DIAMOND®
CHAIN COMPANY

British Standard

Chain Product Guide 0508

DIAMOND®
CHAIN COMPANY

Diamond Chain **History**

1890

The Indianapolis Chain & Stamping Company began trading as specialist bicycle chain makers.

Diamond Chain has a long history of producing the highest quality roller chain. As one of the oldest roller chain manufacturers in the world, Diamond has a heritage rich in the traditions of improving the quality and ultimately the value of every chain it makes. History has taught us that to continue to make the best roller chain possible, we must provide our customers with high quality products meeting or exceeding their performance, reliability, value and delivery requirements. Continuous improvement in all our company functions will ensure our ability to respond to our customers' needs and provide them with an acceptable return on investments.

Contents

present day

Diamond Chain continues its heritage of strength and reliability by being used in a wide range of industries.

1903

The pioneering Wright Brothers' first flying machine used Diamond Chain

1962

Following it's acquisition in 1950, Diamond Chain's parent company changed its name to AMSTED Industries inc.

Arthur C. Newby, Edward C. Fletcher and Glenn Howe, with a $5,000 investment, started what was to become the Diamond Chain Company by forming The Indianapolis Chain & Stamping Company on December 24, 1890. They took the diamond as their trademark because it symbolized perfection and acted as a constant reminder of their endeavor. In its humble beginnings, The Indianapolis Chain & stamping Company (IC&SC) specialized in bicycle chain. As one of the first companies in the United States to produce bicycle chain, IC&SC prospered, outgrowing its original quarters and moving to larger facilities in 1892.

In 1901, when the bicycle chain business slumped, IC&SC rebounded by developing and introducing to industry a twinroller roller chain. From December 17, 1903, when Diamond chain was used on the Wright brothers' first flying machine, to the present, Diamond Chain has been a major supplier of chain not just for aircraft, but for power transmission and product conveying throughout manufacturing industries. In 1950 Diamond Chain was acquired by American Steel Foundries, Inc. – the largest steel foundry in the world, and in 1962 the name of the parent company was changed to AMSTED Industries Incorporated.

During Diamond's many years of producing the highest quality roller chain they have tested, examined and discovered many developments which have significantly increased the performance of their roller chains. These developments have rarely become "product lines" but rather, "product improvements" which have been incorporated into daily production so that all customers can benefit, without special requests or premium prices.

In addition to continued product improvement, Diamond has introduced a detailed roller chain Drive Selection Software program. This software will improve the way chain is specified by engineers and designers by simplifying a multitude of sometimes difficult calculations and equations. In today's environment, Diamond, while focusing on the increased use of technology, still operates under the same inventive, grassroots philosophy it was founded on. To provide its customers with a high-quality product possessing the best possible balance of performance, reliability, price, and delivery that meet or exceed their requirements.

*Why choose **Diamond Chain**?*

The best roller chain for the job

If you're looking for the best roller chain for the job, it will pay to take a closer look at Diamond roller chain. Diamond roller chain may look like your everyday chain, but upon closer inspection the unique differences that make Diamond chain better become evident. From the strict attention to detail we devote to every chain design, to the extra steps we take during fabrication and assembly operations, those differences really add up. We build long life, lasting value and enduring customer relationships into every link of chain...that is the Diamond difference. Over the years we've produced tens of thousands of types of roller chain for a wide variety of applications from oil field and deco ovens, to conveyors and combines. So, if your application calls for some special attention, our application engineers can easily help you find that lasting solution.

Please, take a closer look at Diamond roller chain...we do. That closer look is what makes ours better than other chains. And what you can't see, you can experience with improved performance – which means less downtime, less repair costs, and increased productivity. Those are just some of the differences that a Diamond chain makes.

ISO / DIN / BS Standards

Building high-quality roller chain is a matter of demanding precision – a matter of establishing critical parameters, both in component fabrication and final assembly, and monitoring them to ensure that they are maintained.

ISO 9001 certification is awarded to companies that develop, and consistently adhere to, a well-documented quality system. ISO 9001 requires compliance with 20 elements, some of which include customer service, contract review, manufacturing procedures, and product design and development. Diamond is ISO 9001 certified. That means you can be sure that Diamond chain is consistently manufactured following detailed processes developed by Diamond and proven to produce some of the longest running and best performing roller chain.

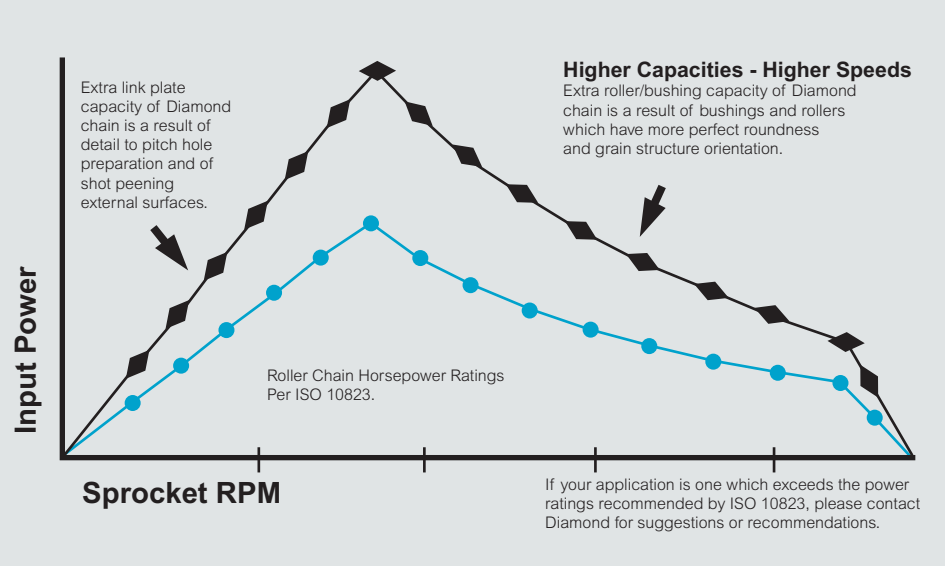
Each component of a Diamond chain is engineered and produced with optimum performance in mind. Exacting specifications cover critical properties of all component parts and assemblies. Diamond's ISO 9001 certification is proof of the fact that "we say what we do and do what we say."

Meets ALL
ISO606 / DIN8187 / BS228
Standards

ISO 9001 certified

The professional choice

Diamond Chain performance



You could look at two different brands of roller chain and probably not see a difference on the surface. However, where you will see a difference is in the performance. The working load of a roller chain is often its most important characteristic. Contrary to popular belief, there is no consistent relationship between a roller chain's working load capacity and its ultimate tensile strength. Many times chains are selected on their published tensile strengths, which are breaking loads. Chains must be selected based upon loads that they can transmit repeatedly over millions of cycles. So, chains with equal tensile strengths can, and commonly do, have very different working load capacities. In fact, chains with higher published tensile strengths than Diamond could easily have much lower working load capacities.

The benefits of roller chain:

DURABILITY Roller chain drives give long service life because the chain load is distributed over several sprocket teeth, keeping bearing pressures relatively low for the power transmitted.

RUGGEDNESS The proportions, parts heat treatment, and press-fit construction of roller chains help them withstand shock loads and rough drive conditions.

EFFICIENCY Roller chains transmit power with high efficiency throughout the entire life of the drive. There are no large separating forces, radial loads, thrusts, or bearing pressures to waste power. Therefore, machine frames and bearings may be smaller, lighter and less costly.

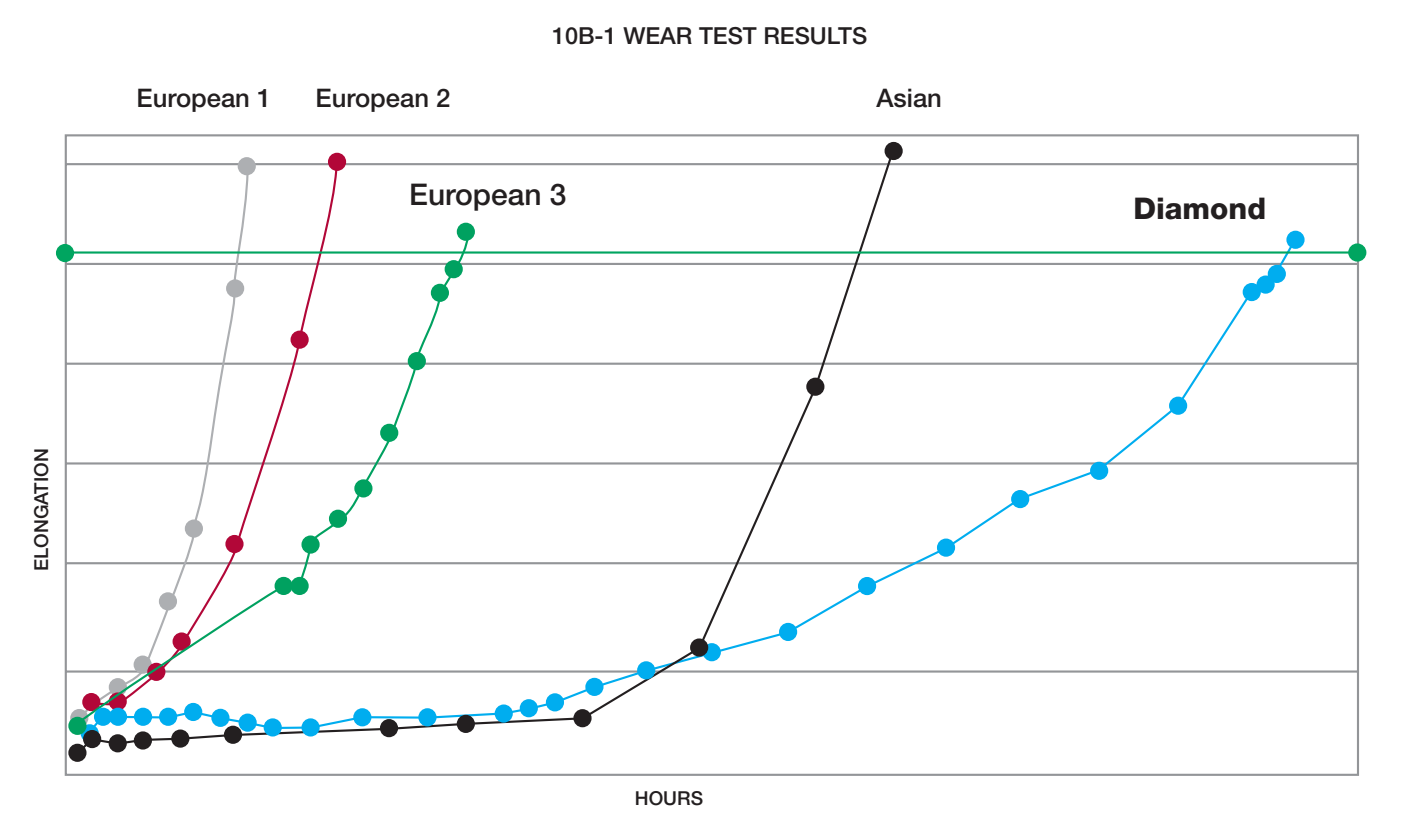
VERSATILITY Drive centre distances may be long or short, fixed or adjustable, to suit machine design. Roller chain can transmit power to several shafts from a single drive shaft. Roller chains can engage sprockets on either side and drive sprockets in either direction. Roller chains operate efficiently over a wide speed range in minimum space.

CONVENIENCE Chain installation requires only the alignment that can be readily obtained with commonly available hand tools. Roller chains can be easily connected and disconnected with standard connecting links. Roller chains can be replaced or maintained without disturbing the sprockets, shafts or bearings.

PRECISION Diamond roller chains are manufactured with great precision. Close control of chain length, roller diameters and other critical dimensions contribute to smooth, quiet action and high efficiency.

Reduce maintenance repair and downtime costs

Wear comparison



Another key aspect of the performance advantage of using Diamond over other brands is the wear life of the chain. Specially developed processes include optimized heat treatment, the preloading of chains before packaging, high quality initial lubrication, and the precision tolerances to which the components are designed and manufactured.

Diamond Chain regularly perform wear testing of chains taken from production. Results are compared against a long history of internal testing data. Diamond also regularly run wear tests on the chains of our competitors for the purpose of benchmark comparison.

All of these measures combine to result in the superior wear performance that our customers have come to depend on.

The manufacturing process

The process of manufacturing the longest lasting chain begins by purchasing the materials to detailed specifications. This is the way we've always done it because we must specify chemistry, dimensional size and even the direction of the grain in order to produce components capable of performing to your expectations.

Transforming these raw materials into individual components that meet our high standards is no easy task. Again, we've learned that attention to detail is a key to achieving the desired result, which is the user's satisfaction. Some of the steps taken to provide this satisfaction are:

"attention to detail is a key to achieving the desired result"

Link plate pitch holes are produced using a three-part process to create a polished hole with maximum bearing area and minimal surface imperfection. Maximum bearing area increases chain integrity, and a smooth surface within the pitch hole maximizes the ability to handle heavy loads, especially in fatigue-sensitive applications.

Diamond use solid rollers because in the majority of applications, power is transmitted using higher loads and lower speeds. Under these conditions the integrity of a solid roller is beneficial and therefore, it is provided.

To most users, the obvious indication of quality is superior wear life. Poor wear life often leads to regular adjustment or replacement, which reduces productivity and adds cost to an operation. Heat treatment of component parts is an additional procedure to prolong wear life which gives them the ability to perform to their optimum, depending upon what the environment may be. In the vast majority of applications, wear life is critical, so tight controls are placed on the heat treat processing to assure the proper mechanical properties are met.

Virtually all of our standard pins, bushings and rollers are carburized (case hardened). This closely controlled process transforms the outside of the parts into a hard, wear-resistant surface but allows the inner core to remain tough and ductile so as to absorb normal shock loading. In most applications this combination provides the perfect balance between wear resistance and durability.

Link plates, on the other hand, are not normally subjected to wear but must be tough to resist the loads, sometimes heavy, to which the chain may be exposed. Their heat treatment is designed to produce tough, ductile and shock-resistant properties, but sometimes heat treatment is not enough. For those sizes that are routinely subjected to heavy or shock loads, the link plates undergo a process called "shot peening." In this process, small steel pellets, or shot, are propelled at the link plates. When they strike the surface they leave a tiny indentation which causes the material to work harden. This work hardening creates compressive stresses on the surface of the link plate that allows it to resist, beyond conventional heat treatment, premature fatigue failures.

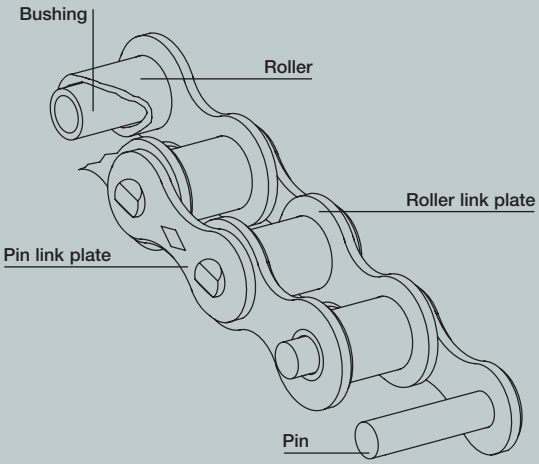
The attention to detail that goes into the fabrication of component parts is not forgotten when assembly operations begin. During the assembly of every pitch of Diamond chain, four key components (pin, bushing, pin link plates and roller link plates) are examined carefully. These four parts are critical in maintaining chain integrity and controlling chain length.

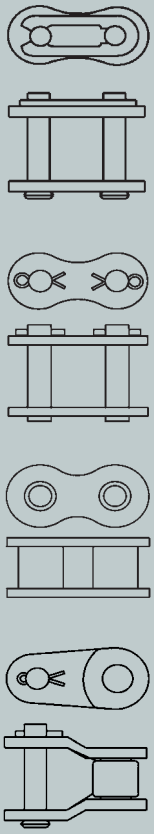
One might think that assembly is the final step in producing a product, but at Diamond we still have a couple of things left to do. After the chains are assembled, we apply an initial load to the chains, called preload. This loading approximates the recommended loading a chain can expect in service. Preloading is done to align the various chain components such as pins, bushings and link plates. Preloading helps eliminate initial elongation or "wear-in" and can increase the usable service life of your chain.

"testing at conditions well beyond recommended limits"

We even subject our own product to performance testing at conditions well beyond recommended limits. Tests on link plate fatigue, roller / bushing fatigue and initial lubrication wear are performed to search out the chain's endurance limits. This "torture testing" allows us to set recommended limits that we can stand behind.

Chain components





Roller chain is not that hard to understand. It is normally made up of five components as shown above.

Collectively, these components produce a series of "traveling bearings." To accomplish this, the chain is assembled with alternate inside and outside links. The inside links that employ bushings and/or rollers are called roller links, and the outside links that employ the pins are called pin links, or connecting links. In operation, the pins articulate inside the bushings leaving the rollers free to turn on the outside of the bushings for "rolling" action as the chain enters and exits the sprocket.

Every Diamond chain is made from the highest quality raw materials available. Starting with the proper raw materials is the foundation of any quality product. Diamond pays close attention to chemistry and dimensional specifications which are critical factors as the material is transformed into components capable of handling the toughest job.

Chain descriptions

Connecting link spring lock type

The two pins and one link plate are furnished assembled. The standard coverplate is designed for a slip-fit on the pins. It is held in place by a flat spring-steel lock, split at one end to permit installation in grooves at the end of each pin. Press-fit coverplates are also available and are recommended for heavy duty applications.

Connecting link cotter pin type

The two pins and one link plate are furnished assembled. The coverplate may be either press-fit or slip-fit on the pins. Press-fit connecting links are recommended for heavy duty applications. Press-fit coverplates are standard on multiple strand oil field chains.

Roller link

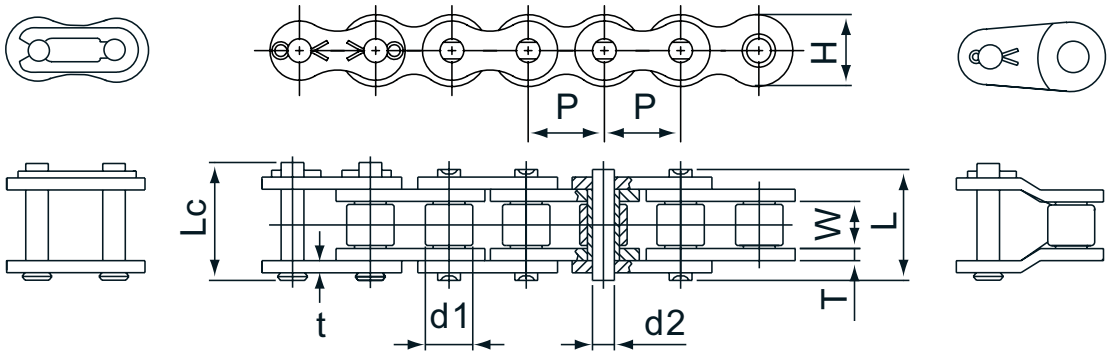
Standard for all sizes of roller chains. They are furnished as complete roller link assemblies. The two bushings are press-fit in each of the link plates. The same roller links are used for single and multiple strand chains.

Single pitch offset link slip-fit type

This link is furnished with slip-fit pin unassembled in the offset link plates. The flat milled on one end of the pin prevents it from turning in the link plate.

British Standard ***Simplex Roller Chain***

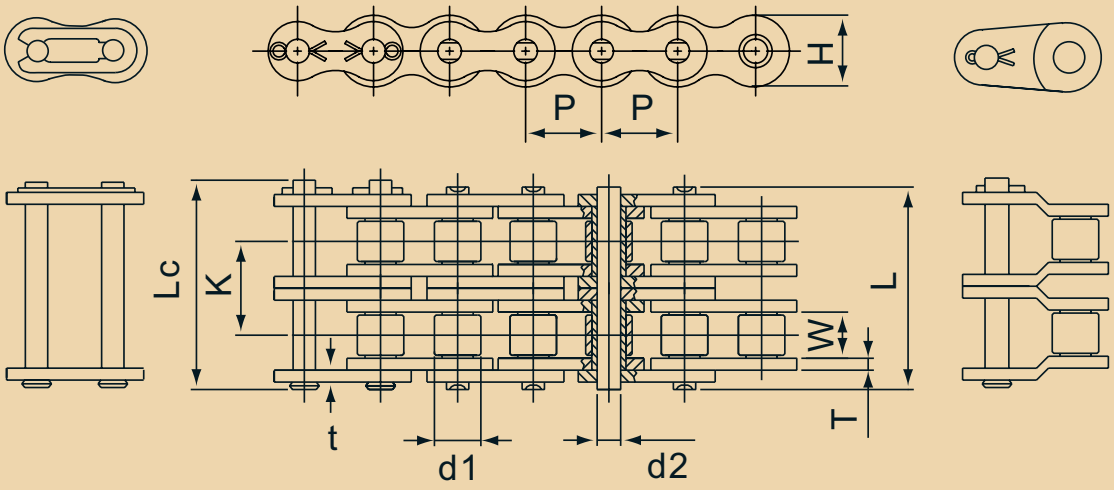
Single strand roller chain



Diamond Number	Pitch	Roller		Pin Outer Diameter	Pin Length		Link Plate Height	Link Plate Thickness	Average Tensile Strength
	P mm	W min mm	d1 max mm	d2 max mm	L max mm	Lc max mm	H max mm	T/t mm	N
05B-1	8.00	3.00	5.00	2.31	8.6	11.7	7.1	0.9	5884
06B-1	9.53	5.72	6.35	3.28	13.5	16.8	8.2	1.4 / 1.1	10787
08B-1	12.70	7.75	8.51	4.45	17.0	20.7	11.8	1.5	19123
10B-1	15.88	9.65	10.16	5.08	19.6	23.7	14.7	1.7	27459
12B-1	19.05	11.68	12.07	5.72	22.7	27.3	16.1	1.8	32852
16B-1	25.40	17.02	15.88	8.28	36.1	41.5	21.0	4.0 / 3.2	73550
20B-1	31.75	19.56	19.05	10.19	43.2	49.3	26.4	4.7	106402
24B-1	38.10	25.40	25.40	14.63	53.4	60.0	33.4	6.3	178481
28B-1	44.45	30.99	27.94	15.90	65.1	72.5	37.0	7.8	225553
32B-1	50.80	30.99	29.21	17.81	67.4	75.3	42.2	7.3	279490
40B-1	63.50	38.10	39.37	22.89	82.6	92.6	52.9	8.8	397169
48B-1	76.20	45.72	48.26	29.24	99.1	109.1	63.8	12.4	622722

British Standard ***Duplex Roller Chain***

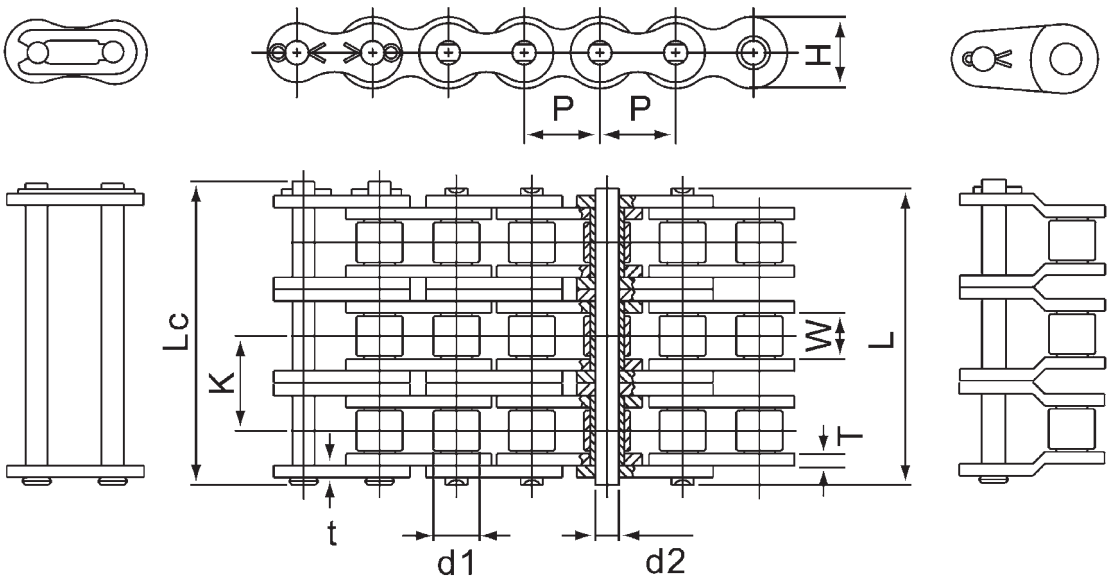
Double strand roller chain



Diamond Number	Pitch	Roller		Pin Outer Diameter	Pin Length		K	Link Plate Height	Link Plate Thickness	Average Tensile Strength
	P mm	W min mm	d1 max mm	d2 max mm	L max mm	Lc max mm	mm	H max mm	T/t mm	N
06B-2	9.53	5.72	6.35	3.28	23.8	27.1	10.24	8.2	1.4 / 1.1	18633
08B-2	12.70	7.75	8.51	4.45	31.0	34.9	13.92	11.8	1.5	37756
10B-2	15.88	9.65	10.16	5.08	36.2	40.3	16.59	14.7	1.7	54817
12B-2	19.05	11.68	12.07	5.72	42.2	46.8	19.46	16.1	1.8	63743
16B-2	25.40	17.02	15.88	8.28	68.0	73.4	31.88	21.0	4.0 / 3.2	147100
20B-2	31.75	19.56	19.05	10.19	79.7	85.8	36.45	26.4	4.7	212804
24B-2	38.10	25.40	25.40	14.63	101.0	107.6	48.36	33.4	6.3	356962
28B-2	44.45	30.99	27.94	15.90	124.0	131.4	59.56	37.0	7.8	451106
32B-2	50.80	30.99	29.21	17.81	126.0	133.9	58.55	42.2	7.3	558979
40B-2	63.50	38.10	39.37	22.89	154.0	164.0	72.29	52.9	8.8	794339
48B-2	76.20	45.72	48.26	29.24	190.0	200.0	91.21	63.8	12.4	1245445

British Standard ***Triplex Roller Chain***

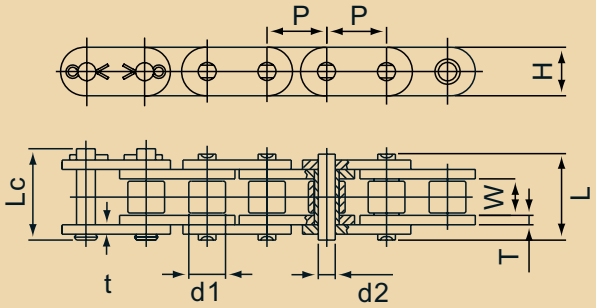
Triple strand roller chain

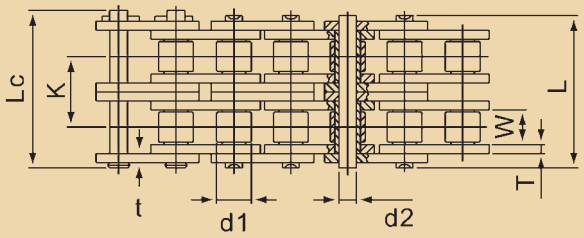


Diamond Number	Pitch	Roller		Pin Outer Diameter	Pin Length		K	Link Plate Height	Link Plate Thickness	Average Tensile Strength
	P mm	W min mm	d1 max mm	d2 max mm	L max mm	Lc max mm	mm	H max mm	T/t mm	N
06B-3	9.53	5.72	6.35	3.28	34.0	37.3	10.24	8.2	1.4 / 1.1	27950
08B-3	12.70	7.75	8.51	4.45	44.9	48.8	13.92	11.8	1.5	56634
10B-3	15.88	9.65	10.16	5.08	52.8	56.9	16.59	14.7	1.7	82226
12B-3	19.05	11.68	12.07	5.72	60.9	65.5	19.46	16.1	1.8	95615
16B-3	25.40	17.02	15.88	8.28	99.9	105.3	31.88	21.0	4.0 / 3.2	220650
20B-3	31.75	19.56	19.05	10.19	116.0	122.1	36.45	26.4	4.7	319206
24B-3	38.10	25.40	25.40	14.63	150.0	156.6	48.36	33.4	6.3	535443
28B-3	44.45	30.99	27.94	15.90	184.0	191.4	59.56	37.0	7.8	676660
32B-3	50.80	30.99	29.21	17.81	187.0	194.9	58.55	42.2	7.3	838470
40B-3	63.50	38.10	39.37	22.89	229.0	239.0	72.29	52.9	8.8	1191507
48B-3	76.20	45.72	48.26	29.24	280.0	290.0	91.21	63.8	12.4	1868166

British Standard ***Chain***

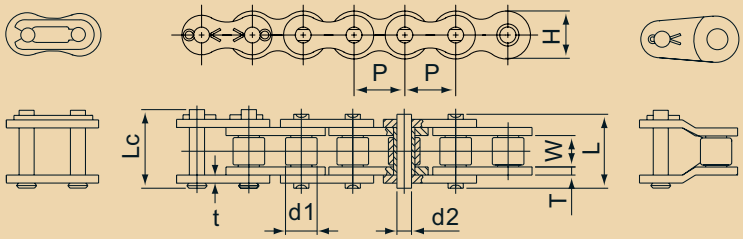
Oval contour side plate chain

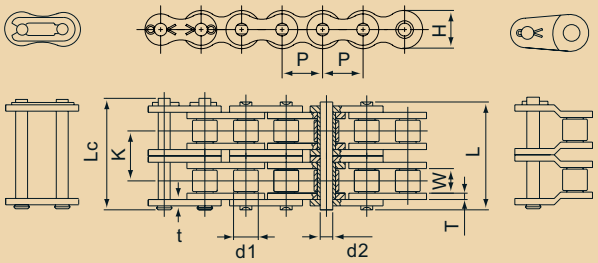




Diamond Number	Pitch	Roller		Pin Outer Diameter	Pin Length		K	Link Plate Height	Link Plate Thickness	Average Tensile Strength
	P mm	W min mm	d1 max mm	d2 max mm	L max mm	Lc max mm	mm	H max mm	T/t mm	N
08B0C	12.70	7.75	8.51	4.45	17.0	20.7	-	11.8	1.5	19123
08B0C-2	12.70	7.75	8.51	4.45	31.0	34.9	13.92	11.8	1.5	37756
10B0C	15.88	9.65	10.16	5.08	19.6	23.7	-	14.7	1.7	27459
10B0C-2	15.88	9.65	10.16	5.08	36.2	40.3	16.59	14.7	1.7	54817
12B0C	19.05	11.68	12.07	5.72	22.7	27.3	-	16.1	1.8	31872
12B0C-2	19.05	11.68	12.07	5.72	42.2	46.8	19.46	16.1	1.8	63743
16B0C	25.40	17.02	15.88	8.28	36.1	41.5	-	21.0	4.0/3.2	73550
16B0C-2	25.40	17.02	15.88	8.28	68.0	73.4	31.88	21.0	4.0/3.2	147100

Stainless steel chain - 300 series





Diamond Number	Pitch	Roller		Pin Outer Diameter	Pin Length		K	Link Plate Height	Link Plate Thickness	Average Tensile Strength
	P mm	W min mm	d1 max mm	d2 max mm	L max mm	Lc max mm	mm	H max mm	T/t mm	N
06BSS	9.53	5.72	6.35	3.28	13.5	16.8	-	8.2	1.4/1.1	7453
08BSS	12.70	7.75	8.51	4.45	17.0	20.7	-	11.8	1.5	14710
10BSS	15.88	9.65	10.16	5.08	19.6	23.7	-	14.7	1.7	19613
10BSS-2	15.88	9.65	10.16	5.08	36.2	40.3	16.59	14.7	1.7	38245
12BSS	19.05	11.68	12.07	5.72	22.7	27.3	-	16.1	1.8	24517
16BSS	25.40	17.02	15.88	8.28	36.1	41.5	-	21.0	4.0/3.2	52956

Other available products

Along with the British Standard chains featured in this publication, Diamond Chain Company offers a full line of U.S. manufactured ASME/ANSI roller chains. This product offering includes:

ASME/ANSI Standard & Heavy Series Roller Chains

Though these are referred to as “standard chains”, they are anything but. Diamond’s standard and heavy series roller chains, built to ASME/ANSI B29.1 standards, are manufactured to very specific requirements. The only thing standard about our chains are their ability to fit many standard applications. From industry to agriculture, our Standard and Heavy Series chains are designed to last longer than any other manufacturer’s roller chain.

ASME/ANSI High Strength (HS) Drive Chain

HS Series Drive chains are built in accordance with ASME/ANSI B29.1 standards and are dimensionally identical to Heavy Series Drive chains, but are specially designed and incorporate pins produced from medium carbon alloy steel. These pins are through-hardened to give the chain a higher working load capacity and additional resistance to fatigue in high load and pulsating type applications. Users of these chains should remember that wear life may be slightly reduced due to the material and heat treatment of the chain pins. Slip-fit type connecting links and offset links are not available for these chains.

ASME/ANSI Oilfield Chain

Roller chains used in the oil and gas industries are subjected to some of the greatest loads and harshest environments. These conditions are far more severe than usually found in industrial applications. These “Oilfield” chains can be either single strand or multiple strand and are typically constructed using Heavy Series components. We produce our Oilfield chains with the same attention to detail that goes into all our products, but additionally these models are subjected to the most up to date API (American Petroleum Institute) Specification 7F performance testing. For more information, please reference our Oilfield Roller Chain Brochure or the Diamond Product Guide 1004.

ASME/ANSI Corrosion/Moisture Resistant Roller Chain

Diamond Chain produces a full line of corrosion/moisture resistant chains for a variety of uses in environments where the chains are exposed to moisture or corrosive materials. Standard attachments are available with quick delivery.

Diamond Nickel-Plated Chain is different from many rust-resistant chains because Diamond electroless nickel plates all of the components before assembly, virtually eliminating the possibility of stress-corrosion cracking. Pre-assembly plating also ensures all components are plated, which prevents internal rust from seeping out and causing contamination. Common uses for Nickel-Plated chains include roller chain applications exposed to the weather, high humidity or those on machines that are frequently washed down with water.

Diamond produces a wide range of Single-Pitch Drive and Double Pitch Conveyor chains manufactured in four combinations of stainless steel depending upon the specific application. ***AP Stainless Chain*** is assembled using 300 Series (austenitic stainless) link plates, bushings and rollers along with a precipitation-hardened stainless steel pin. This combination increases the wear life of this chain over those constructed entirely of 300 Series components. AP Stainless chains are well suited for food processing and are approved by the U.S. Food and Drug Administration. AP Stainless will be supplied unless otherwise specified. To learn more about the various resistance levels of these chains against certain substances, please consult the Diamond Corrosion/Moisture Resistant Chain Brochure or the Diamond Product Guide 1004.

Installation

To obtain maximum service-life and efficiency from a chain drive, it is necessary that certain precautions in installation be taken. Chain drive installation is relatively simple and good results may be obtained when the following conditions are met:

1. The roller chain, sprockets, and other components are in good condition.
2. The sprockets are properly aligned.
3. Provision is made for adequate lubrication.
4. The chain is correctly tensioned.

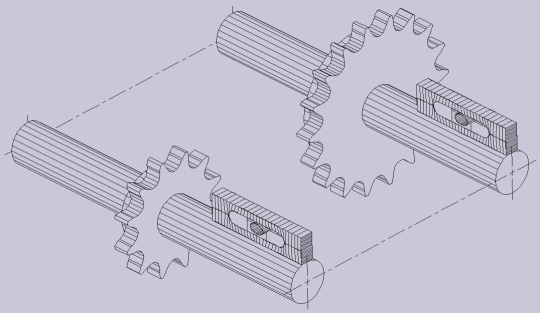
Condition of components

Shafting, bearings, and foundations should be supported rigidly to maintain the initial alignment. Roller chain should be free of grit and dirt. Wash chain in kerosene when required and then re-lubricate!

Drive alignment

Misalignment results in uneven loading across the width of the chain and may cause roller linkplate and sprocket tooth wear. Drive alignment involves two things: parallel shaft alignment and axial sprocket alignment.

1. Shafts should be parallel and level. This condition may be readily checked by the use of a feeler bar, and a machinist's level. If there is axial movement of the shaft (as in the case of an electric motor), lock the shaft in the normal running position before aligning the sprockets.



Most single strand drives will perform acceptably if the shafts are parallel and in the same plane within 4.2 mm/m. However, high speed, high horse power, or multiple strand drives should be aligned within the tolerance obtained from the following formula:

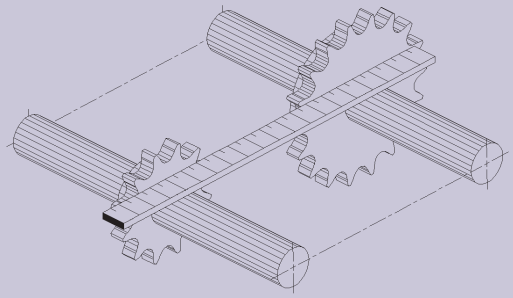
$$\text{Tolerance} = \frac{.111\ C\ (\text{mm/m})}{P\ n}$$

Where: C = centre distance, in mm.

P = chain pitch, in mm.

n = number of chain strands.

2. Sprocket axial alignment can be checked with a straight edge which will extend across the finished sides of the two sprockets. Normally, it is good practice to align the sprockets as close to the shaft as possible. For long centre distances, use a taut cord, or wire long enough to extend beyond each of the sprockets. The maximum allowable amount of axial misalignment is obtained from the following formula:



Max. Offset = 0.045 P mm

Where: P = chain pitch, in mm.

This formula applies to both single and multiple strand chains.

Installing the chain

Recheck all preceding adjustments for alignment and make certain all setscrews, bolts and nut are tight. Fit chain around both sprockets and bring the free ends together on one sprocket for connection. The sprocket teeth will locate the chain end links. Install the connecting link, and connecting link coverplate, and the spring clip or cotter pins. On larger pitch or heavy multiple strand chains, it may be necessary to lock the sprockets for this operation. When press fit coverplates are used, be careful not to drive the plate on so far as to grip the roller links. Stiff joints can result if this is done. On drives with long spans, it may be necessary to support the chain with a plank or bar as the connection is made.

Lubrication

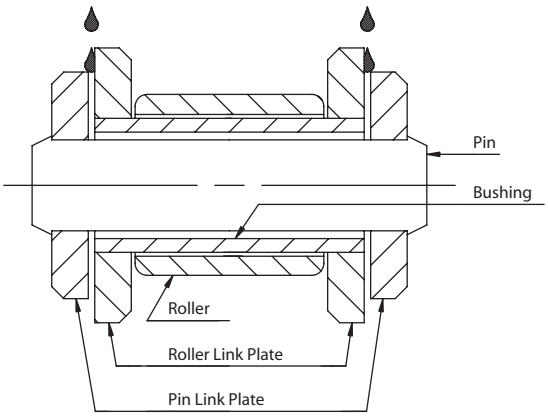
Roller chain consists of a series of connecting traveling metallic bearings, which must be properly lubricated to obtain the maximum service life of the chain. Although many slow speed drives operate successfully with little or no lubrication beyond the initial factory lubrication, proper lubrication will greatly extend the useful life of every chain drive. The chain drive requires lubrication for six purposes:

1. To resist wear of the pin-bushing joint.
2. To cushion impact loads.
3. To dissipate any heat generated.
4. To flush away foreign materials.
5. To lubricate chain-sprocket contact surfaces.
6. To retard rust or corrosion.

A good grade of clean petroleum oil without additives, free flowing at the prevailing temperatures, should be used. Some additives leave a varnish or gum deposit which prevents the oil from entering chain joints. Heavy oils and greases are generally too stiff to enter the chain joints and should not be used. With proper lubrication, a separating wedge of lubrication is formed between the pins and bushings in the chain joints much like that formed in journal bearings. The viscosity of the lubricant greatly affects its film strength, and its ability to separate moving parts. The highest viscosity oil which will flow between the chain linkplates and fill the pin-bushing areas will provide the best wear life. This is essential to minimize metal to metal contact and, if supplied in sufficient volume, the lubricant also provides effective cooling and impact dampening at higher speeds.

Note: Speeds beyond the maximum recommended for chain operation are indicated in the power rating tables with zero power. Operation at these or higher speeds will result in excessive galling of the chain pins and bushings regardless of the volume of oil applied.

Chain drives should be protected from abrasive and corrosive conditions, and the oil supply kept free of contamination. Periodic oil changes are desirable.



Chain cross-section showing exaggerated clearances

Oil applied to rollers only cannot reach pin-bushing joints, and therefore, cannot retard chain elongation due to wear. The lengthening of chains in service results from wear on pin and bushing surfaces, not rollers. When lubricating multiple strand chain, it is important that lubricant be directed to each row of chain linkplates. In conveyor applications, oil should be directed between the rollers and bushings as well as between the chain linkplates.

The following table indicates the lubricant viscosity recommended for various surrounding temperatures:

Recommended Grade	Temperature ˚C
SAE 5	- 46 to + 10
SAE 10	- 30 to + 30
SAE 20	- 12 to + 43
SAE 30	- 7 to + 54
SAE 40	- 1 to + 60
SAE 50	+ 4 to + 66

There are three basic types of lubrication for roller chain drives. Close adherence to the recommended type of lubrication is essential to obtaining maximum service life of a chain drive.

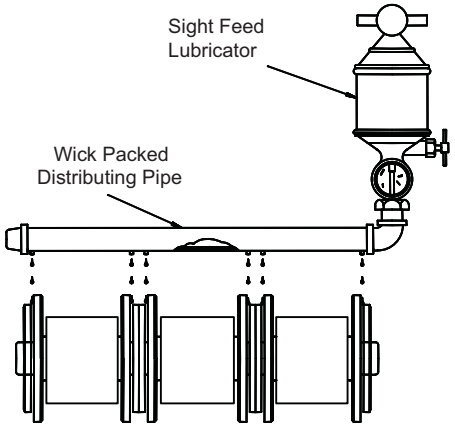
The recommended type of lubrication as shown in the power rating tables is determined by the chain speed and the amount of power transmitted.

Methods of Lubrication

Note: When applying lubricant to multiple strand chain, it is important that lubricant be directed to each row of chain link plates, not just the outermost rows; and, in conveying applications, oil should be directed between the rollers and bushings as well as between the chain link plates, as significant wear can result from external loading.

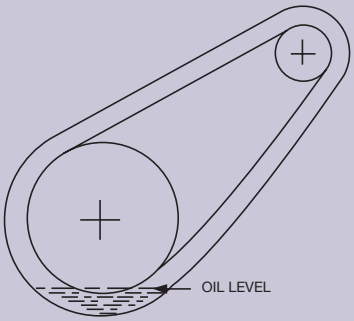
Manual or drip lubrication (type A)

Oil should be applied periodically between the chain linkplate edges with a brush, spout can, or drip lubrication.



Oil bath or oil slinger (type B)

With bath lubrication, the lower strand of chain runs through a sump of oil in the drive housing. The oil level should reach the pitch line of the chain at its lowest point while operating. Only a short length of chain should run through the oil. A typical drive arrangement for bath lubrication is shown in the illustration below.

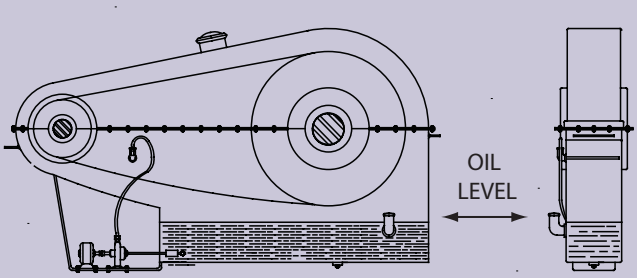


Drive arrangements which permit long length of chain to travel through the oil should be avoided as overheating or foaming may result.

With slinger disc lubrication, the chain operates above the oil level. The disc picks up oil from the sump and deposits it into the chain, usually by means of a trough. The diameter of the disc should produce rim speeds between 183m/min. minimum and 2438m/min. maximum. A collector plate is usually required to direct the oil to the chain linkplates. See typical drive installation using slinger disc lubrication immediately below.

Oil stream lubrication (type C)

This type of lubrication is required for large power, high speed drives. An oil pump should be provided to spray the oil across the lower span of chain in a continuous stream. Orifices should be placed so that oil is sprayed across each strand of the chain. This type of lubrication may be used up to the maximum speeds shown in the power rating tables for each size of chain, except where the rating is zero.



Limiting Chain Speed for Various Types of Lubrication (Chain Speed in m/min.)

Chain No.	06B	08B	10B	12B	16B	20B	24B	28B	32B	40B
Type A	107	91	76	66	50	44	38	34	30	24
Type B	808	671	579	533	450	381	357	320	305	264
Type C	Use for speeds higher than Type B limits									

Inspections

All chain drives should receive regular maintenance. Each drive should be inspected after the initial 100 hours of operation. Thereafter, most drives may be inspected at 500 hour intervals. However, drives subjected to shock loads or severe operating conditions should be inspected at 200 hour intervals.

At each inspection, the following items should be checked and corrected, if necessary.

1 Check lubrication

On slow speed drives, where manual lubrication is used, be sure the lubrication schedule is being followed. If the chain is covered with dirt and debris, clean the chain with kerosene and re-lubricate it.

WARNING! NEVER USE GASOLINE OR OTHER FLAMMABLE SOLVENTS TO CLEAN A CHAIN. A FIRE MAY RESULT.

If drip lubrication is used, check for adequate oil flow and proper application to the chain. With bath or pump lubrication, check oil level and add oil if needed. Check oil for contamination and change oil if needed. Change oil after the first 100 hours of operation and each 500 hours thereafter. If pump lubrication is used, check each orifice to be sure it is clear and is directing oil onto the chain properly.

2 Check chain tension

Check chain tension and adjust as needed to maintain the proper sag in the slack span. If elongation exceeds the available adjustment, remove two pitches and reconnect the chain.

3 Check chain wear

Measure the chain wear elongation and if elongation exceeds functional limits or is greater than 3% (30 millimeters in one meter) replace the entire chain. Do not connect a new section of chain to a worn chain because it may run rough and damage the drive. Do not continue to run a chain worn beyond 3% elongation because the chain will not engage the sprockets properly and it may damage the sprockets.

4 Check sprocket tooth wear

Check for roughness or binding when the chain engages or disengages from the sprocket. Inspect the sprocket teeth for reduced tooth section and hooked tooth tips. If these conditions are present, the sprocket teeth are excessively worn and the sprocket should be replaced. Do not run new chain on worn sprockets as it will cause the new chain to wear rapidly. Conversely, do not run a worn chain on new sprockets as it will cause the new sprockets to wear rapidly.

5 Check sprocket alignment

If there is noticeable wear on the inside surface of the chain roller linkplates, the sprockets may be misaligned. Realign the sprockets as outlined in the installation instructions to prevent further abnormal chain and sprocket wear.

6 Check for drive interference

Check for interference between the drive and other parts of the equipment. If there is any, correct it immediately. Interference can cause abnormal and potentially destructive wear on the chain or the interferring part. If the edges of the chain linkplates impact against a rigid part, linkplate fatigue and chain failure can result.

Check for and eliminate any buildup of debris or foreign material between the chain and sprockets. A RELATIVELY SMALL AMOUNT OF DEBRIS IN THE SPROCKET ROLL SEAT CAN CAUSE TENSILE LOADS GREAT ENOUGH TO BREAK THE CHAIN IF FORCED THROUGH THE DRIVE.

7 Check for failure

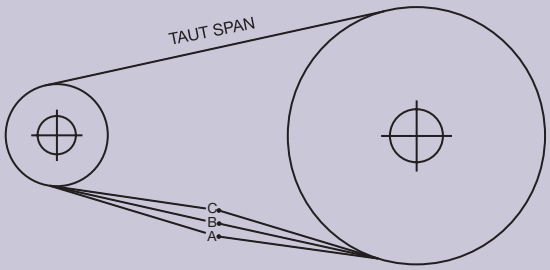
Inspect the chain for cracked, broken or deformed parts. If any of these conditions are found, REPLACE THE ENTIRE CHAIN, even though portions of the chain appear to be in good condition. In all likelihood, the entire chain has been damaged.

For additional technical assistance, contact any of Diamond Chain's Distribution Centers, United States sales offices or stocking distributors located throughout the world. Our engineers will assist with any custom chain application or installation. At Diamond Chain Company, we believe service is as important as quality.

Chain tensioning & length adjustment

Proper chain tension is critical to achieving acceptable service life. Chain tensioning may be accomplished by either: adjusting one of the shafts to increase the centre distance, using a movable idler sprocket, or removing pitches from the chain to compensate for wear elongation.

For the majority of slow and medium speed chain drives, the total mid-span movement in the slack span should be approximately 4-6% of the drive's centre distance. For drives operating at high speeds, impulse or reversing loads, the total movement should be reduced to 2-3% of the centre distance. Drives with vertical centres should also be adjusted to the smaller percentage. If the drive incorporates shaft adjustment or an idler, the amount of movement or "take-up" should always allow for the removal of two pitches of chain.

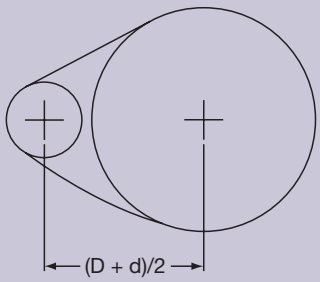


Recommended possible mid-span movement, A-C, of slack span

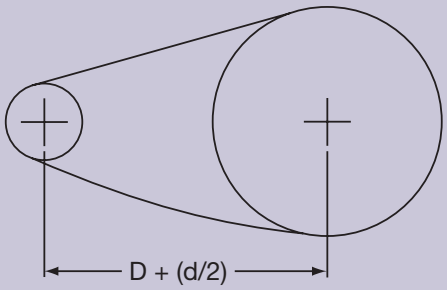
Tangent Length Between Sprockets	all dimensions in millimeters							
	125	250	375	500	750	1000	1500	2000
A-C for Horizontal to 45	6	13	19	25	38	50	75	100
A-C for Vertical to 45	3	6	9	13	19	25	38	50.

Drive centre distance

The distance between driver and driven sprockets on a two-sprocket drive must be greater than one-half the sum of the sprocket outside diameters to avoid tooth interference. The shortest practical centre distance is recommended.



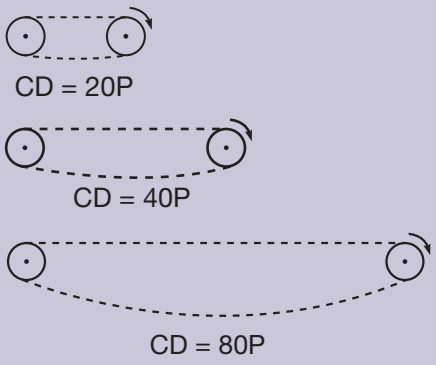
Absolute minimum centre distance



Recommended minimum centre distance

General guidelines for the selection or determination of the centre distance for any two-sprocket drive are:

1. For the average application, a centre distance of approximately 40 pitches of chain represents good practice.
2. A centre distance of 80 pitches may be considered as an approved maximum.
3. For high speed or pulsating drives a centre distance as short as 20 pitches may be desirable to avoid chain whipping and potential drive damage.

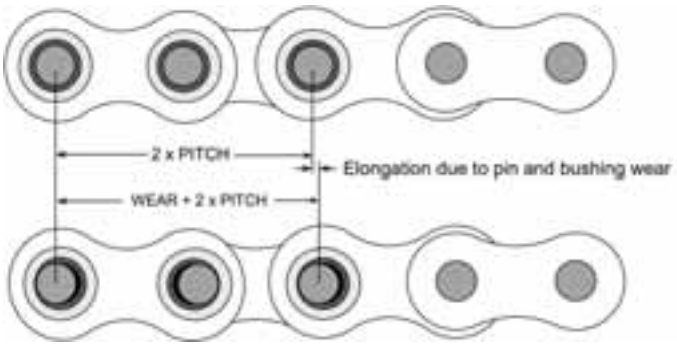


Fixed centres

When adjustable centres or idlers cannot be used, the exact centre distance must be calculated and built into the drive. Drives with fixed centres should be conservatively selected and well lubricated to minimize the rate of chain wear. Adjustment for wear elongation in fixed centre distance drives is accomplished only by removing links or pitches to compensate for wear elongation.

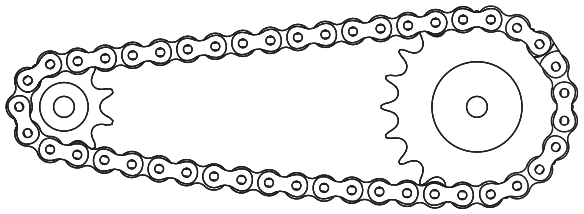
Chain wear

The individual joints in a roller chain articulate as they enter and leave the sprockets. This articulation results in wear on the pins and bushings. As material is worn away from these surfaces the chain will gradually elongate.



Chain does not 'stretch' - material is removed from pin and bushing

Elongation is normal and may be minimized by proper lubrication and drive maintenance. The rate of wear is dependent upon: the relationship between the load and the amount of bearing area between pin and bushing, the material and surface condition of the bearing surfaces, the adequacy of lubrication, and the frequency and degree of articulation between pins and bushings. The latter is determined by the quantity of sprockets in the drive, their speeds, the number of teeth and the length of the chain in pitches.



Measurement of chain for wear elongation

Relatively accurate wear measurements can be made by using the above illustration. Measure as closely as possible from the centre of one pin to the centre of another. The more pitches (pins) contained within the measurement increase the accuracy. If the measured value exceeds the nominal by more than the allowable percentage the chain should be replaced. The maximum allowable wear elongation is approximately 3% for most industrial applications, based upon sprocket design. The allowable chain wear in percent can be calculated using the relationship: 200/N, where N is the number of teeth in the large sprocket. This relationship is often useful since the normal maximum allowable chain wear elongation of 3% is valid only up to 67 teeth in the large sprocket. In drives having fixed centre distances, chains running in parallel or where smoother operation is required, wear should be limited to approximately 1.5%.

For example, if 12 pitches (12 pins) of a 16B-1 chain were measured and the result was 313.9mm or greater (using 3% as the maximum allowable wear), the chain should be replaced. Anything less than 313.9mm would still be acceptable by most industry standards.

Chain wear elongation limits

ISO Chain No.	Chain Pitch		Pitches	MEASURED LENGTH			
				Nominal		At 3% Wear	
	In.	mm		In.	mm	In.	mm
04B	.250	6.35	48	12.00	305	12.375	314
06B	.375	9.52	32	12.00	305	12.375	314
08B	.500	12.70	24	12.00	305	12.375	314
10B	.625	15.88	20	12.50	318	12.875	327
12B	.750	19.05	16	12.00	305	12.375	314
16B	1.000	25.40	12	12.00	305	12.375	314
20B	1.250	31.75	20	25.00	635	25.750	654
24B	1.500	38.10	16	24.00	610	24.719	628
28B	1.750	44.45	14	24.50	622	25.250	641
32B	2.000	50.80	12	24.00	610	24.719	628
40B	2.500	63.50	10	25.00	635	25.750	654
48B	3.000	76.20	8	24.00	610	24.719	628

A chain is only worth its weakest link...

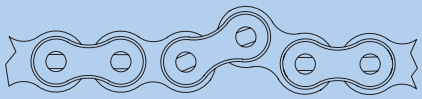
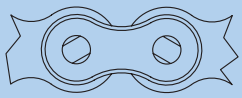
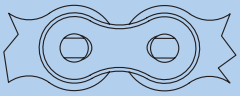
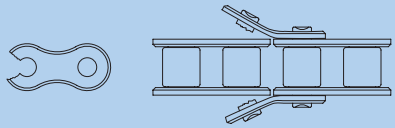
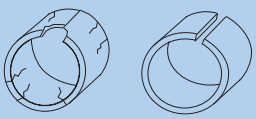
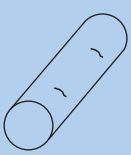
Let's face it, there are less expensive chains out there, but are they worth it? Probably not in the long run. In most cases, cheap chain doesn't last as long so you have to replace it more often. That means downtime and all of the costs associated with it: idle workers, lost production, repair/replacement cost - it all adds up. Don't be fooled. Initial costs aren't necessarily real costs. Clarifying the real costs associated with less expensive chain can be done very easily. Using chains and costs that reflect your specific drive conditions, use the following worksheet to illustrate the investment in Diamond roller chain is definitely worth it when compared to the longterm repair and replacement costs of a less expensive chain.

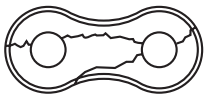
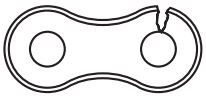
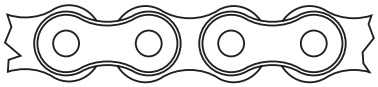
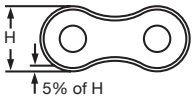
Annual chain cost analysis

		Bargain Chain	Diamond Chain
A	Unit cost of new chain (£/chain-Ft):		
B	Length required for application (chain-Ft):		
C	Chain cost per application, A x B (£/chain):		
D	Chains used per year (chains/Yr):		
E	Annual cost of chains, C x D (£/Yr):		
F	Chain repairs per year (repairs/Yr):		
G	Average hours of downtime per repair (downtime-Hrs/repair):		
H	Costs per downtime-hour, including cost of repair labor, lost efficiency, lost profits, etc. (£/downtime-Hr):		
I	Annual dowtime costs, F x G x H (£/Yr):		
J	Total annual costs incurred, E + I (£/Yr):		

Nothing** outlasts a **Diamond

Troubleshooting guide

CONDITION / SYMPTOM	*POSSIBLE CAUSE*	*WHAT TO DO*
Tight Joints 	Dirt or foreign material in chain joints.	Clean and re-lubricate chain.
	Inadequate lubrication.	Replace chain. Re-establish proper lubrication.
	Misalignment.	Replace sprockets and chain if needed. Realign sprockets.
	Internal corrosion or rust. protect chain.	Replace chain. Eliminate cause of corrosion or
	Overload bends pins or spreads roller linkplates.	Replace chain. Eliminate cause of overload.
Rusted Chain	Exposed to moisture.	Replace chain. Protect from moisture.
	Water in lubricant.	Change lubricant. Protect lubrication system from water. Replace chain.
	Inadequate lubrication.	Provide or re-establish proper lubrication. Replace chain, if needed.
Turned Pins 	Overload.	Replace chain. Eliminate cause of overload.
	Inadequate lubrication	Replace chain. Re-establish proper lubrication.
Enlarged Holes 	Overload.	Replace chain. Eliminate cause of overload.
Broken Pins **Broken Linkplates** 	Extreme Overload.	Replace chain. Replace sprockets if indicated. Eliminate cause of overload or redesign drive for larger pitch chain.
Missing Parts	Missing at assembly.	Replace chain.
	Broken and lost.	Find and correct cause of damage. Replace chain.
Broken, Cracked or Deformed Rollers 	Speed too high.	Replace chain. Reduce speed.
	Sprockets too small.	Replace chain. Use larger sprockets, or possibly redesign drive for smaller pitch chain.
	Chain riding too high on sprocket teeth.	Replace chain. Re-tension chain more often.
Pin Galling 	Speed or load too high.	Reduce speed or load. Possibly redesign drive for smaller pitch chain.
	Inadequate lubrication.	Provide or re-establish proper lubrication.
Chain Climbs Sprocket Teeth	Excess chain slack.	Re-tension chain.
	Excessive chain wear.	Replace and re-tension chain.
	Excessive sprocket wear.	Replace sprockets and chain.
	Excessive overload.	Replace chain. Eliminate cause of overload.

CONDITION / SYMPTOM	*POSSIBLE CAUSE*	*WHAT TO DO*
Missing or Broken Cotters	Cotters installed improperly. I	install new cotters per manufacturer's instructions.
	Vibration.	Replace chain. Reduce vibration. Use larger sprockets.
	Excessively high speed.	Replace chain. Reduce speed. Redesign drive for smaller pitch chain.
Exposed Chain Surfaces Corroded or Pitted	Exposure to corrosive environment.	Replace chain. Protect from hostile environment.
Cracked Linkplates (Stress Corrosion) 	Exposure to corrosive environment combined with stress from press fits.	Replace chain. Protect from hostile environment.
Cracked Linkplates (Fatigue) 	Loading greater than chain's dynamic capacity.	Replace chain. Reduce dynamic loading or redesign drive for larger chain.
Battered Linkplate Edges 	Chain striking an obstruction.	Replace chain. Eliminate interference.
Worn Linkplate Contours 	Chain rubbing on casing, guide, or obstruction.	Replace chain if 5% or more of height worn away. Retention chain. Eliminate interference.
Excessive Noise	Chain striking an obstruction.	Replace chain. Eliminate interference.
	Loose casing or shaft mounts.	Tighten fasteners.
	Excess chain slack.	Re-tension chain.
	Excessive sprocket wear.	Replace and re-tension chain.
	Sprocket misalignment.	Replace chain and sprockets, if needed. Realign sprockets.
	Inadequate lubrication.	Replace chain if needed. Re-establish proper lubrication.
	Chain pitch too large.	Redesign drive for smaller pitch chain.
	Too few sprocket teeth.	Check to see if larger sprockets can be used. If not, redesign drive.
Wear on Inside of Roller Linkplates and One Side of Sprockets	Sprocket misalignment.	Replace sprockets and chain if needed. Realign drive. Re-tension chain.
Chain Clings to Sprocket	Excessive sprocket wear.	Replace sprockets and chain.
	Sprocket misalignment.	Replace sprockets and chain if needed. Realign sprockets.

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