCTIONS

The chains are connected to each other with the connecting link supplied with the chains. If a chain breaks, it needs to be re-connected with a connecting link obtained as a spare part.

Lubrication first

Before connecting the chain, the pins are greased with machine grease, Vaseline or with a similar lubricant. The chain's ends need to be placed the correct distance from each other so that they can be connected with a connecting link. Once the chain ends have been connected, the side plate is now pressed into place.

Use a hammer or clamps

All of the chain's pins are fitted by being pressed on. This includes the pins of the connecting links. This significantly increases the durability of the connection made between the pin and the side plate. For this reason, installing the plate correctly to its place on the connecting links requires plenty of strength.

To assist you, you can use various types of clamps, a hammer or a pin punch. Please make sure that the plate does not bend during installation. The plate must be pressed to a depth such that the width of the connecting link is the same as that of the other links in the chain.

However, the pin holes on the connecting links and the pin itself must not be loosened to ease the connection. If they are, then this would significantly decrease the connection's durability.

Riveting or welding

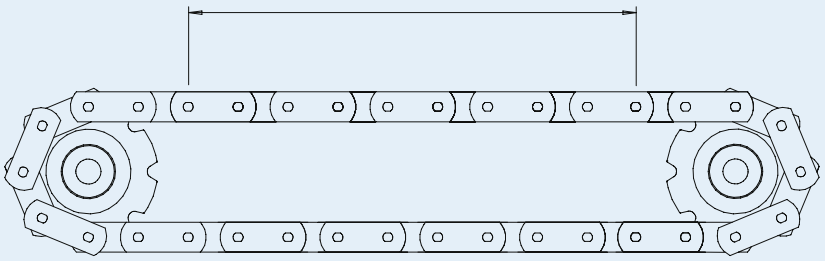
For the small chain types (M40 to M80), the connecting pins can be riveted into place, if suitable riveting equipment is available. The most common method of installing the connections is welding. The end of the pin is welded using the normal welding methods applicable to structural steel: metal arc welding, metal inert gas (MIG) welding, or metal active gas (MAG) welding. When welding, make sure that the end of the pin and the side plate are solidly joined and that there are no gas pores in the joint.

Even though the pins have been heat-treated, their weldability remains good. Never cool welds with, for example, water or snow. If the welds are cooled quickly then there is a risk of the end of the pin rehardening and the joint becoming brittle.

The connecting pins are welded using the normal welding methods applicable to structural steel.

When welding the end of the pin, make sure that the joint becomes smooth.

$$\frac{\text{measured result} - \text{rated size}}{\text{rated size}} \cdot 100 = \text{elongation \%}$$



When the chain has elongated by 3 to 5 per cent then the chain should be replaced.

MONITORING THE CHAIN

Most often, chains first wear at their joints. This results in the chain elongating. If the chain runs on a sliding guide and is supported by its side plates, then the side plates may become exposed to the highest levels of wear.

By monitoring the chain's elongation, you can very precisely assess the remaining operational life of the chain. Monitoring the chain's elongation will help scheduling chain replacement at the optimal time. The chain's replacement interval becomes as long as possible when the chain does not have to replaced early.

Calculating the chain's elongation

You can monitor the elongation by measuring, for example, the length of 10 chain joints. When the chain has elongated by 3 to 5 per cent then the chain should be replaced. The elongation is calculated using the formula given above.

The elongation of the chain should be monitored regularly, from the installation of a new chain onwards. This way, the rate of the chain's elongation can be calculated and its remaining operational life reliably estimated.

Monitoring the side plates

The wearing of side plates should also be monitored. Even though in most conveyors the joints wear faster than the side plates, in certain conveyors the opposite is true.

It is difficult to provide limiting values for the wear of side plates. The wearing of these plates affects the breaking strength of the chain even more than the wearing of the joints does. The chain's operational conditions, its size and its load all vary depending on the type of conveyor. This means that the limiting values for each conveyor are different.