SKSSWEDEN

Catalogue 1 | Drive Chain

Innovation in Motion
TSUBAKI

TSUBAKI | Chain Products | 2008

INTRODUCTION TO TSUBAKI ROLLER CHAIN

Glossary

1. Minimum Tensile Strength as per ISO Standardisation

This is the Minimum Tensile Strength determined by ISO. If a roller chain fails a tensile load below this value, it does not surpass the standards.

2. Minimum Tensile Strength as per TSUBAKI Standardisation

This is a minimum value determined by statistical processes at TSUBAKI. If a roller chain fractures at a tensile load below this value, it does not surpass TSUBAKI standards. TSUBAKI standards are higher than ISO standards.

3. Average Tensile Strength as per TSUBAKI Standardisation

This is a fracture load reading obtained after a long period of actual tensile strength testing of a large number of chain strands. Of course, when any given strand of roller chain fractures, this value may be higher or lower, so it does not represent a guaranteed value.

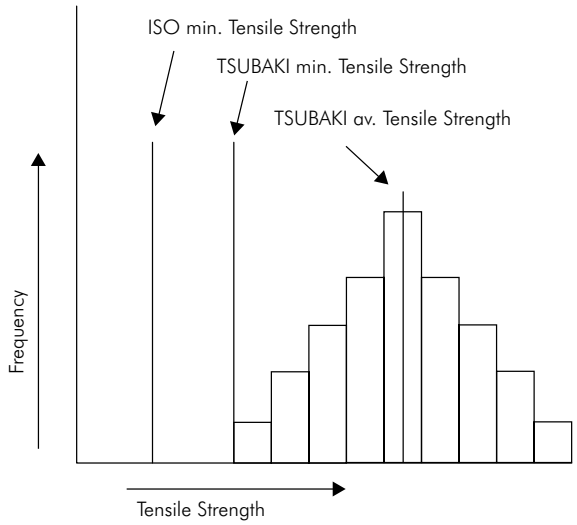


Fig. 1 Relationship between the three tensile strengths mentioned above.

4. Tensile Strength Testing Method

As shown in Fig. 2, a roller chain with minimum of five links is fixed at both ends by clevises and tensioned until fracture occurs. The type of fracture can be used to determine the cause of the breakage of the chain (Fig. 3).

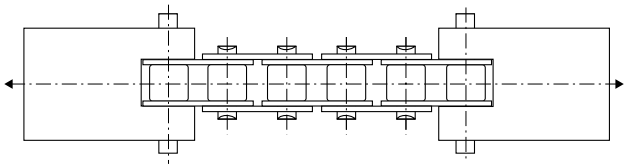


Fig. 2 Tensile Strength test

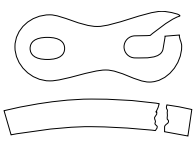


Fig. 3 Shape of fracture

5. Maximum Allowable Load

The Maximum Allowable Load (M.A.L.) of a roller chain (excluding Stainless Steel Chain and Engineering Plastic Chain) is the value derived from the lowest fatigue limit. When a load lower than this value is repetitively applied to the roller chain, fatigue failure will never occur.

The TSUBAKI M.A.L. is determined after 10 million repetitive loads instead of 3 million repetitive loads which is the European Standard.

The Maximum Allowable Load of Stainless Steel Chain and Engineering Plastic Chain is determined by the surface pressure between the pins and bushes.

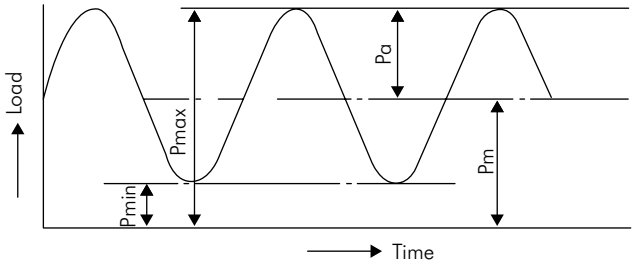


Fig. 4 Summary chart for repetitive loads

6. Ring Coining Process

For easy assembling the pin and link plate of a connecting link are slip fit. In general, this type of connecting link has a 20% lower fatigue strength than the chain itself. However, TSUBAKI developed a special process to eliminate that loss of fatigue strength and still satisfy the customers demand for easy assembling: the patented Ring Coining process. By applying the patented Ring Coining process, TSUBAKI generates a cold deformation around the pin hole of the connecting link plate. This results in residual stress around the pin hole and thereby adds strength. By using this process, transmission capacity is increased back to 100%.

TSUBAKI applies the patented Ring Coining process to all slip fit connecting links.

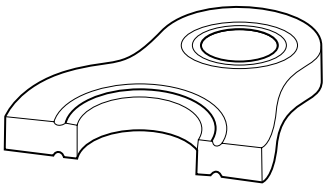


Fig. 5 Ring Coining

For severe conditions, TSUBAKI has developed the Heavy Duty Chain series. These chains are standard equipped with press fit connecting links. The installation is more difficult than in case of standard connecting links.

7. Ball Drifting Process

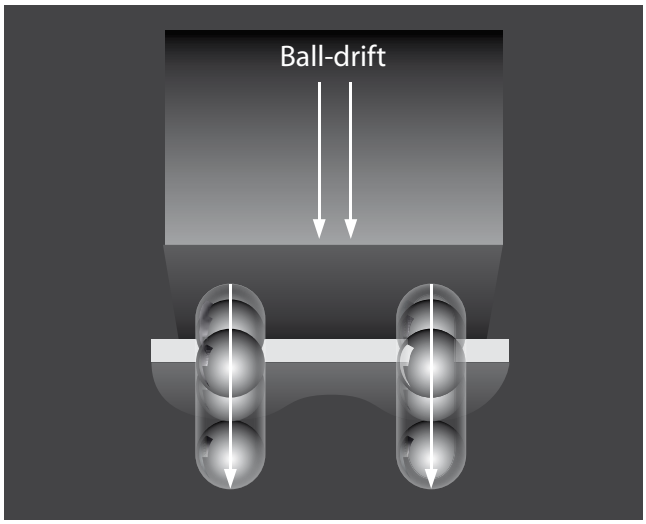


Fig. 6 Ball Drifting

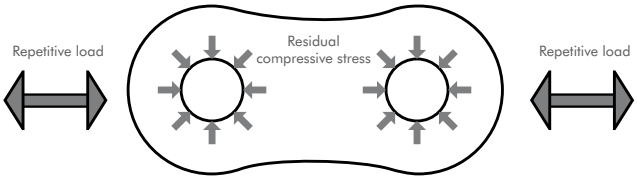


Fig. 7 Residual Compressive Stress

Ball drifting is the process of pressing a hardened steel ball through a hole in an already hardened steel plate (Fig. 6). The goal of this process is to create local plastic deformation and effectively add compressive stress (Fig. 7) to the walls of the hole. Besides this, the process generates precisely controlled holes for an optimum press fit. Together, this leads to significantly improved fatigue life (up to 30%).

8. Shot Peening Process

Shot peening is a process used to produce a compressive residual stress layer and modify mechanical properties of metals. It means impacting a surface with shot (round metallic or ceramic particles) with force sufficient to create plastic deformation.
At TSUBAKI, all basic chain parts (except pins) are shot peened.

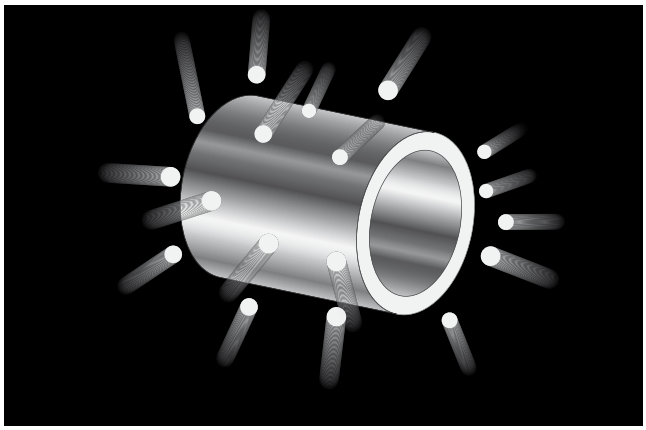


Fig. 8 Shot Peening

Shot Peening increases resistance to:

- fatigue failure
- corrosion fatigue
- hydrogen assisted cracking
- cavitation erosion
- stress corrosion cracking
- galling
- fretting

9. Pre-Loading Process

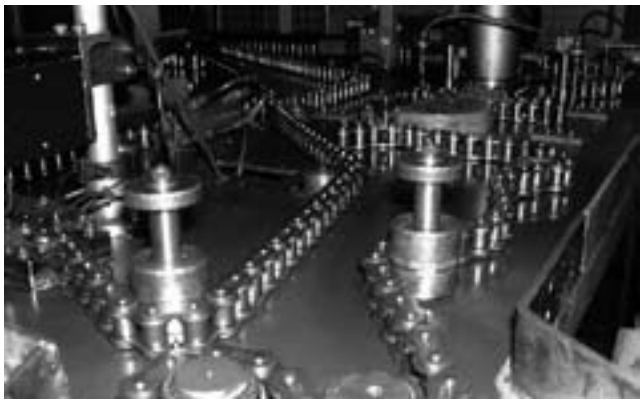
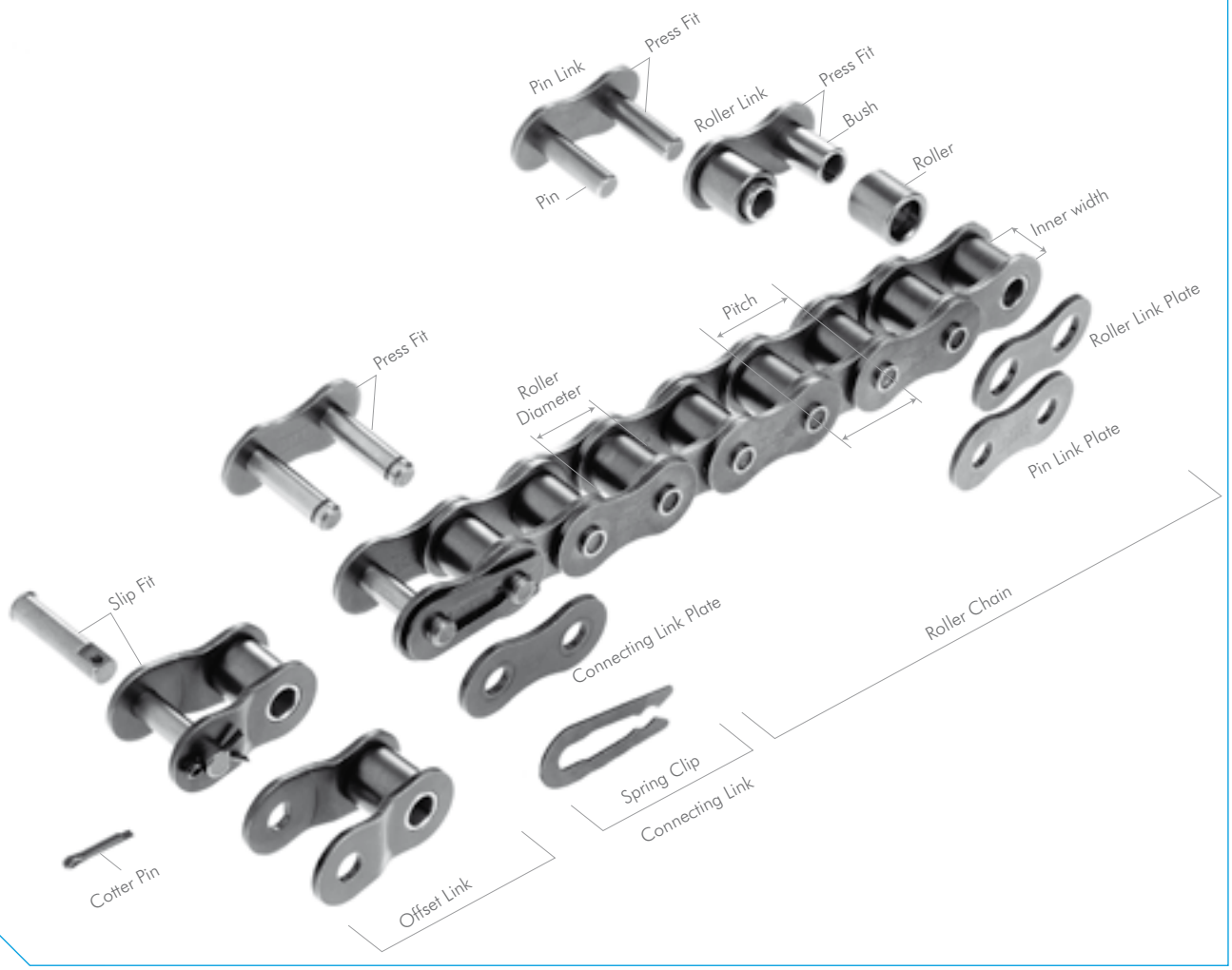


Fig. 9 Pre-Loading

After the assembly of a chain, TSUBAKI always applies an initial load, which is called a pre-load. The pre-load force approximates the recommended Maximum Allowable Load and is applied to seat the various chain components such as pins, bushes and link plates. The benefit of pre-loading is that it minimizes the initial elongation. Minimization of this initial elongation increases the chains service life therefore pre-loading is very important.

INTRODUCTION TO TSUBAKI ROLLER CHAIN

Roller Chain Structure



Roller Chain Structure

1. Three Basic Dimensions

Pitch, Roller Diameter and Inner Width are known as the "Three Basic Dimensions of Roller Chain." When these three dimensions are identical, roller chains and sprockets are dimensionally compatible.

2. Basic Parts

Link Plate

The plate is the component that bears the tension placed on the chain. Usually this is a repeated loading, sometimes accompanied by shock. Therefore, the plate must not only have great static tensile strength, it must also hold up to the dynamic forces of load and shock.

Pin

The pin is subject to shearing and bending forces transmitted by the plate. At the same time, it forms a load-bearing part (together with the bush) when the chain flexes during sprocket engagement. Therefore, the pin needs high tensile and shear strength, resistance to bending, and must also have sufficient endurance against shock and wear.

Bush

The bush is subject to complex forces from all parts, especially from the repetition of shock loads when the chain engages the sprocket. Therefore, the bush needs extremely high shock resistance. In addition, the bush forms a load-bearing part together with the pin and as such requires great wear resistance.

Roller

The roller is subject to impact load as it mates with the sprocket teeth during engagement of the chain with the sprocket. After engagement, the roller changes its point of contact and balance. It is held between the sprocket teeth and bush, and moves on the tooth face while receiving a compression load. Therefore, it must be resistant to wear and still have strength against shock, fatigue and compression. (RS25 and RS35 are bush chains and do not have rollers).

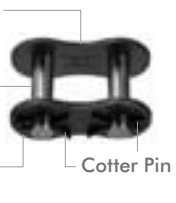
Roller Link

Two bushes are press fit into two roller link plates and rollers are

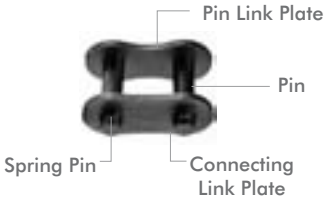
Connecting Links

Spring Clip Connecting Link

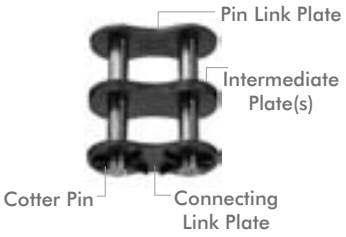
Cotter Pin Connecting Link



Spring Pin Connecting Link



Cotter Pin Connecting Link Multi-Strand (2-strand shown)



ONE Pitch Offset Links (OL)

Single Strand

Multi-strand (2-strand shown)

TWO Pitch Offset Links (2POL)

Single Strand

Multi-strand (2-strand shown)

inserted to allow rotation around the outside of the bushes during operation. This is the same for single and for multi strand chains.

Pin Link and Intermediate Plate

The pin link consists of two pins that have been press fit into two pin link plates. In case of multi-strand roller chain up till size 08B, an intermediate plate is added to the pin link. In case of multi-strand roller chain above size 08B, two intermediate plates are added to the pin link. The intermediate plates are slip fit for standard roller chain and press fit for SUPER roller chain.

3. Assembly Parts

Roller chains are usually made up of a number of inner and outer links in an endless formation. Although offset links can be used when there is an odd number of links in the roller chain, it is better to use a design that requires an even number of links. If an odd number of links cannot be avoided, it is recommended to use a two-pitch offset link in stead of a one-pitch offset link. As it is riveted into the chain, a two-pitch offset link has a 100% Maximum Allowable Load, where as the one-pitch offset link has a Maximum Allowable Load of 65%.

Connecting Links

There are three types of connecting links: spring clip connecting link, cotter pin connecting link and spring pin connecting link.

It's common to use slip fit spring clip connecting links for small size roller chains. Cotter pin and spring pin connecting links are used for large size roller chains and on customer request.

Offset Links

An offset link is used when an odd number of chain links is required. Different types are available:

One pitch offset link (OL).
The pin and two plates are slip fit. The fatigue strength is 35% lower than the chain itself.

Two pitch offset link (2POL).
Two pitch offset links are the combination of a roller link and an offset link connected with a rivet pin. The fatigue strength is the same as the fatigue strength of the base chain. Please refer to the dimension tables for roller chain types and sizes suitable for offset links.

ANSI CHAIN FOR CORROSIVE ENVIRONMENTS

Whether your operation requires a sanitary environment, is exposed to corrosive chemicals, is heated to extreme temperatures, runs through a freezer, is exposed to the outdoors or is affected by excessive moisture: our specially designed and tested chains will outlast your current chains and contribute to a cost effective application.

Corrosion Resistant Chain (Stainless Steel base)

ANSI PC Engineering Plastic Combination Chain

The pins and pin link plates of these chains are made of SUS304 (spring clips SUS301). Engineering Plastic (white) is used for the inner link. This combination makes it a lube-free, low noise (5 dB lower than ANSI standard roller chain) and lightweight chain (50% lighter than ANSI standard roller chain). Working temperature range: -10°C to +80°C. For details on corrosion resistance, please check out the table in the back of this catalogue as a basic guide.

ANSI SS Stainless Steel Chain

All basic components of this chain are made of Stainless Steel SUS304 (except the spring clips, which are made of SUS301). This chain can be used in special environments such as underwater, acidic and alkaline applications. It can also be used in high and low temperatures (-20°C to +400°C). SUS304 is only marginally magnetic, due to the cold-forging process. For details on corrosion resistance, please check out the table in the back of this catalogue as a basic guide.

ANSI AS Stainless Steel Chain

The pins and rollers of this roller chain are made of precipitation-hardened, tempered stainless steel (SUS600). The link plates and the bushes are made of SUS304 stainless steel (spring clips are SUS301). The Maximum Allowable Load is 1.5 times that of ANSI SS chain. Corrosion resistance is slightly lower than standard SS chain. This chain is suitable where corrosion and heat resistance is required in a heavy duty drive application and where a smaller ANSI SS chain is preferred. Magnetism exists due to the use of precipitation-hardened SUS600. The working temperature range: -20°C to +400°C.

Corrosion Protected Chain (Carbon Steel base)

ANSI N.E.P. New Environmental Plating Chain

ANSI N.E.P. Chain is a TSUBAKI ANSI G7 chain that has undergone a special surface treatment. The link plates, bushes and pins have a special three stage layer applied in order to provide the maximum protection from the operating or environmental conditions. (Spring clips are SUS301). N.E.P. Rollers have a special coating designed to resist the corrosive conditions as well as the severe dynamic contact between roller and sprocket.

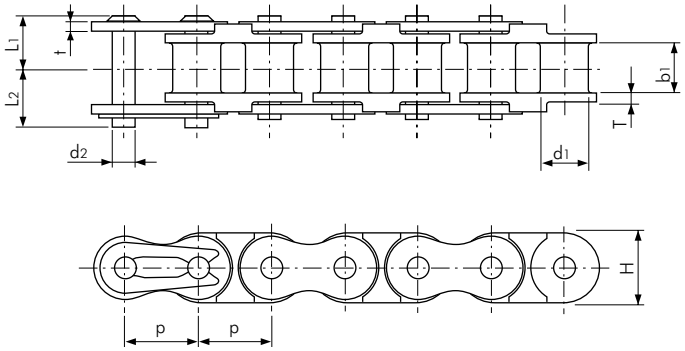
This chain is suitable for use in environments exposed to seawater, acid-rain and other adverse weather conditions. This chain does not contain any chemically hazardous substances such as Hexavalent Chromium, Lead, Cadmium and Mercury as regulated by RoHS√. The kilowatt ratings are the same as those of the corresponding ANSI G7 chain. Working temperature range is: -10°C to +150°C. Above +60°C a special high-temperature lubrication is required. Of course, ANSI LAMBDA N.E.P. chain is also available.

ANSI NP Nickel-Plating Chain

ANSI NP Chain is a TSUBAKI ANSI G7 chain that has been plated with Nickel. NP chain has a light corrosion resistance and an attractive appearance. NP chain is suitable for outdoor conditions exposed to water. There is a 15% reduction in Maximum Allowable Load compared to the corresponding ANSI G7 chain, so please take this into account when making your chain selection. The working temperature range is: -10°C to +60°C. Of course, ANSI LAMBDA NP chain is also available.

√RoHS = Restriction of Hazardous Substances

ANSI CHAIN FOR CORROSIVE ENVIRONMENTS



ANSI PC Chain

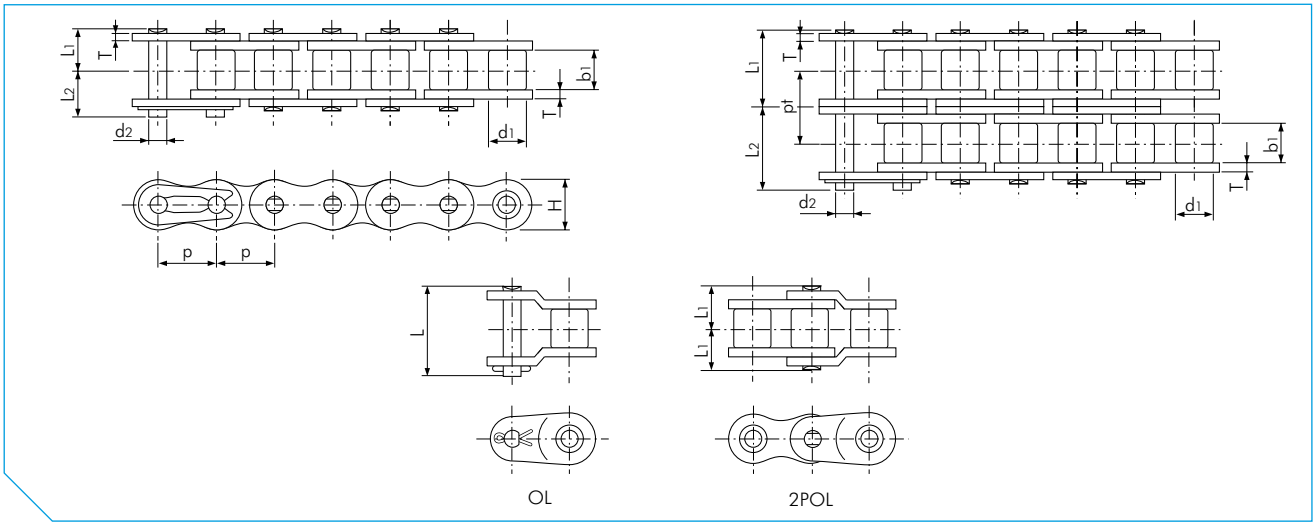
Dimensions in mm

TSUBAKI Chain No.	Pitch p		Bush Diameter d1	Inner Width b1	Pin Diameter d2	Pin Length L1	Pin Length L2	Link Plate Thickness T	Link Plate Thickness t	Link Plate Height H (max)	Max. Allowable Load acc. to Tsubaki kN	Approx. Mass kg/m
RF25-PC-1	6.35	(1/4")	3.30	3.18	2.31	4.50	5.50	1.30	0.75	6.00	0.08	0.10
RF35-PC-1	9.525	(3/8")	5.08	4.78	3.59	6.85	7.85	2.20	1.25	9.00	0.18	0.22
RF40-PC-1	12.70	(1/2")	7.92	7.95	3.97	8.25	9.95	1.50	1.50	12.00	0.44	0.39
RF50-PC-1	15.875	(5/8")	10.16	9.53	5.09	10.30	12.00	2.00	2.00	15.00	0.69	0.58
RF60-PC-1	19.05	(3/4")	11.91	12.70	5.96	12.85	14.75	2.40	2.40	18.10	0.88	0.82

Note:

1. Make sure to check the chain tension again when replacing Stainless Steel Chain with PC Chain.
2. Offset links are not available.
3. For details on corrosion resistance selection, please consult our Corrosion Resistance Guide in this catalogue.

ANSI CHAIN FOR CORROSIVE ENVIRONMENTS



ANSI SS Chain

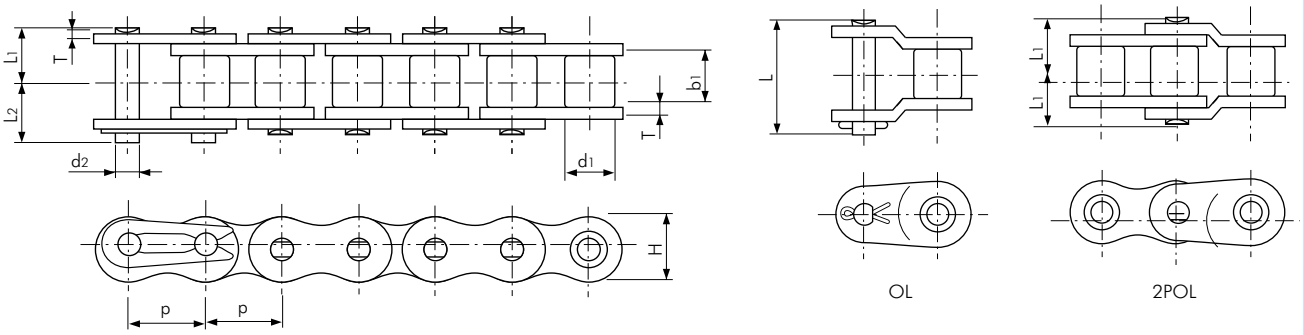
Dimensions in mm

TSUBAKI Chain No.	Pitch p		Roller Diameter d1	Inner Width b1	Pin Diameter d2	Pin Length L1	Pin Length L2	Pin Length L	Link Plate Thickness T	Link Plate Height H (max)	Transverse Pitch pt	Max. Allowable Load acc. to Tsubaki kN	Approx. Mass kg/m
RS11-SS-1	3.7465	(-)	2.285	1.83	1.57	2.275	3.165	-	0.38	3.50	-	0.05	0.052
RS25-SS-1	6.35	(1/4")	3.30	3.18	2.31	3.80	4.80	-	0.75	5.84	-	0.12	0.14
RS35-SS-1	9.525	(3/8")	5.08	4.78	3.59	5.85	6.85	14.70	1.25	9.00	-	0.26	0.33
RS35-SS-2						11.05	11.95	24.60			10.10	0.52	0.69
RS40-SS-1	12.70	(1/2")	7.92	7.95	3.97	8.25	9.95	18.60	1.50	12.00	-	0.44	0.64
RS40-SS-2						15.45	17.15	33.50			14.40	0.88	1.27
RS50-SS-1	15.875	(5/8")	10.16	9.53	5.09	10.30	12.00	23.90	2.00	15.00	-	0.69	1.04
RS50-SS-2						19.35	21.15	41.80			18.10	1.37	2.07
RS60-SS-1	19.05	(3/4")	11.91	12.70	5.96	12.85	14.75	29.40	2.40	18.10	-	1.03	1.53
RS60-SS-2						24.25	26.25	52.60			22.80	2.06	3.04
RS80-SS-1	25.40	(1")	15.88	15.88	7.94	16.25	19.25	39.00	3.20	24.10	-	1.77	2.66
RS80-SS-2						30.90	33.90	68.05			29.30	3.53	5.30
RS100-SS-1	31.75	(1 1/4")	19.05	19.05	9.54	19.75	22.85	46.50	4.00	30.10	-	2.55	4.01
RS100-SS-2						37.70	40.80	81.60			35.80	5.10	7.99

Note:

1. RS11-SS to RS35-SS are rollerless chain (only bush). The figure shown is the bush diameter.
2. Connecting links are clip type for sizes RS11-SS to RS60-SS, and cotter type for sizes RS80-SS to RS100-SS.
3. The rivet-type for single-strand and multi-strand chain above RS80-SS is quad-rivet.
4. For details on corrosion resistance selection, please consult our Corrosion Resistance Guide in this catalogue.

ANSI CHAIN FOR CORROSIVE ENVIRONMENTS



ANSI AS Chain

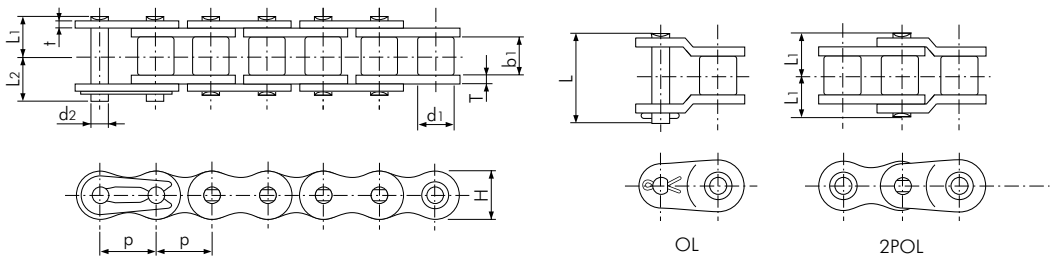
Dimensions in mm

TSUBAKI Chain No.	Pitch p		Roller Diameter d1	Inner Width b1	Pin Diameter d2	Pin Length L1	Pin Length L2	Pin Length L	Link Plate Thickness T	Link Plate Height H (max)	Max. Allowable Load acc. to Tsubaki kN	Approx. Mass kg/m
RS35-AS-1	9.525	(3/8")	5.08	4.78	3.59	5.85	6.85	14.70	1.25	9.00	0.26	0.33
RS40-AS-1	12.70	(1/2")	7.92	7.95	3.97	8.25	9.95	18.60	1.50	12.00	0.69	0.64
RS50-AS-1	15.875	(5/8")	10.16	9.53	5.09	10.30	12.00	23.90	2.00	15.00	1.03	1.04
RS60-AS-1	19.05	(3/4")	11.91	12.70	5.96	12.85	14.75	29.40	2.40	18.10	1.57	1.53
RS80-AS-1	25.40	(1")	15.88	15.88	7.94	16.25	19.25	39.00	3.20	24.10	2.65	2.66

Note:

1. Connecting links are clip type for sizes RS35-AS to RS60-AS, and cotter type for size RS80-AS.
2. RS35-AS is rollerless chain (only bush). The figure shown is the bush diameter.
3. For details on corrosion resistance selection, please consult our Corrosion Resistance Guide in this catalogue.

ANSI CHAIN FOR CORROSIVE ENVIRONMENTS



ANSI LAMBDA N.E.P. Chain

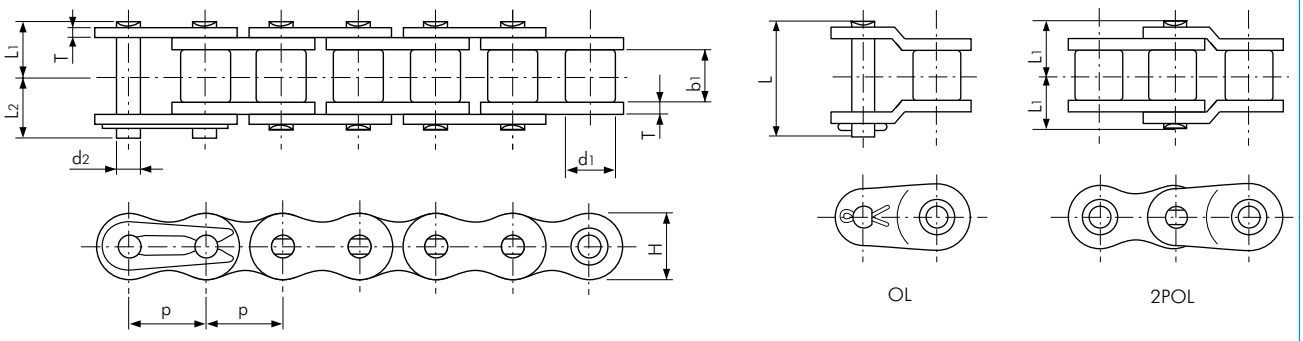
Dimensions in mm

TSUBAKI Chain No.	Pitch p		Roller Diameter d1	Inner Width b1	Pin				Link Plate			Min. Tensile Strength acc. to ANSI kN	Av. Tensile Strength acc. to Tsubaki kN	Approx. Mass kg/m
					Diameter d2	Length L1	Length L2	Length L	Thickness T	Thickness t	Height H (max)			
RS40-LMD-NEP-1	12.70	(1/2")	7.95	7.55	3.97	8.78	10.45	20.00	2.00	1.50	12.00	15.2	19.1	0.70
RS50-LMD-NEP-1	15.875	(5/8")	10.16	9.26	5.09	10.75	12.45	24.00	2.40	2.00	15.00	24.0	31.4	1.11
RS60-LMD-NEP-1	19.05	(3/4")	11.91	12.28	5.96	13.75	15.65	32.00	3.20	2.40	18.10	34.2	44.1	1.72
RS80-LMD-NEP-1	25.40	(1")	15.88	15.48	7.94	17.15	20.25	39.90	4.00	3.20	24.10	61.2	78.5	2.77
RS100-LMD-NEP-1	31.75	(1 1/4")	19.05	18.70	9.54	20.65	23.85	47.50	4.80	4.00	30.10	95.4	118.0	4.30
RS120-LMD-NEP-1	38.10	(1 1/2")	22.23	24.75	11.11	25.75	29.95	59.00	5.60	4.80	36.20	137.1	167.0	6.40
RS140-LMD-NEP-1	44.45	(1 3/4")	25.40	24.75	12.71	27.70	32.20	63.70	6.40	5.60	42.20	185.9	216.0	8.10

Note:

1. Connecting links are clip type for sizes RS40-LMD-NEP to RS60-LMD-NEP, and cotter type for sizes RS80-LMD-NEP to RS140-LMD-NEP.
2. Drive and Conveyor series LAMBDA chain cannot be intercoupled or interchanged.
3. Due to increased roller link plate thickness, Drive LAMBDA connecting links are required.
4. Due to increased roller link plate thickness, the pins are longer. Check for machine interference.
5. When a single pitch offset link is used, please calculate a 35% reduction in fatigue strength.

ANSI CHAIN FOR CORROSIVE ENVIRONMENTS



ANSI N.E.P. Chain

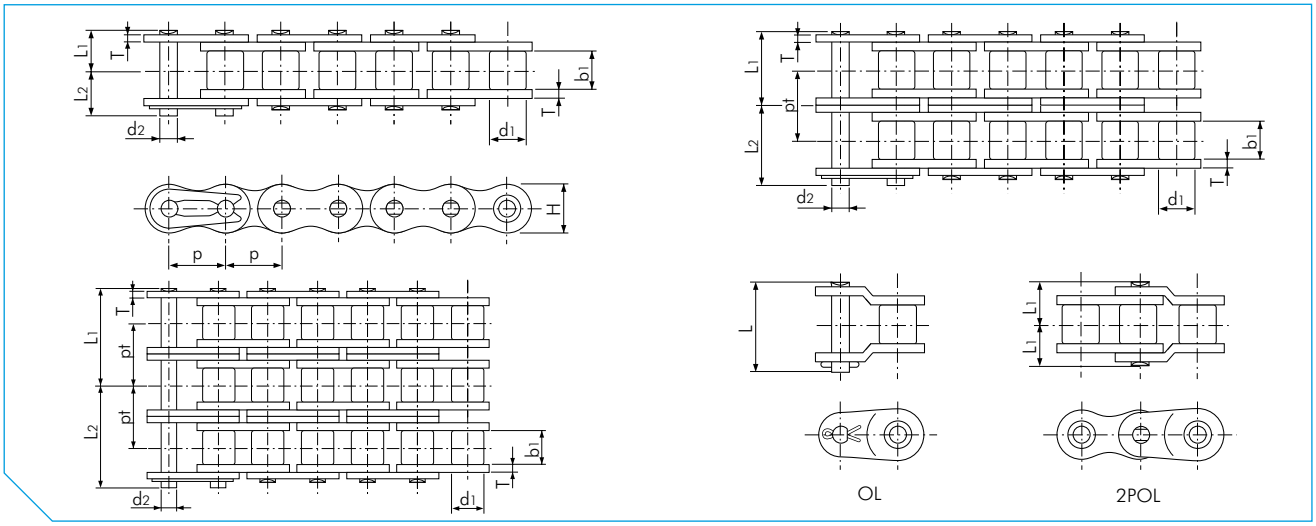
Dimensions in mm

TSUBAKI Chain No.	Pitch p		Roller Diameter d1	Inner Width b1	Pin Diameter d2	Pin Length L1	Pin Length L2	Pin Length L	Link Plate Thickness T	Link Plate Height H (max)	Min. Tensile Strength acc. to ANSI kN	Min. Tensile Strength acc. to Tsubaki kN	Av. Tensile Strength acc. to Tsubaki kN	Approx. Mass kg/m
RS35-NEP-1	9.525	(3/8")	5.08	4.78	3.59	5.85	6.85	13.50	1.25	9.00	8.7	9.8	11.3	0.33
RS40-NEP-1	12.70	(1/2")	7.92	7.95	3.97	8.25	9.95	18.00	1.50	12.00	15.2	17.7	19.1	0.64
RS50-NEP-1	15.875	(5/8")	10.16	9.53	5.09	10.30	12.00	22.50	2.00	15.00	24.0	28.4	31.4	1.04
RS60-NEP-1	19.05	(3/4")	11.91	12.70	5.96	12.85	14.75	28.20	2.40	18.10	34.2	40.2	44.1	1.53
RS80-NEP-1	25.40	(1")	15.88	15.88	7.94	16.25	19.25	38.20	3.20	24.10	61.2	71.6	78.5	2.66

Note:

1. Connecting links are clip type for sizes RS35-NEP to RS60-NEP, and cotter type for size RS80-NEP.
2. When a single pitch offset link is used, please calculate a 35% reduction of the fatigue strength.

ANSI CHAIN FOR CORROSIVE ENVIRONMENTS



ANSI NP Chain

Dimensions in mm

TSUBAKI Chain No.	Pitch p		Roller Diameter d1	Inner Width b1	Pin Diameter d2	Pin Length L1	Pin Length L2	Pin Length L	Link Plate Thickness T	Link Plate Height H (max)	Transverse Pitch pt	Min. Tensile Strength acc. to Tsubaki kN	Approx. Mass kg/m
RS25-NP-1	6.35	(1/4")	3.30	3.18	2.31	3.80	4.50	7.60	0.75	5.84	-	4.1	0.14
RS35-NP-1						5.85	6.85	13.50			-	9.8	0.33
RS35-NP-2	9.525	(3/8")	5.08	4.78	3.59	10.90	11.90	24.50	1.25	9.00	10.10	19.6	0.69
RS35-NP-3						16.00	16.90	34.60			10.10	29.4	1.05
RS40-NP-1						8.25	9.95	18.00			-	17.7	0.64
RS40-NP-2	12.70	(1/2")	7.92	7.95	3.97	15.45	17.15	33.50	1.50	12.00	14.40	35.3	1.27
RS40-NP-3						22.65	24.15	47.90			14.40	53.0	1.90
RS50-NP-1						10.30	12.00	22.50			-	28.4	1.04
RS50-NP-2	15.875	(5/8")	10.16	9.53	5.09	19.35	21.15	41.80	2.00	15.00	18.10	56.9	2.07
RS50-NP-3						28.40	30.20	59.90			18.10	85.3	3.09
RS60-NP-1						12.85	14.75	28.20			-	40.2	1.53
RS60-NP-2	19.05	(3/4")	11.91	12.70	5.96	24.25	26.25	52.60	2.40	18.10	22.80	80.4	3.04
RS60-NP-3						35.65	38.15	75.50			22.80	121.0	4.54
RS80-NP-1						16.25	19.25	36.00			-	71.6	2.66
RS80-NP-2	25.40	(1")	15.88	15.88	7.94	30.90	33.90	67.50	3.20	24.10	29.30	143.0	5.27
RS80-NP-3						45.60	48.50	96.90			29.30	215.0	7.89
RS100-NP-1	31.75	(1 1/4")	19.05	19.05	9.54	19.75	22.85	44.40	4.00	30.10	-	107.0	3.99

Note:

1. RS25-NP to RS35-NP are rollerless chains (only bush). The figure shown is the bush diameter.
2. Connecting links are clip type for sizes RS25-NP to RS60-NP, and cotter type for size RS80-NP to RS100-NP.
3. When a single pitch offset link is used, please calculate a 35% reduction of the fatigue strength.

CORROSION RESISTANCE GUIDE

☆☆	Highly corrosion resistant
☆	Partially corrosion resistant
-	Unknown
×	Not corrosion resistant

Substance	Concentration	Temp. °C	AS	SS	PC
Acetic Acid	10%	20	☆☆	☆☆	☆☆
Acetone		20	☆☆	☆☆	☆☆
Alcohol			☆☆	☆☆	☆☆
Aluminum Sulfate	Saturation	20	-	☆☆	×
Ammonia Water		20	☆☆	☆☆	☆☆
Ammonium Chloride	50%	Boiling	-	☆	×
Ammonium Nitrate		Boiling	☆☆	☆☆	☆
Ammonium Sulfate	Saturation	Boiling	☆	☆☆	×
Beer		20	☆☆	☆☆	☆☆
Benzene		20	☆☆	☆☆	☆☆
Boric Acid	50%	Boiling	☆☆	☆☆	×
Butyric Acid		20	☆☆	☆☆	☆☆
Calcium Chloride	Saturation	20	-	☆	☆
Calcium Hydroxide	20%	Boiling	☆☆	☆☆	☆☆
Calcium Hypochlorite	11-14%	20	-	☆☆	×
Carbolic Acid			☆☆	☆☆	×
Carbon Tetrachlorite (dry)		20	☆☆	☆☆	☆☆
Chlorinated Water			-	-	-
Chlorine Gas (dry)		20	-	☆	×
Chlorine Gas (moist)		20	-	-	×
Chromic Acid	5%	20	☆	☆☆	-
Citric Acid	50%	20	☆☆	☆☆	×
Coffee		Boiling	☆☆	☆☆	☆☆
Creosote		20	☆☆	☆☆	×
Developing Solution		20	☆	☆☆	☆☆
Ethyl Ether		20	☆☆	☆☆	☆☆
Ferric Acid	50%	20	☆☆	☆☆	-
Ferric Chloride	5%	20	-	☆	×
Formalin	40%	20	☆☆	☆☆	×
Formic Acid	50%	20	☆☆	☆☆	-
Fruit Juice		20	☆	☆☆	☆☆
Gasoline		20	☆☆	☆☆	☆☆
Glycerol		20	☆☆	☆☆	☆☆
Honey			☆☆	☆☆	☆☆
Hydrochloric Acid	2%	20	-	-	-
Hydrogen Peroxide	30%	20	☆	☆☆	-
Hydrogen Sulfide (dry)			☆☆	☆☆	☆☆
Hydrogen Sulfide (wet)			-	-	-
Hydroxybenzene		20	☆☆	☆☆	-
Kerosene		20	☆☆	☆☆	×
Ketchup		20	☆☆	☆☆	☆☆
Lactic Acid	10%	20	☆	☆☆	☆☆
Lard			☆☆	☆☆	×
Linseed Oil	100%	20	☆	☆☆	☆☆
Malic Acid	50%	Boiling	☆☆	☆☆	☆☆
Mayonnaise		20	☆	☆☆	☆☆
Milk		20	☆☆	☆☆	☆☆

Key: AS: 600 AS Series PC: Poly-Steel Chain
SS: 304 SS Series

CORROSION RESISTANCE GUIDE

Substance	Concentration	Temp. °C	AS	SS	PC
Nitric Acid	5%	20	☆	☆☆	-
Nitric Acid	65%	20	-	☆☆	-
Nitric Acid	65%	Boiling	-	☆	-
Oil (Plant, Mineral)		20	☆☆	☆☆	☆☆
Oleic Acid		20	☆☆	☆☆	☆☆
Oxalic Acid	10%	20	☆	☆☆	-
Paraffin		20	☆☆	☆☆	☆☆
Petroleum		20	☆☆	☆☆	☆☆
Phosphate			☆☆	☆☆	×
Phosphoric Acid	5%	20	☆	☆☆	-
Phosphoric Acid	10%	20	☆	☆	-
Picric Acid	Saturation	20	☆☆	☆☆	×
Potassium	Saturation	20	☆	☆☆	×
Potassium Bichromate	10%	20	☆☆	☆☆	☆☆
Potassium Chloride	Saturation	20	☆	☆☆	×
Potassium Hydroxide	20%	20	☆☆	☆☆	☆☆
Potassium Nitrate	25%	20	☆☆	☆☆	☆☆
Potassium Nitrate	25%	Boiling	-	☆☆	×
Potassium Permanganate	Saturation	20	☆☆	☆☆	×
Sal Ammoniac	50%	Boiling	-	☆	×
Sea-Water		20	-	☆	☆
Soap-and-Water-Solution		20	☆☆	☆☆	☆☆
Sodium Carbonate	Saturation	Boiling	☆☆	☆☆	×
Sodium Chloride	5%	20	☆	☆☆	☆☆
Sodium Cyanide		20	×	☆☆	×
Sodium Hydrocarbonate		20	☆☆	☆☆	☆☆
Sodium Hydroxide	25%	20	☆☆	☆☆	☆☆
Sodium Hypochlorite	10%	20	-	-	-
Sodium Perchlorate	10%	Boiling	-	☆☆	×
Sodium Sulfate	Saturation	20	☆☆	☆☆	×
Sodium Thiosulfate	25%	Boiling	☆☆	☆☆	×
Soft Drink		20	☆☆	☆☆	☆☆
Stearic Acid	100%	Boiling	-	-	-
Sugar Solution		20	☆☆	☆☆	☆☆
Sulfuric Acid	5%	20	-	-	-
Sulfur Dioxide		20	-	☆☆	×
Synthetic Detergent			☆☆	☆☆	☆☆
Syrup			☆☆	☆☆	☆☆
Tartaric Acid	10%	20	☆☆	☆☆	☆☆
Turpentine		35	☆☆	☆☆	×
Varnish			☆☆	☆☆	×
Vegetable Juice		20	☆☆	☆☆	☆☆
Vinegar		20	-	☆	☆
Water			☆☆	☆☆	☆☆
Whiskey		20	☆☆	☆☆	☆☆
Wine		20	☆☆	☆☆	☆☆
Zinc Chloride	50%	20	-	☆	☆
Zinc Sulfate	25%	20	☆☆	☆☆	×

This table is intended only as a guide and TSUBAKI does not take responsibility for mishaps arising from its use.