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Sprocket and Chain Optimisation

Roller Chain, or Transmission Chain, is used to transmit power or convey products

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What makes a ‘Quality’ Chain?

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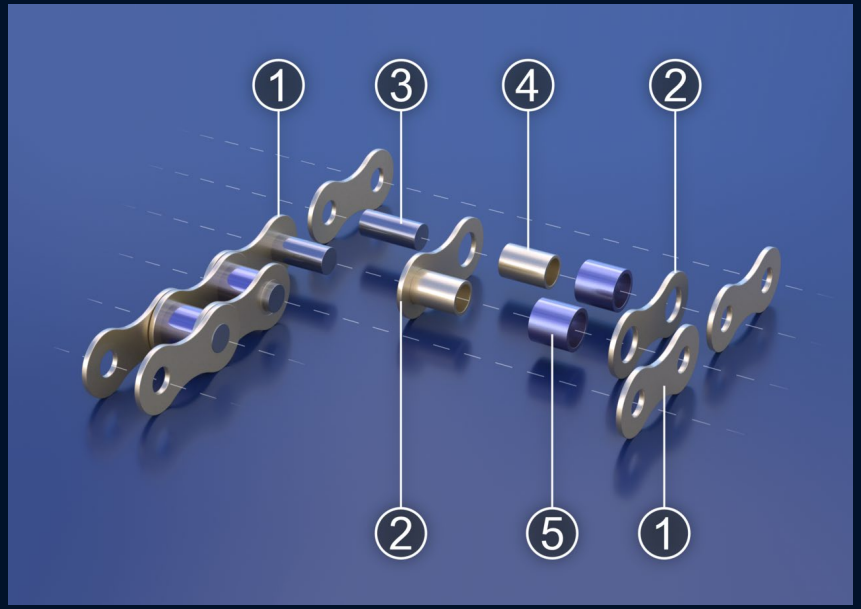
Roller Chain Components



1&2. LINK PLATES- Link plates are the component part receiving chain tension. The holes for press-fitted pins or bushings are accurately punched to maintain uniform pitch.

3. PINS- Pins are made to exact specifications for high strength, sturdiness and wear resistance and rigidly press-fitted to the link plates. Pins resist shearing force through chain tension and rotate in the bushings, providing bearing surfaces when the chain articulates over a sprocket.

4. BUSHINGS- Bushings are made to achieve high wear resistance and are press-fitted to the roller link plates, providing a bearing surface for pin rotation.

5. ROLLERS- Rollers are free to rotate over the bushings. When the chain engages with the sprocket, the rollers work as bearings and serve to reduce shock and wear. When the chain is running on rails or wear strips, the rollers reduce running friction on the chain.

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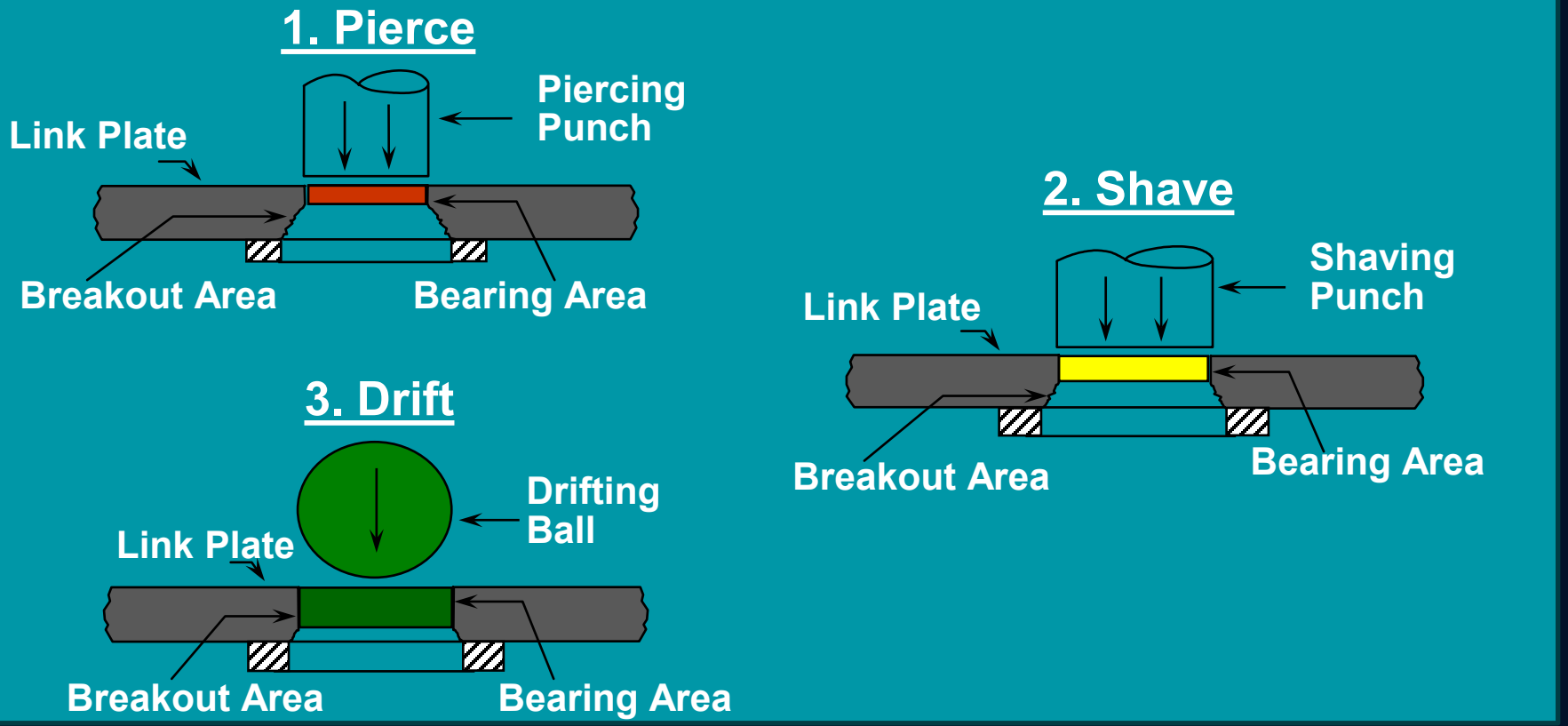
Plates – 3 Stage Holing



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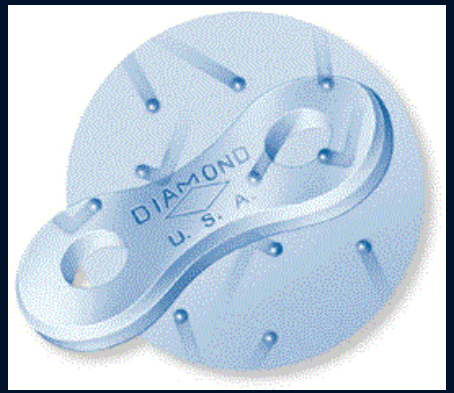
Plates – 3 Stage Holing

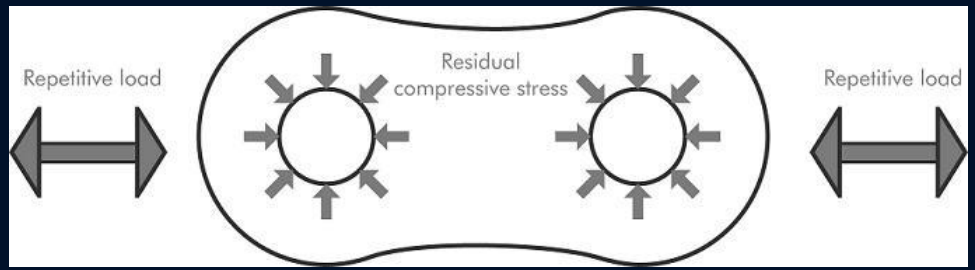
Plates – Shot Peening



Link plates are tumbled and bombarded with steel shot to induce positive stress in the surface of the material following the holing processes.

Shot peening must be consistent in intensity and coverage to create the correct level of compressive stress ensuring consistent press fit of the bushings and pins.

Shot peening increases the fatigue life of the chain by up to 20%.



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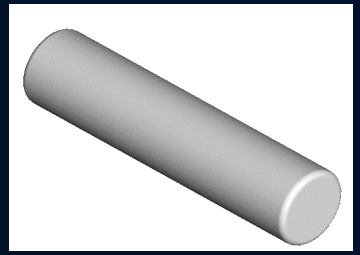
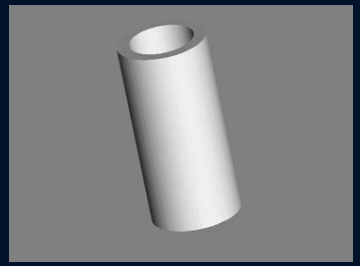
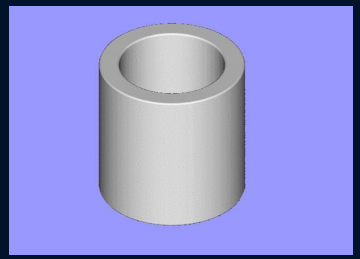
Round Parts



- Pin Design
  - Precision ground guarantees best fitment
  - Heat treat to maximize wear performance



- Bushing Design
  - Solid Bushing w/close tolerances formed on multiple station extruder
  - Uniform wall thickness
  - Stringent material selection
  - **Tight** dimensional control



- Roller Design
  - Solid roller design
  - Heat treated for maximum wear resistance & impact strength
  - Tight dimensional control ensures roundness

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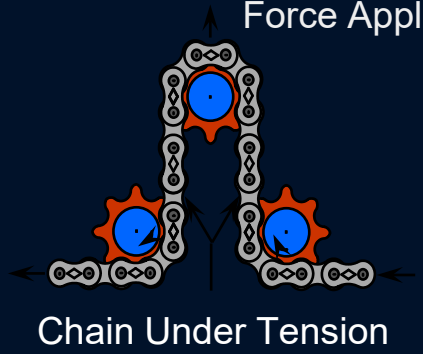
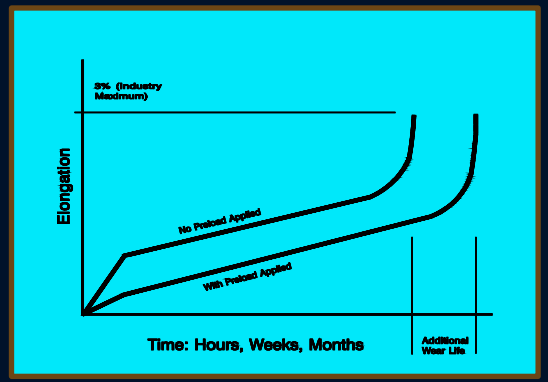
Pre-Loading

DYNAMIC PRELOAD



STATIC PRELOAD



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Tensile Strength vs Working Load

Ultimate Tensile Strength: The load applied once required to break the chain. This figure should NOT be used to determine chain selection.

Yield Strength: Approx. 60% of the tensile strength. A chain will yield, or plastically deform, at this load.

Working Load: Approx. $1/6^{th}$ -$1/9^{th}$ of the minimum tensile strength. This is the figure used for chain selection.

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Installation & Maintenance

Lubrication

Tension

Alignment

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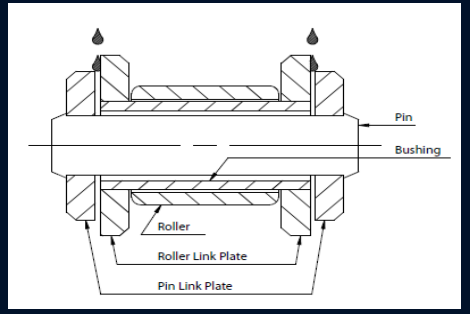
Lubrication

Proprietry hot dip lubrication applied to the chain after assembly ensures complete coverage of all components and more importantly, within the bearing areas. It contains corrosion resistant additives and superior surface retention to extend wear life.

Roller chain must be properly lubricated to obtain the maximum service life of the chain. Proper lubrication will greatly extend the useful life of every chain drive and serves the following purposes:

To resist wear of the pin-bushing joint.
To cushion impact loads.
To dissipate any heat generated.
To flush away foreign materials.
To lubricate chain-sprocket contact surfaces.
To combat rust or corrosion.



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 applied in sufficient volume without over-lubricating, the lubricant also provides effective cooling and impact dampening at higher speeds.

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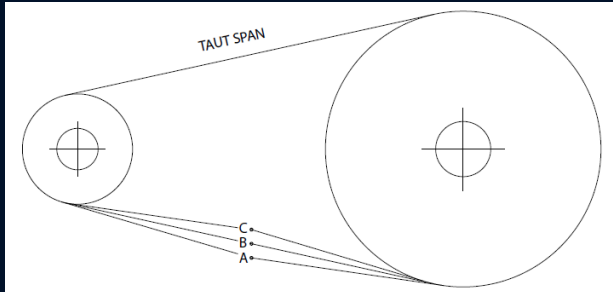
Chain Tension

The proper chain tension is critical to achieving maximum 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.

For most 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 centre distance.
For high speeds, impulse or reversing loads, the total mid-span movement should be reduced to 2-3% of the centre distance.

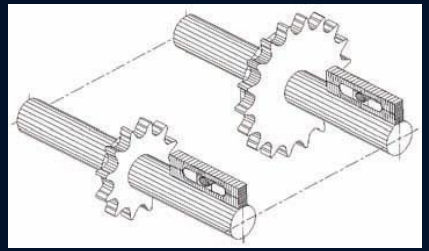
Recommended Possible Mid-Span Movement AC

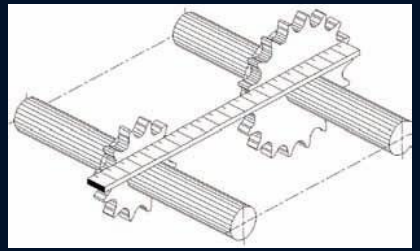
Drive Center-Line	Tangent Length Between Sprockets								
	5″	10″	15″	20″	30″	40″	60″	80″	100″
Horizontal to 45°	.25″	.5″	.75″	1″	1.5″	2″	3″	4″	5″
Vertical to 45°	.12	.25	.38	.5	.75	1	1.5	2	2.5



AC = Total Possible Mid-Span Movement

Drive Alignment





Shafts must be parallel and level

Check for parallel using a feeler bar and
Check for level using a machinist's level
Tolerance for most single-strand drives is 4.2mm/m
For high speed, high load, or multiple-strands use:

Tolerance = 0.111 x C
P x n
Where: C= Center distance in mm
P = chain Pitch (in mm)
n = number of strands

Sprockets must be in alignment

Tolerance = 0.045 x P
Where: P = chain Pitch (in mm)

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Chain Drive 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 list should be checked and corrected when necessary

- Check Lubrication
- Check Chain Tension
- Check Chain Wear
- Check Sprocket Tooth Wear
- Check Sprocket Alignment
- Check for Drive Interference
- Check for Chain Failure

Chain Failure Modes

- Wear
  - The designed failure mode. Chain does not stretch. Over time, material is worn from the pin OD and the bushing ID creating more clearance between the two resulting in an increase in the overall chain length. The maximum allowable wear is 3% with a tensioner and 1.5% on fixed centre applications.

- Fatigue
  - Occurs when the chain is subjected to frequent cyclical loads above the Yield Strength of the chain.

- Tensile
  - Occurs when an extreme load is applied once to break the chain. This should never occur in application.

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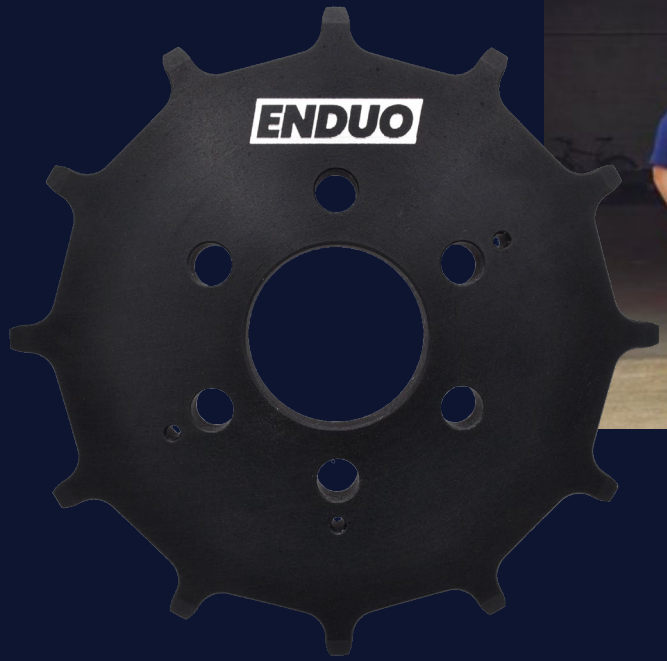

What is Enduo - THE SPROCKET RE- INVENTED

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- The first innovation in sprocket design in over a century.
- Dual contact on both sides of the tooth - Dual Engagement.
- Dramatically reduces friction and wear, extending chain lifetime up to 3.5X
- Reduces power loss over the lifetime of the chain drive
- Reducing downtime and increasing productivity.
- Cash and carbon savings!
- Award winning Enduo Technology
- Worldwide patented technology – 14 Patents granted, 10 pending
- A more secure chain and sprocket engagement

Direct plug and play solution – Compatible with any chain

reddot winner 2023

EPTDA Member

SOLUTION: ENDUO TOOTH PROFILE

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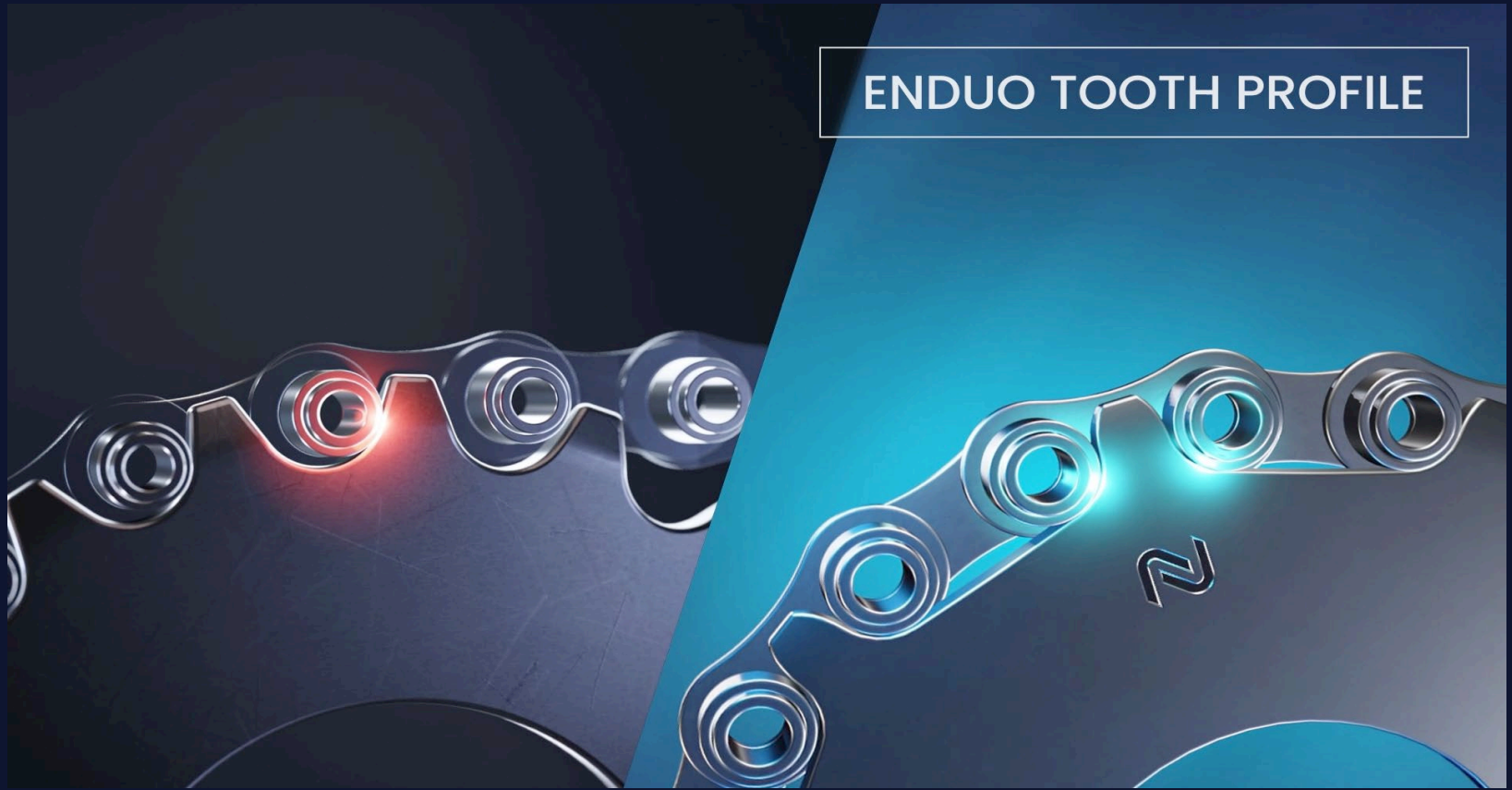

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Q&A