



## Frequently Asked Questions

### *Roller Chain Components*

#### **What is a roller chain roller link?**

A roller link is the interior assembly of the chain consisting of two bushings press-fit into each of the linkplates, including rollers if applicable (example: no rollers in rollerless chains #25 & #35). It should be noted that the same roller links are used for both single and multiple strand chains.

#### **What is a roller chain offset link?**

Offset links, also known as  $\frac{1}{2}$  links or crank links, are used to make a chain an odd number of pitches in length, often used to shorten a chain by one pitch. Offset links are available in two different configurations.

Single-pitch offset links, slip-fit type, are furnished with a slip-fit pin unassembled in the linkplates. A flat is milled on one end of the pin preventing it from turning in the linkplate once installed.

Two-pitch offset links, press-fit type, are an offset link and a roller link assembled together. The press-fit construction of this assembly greatly increases its structural rigidity, reliability, and durability. For these reasons, the two-pitch offset assembly is recommended in preference to the single-pitch offset. However, due to the reduction in the chain's working capacity, offset links, of either type, are not recommended in performance oriented drives.

#### **What is a roller chain connecting link used for and what is its impact on the chain's load capacity?**

Connecting links are used to join the two ends of the chain together and are provided in two different configurations, depending on the application.

Slip-fit links, the most common and most popular, are provided for general chain applications and allow the easy slip fit assembly of the cover plate over the pin ends. This slip-fit construction does not have the same integrity found in the assembled chain and can reduce the chain's working load capacity by as much as 30%.

Press-fit connecting links are provided when the integrity of the connecting link needs to be equal to that of the base chain. This design uses pitch holes in the cover plate that are smaller than the chain pins, requiring the user to press the cover plate onto the pins before installing the spring clip or cotter. While more difficult to install, this type of connection provides the greatest load carrying capability.

### *Roller Chain Failure*

#### **A chain failed in service. Inspection of the failure revealed a bent or broken pin, or pins that appear to be turned within the outer (pin) link plates. Why?**

Shock loads that are greater than the component's yield strength, approximately 55-60% of the chain's tensile, are the cause of this problem. Changing to High Strength Series chain, increasing the chain size (i.e. #80 up to #100), or working to eliminate the shock load on the drive system are some of the ways the chain's performance may be improved.

**A roller chain failed in service and upon inspection of the failure it was determined to be a “crack” in an inner (roller) plate. Why did this happen?**

Cracked roller linkplates are often a sign of a fatigue failure due to the cyclic loading. The fatigue life of a chain can be improved by using Heavy Series chains, by increasing the overall chain size (i.e. #80 up to #100), or by reducing the dynamic load on the chain.

*Roller Chain FAQ's*

**What is the tensile strength and load rating for Diamond’s ANSI 60 and ANSI 60 Heavy roller chain?**

The average tensile strength of Diamond Chain’s Diamond Series ANSI 60 and ANSI 60 Heavy Series chain is 8500 pounds. Diamond Chain calculates the average tensile strength based on current and historical test data taken from each production lot of ANSI 60 and ANSI 60 Heavy roller chain.

Tensile strength for all the products in Diamond Chain’s portfolio can be found in the Product Guides available under the Product tab.

Generally, working load for any chain should not exceed 1/6th of the average tensile strength when using press-fit connecting links, or 1/9th of the average when using slip-fit connecting links or offset links.

When calculating working load based on a manufacturer’s ultimate or maximum tensile strength data, it’s important to remember that these numbers may not reflect the expected tensile strength for each chain of that given size. Tensile strength described as ultimate or maximum merely indicates the highest level recorded in their test procedures, which may not be repeatable.

**What is meant by “pre-stretching” or “pre-loading” roller chain, why is it done, and is it important?**

Following assembly, an initial load is applied to the chain, which is called a pre-load. This loading approximates the recommended maximum loading in service and is done to align the various chain components such as pins, bushings, and link plates. The benefit of pre-loading is that it greatly helps eliminate the initial elongation often found in “lesser” chains. Elimination of this initial elongation can increase the chain’s useable service life, and therefore pre-loading is very important. Diamond Chain Company pre-loads every Standard and Heavy Series chain it manufactures.

**How can the wear in a roller chain be accurately measured and when is the chain considered worn out?**

Roller chain can be measured relatively accurately by measuring the tight span of the drive when the drive is OFF, by measuring from center of one pin to the center 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. The 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 center distances, chains running in parallel, or where smooth operation is required, the amount of wear should be limited to approximately 1.5%.

### **How is proper chain tension measured and why is it important?**

Proper chain tension is critical to achieving acceptable service life, as excessive tension can cause accelerated wear or chain overload and excessive slack can cause rough chain operation and possibly result in the chain skipping a sprocket tooth, resulting in a catastrophic failure. For the majority of slow- and medium-speed drives, the total mid-span movement in the slack span of the chain should be approximately 4-6% of the drive's center distance. For drives operating at high speeds, impulse, or reversing loads, the total mid-span movement should be reduced to 2-3% of the center distance. Drives with vertical centers should also be adjusted to the smaller percentage. If the drive is designed to incorporate shaft adjustment or an idler, the amount of movement or "take-up" should always allow for the removal of two pitches of chain.

### **What is the difference between slip-fit center plate- and press-fit center plate-type multiple strand chain?**

Multiple strand chains manufactured using slip-fit center plates are most common and are well suited for drives of moderate severity. These chains are designed for ease of disassembly throughout the entire length of chain. The chains can be shortened or sections can be added quickly with minimal effort. However, with the slip-fit center plate design, the user may experience accelerated fatigue failures in exchange for the ease of alteration in the field.

Multiple strand chains manufactured using press-fit center plates were originally developed by Diamond Chain for service in applications that require the utmost in multiple strand chain capacity. Multiple strand chains with press-fit center plates have significantly greater fatigue strength than their slip-fit center plate counterparts, because press-fit construction assures rigid, permanent support for the pins at each tension point with no relative movement, which can cause wear or fatigue. While the press-fit construction does provide the increased fatigue resistance that is often essential in critical applications, the user does give up some convenience because the chain's length cannot readily be altered in the field. For this reason, press-fit riveted multiple strand chain should always be ordered in the exact pitch length required, including a Bushed Center Plate Link (BCL) connecting link.

### **What is roller chain length matching and why is it used?**

Many applications require two or more chains, normally with attachments, to run in parallel with "flights" joining the chains together forming a conveyor- or transfer-type system. In these cases, it is critical to have the chains ordered as a set, matched for length, and installed on the machinery with the same relationship to one another as when they were matched.

Diamond Chain Company offers two degrees of precision matching for chains used in parallel operation. Class I matching insures the chains within a given set will not vary in overall length by more than .006"/ft. Class II matching is much more stringent, and assures that the longest and the shortest chain in a given set will not vary in overall length by more than .002"/ft.

### **What is the difference between riveted and cottered chain?**

Riveted chain is constructed using pins that extend through the plate on each side and are then riveted, or sidemashed, on their ends to add some additional strength to the hold between the pin and plate. Note: the riveting, or sidemashing, is NOT what holds the pin and plate together. The interference fit between the plate hole size and the pin diameter hold the two together.

Cottered chain is constructed using pins that extended through one plate and are sidemashed and through the second side a further distance than through the first plate, with a cross-drilled hole for inserting a cotter pin. Note: cottered chain is also manufactured using an interference fit between the plate hole size and pin diameter. However, the plate is easier to remove following removal of the cotter, because grinding of the riveted pin end is not necessary.

### **What are the temperature limitations of Diamond roller chain?**

Carbon steel chains can routinely be used where temperatures are between 0 and 350 degrees Fahrenheit. For applications where temperatures are greater than 350 degrees, chain with extra clearance in some of the components and a special synthetic high temperature lubricant are required.

### **Why is my chain “stretching,” or elongating, too quickly?**

Proper lubrication is critical in achieving the maximum wear life of any roller chain. As the chain articulates around the sprockets, the pin and bushing wear. This wearing causes the elongation, or “stretch,” in the chain. Lubrication of these surfaces through proper lube application or the use of Diamond DURALUBE or Ring Leader o-ring chains can greatly increase the wear life of the chain.

### **My roller chain is rusting in service. What should I do?**

Review the drive requirements and surroundings. For chains requiring no rusting and being used in acidic or caustic environments, consider using stainless steel chains. For chains exposed to moisture only, consider using plated chains (such as Diamond ACE or Nickel Plated chains).

### **Will the typical chain breaker (pin extractor) break multiple strand roller chain?**

Yes, the Diamond Chain pin extractor is designed to remove the press-fit cover plate from a chain—single or multiple strands. Removal of the cover plate is generally sufficient to allow the chain to be easily disassembled, with the exception of Diamond’s press-fit riveted multiple strand chain series.

### **Do the Diamond Chain connecting tools work for multiple strand roller chains?**

The connecting tools are specifically designed to pull a single strand of chain together at a time. However, multiple strand chains can be connected by pulling on a strand with the connecting tool and holding the remaining loose strand(s) up while inserting the connecting link. Please note that very large multiple strand chains may overload the connecting tools.



**How is the drive ratio of a roller chain drive calculated and what is the maximum recommended single reduction?**

The drive ratio is a function of the number of teeth on the large sprocket divided by the number of teeth on the smaller sprocket, not the sprockets' diameters.

The maximum recommended ratio for a single reduction is 7:1. In practice, the practical single reduction limit is affected by the minimum size of the small sprocket, the maximum size of the large sprocket, and the need for sufficient wrap on the small sprocket. For ratios larger than 7:1, a double reduction is preferred.

*Roller Chain Lubrication*

**What type of lubrication is recommended at various ambient temperatures?**

Ambient temperature: 20-40 F – SUS Viscosity 100 F of 200-400, SAE Engine Oil of 20 Weight, SAE Gear Oil 80 W, ISO 46 or 68, and AGMA lubrication 1 or 2.

Ambient temperature: 40-100 F – SUS Viscosity 400-650, SAE Engine Oil of 30 Weight, SAE Gear Oil 85 W, ISO 100, and AGMA lubrication 3.

Ambient Temperature 100-120 F – SUS Viscosity 650-950, SAE Engine Oil of 40 Weight, SAE Gear Oil 90, ISO 150, and AGMA lubrication 4.

Ambient Temperature 120-140 F – SUS Viscosity 950-1450, SAE Engine Oil of 50 Weight, SAE Gear Oil 90, ISO 220, and AGMA lubrication 5.

**In what application would forced or circulated (Type C) type lubrication be most appropriate?**

Pumped type (C) lubrication is applied to the chain by pumping it onto the chain under pressure to the upper edges of each row of link plates across the lower span of chain just prior to the chains entry into one of the sprockets. This type of lubrication is most desirable for chains operating in excess of 1500 feet per minute.

**In what application would bath (Type B) type lubrication be most appropriate?**

Bath type (B) lubrication is applied to the chain by allowing the oil level within an enclosed casing to cover the chain at approximately the pitch line at its lowest point of operation. This type of lubrication is most desirable for chains operating up to approximately 1500 feet per minute.

**In what application would drip (Type A) type lubrication be most appropriate?**

Lubricant applied manually with an oilcan or brush is acceptable for slow speed drives, generally not over 600 feet per minute. When lubrication must be accomplished with a minimum amount of oil, it is advisable to equip the system with either felt pads or brushes fed by lubricant from a reservoir and carefully positioned to direct oil into the clearances between each row of link plates in the slack span of the chain.

*Rough Roller Chain Operation*

**Roller chain is not operating smoothly. The chain appears to be climbing the sprocket teeth.**

Check the chain for excessive wear or slack in the drive. Check the sprockets for excessive wear. Replace any worn components and re-tension the drive properly, being sure not to overload the drive.

**The chain does not travel smoothly during operation. Marks appear on the interior of the inner linkplates. Why?**

Check the sprockets closely for misalignment or damage and realign or replace as needed. The wear marks on the interior of the inner plates are likely caused by the teeth of the sprocket.

*Sprockets*

**What is the smallest suggested sprocket size to minimize the effects of chordal action?**

The smallest sprocket is usually the driver or input sprocket. As the chain enters and exits, it rises and falls as each pitch engages and disengages the sprockets. This movement, called chordal action, causes chain-speed variations (drive roughness) that may be objectionable in some applications. These variations can normally be minimized by increasing the size of the sprockets. To minimize the negative effects of chordal action, the following are suggested guidelines for the minimum number of teeth in the smallest sprockets:

- Slow speed drive (drip type lubrication) – 12 teeth
- Medium speed drive (oil bath type lubrication) – 17 teeth
- High speed drive (pumped lubrication) – 25 teeth

**What is the recommended minimum chain wrap in a roller chain drive?**

The recommended minimum wrap angle of the smallest sprocket in the drive is 120°. The wrap angle can be reduced to 90° if good chain tension adjustment is maintained. If chain tension is not closely maintained with less than a 120° wrap, the chain can jump teeth, resulting in damage to the chain and/or the sprocket.

Note: For a sprocket ratio of 3:1 or less there will always be 120° more wrap on the small sprocket, regardless of the center distance.

**When are hardened tooth sprockets recommended?**

Hardened tooth sprockets are recommended for any sprockets of 25 teeth or less and/or when the sprocket will operate in drives that are heavily loaded, operated in abrasive conditions, high speed drives, or drives requiring extremely long life.