1ST EDITION

METRIC ONLINE PRODUCT GUIDE

MECHANICAL COMPONENTS FOR ASSEMBLY AUTOMATION

misumiusa.com

MiSUMi

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WHY MISUMI?

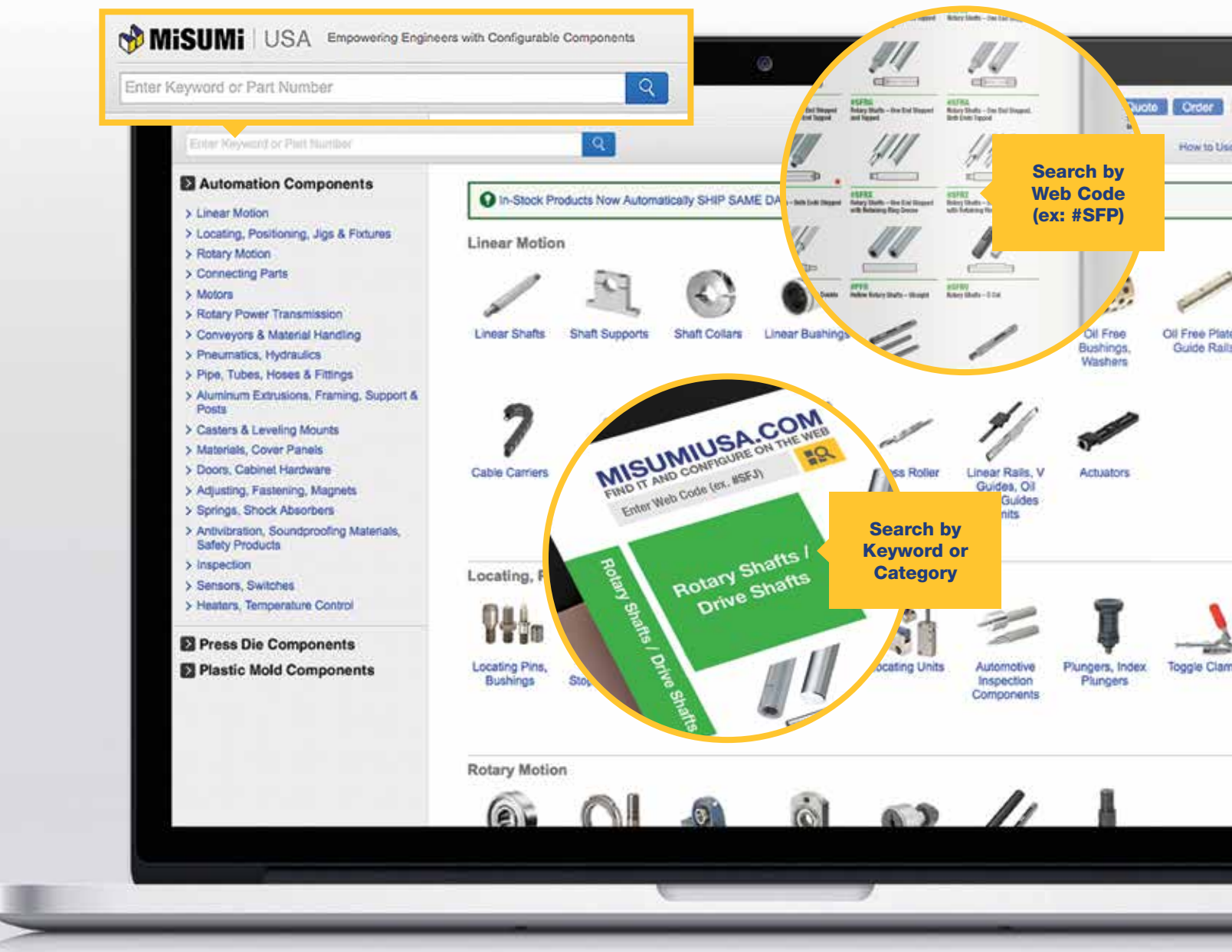
Our mission is to provide innovative configurable products that fulfill our customers' needs for high quality, competitive prices and short delivery times. MISUMI currently serves over 150,000 customers worldwide. MISUMI's products can be utilized in a diverse range of industries including automotive, medical, semiconductor, packaging and 3D Printing.

Find the product you're looking for easily & quickly on misumiusa.com.

Jump from paper to web by product type in seconds

MISUMI e-commerce makes it possible to find, configure, download CAD Data and place orders. Just type the product Web Code or Product Keyword.

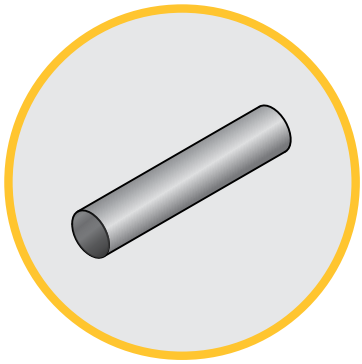
Insert Web Code or Keyword (ex: #SFP or Linear Shaft)



Configurable ordering made easy.

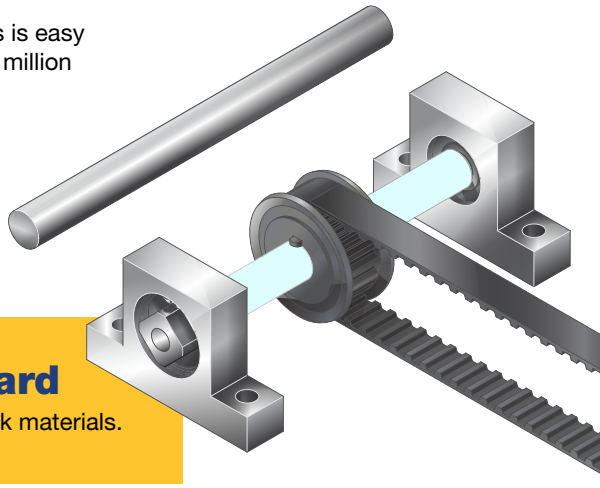
Only MISUMI offers a completely configurable choice.

Configuring your MISUMI components to your exact specifications is easy with our 3D CAD downloads, free engineering support, and over 9 million configurable components.



1

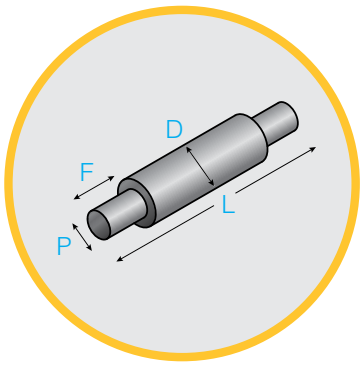
Select Part
Select Material



Standard

Off the shelf, stock materials.

vs.



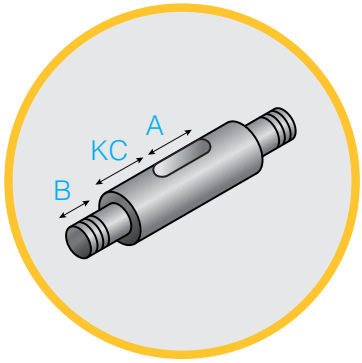
2

Configure Size
(Diameter,
Length, etc.)

Configurable

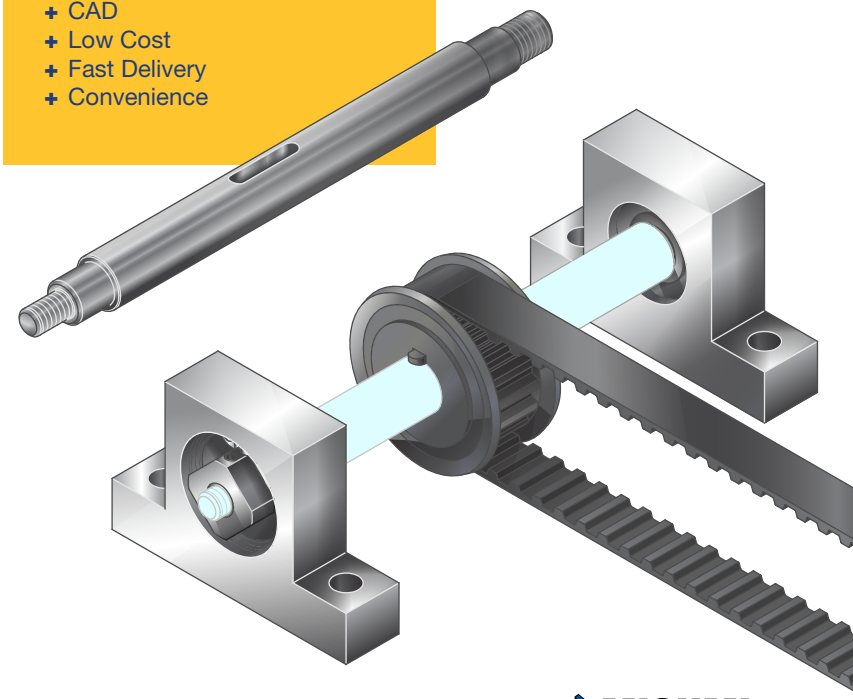
Only MISUMI offers:

- Flexibility
- Unlimited Selection
- Uncompromised Design
- Smart Universal Part Number
- CAD
- Low Cost
- Fast Delivery
- Convenience



3

Add Features
& Refine



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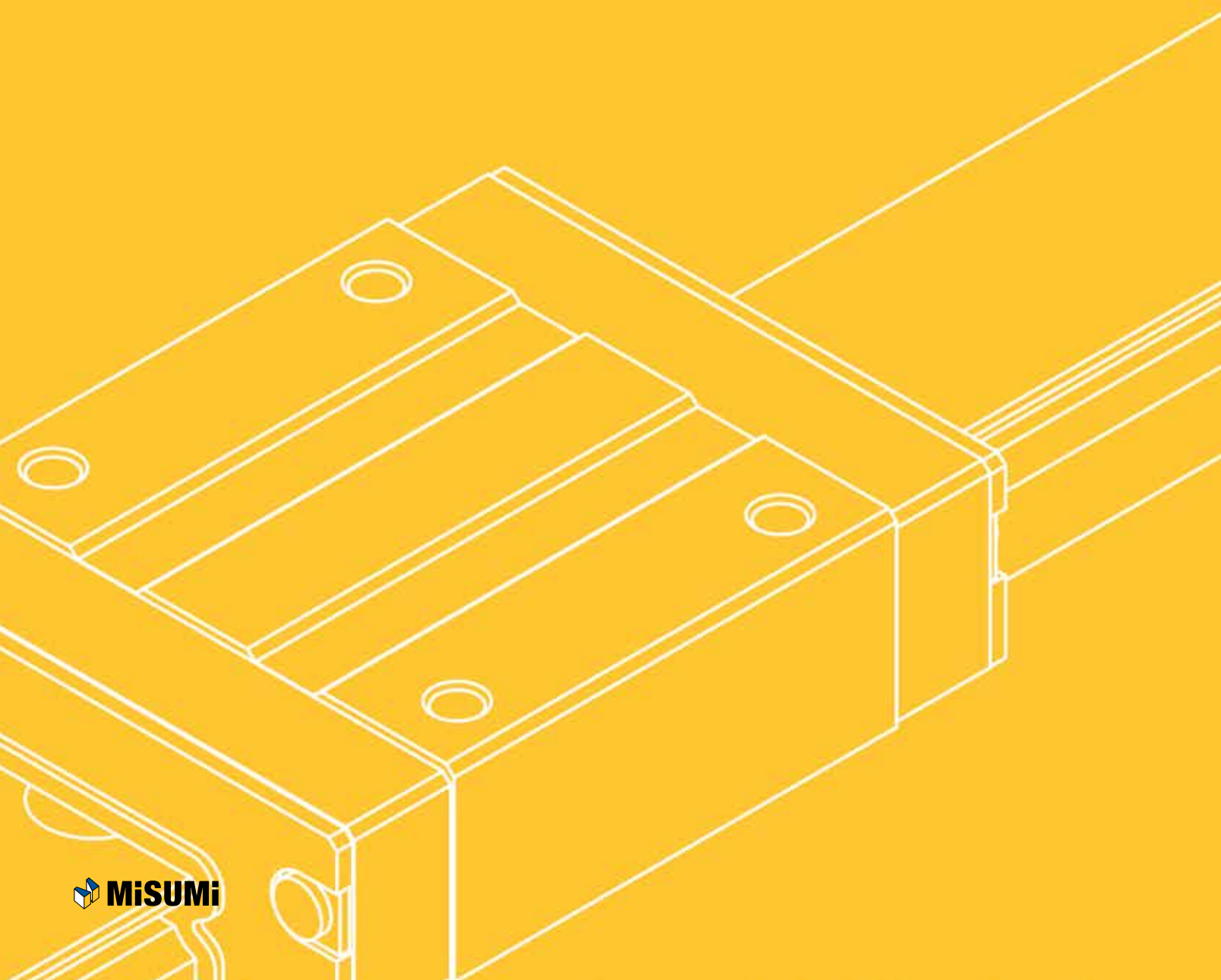
MISUMI USA has more than 9 million configurable components from which to choose, in as fine as 0.01mm. There are no minimum orders, no set up charges, free CAD downloads, and same day shipping on stock components.



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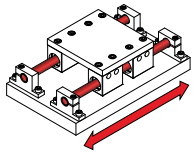
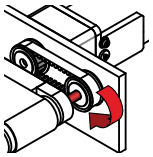
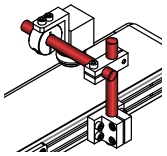
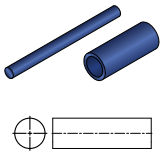
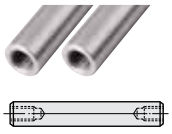
PRODUCT GROUPS

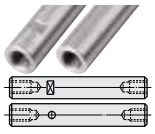
Product Name		Linear Shafts	Rotary Shafts	Standoffs	Rods
Page		pgs. 10–12	pg. 28	pg. 63	pgs. 71–72, 81–82
Usage/Picture					
Motion Type		Linear Motion	Rotary Motion	Structural, Support	General
Size		Ø3~50 mm	Ø2~50 mm	Ø5~50 mm	Ø0.3~80 mm
Max. Length (Max. length depends on shaft dia.)		1500 mm	800 mm	1000 mm	1000 mm
Dia. Tolerance		Ground g6/h5/f8	Ground g6/h6/h7 Drawn h9	0/-0.1mm	0/-0.1(0.2) ±0.1~0.4
Material	Carbon/Alloy Steel	•	•	•	•
	Stainless Steel	•	•	•	•
	Tool Steel	—	—	—	•
	Aluminum	—	—	•	•
	Brass	—	—	—	•
	Titanium	—	—	—	•
	Resin	—	—	—	•
Hardness		– Case Hardened – Unhardened	– Case Hardened – Through Hardened – Unhardened	– Unhardened	– Unhardened – Through Hardened
Cost $		$$$$	$$$	$$	$

Linear Shafts

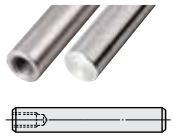
#SFJ
Straight



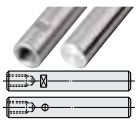
#SFJW
Both Ends Tapped



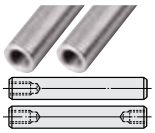
#SFHZ
Both Ends Tapped with Wrench Flats, Hole



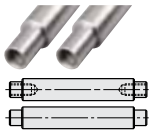
#SFJT
One End Tapped



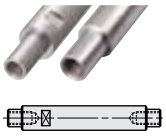
#SFHC
One End Tapped with Wrench Flats, Hole



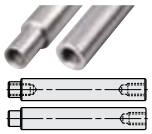
#SFAT
Full Length Case Hardened, One or Both Ends Tapped



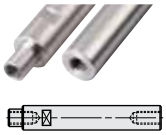
#SFAH
Both Ends Stepped and Tapped, Both Ends Stepped



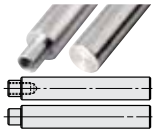
#SFHU
Both Ends Stepped and Tapped with Wrench Flats



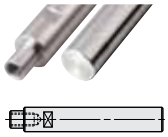
#SFAA
One End Tapped and One End Stepped/Stepped and Tapped



#SFUP
One End Stepped, Both Ends Tapped with Wrench Flats



#SFAC
One End Stepped and Tapped, One End Stepped



#SFPG
One End Stepped and Tapped with Wrench Flats

#SFAD
One End Threaded, One End Tapped

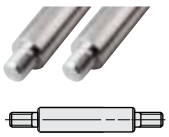
#SFAZ
One End Threaded, One End Tapped with Wrench Flats, Hole

#SAFD
One End Threaded with Undercut, One End Tapped

#SAFZ
One End Threaded with Undercut, One End Tapped – Wrench Flats, Hole

#SFAY
One End Stepped and Threaded, One End Tapped

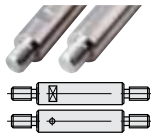
#SFAL
Straight and Both Ends Threaded



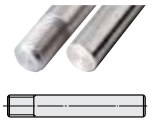
#SFAM
Both Ends Threaded

#SFAU
Both Ends Threaded with Wrench Flats, Hole

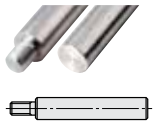
#SAFM
Both Ends Threaded with Undercuts



#SAFU
Both Ends Threaded with Undercut, with Wrench Flats, Hole



#SFAQ
Straight, One End Threaded



#SFAN ★
One End Threaded

#SFAS
One End Threaded, One End Tapped with Wrench Flats, Hole

#SAFN
One End Threaded with Undercut

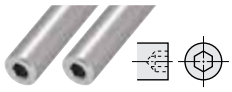
#SAFS
One End Threaded with Wrench Flats, Hole

#SFAF
One End Stepped and Threaded, Both Ends Stepped and Threaded

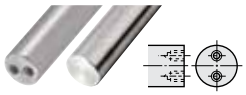
#SFAB
One End Threaded, One End Stepped/ Stepped and Tapped

#PSFC
Fully Plated

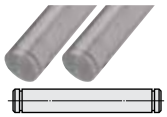
#SFJQ
Set Screw Grooves



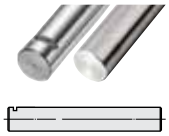
#SFBH
Hexagon Socket



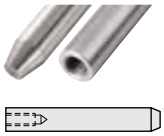
#SFDG
One End Two Tapped Holes



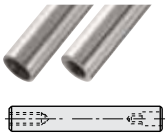
#SFAR
Retaining Ring Grooves on Both Ends



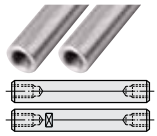
#SFAK
Key Groove on One End



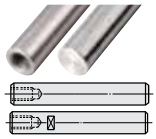
#SFLU
One End Tapered, One End Tapped



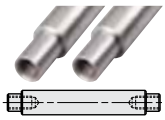
#SFIG
With Tapped Pilot



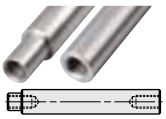
#VFJW ★
Both Ends Tapped with Wrench Flats – Precision



#VFJC ★
One End Tapped with Wrench Flats, Hole – Precision



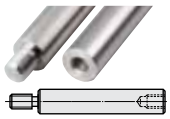
#VFAH
Both Ends Stepped and Tapped – Precision



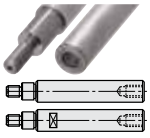
#VFAA
One End Stepped, Both Ends Tapped – Precision

#VFAG
One End Stepped and Tapped – Precision

#VFAZ
One End Threaded, One End Tapped – Precision

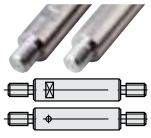


#VAFD
One End Threaded with Undercut, One End Tapped – Precision



#VFAD
One End Stepped and Threaded, One End Tapped – Precision

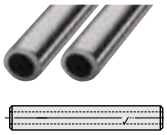
#VFBM
Both Ends Threaded with Wrench Flats – Precision



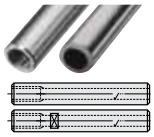
#VAFM
Both Ends Threaded with Undercut, with Wrench Flats – Precision

#VFBN
One End Threaded with Wrench Flats – Precision

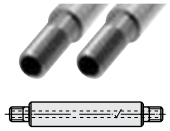
#VAFN
One End Threaded with Wrench Flats, Hole – Precision



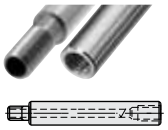
#SPJ
Pipe (Hollow) Shafts



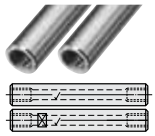
#SPJT
Hollow-One End Tapped with Wrench Flats



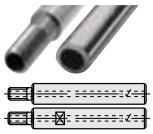
#SPJM
Hollow-Both Ends Threaded



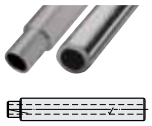
#SPJD
Hollow-One End Threaded, One End Tapped



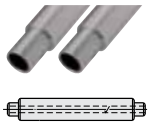
#SPJW
Hollow-Both Ends Tapped with Wrench Flats



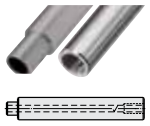
#SPJN
Hollow-One End Threaded, with Wrench Flats



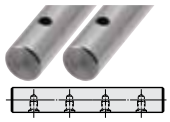
#SPJG
Hollow-One End Stepped



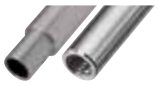
#SPJQ
Hollow-Both Ends Stepped



#SPJA
Hollow-One End Stepped, One End Tapped



#SFAE
Hollow-Continuous Support



#FSFJ
Hollow-One End Threaded, with Wrench Flats

#FSPJ
Hollow, Shaft End Shapes Specified

Shaft Supports

#ATHC
Flanged Mount, Thick Sleeve

#STHI
Flanged Mount with Pilot

#STHC
Flanged Mount with Dowel Holes

#STH1
Flanged Mount

#STH3
Flanged Mount with Pilot, Thick Sleeve

#STH2
Flanged Mount with Dowel Holes

★
#STHW
Flanged Mount, Clamp-On

#STH6
Flanged Mount with Pilot, Clamp-On

#STH5
Flanged Mount with Dowel Holes, Clamp-On

★
#STHM
Compact, Clamp

#STH4
Flanged Mount with Keyway

#STHX
Flanged Mount, Back Mount

★ ✓
#STHP
Flanged, Two Piece Clamp

★ ✓
#SHF
Flange Mount, Cast

★
#SHFL
Flange Mount, Cast, Long Sleeve

★ ✓
#SHA
T-Shaped Casting, Clamp-On

#SHAN
Wide T-Shaped Casting, Clamp-On

#SHT2
T-Shaped Casting

#SHTC
T-Shaped Casting, Side Clamp-On

#SHT3
Compact T-Shaped Casting, Side Clamp-On

#SHTD
Two-PieceT-Shaped Casting

#SHT4
Two-Piece Wide T-Shaped Casting

#SHTA
T-Shaped, Set Screw

#SHTB
T-Shaped, Wide

#SHST
T-Shaped, Clamp-On

#SHS3
Wide T-Shaped, Clamp-On

#SHWT
T-Shaped, Side Clamp-On

#SHW2
Wide T-Shaped, Side Clamp-On

#SHPT
Two-Piece T-Shaped

#SHP2
Two-Piece Wide T-Shaped

#SHM3
Compact, Standard

#SHMT
Compact, Wide

#SHMW
Compact, Standard, Side Clamp-On

#SHMP
Two-Piece Compact

#SHM2
Two-Piece Wide Compact

#SHS4
T-Shaped with Clamp Lever

#SHHT
T-Shaped, Hinged

#SHKH
L-Shaped, Hinged

#SHK2
L-Shaped

#SHK3
L-Shaped, Clamp-On

#SHK4
L-Shaped, Side Clamp-On

#SHKP
Two Piece L-Shaped

#SHKL
L-Shaped Cast

#SHKS
L-Shaped Cast, Clamp-On

#SHKW
L-Shaped Cast, Side Clamp-On

#SHKB
Two-Piece L-Shaped Cast

#SHBM
Bottom Mount

#SHB2
Bottom Mount, Wide

#SHSB
Bottom Mount, Clamp-On

#SHS2
Wide Bottom Mount, Clamp-On

#SHSP
Two-Piece Bottom Mount

#SHSN
Two-Piece Wide Bottom Mount

#SHSW
Bottom Mount, Side Clamp

#SHQB
Side Mount

#SHYA
Side Mount, Clamp-On

#SHUA
Side Mount, Side Clamp

#SHZA
Two-Piece Side Mount

Shaft Collars

#SCC
Set Screw

#SCS
One-Piece Clamp-On

#SCSP
Two-Piece Clamp-On

#SCD
One-Piece Clamp-On with Urethane

#SCSD
Two-Piece Clamp-on with Urethane

#SCS1
Plastic, One-Piece Clamp-on

#SCS3
Plastic, Two-Piece Clamp-on

#SCSA
Aluminum, One-Piece Clamp-on

#SCNP
Aluminum, Two-Piece Clamp-on

#SCBR
Set Screw, Short Shoulder (for Bearings)

★

#SCBN
Clamp-On, Short Shoulder (For Bearings)

#SCMN
Set Screw with 2 Holes

#SCSG
With Counterbored Holes

★

#SCSM
2 Tapped Holes

#SCST
3 Holes, 3 Tapped Holes

#SCS2
Two-Piece Clamp-on, with 2 Holes

#SCWM
Insert Lock, 2 Holes, Threads

#SCWD
With Clamp Lever, Wedge, D Cut

#SCWR
Insert Lock, 3 Holes, Threads

#SCWJ
With Clamp Lever, Wedge, Side Mounting Holes

#SCKL
With Clamp Lever, Standard

#SCDK
With Clamp Lever, D Cut

★

#SCJK
With Clamp Lever, Side Mounting Holes

#SDSN
D Cut, Set Screw

#SDS
D Cut, Compact, Clamp

#SDN
Two-Piece D-Cut

#SCJS
Side Mounting Holes, Clamp

#SCJP
Two-Piece Clamp-on with Side Mounting Holes

#SCJN
2-Flats, Cut Surface Mount Hole

#SCSH
Hinged

#SCPK
2-Flats, Cut Surface Mount Hole

#WSC
One Touch

#SCCN
Threaded I.D., Set Screw

#SCSN
Threaded I.D, Clamp-on

#SCKS
With Key Groove/Set Screw

#SCSK
With Key Groove, Clamp-on

Product Name	Linear Bushings	Oil Free Bushings	Ball Splines	Linear Guides
Page	pgs. 15–16	pgs. 18–19	pg. 17	pgs. 21–22
Usage/Picture				
Typical Usage	Provides smooth linear motion. Runs at higher speed than plain bushings. Used with hardened shafts.	Used for heavy loads in dirty enviroments. Can be used with hardened and unhardened shafts. Most don't require lubrication.	Use for high speed linear motion under high torsional loads.	Used for smooth and high accuracy motion under heavy loads and moment loads.
Motion Type	Linear*	Linear / Rotary	Linear	Linear
Size	Ø3–50 mm	Ø5–100 mm	Ø6–30 mm	Height 6–42 mm
Materials	– Steel – Stainless Steel	– Copper Alloys (Brass, Bronze) – Steel – Resins (PTFE, Polyacetal)	– Steel – Stainless Steel	– Steel – Stainless Steel
Available Coatings	– Electroless Nickel – Low Temperature Black Chrome	N/A	N/A	– Low Temperature Black Chrome
Load Capacity	Medium	Medium–High	Medium–High	High
Operating Temp.	-20 to 120 °C	-200 to 200 °C	-10 to 120 °C	Standard (-10 to 120 °C) Heat Resistant (-100 to 150 °C)
Accuracy	Medium	Low	Medium–High	Medium–High
Cost $	$$	$	$$$$	$$$$

Unit Conversions: °F = (°C * 1.8) + 32 (Example: °F = (100°C * 1.8) + 32 = 212°F)
*Stroke bushings can handle rotary motion

Linear Bushings

★

#LHFC
Flanged Linear Bushings – Single

★

#LHFW
Flanged Linear Bushings – Double

#LHIF
Flanged Linear Bushings with Pilot-Single

★

#LHIW
Flanged Linear Bushings with Pilot-Double

#LHMW
Flanged Linear Bushings – Center Flange

#LHRK
Compact, Single

#LHFD
Flanged Linear Bushings – Medium Lg.

#LHIC
Flanged Linear Bushings with Pilot, Medium Lg.

#LHMC
Flanged Linear Bushings – Medium Lg., Center Flanged

#LHKC
Flanged Linear Bushings, Long Lg.

#LHKM
Flanged Linear Bushings with Long Pilot, Long Lg.

★

#LMU
Linear Bushings – Standard, Single

★

#LMUW
Linear Bushings – Standard, Double

#LMUT
Linear Bushings – Short

#LMUD
Linear Bushings – Medium

#LMK
Linear Bushings – Compact, Single

#LHBB
Wide Pillow Block Bushings

#LHBBW
Long and Wide Pillow Block Bushings

#LHSS
Pillow Block Bushings

#LHSW
Pillow Block Bushings, Double

#LHSD
Pillow Block Bushings, Tall Block

#LHGS
Pillow Block Bushings, Wide Mount

#LHSL
Pillow Block Bushings with Clamp

#LHBBC
Wide Pillow Block Bushings with Clamp

#LHRC
Flanged Linear Bushings with Clamp Lever

#LCSC
Height Adjust Spacer for Linear Bushings

#LBS
Spacers for Linear Bushings

#LMST
Stoppers for Linear Bushings

#LMUM
Linear Bushings with MX Unit

#LHFX
Flanged Linear Bushings with MX Unit

#LHFM
Flanged Linear Bushings-Double w/ MX Unit

#LHMM
Flanged Linear Bushings w/ MX Unit-Center Flange

#LHIM
Flanged Linear Bushings w/ MX Unit- w/Pilot

#LHIX
Flanged Linear Bushings w/ MX Unit-Double Bushing w/ Pilot

#LHSM
Pillow Block w/MX Unit

#LHBM
Wide Pillow Block w/ MX Unit

#LBUS
Stroke Ball Bushings

#LBHR
Flanged Stroke Ball Bushings

Ball Guides

#BGZ
Miniature Ball Bearing Guide Sets

#BGA
Miniature Ball Bearing Guide Sets – One End Tapped

#BGY
Miniature Ball Bearing Guide Sets – Both Ends Tapped

#BGSZ
Miniature Ball Bearing Guide Sets – With Retaining Ring

#BGBP
Shafts for Miniature Ball Bearing Guides – Straight

#BGST
Miniature Ball Bearing Guide Sets – With Retaining Ring

#BGDP
Shafts for Miniature Ball Bearing Guides – One End Tapped

#BGEP
Shafts for Miniature Ball Bearing Guides – One End Threaded

#BGAP
Hollow Shafts for Miniature Ball Bearing Guides – One End Tapped

#BGFP
Shafts for Miniature Ball Bearing Guides – Both Ends Tapped

#BGHP
Shafts for Miniature Ball Bearing Guides – One End Threaded, One End Tapped

#BGCP
Hollow Shafts for Miniature Ball Bearing Guides – Both Ends Tapped Hollow

#BGB
Bushings for Miniature Ball Bearing Guides

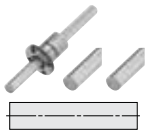
#BGHT
Flanged Bushings for Miniature Ball Bearing Guides

Ball Splines

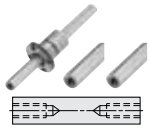
★

#BGS
Miniature Ball Bearing Guide Components – Ball Slider

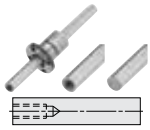
#BYS
Miniature Ball Bearing Guide – Ball Slider Compact



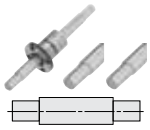
#BHSM
Ball Splines – Standard



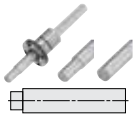
#BSHM
Ball Splines – Both Ends Tapped



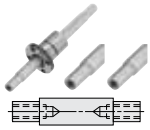
#BSFM
Ball Splines – One End Tapped



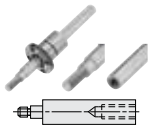
#BSJM
Ball Splines – Both Ends Stepped



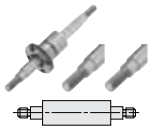
#BSDM
Ball Splines – One End Stepped



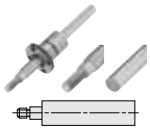
#BSLM
Ball Splines – Both Ends Stepped and Tapped



#BSBM
Ball Splines-One End Stepped and Threaded, One End Tapped



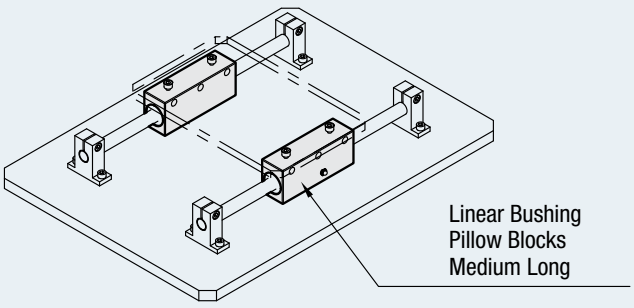
#BSYM
Ball Splines – Both Ends Stepped and Threaded

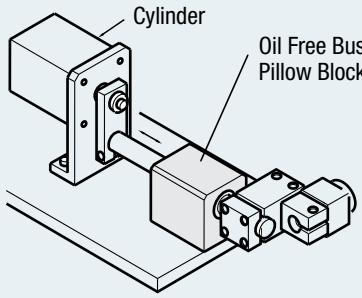


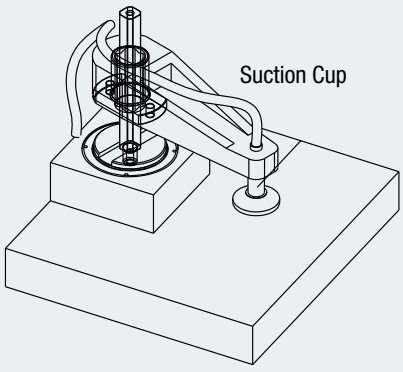
#BSKM
Ball Splines – One End Stepped and Threaded

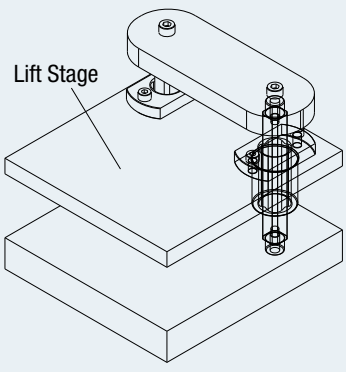
#RGPF
Needle Bearing Guide Sets

Example









Product Name		Copper Alloy (Bronze)		Copper Alloy (Brass)		Cast Iron		Multi-Layer (PTFE Filler)	Multi-Layer (Fluororesin Filler)	Resin (Polyacetal)	Resin (PTFE)
Usage, Picture											
Typical Usage		Best suited for high speed and low load applications when lubricated.		Best suited for high load and low speed applications.		Best suited for medium load and low speed applications.		Thin wall and light weight. Best suited for high load and low speed applications.	Thin wall and light weight. Best suited for high speed applications.	Light weight. Best suited for high speed and food applications.	Light weight. Best suited for high speed and food applications.
Lubrication Type		Grease	Oil	Grease	Oil	Grease	Oil	Lube Free	Lube Free	Lube Free	Lube Free
Rotation, Oscillating & Reciprocation Motion		•		•		•		•	•	•	•
Recommended Mating Shaft Tolerance		f8, g6		d8, e7, f8, g6		e7, h7, g6		f8	f8, h7, g6	h7, g6	g6
Operating Temp.		-40 to 150 °C		-40 to 150 °C	-40 to 200 °C	-40 to 150 °C		-195 to 280 °C	-50 to 140 °C	-40 to 80 °C	-200 to 200 °C
Load vs. Velocity	Allowable Load [N/mm²]	10.0		29.0, 98.0*		5.0	8.0	49.0, 137.0*	6.0	17.5	7.0
	Allowable Speed [m/s]	1.66	5.00	0.50	1.00	0.15	0.25	0.65	3.33	0.85	1.65
	Allowable PV Value [N/mm² * m/s]	1.65	3.25	1.65	3.25	0.50	0.80	3.60	0.98	2.45	1.00
Enviromental Conditions	Air	G		G		G		G	G	G	G
	Oil	G		G		G		G	P	G	G
	Water	P		P	—	P		A	P	A	G
	Seawater	P		P	—	P		P	P	A	G
	Chemicals	P		P	—	P		A	P	A	G
	Corrosive Atmosphere	P		A		P		A	G	A	G
Cost $		$$		$$		$$$		$	$$$$	$	$$

*Allowable static surface pressure (no sliding motion or extremely low speed)
Unit Conversions: 1. °F = (°C * 1.8) + 32 (Example: °F = (100°C * 1.8) + 32 = 212°F) 2. kgf = N x 0.10192

Good Acceptable Poor

Oil-Free Bushings / Washers

#MPBZ
Oil-Free Bushings – Copper Alloy, Standard, I.D. F7, O.D. m6

#MPFZ
Oil-Free Bushings – Copper Alloy, Flanged

#MPBU
Oil-Free Bushings – Copper Alloy, Thin Wall, I.D. F7, O.D. m6

#MPBR
Oil-Free Bushings – Copper Alloy, I.D. E7

#MPBP
Oil-Free Bushings – Copper Alloy, Standard, I.D. G6, O.D. h6

#MPFU
Oil-Free Bushings – Copper Alloy, Flanged, Thin Wall

#MPGZ
Oil-Free Bushings – Copper Alloy, Thrust

#MPTP
Oil-Free Bushings – Copper Alloy Standard, Flanged I.D. F7

#MPIZ
Flanged Oil-Free Bushings with Pilot

#MPCZ
Flanged Oil-Free Bushings – Center Flange

#MPWZ
Oil-Free Copper Alloy Washers

#SHBR
Oil-Free Bushings – Bronze, Straight, O.D. m6

#SHFZ
Oil-Free Bushings – Bronze, Flanged

#SHTZ
Oil-Free Bronze Bushings with Mounting Flange

#MFCK
Center Flanged Oil-Free Bushings – Double Bushing

#MFKL
Oil-Free Bushings – Flanged, Standard

#MFIK
Pilot, Flanged Oil-Free Bushings – Single Bushing

#MHUT
Oil-Free Bushing Pillow Block – Tall Block, Single Bushing

#MHUA
Oil-Free Bushing Wide Pillow Block – Single Bushing

#MHCT
Oil-Free Bushing Compact Pillow Block

#MHCA
Oil-Free Bushings Wide Pillow Block

#SMZ
Oil-Free Metal Bushings

#MDZB
Multi-Layer LF Bushings – Straight

#MHSR
Metal Bushings with Mounting Flanged

#MDZF
Multi-Layer LF Bushings – Flanged

#SMZH
Oil-Free Bushings – Casting, Flanged

#MDZW
Thrust Washers – Multi-Layer LF

#BFLB
Oil-Free Bushings – High Precision

#MDCA
Flanged Housings with Oil-Free Bushings

#MDBA
Wide Pillow Blocks with Oil-Free Bushings

#MDBC
Compact Pillow Blocks with Oil-Free Bushings

#MDWB
Tall Pillow Blocks with Oil-Free Bushings

#JZB
Oil-Free Bushings – Polyacetal Resin, Straight

#JZF
Oil-Free Bushings – Polyacetal Resin, Flanged

#JZW
Oil-Free Resin Washers

#TFZB
Oil-Free Bushings – PTFE Resin, Straight

#JFMA
Pillow Blocks with Resin Bushings

#TFZF
Oil-Free Bushings – PTFE Resin, Flanged

#JFBA
Flanged Housing Unit with Resin Bushings

Oil-Free Plates / Guide Rails

#GRR1
Guide Rails – Standard with Dowel Hole

#GRRM
Guide Rails – Steel, Oil Groove

#GRMZ
Guide Rails – Lubrication-Free Copper Alloy

#GRRP
Guide Rails – Plastic

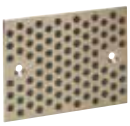
#GRRF
Guide Rails – Length and Screw Hole Pitch Configurable

#SGRM
Guide Rails – Oil-Free Copper Alloy

#GRMF
Guide Rails – Copper Alloy, Length and Screw Hole Pitch Configurable

#SLD
Guide Rails – Block

#STRL
Oil-Free Slide Plates – Copper Alloy (Top-Bottom Surface Ground)



#GRPZ
Oil-Free Slide Plates – Copper Alloy Configurable

#UTW
Oil-Free Slide Plates – Copper Alloy (Top-Bottom Surface Ground)

#STW
Oil-Free Slide Plates – Copper Alloy

#GRFZ
Oil-Free Slide Plates – Multi-Layer

#SGRA
Gibs

		HIGH ← PRECISION SPEED → LOW				
		LOW				HIGH
Product Name		Motorized Stages	LX Actuator	KU Actuator	RS Actuator	MSA Belt-Driven Actuator
Usage, Picture						
Typical Usage		Ideal for short positioning motions where high accuracy and repeatability are key.	High precision, compact linear motion unit.	High moment load, precision linear motion unit.	Fully integrated system with motor and controller.	Ideal for long stroke, fast motion and high acceleration.
Integrated Motor		Yes	Optional	Optional	Yes	Optional
Drive Mechanism		– Precision Ball Screw – Worm Gear	– Precision Ball Screw	– Rolled/Precision Ball Screw	– Rolled/Precision Ball Screw – Belt	– Belt
Pneumatic Options		No	No	Yes	No	No
Specifications	Positioning Repeatability	0.5 microns	3 to 5 microns	5 to 8 microns	10 to 40 microns	25 microns
	Stroke Range	13 to 50 mm	17 to 530 mm	130 to 610 mm	50 to 1,050 mm (Screw) 150 to 3,050 mm (Belt)	184 to 5,992 mm
	Max. Speed	10 mm/sec	1,040 mm/sec	1,550 mm/sec	1,800 mm/sec	15,000 mm/sec
	Actual Load/ Basic Load Ratings	Up to 10kg (Horizontal) Up to 5kg (Vertical)	Check Online for Sizing Software		Up to 80 kg (Horizontal) Up to 30kg (Vertical)	Up to 1,130kg (Horizontal) Up to 567kg (Vertical)

*NEMA/Metric Standard motor plates for LX, KU and MSA, can be specified to match your motor.

Linear Actuators




★

#ACLX
High Precision Ball Screw Actuators & Accessories






★

#ACRS
RS Actuators





NEW

#MSA
Belt Driven Actuators





NEW

NEW

#ACKU
High Moment Load Ball Screw Actuators

#MSG
Motorized Stages

#SV
Servo Motors & Drivers

#ST
Stepper Motors & Drives

Linear Guides

#REB
With Low Temperature Black Chrome Plating

#SEB ★
Standard Block, Light Preload

#SEBN ★
Standard Block with Dowel Holes

#SELB ★
Long Blocks

#SEL1
Long Block with Dowel Holes

#SEBS
Short Block

#SEB1
Short Block with Dowel Holes

#SEBM
Wide Block

#SELM
Wide Long Block

#SECB
Extra Long Block, Light Preload

#SEBW ★
Wide Rails, Standard Blocks, Light Preload

#SEB3 ★
Wide Rails, Standard Block with Dowel Holes

#SEB2
Wide Rails, Wide Block

#SELW
Wide Rails, Long Blocks, Light Preload

#SEL3
Wide Rails, Long Block with Dowel Holes

#SEL2
Wide Rails, Long Wide Block

#SVR
For Medium Load (Max Height 33mm)

#SRZL
For Medium Load, with Resin Retainers (Max Height 42mm)

#SXR ★
For Heavy Load (Max Height 33mm)

#SXRB
For Heavy Load with Resin Retainers (Max Height 42mm)

#SHRB
For Ultra Heavy Load with Resin Retainers (Max Height 42mm)

#SERB
For Super Heavy Load with Resin Retainers (Max Height 42mm)

#SSVR ★
For Medium and Heavy Load, Stainless Steel

#SSRZ
For Medium Load, Stainless Steel with Resin Retainer

#SSXR
For Heavy Load, Stainless Steel with Resin Retainer

#SSHR
For Ultra Heavy Load, Stainless Steel with Resin Retainer

#SVRN
For Medium Load, Dowel Hole

#SSEB
Heat Resistant

#SEBD
Dust Resistant Standard Blocks, Light Preload, Advanced Selectable L

#SVRD
For Medium Load, Dust Resistant

#SXRD
For Heavy Load, Dust Resistant

#SECK
Clamps for Miniature Linear Guides

#SVCK
Clamping Units for Medium/Heavy Load Linear Guides

#LGBE
Height Adjusting Blocks for Linear Guide, Economy

#BETA
Height Adjusting Blocks for Linear Guides

#GETA
Height Adjusting Blocks for Miniature Linear Guides

#SBLT
Stopper Bolts for Linear Guides

#SVP
Linear Guide Block Stopper Plates

#PSGL
Slide Guide Mounting Hole Caps (Pack)

#SGU
Linear Guide Lock Units

#LLT
Linear Locks

#LLTA
Simplified Linear Locks

#LLPU
Linear Guide Lock Plates, Threaded

#LLPL
Linear Guide Lock Plates, Grooved

#LLTG
Linear Lock Lock Units

#LLKA
Linear Guide Lock Plates, Counterbored

Cross Rollers

#CRT
Cross Roller Tables with Counterbored Holes and Tapped Holes

#CRU
Cross Roller Tables

#CRV
Cross Roller Guides

#BSG
Ball Slide Guides with Counterbored Holes and Tapped Holes

Telescopic Slide Rails

#SAR2
Telescopic Slide Rails – Aluminum Alloy, Light Load, Two Step

#SAR3
Telescopic Slide Rails – Light Load, Aluminum Alloy

#SRY2
Telescopic Slide Rails – Light Load

#SSRP
Telescopic Slide Rails – Light Load

#SRXY
Telescopic Slide Rails – Light Load, Three Step Slide

#SSRX
Telescopic Slide Rails – Light Load, Stainless Steel

#SR36
Telescopic Slide Rails – Medium Load, Steel, Two Step Slide

#SSRN
Telescopic Slide Rails – Medium Load, Stainless Steel, Two Step Slide

#SRX3
Telescopic Slide Rails – Medium Load, Steel, Three Step Slide

#SSR3
Telescopic Slide Rails – Medium Load, Stainless Steel, Three Step Slide

#SRR3
Telescopic Slide Rails with Lock Mechanism

#SRH1
Telescopic Slide Rails – Heavy Load, Three Step Slide

#SSRR
Telescopic Slide Rails – Stainless Steel with Lock Mechanism

#SSRH
Telescopic Slide Rails – Heavy Load, Stainless Steel, Two Step Slide

Slide Packs / V Guides / Linear Rails

#SROM
Simplified Slide Rails – Aluminum, Oil-Free

#KSRM
Simplified Slide Rails – Stainless Steel Retainer Sets

#RSR
Roller Slide Rails

#PLRC
Linear Slide Rails – Preload, Stainless Steel Bearing

#KSRL
Simplified Slide Rails – Aluminum with Ball Bearing

#KSR
Simplified Slide Rails – Aluminum, Bearing

#JKSC
Simplified Slide Rails – Aluminum Block and Rail with Ball Bearings

#BJKR
Simplified Linear Guides – Steel with Ball Rollers

#BVGH
V Guide Systems – Stainless Steel Wheel

#BVGB
V Guide Systems – Bushing

#BVGT
V Guide Systems – Track with Mounting Hole, L Configurable

#BVGR
V Guide Systems – Double Sided Tracks

#BVGU
V Guide System Units – Set

#MVH
V Guide Systems – 70° Wheels, Short

#MVR
V Guide Systems – 70° Wheels, Double Sided Track

Cable Carriers

#SE14
With Split Opening

#MHPK
Compact, No-Flaps

#MHPU
With Flaps and Mounting Brackets

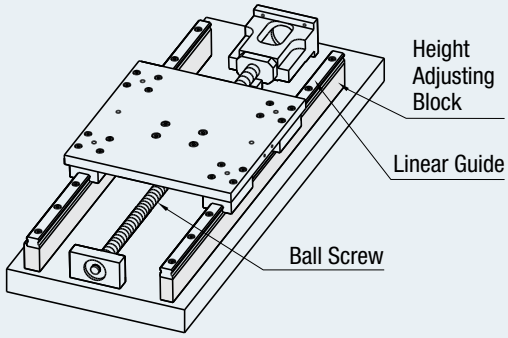
#FHPS
Fully Enclosed, with Flaps

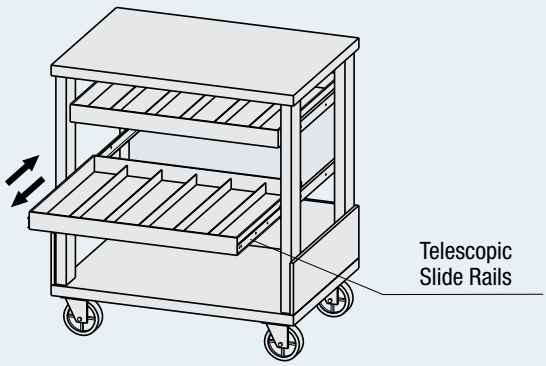
#MPSC
Low Particles, Low Noise

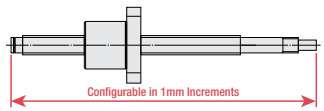
#FHP2
Low Friction, Low Noise

#CBC
Supporter Channels

Example





Screw Shaft Length	Screw Shaft Machined	Support Units
		

Screw Shaft Dia. (mm)		6	8			10			12				14	15			20			25				28	32	
Lead (mm)		1	1	2	4	2	4	10	2	4	5	10	5	5	10	20	5	10	20	5	10	20	25	6	10	32
Max. Length (mm)		205	255	400	380	585	600	585	445	800	450	800	800	1200			2000			2000		1500	2000	2000	2000	
Rolled Ball Screw				•	•	•	•	•		•		•	•	•	•	•	•	•	•	•	•		•	•	•	•
Precision Ground Ball Screw		•	•	•		•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•			
Accuracy Grade (C3,C5,C7,C10)		C3	C3	ALL	C10	C3 C5	C5 C7 C10	C10	C3 C5 C7	C5 C7 C10	ALL	C5 C7 C10	C10	ALL	C5 C7 C10		C5 C7 C10			C5 C7 C10			C10	C10	C10	
Support Unit (size)	Rolled Ball Screw	—	6			8, 8S			10,10S					12			15			20				20	25	
	Precision Ground Screw	6	8			8, 8S	10S	10	8 (10 for C3)	10S (8 for C3)			—	12			15			20				—	—	

EX: Accuracy vs. Price

Type	Ball Screw Size (mm)	Max. Length Available (mm)	Accuracy Grade	Axial Clearance (mm)	Price Level
Rolled	15 x 5	1200	C7	0.03 or Less	$
		1200	C10	0.10 or Less	$
Precision Ground	15 x 5	590	C3	0 (Preload)	$$$$
		1095	C5	0.005 or Less	$$$
		1095	C7	0.030 or Less	$$$

Ball Screws

#BC08
Rolled Ball Screw – Compact Nuts, Shaft Dia. 8, Lead 2

#BR08
Rolled Ball Screws – Shaft Dia. 8, Lead 2 or 4

#BC10
Rolled Ball Screw – Compact Nut, Shaft Dia. 10, Lead 4

#BR10
Rolled Ball Screw – Shaft Dia. 10, Lead 2, 4 or 10

#BC12
Rolled Ball Screw – Compact Nut, Shaft Dia. 12, Lead 4

#BR12 ★
Rolled Ball Screw – Shaft Dia. 12 or 14, Lead 4, 5 or 10

#BC15
Rolled Ball Screw – Compact Nut, Shaft Dia. 15, Lead 5, 10

#BR15
Rolled Ball Screw – Shaft Dia. 15, Lead 5, 10 or 20

#BC20 ★
Rolled Ball Screw – Compact Nut, Shaft Dia. 20, Lead 5, 10

#BR20
Rolled Ball Screw – Shaft Dia. 20, Lead 5, 10 or 20

#BC25
Rolled Ball Screw – Compact Nut, Shaft Dia. 25, Lead 5

#BR25
Rolled Ball Screws – Shaft Dia. 25, Lead 5, 10 or 25, C7 or C10

#BR28
Rolled Ball Screw – Shaft Dia. 28 or 32, Lead 6, 10 or 32

#BSBR
Rolled Ball Screw – Shaft Dia. 15, 20 or 25, Lead 5 or 10

#FBSS
Rolled Ball Screws – Shaft Ends Configurable, Standard Nuts

#BSS0
Precision Ball Screws – Shaft Dia. 6 or 8, Lead 1 or 2

#BS10
Precision Ball Screws – Shaft Dia. 10, Lead 2, 4 or 10

#BS12
Precision Ball Screws – Shaft Dia. 12, Lead 2, 4, 5 or 10

#BS15 ★
Precision Ball Screws – Shaft Dia. 15, Lead 5, 10, 20 or 40

#BS20
Precision Ball Screws – Shaft Dia. 20, Lead 5, 10, 20

#BS25
Precision Ball Screws – Shaft Dia. 25, Lead 5, 10, 20

#BNFA
Ball Screw Nut Brackets

Support Units

#BSW
Support Units – Fixed Side, Square

#BUN
Support Units – Square, Support Side, Standard

#BRW
Support Units – Fixed Side, Round

#BUR
Support Units – Round, Support Side, Standard

#BSQ
Support Units – Square, Fixed Side, Compact

#BSV
Support Units – Square, Fixed Side, Low Profile

#BSA
Support Units – Square, Fixed Side, 4 Mounting Holes

#BUQ
Support Units – Square, Support Side, Compact, Low Profile

#BUV
Support Units – Square, Support Side, Low Profile

#BUA
Support Units – Square, Support Side, Mounting Hole Narrow Pitch

#BSWD
Standard Units with Dampers – Fixed Side, Economy, Square

#BSWG
Support Units – Fixed Side, Square with Dowel Holes

#BUND
Support Units with Dampers – Support Side, Square

#BTN
Support Units – Square, Support Side Retaining Ring

#BSWE
Support Units – Fixed Side, Economy, Square

#BSWZ
Support Units – Fixed Side, Radial Bearing

#BRWE
Support Units – Fixed Side, Economy, Round

#BRWZ
Support Units with Radial Bearings – Fixed Side, Economy, Round

#BTR
Support Units – Round, Support Side Retaining Ring

#BJS
For Ball Screws and Motors

#BSTP
Stopper for Ball Screws

#BUSC
Spacers for Ball Screw Support Units

Product Name	Slide Screws	Lead Screws	Ball Screws
Page	pg. XX	pg. XX	pg. XX
Usage/Picture			
Max . Available Size (Dia x Length) (mm)	12 x 550 mm	50 x 1200 mm	32 x 2000 mm
Accuracy	Medium	Medium	High
Allowable Rotational Speed	Low Speed	Medium Speed	High Speed
Max Allowable Axial Load (Ref. Only)	540 N	30,000 N	9,960 N
Efficiency	0.7	0.8	0.95
Friction	High	High	Low
Grease	Not Required	Not Required	Required
Noise Level	Low	Low/Medium	High
Cost $	$$	$	$$$$

Lead Screws / Slide Screws

#MTWK
Lead Screw, Ends Fit Support Units

#MTWZ
Lead Screws – Fixed Side Support Units

#MTUZ
Lead Screws – Support Side Support Units

NEW
#MRWZ
Round Support Units – Fixed Side

NEW
#MRUZ
Lead Screw Support Units – Round, Support Side

★
#MTSC
Compact Flanged Lead Screw Nuts

#MTS5
Flanged Lead Screw Nuts with Pilot, Right-Hand Thread

#MTSJ
Flanged Lead Screw Nuts – Slotted Holes, Right-Hand Thread

#MTRF
Flanged Lead Screw Nuts – Fine Pitch

#MTSE
Flanged Lead Screw Nuts – with Tapped Holes, Right-Hand Thread

#MTBL
Lead Screw Nuts – Anti-Backlash

#MTSM
Oil-Free Lead Screw Nuts – Flanged

#MTSS
Lead Screw Nuts – Straight

★
#MTS3
Resin Lead Screw Nuts – Heavy Load

#MTSF
Resin Lead Screw Nuts

#MTSN
Block Style Lead Screw Nuts

#MTSH
Wide Block Lead Screw Nuts

#DNBA
Lead Screw Nut Brackets

#MTKL
Spacers for Wide Block

#MTS1 ★
Lead Screws – Multi-Pitch, Both Ends Stepped

#MTS4
Lead Screws – Right and Left-Hand Thread, Center h7, Both Ends Stepped

#MTSK ★
Lead Screws – One End Stepped, One End Double Stepped

#MTSA
Lead Screws – Right and Left-Hand Thread, Center h7, One End Stepped, One End Double Stepped

#MTSRA
Lead Screws – One End Stepped

#MTS2
Lead Screws – One End Double Stepped

#MTSX
Lead Screws – Both Ends Double Stepped

#MTSR ★
Lead Screws – Straight

#MTSW
Lead Screws – Straight, Right and Left-Hand Thread

#DPLL
Large Digital Positioning Indicators – Standard

#DPRL
Large Digital Positioning Indicators – Front

#DPZL
Large Digital Positioning Indicators – Vertical

#DPNL
Digital Positioning Indicators

#DPML
Digital Positioning Indicators – Front Display

#DPTL
Digital Positioning Indicators – Vertical Spindle

#DPQK
Clamp Plates for Large Positioning Indicators with Lever

#DPQB
Clamp Plates for Large Positioning Indicators with Lever and Bearing

#DPNK
Clamp Plates for Compact Positioning Indicator with Lever

#DPNB
Clamp Plates for Compact Positioning Indicator with Lever and Bearing

#MTQD
Stop Plate For Lead Screws

#MTQA
Stop Plates for Lead Screws – Round, Flanged

#MTSWB
Stop Plate Sets for Lead Screw – Two Screw Mount

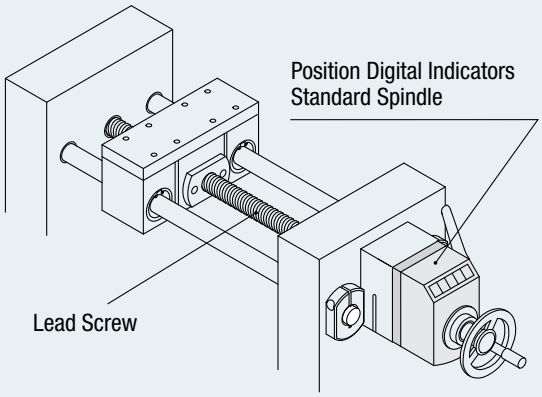
#MTSB
Stop Plates for Lead Screws – Square

#MSSA
Miniature Slide Screws with Nuts – One End Stepped

#MSSR
Miniature Lead Screws with Nuts – Straight

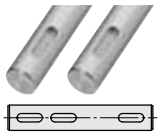
#MSSW
Miniature Slide Screws with Nuts – Both Ends Stepped

Example

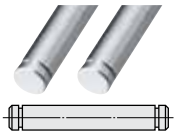


Rotary Shafts / Drive Shafts

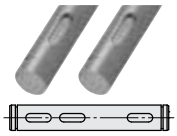
#HFR
Rotary Shafts – Straight



#SFGK
Rotary Shafts – Straight with Key Grooves

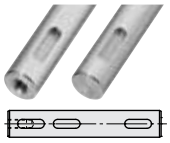


#SFRR
Rotary Shafts – with Retaining Ring Grooves



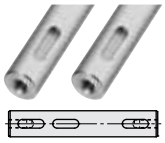
#SFGR
Rotary Shafts – with Retaining Ring Grooves and Key Grooves

#HFRT
Rotary Shafts – One End Tapped



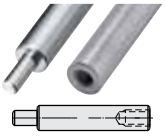
#SFGT
Rotary Shafts – One End Tapped with Key Grooves

#HFRW
Rotary Shafts – Both Ends Tapped



#SFGW
Rotary Shafts – Both Ends Tapped with Key Grooves

#HFRP
Rotary Shafts – One End Stepped



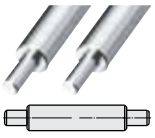
#SFRF
Rotary Shafts – One End Stepped, One End Tapped

#HFRN
Rotary Shafts – One End Stepped and Threaded

#SFRD
Rotary Shafts – One End Stepped and Threaded, One End Tapped

#SFRG
Rotary Shafts – One End Stepped and Tapped

#SFRA
Rotary Shafts – One End Stepped, Both Ends Tapped

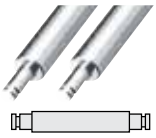


#HFRQ
Rotary Shafts – Both Ends Stepped

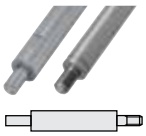
#HFRM
Rotary Shafts – Both Ends Stepped and Threaded

#SFRH
Rotary Shafts – Both Ends Stepped and Tapped

#SFRX
Rotary Shafts – One End Stepped with Retaining Ring Groove



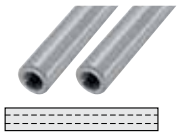
#SFRZ
Rotary Shafts – Both Ends Stepped with Retaining Ring Groove



#SFRE
Rotary Shafts – Both Ends Stepped, One End Threaded

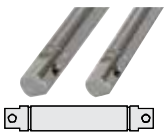
#SFRB
Rotary Shafts – Both Ends Stepped, One End Threaded, One End Tapped

#SFRJ
Rotary Shafts – Both Ends Double Stepped



#PFR
Hollow Rotary Shafts – Straight

#SFRV
Rotary Shafts – D Cut



#SFRT
Rotary Shafts for Tension

#SFMR
Rotary Shafts for Tension – Push, Pull

#SFR1
Rotary Shafts – End Shape Selectable

#KZAC
Drive Shafts – Straight

#KZBC
Drive Shafts – One End Stepped

#KZCC
Drive Shafts – Both Ends Stepped

#KZDC
Drive Shafts – One End Stepped, One End Double Stepped

#KZEC
Drive Shafts – Flanged

#KZFC
Drive Shafts – One End Stepped with Flange

Cantilever Shafts

#FXAA ★
Standard Shoulder, Threaded with Retaining Ring Groove

#FXBA
Stepped Shoulder, Threaded with Retaining Ring Groove

#LXAA
Hex Shoulder, Threaded with Retaining Ring Groove

#FXAB
Standard Shoulder, Threaded with Tapped End

#FXBB
Stepped Shoulder, Threaded with Tapped End

#LXAB
Hex Shoulder, Threaded with Tapped End

#FXAC
Standard Shoulder, Both Ends Threaded

#FXBC
Stepped Shoulder, Both Ends Threaded

#LXAC
Hex Shoulder, Both Ends Threaded

#FXCA
Standard Shoulder, with Pilot, Threaded with Retaining Ring Groove

#FXDA
Stepped Shoulder – Pilot, Threaded with Retaining Ring Groove

#LXCA
Hex Shoulder- Pilot, Threaded with Retaining Ring Groove

#FXCB
Standard Shoulder – Pilot, Threaded with Tapped End

#FXDB
Stepped Shoulder – Pilot, Threaded with Tapped End

#LXCB
Hex Shoulder – Pilot, Threaded with Tapped End

#FXCC
Standard Shoulder – Pilot, Both Ends Threaded

#FXDC
Stepped Shoulder – Pilot, Both Ends Threaded

#LXCC
Hex Shoulder – Pilot, Both Ends Threaded

#FXHA
Bolt Mount, Standard with Retaining Ring

#FXJA
Bolt Mount, Stepped with Retaining Ring Groove

#LXHA
Bolt Mount, Hexagon with Retaining Ring Groove

#FXHB
Bolt Mount, Tapped End

#FXJB
Bolt Mount, Stepped with Tapped End

#LXHB
Bolt Mount, Hexagon with Tapped End

#FXHC
Bolt Mount, Standard with Threaded End

#FXJC
Bolt Mount, Stepped with Threaded End

#LXHC
Bolt Mount, Hexagon with Threaded End

#FXMA
Heavy Load with Retaining Ring Groove

#FXMB
Heavy Load with Tapped End

#FXEA
Flanged with Retaining Ring Groove

#FXEB ★
Flanged with Tapped End

#FXFC
Flanged with Threaded End

#FXKA ★
For Tension, Threaded with Retaining Ring

#FXKB
For Tension, Threaded with Tapped End

Fulcrum Pins

#CBD
Standard Thread Length

#FCBD
Configurable Thread Length

#CBDW
Wrench Flats

#CBDR
Hex Socket

#CBDL
Hex Head

#CMSG
Low Head, Stepped

Hinge Pins

#CMG
Straight, Cotter Pins

#CCG
Straight, Retaining Rings

#HCMG
Flanged, Cotter Pin

#HCCG
Flanged, Retaining Ring

#CLBD
Flanged, Threaded with Lock Nut

#CLBR
Flanged, Hex Socket Head, Threaded with Lock Nut

#CLBK
Low Hex Socket Head, Threaded with Lock Nut

#HCLB
Flanged, Tapped

#CLB2
Flanged, Hex Socket Head, Tapped

#CLBM
Both Ends Tapped

#CLBN
Both Ends Threaded

#CLKG
With Keyway

#HPK
Keys

#CLSG
Straight with Set Screw Flat

#HCLS
Flanged, Set Screw Flat

#CLSW
Two Set Screw Flats, D-Cut

#FCLA
End Shape Selectable

#KCLB
D Tolerance Selectable

#CNPR
With Two Retaining Rings

#CNPP
With Two Retaining Rings, Tapped Ends

Product Name	Ball Bearings				Roller Bearings	Combination Bearings
	Deep Groove Ball Bearings	Self-Aligning	Angular Ball Bearings	Thrust Bearings	Needle Bearings	
Usage, Picture						
Bore Size (mm)	Ø3~50	Ø10~20	Ø10~50	Ø10~30	Ø4~30	Ø7~50
Load Capacity Radial	G	G	G	—	—	E
Load Capacity Axial	F	P	G	G	E	E
Speed	E	G	E	F	P	F
Accuracy Class	Class 0 (JIS) / ABEC-1 (ASTM)					

Excellent Good Acceptable Fair Poor

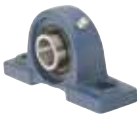
Bearings / Bearings with Housings / Accessories






★

#BGHS
Bearings with Housings – Block | Bearings with Housings – Flanged | Bearings with Housings – T-Shaped | Bearings with Housings – L-Shaped





✓

#BGPB
Pillow Block Bearings




★ ✓

#BRGS
Ball Bearings


#NDBG
Needle Bearings

✓

#CFRF
Cam Followers, Roller Followers

✓

#BGLN
Bearing Lock Nuts

#BGSS
Bearing Shaft Screws

#BGSR
Bearing Spacers

#BCO
Bearing Cover Plates

Product Name	Disc	Flex	Oldham	Jaw	Bellow	Rigid	Universal Joints	Chain Coupling
Usage, Picture								
Bore Size	Ø2~45 mm	Ø2~18 mm	Ø1~38 mm	Ø3~40 mm	Ø3~14 mm	Ø5~24 mm	Ø6~30 mm	Ø14~55 mm
Hybrid Couplings (Inch Bores)	Yes	Yes	Yes	Yes	No	Yes	No	No
Recommended Motor	– Servo Motor – Stepper Motor	– Servo Motor – Stepper Motor	– General Purpose Motor	– Stepper Motor – General Purpose Motor	– Stepper Motor	– Servo Motor – Stepper Motor	– Stepper Motor – General Purpose Motor	– General Purpose Motor
Torque	0.1 to 250 N·m	0.1 to 8 N·m	0.3 to 80 N·m	0.7 to 180 N·m	0.3 to 3 N·m	0.3 to 6 N·m	20 to 495 N·m	100 to 2372 N·m
Zero Backlash	E	E	P	P	G	E	P	P
Angular Misalignment	G	G	E	F	E	P	E	F
Lateral Misalignment	F	F	E	F	F	P	P	F
Axial Misalignment	G	F	G	P	E	P	P	P
Cost $	$$$	$$	$$	$$$	$$	$	$$	$$$$

Excellent Good Fair Poor

Shaft Couplings

#MCSL ★
High Torque Disc, Clamping (Double Disc)

#MCSS
High Torque Disc, Clamping (Single Disc)

#CPO
Oldham – Clamping/Set Screw

#CPOS
Spacer for Oldham Couplings (CPO, CPOC)

#CPCX ★
Flex – Clamping, Set Screw

#CPLX
Flex Duraluminum – Clamping Long

#CPLC ★
Flex-Clamping

#CPL
Flex-Set Screw

#CPDW
Disc, Clamping

#SCPS
High Rigidity Disc, Clamping

#SCXW
High Positioning Accuracy Disc, Clamping, Keyway

#CPSH
High Ridigity Disc, O.D. 65 mm, Clamping

#CPAH
High Ridigity Disc, O.D. 65 mm, Keyless, Clamping

#CPSW
High Ridigity Disc, O.D. 87mm, Keyway, Clamping

#CPSN
High Rigidity Disc, O.D. 87mm, One Side Keyless, Both Sides Keyless

#CPAS
High Rigidity Disc, O.D.40mm

#CPDD
Disc, Stepped, Clamping

#MCGL
Standard Torque Disc, Set Screw

#MCGC
Standard Torque Disc, Clamping

#MCKL
High Torque Disc, Set Screw

#MCKC ★
High Torque Disc, Clamping

#MCO
Oldham, Set Screw

#MCOS
Spacer for Oldham Couplings (MCO, MCOC)

#MCOC
Oldham, Clamping

#MCOG
High Rigidity, Oldham, Set Screw

#MCO1
High Rigidity, Oldham, Clamping

#MFJ
Oldham, Large Shaft Diameter

#MFJS
Spacer for Oldham Couplings (MFJ, MFJC)

#MFJG
Oldham – High Rigidity, Large Bore Sizes

#CPOC
Oldham – Blue/Green Spacer, Set Screw and Clamping

#SCOC
Super Short Oldham, Clamping

#CPF
Sleeve, Set Screw

NEW
#CPJL
Jaw, Spider

#CPJ
Jaw, Setscrew with Key Groove

#CPJC
Jaw, Clamping with Key Groove

#MMJN
Jaw, Clamping

#CPN
N Couplings (Keyless)

#BHE
Chain Couplings

#CPR
Rigid, Setscrew

#CPRC
Rigid, Clamping

#CPSR
Rigid, Two-Piece Clamping

#CPND
Rigid, One-Piece Long, Clamping

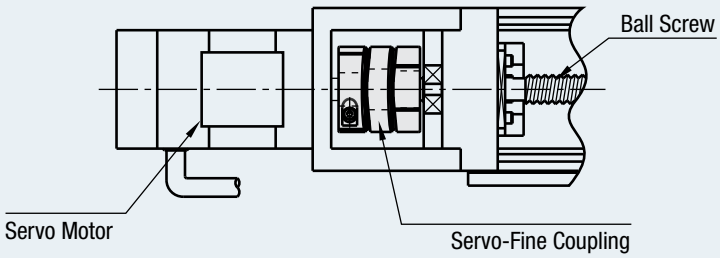
#UNCA
Universal Joints, Set Pin

#UNKA
Universal Joints – Keyway, Set Screw

#CPB ★
Bellows, Set Screw, Clamping

#MCJN
Resin

Example



Rollers




#CORO
Conveyor Rollers





★

#ROLE
Rollers





★

#ENGB
Bearings with Resin

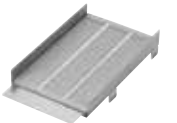




#BALR
Ball Rollers







#GURL
Guide Rollers

#COWH
Conveyor Wheels

#ROCR
Roller Carriers

#ROCV
Gravity Conveyors, Chutes





#ROLJ
Pipe Rollers with Shafts

#RORS
Precision Rollers

#USH
Rollers with Shafts – Urethane, Straight

#USRH
Rollers with Shafts – Urethane, Configurable Liner Thickness

#BWP
One-Sided Rollers



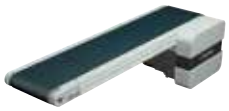

NEW

#TGR1
Vertical Guide Rollers – Metal

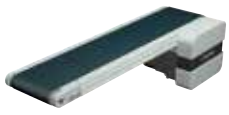
#TGRU
Vertical Guide Rollers – Urethane

#RONA
Belt Tensioners – Screw

#ROBJ
Belt Tensioners – Spring-Loaded

Type		Standard	Heavy Duty	Built-In Drive	Slim	Dual Track
Usage, Picture						
Size	Width	30 to 300 mm	100 to 500 mm	60 to 300 mm	10, 20mm	80 to 300 mm
	Length	200 to 3,000 mm	440 to 6,000 mm	370 to 2,000 mm	245 to 2,000 mm	255 to 3,000 mm
	Width Increment	1, 10 mm	100 mm	10 mm	—	1, 10 mm
	Length Increment	5 mm	5 mm	5 mm	5 mm	5 mm
Motor	Power	6, 25, 40 W	60, 90 W	3.5, 6 W	6 W	6, 25, 40 W
	Voltage	100,110, 115, 200, 220, 230V (Single Phase)		200, 220, 230V (Three Phase)	DC24V (Built-In Drive Only)	
	Speed	– Variable Speed – Constant Speed				
	Position	– End – Center	– End – Center	– Built-In	– End – Center	– End – Center
Belt Type		– Flat Belts – Guided Flat Belts – Cleated Belts	– Flat Belts – Guided Flat Belts	– Flat Belts	– Timing Belts	– Timing Belts – Plastic Chains
Recommended Load		Up to 15 kg	Up to 50 kg	Up to 15 kg	Up to 15 kg	Up to 35 kg

Belt Conveyors / Plastic Chain Conveyors

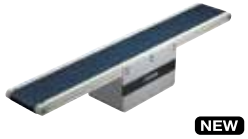


NEW ★

#SVKA
End Drive, 2-Groove Frame, Pulley Dia. 30 mm

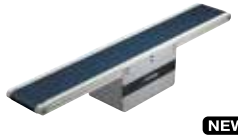
NEW ★

#SVKB
End Drive, Guided Belt, 2-Groove Frame, Pulley Dia. 30 mm



NEW

#SVKN
Center Drive, 2-Groove Frame, Pulley Dia. 30 mm

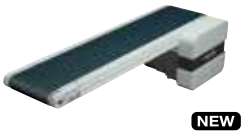


NEW

#SVKR
Center Drive, Guided Belt, 2-Groove Frame, Pulley Dia. 30 mm

NEW

#CVGA
End Drive, 2-Groove Frame, Pulley Dia. 30 mm



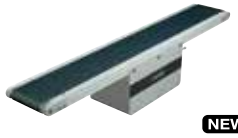
NEW

#CVGB
End Drive, Guided Belt, 2-Groove Frame, Pulley Dia. 30 mm

#CVGC
End Drive, 3-Groove Frame, Pulley Dia. 50 mm

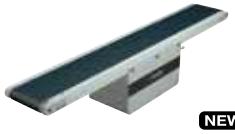
NEW

#CVGD
End Drive, Guided Belt, 3-Groove Frame, Pulley Dia. 50 mm



NEW

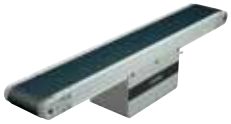
#CVGN
Center Drive, 2-Groove Frame, Pulley Dia. 30 mm



NEW

#CVGP
Center Drive, Guided Belt, 2-Groove Frame, Pulley Dia. 30 mm

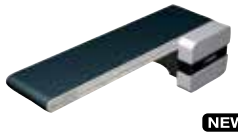
#CVGR
Center Drive, 3-Groove Frame, Pulley Dia. 50 mm



#CVGW
Center Drive, Guided Belt, 3-Groove Frame, Pulley Dia. 50 mm

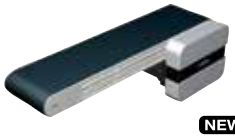
NEW

#CVSA
End Drive, 2-Groove Frame, Pulley Dia. 30 mm



NEW

#CVS3
End Drive, Guided Belt, 2-Groove Frame, Pulley Dia. 30mm



NEW

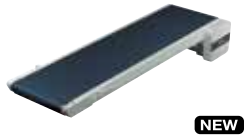
#CVS2
End Drive, 3-Groove Frame, Pulley Dia. 50 mm

NEW

#CVSD
Guided Belt, 3-Groove Frame, Pulley Dia. 50 mm

NEW

#CVSE
Heavy-Duty End Drive, 3-Groove Frame, Pulley Dia. 60 mm, 30 mm



NEW

#CVSF
Heavy-Duty End Drive, Guided Belt, Pulley Dia. 60 mm, 30 mm

NEW

#CVSX
Heavy-Duty Center Drive, 3-Groove Frame, Pulley Dia. 30 mm

NEW

#CVSY
Center Drive, Heavy-Duty, Guided Belt, 3-Groove Frame, Pulley Dia. 30 mm

NEW

#CVMA
Head Drive, 2-Groove Frame, Pully Dia. 30 mm

NEW

#CVMB
Head Drive with Meandering Prevention Crosspiece, 2-Groove Frame

NEW

#CVLP
Center Drive, 1-Groove Frame, Pully Dia. 15 mm

NEW

#CVSJ
Center Drive, Short Length, Guided Belt, 2-Groove Frame, Pulley Dia. 30 mm

★

#CVSM
Motor Integrated, 3-Groove Frame, Pulley Dia. 70 mm

NEW

#CVSB
Built-in Motor, 2-Slot Frame, Pulley Dia. 32 mm

NEW

#CVDS
End Drive, Guided Belt, 3-Slot Frame, Pulley Dia. 50 mm

NEW

#CVS4
Timing Belt, Center Drive, Belt Pitch Adjustable, Dual Track, 2-Slot Frame

NEW ★

#CVGT
Timing Belt, End Drive, Dual Track, 2-Groove Frame

NEW

#CVG2
Timing Belt, End Drive, Dual Track, 3-Groove Frame

NEW ★

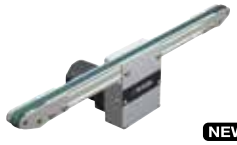
#CVG3
Timing Belt Conveyors, Center Drive, Dual Track, 2-Groove Frame

NEW

#CVG4
Timing Belt Conveyors, Center Drive, Dual Track, 3-Groove Frame

NEW

#CVST
Timing Belt, Head Drive, Single Track, 2, 3-Groove Frame



NEW

#CVSR
Timing Belt, Center Drive, Single Track, 2, 3-Groove Frame

NEW

#CVSC
Plastic Chain, Single Track, End Drive, 3-Slot Frame (Sprocket Dia. 57 mm)

#CVSP
Plastic Chain, Dual Track, End Drive, 3-Groove Frame (Sprocket Dia. 57 mm)

NEW

#CVSS
Stainless Steel Belt Conveyor, End Drive, 3-Groove Frame (Pulley Dia. 50 mm)

#FENB
Stainless Steel Sliding Plates

#FSRP
Product Chutes

NEW

#CSTP
Conveyor Stands Tube

NEW

#CSTS
Conveyor Stands, I-Type

NEW

#CSTW
Conveyor Stands, H-Type

#CGF
Conveyor Support Stands

NEW

#LGBR
Conveyor L-Type Mounting Brackets

NEW

#CTCA
Transparent Covers for Conveyor

NEW

#CGTA
Conveyor Work Benches Folding

NEW

#CHOP
Conveyor Hoppers

NEW

#CSHW
Conveyor Chute

NEW

#CSHRA
Angle Adjustment Bracket Single Article

NEW

#CDPT
Dust Pans

NEW

#CSTE
Stoppers

NEW

#CGNR
Transfer Rollers

NEW

#CGST
Conveyor End Tables

NEW

#CBRN
Conveyor Press Rollers – Small

NEW

#BFCB
Conveyor Sensor Brackets

NEW

#PCHN
Post-Assembly Insertion Nuts for Sensors

#CSAA
Conveyor Air Nozzle Stands

NEW

#HFSD
Conveyor Aluminum Extrusion

NEW

#CVBK
Conveyor Belt Support Cover K

NEW

#GPRF
Conveyor Belt Support Cover Reinforcements

NEW

#CHTD
Conveyor Drive Pulley

NEW

#CHRS
Conveyor Press Rollers, Standard

#NLBA
UHMW Guide Rails

#NLA
UHMW Guide Rail Shields

#NLTP
UHMW Tape

#RMT
Double-Sided Tape, Polyester

#SGL
Guide Rails

NEW

#CGPS
Conveyor Guide Rails – Straight

NEW

#CGPZ
Conveyor Guide Rails – Z-Type

NEW

#CGPY
Conveyor Guide Rails – Y-Type

NEW

#CGE
Engineering Plastic Rails – Adjustable with Slotted Holes

NEW

#CGVN
Guide Rail Brackets – Angle Bracket, Adjustable

NEW

#CGX
Conveyor Engineering Plastic Guide Rail Brackets – Standard

#CGY
Conveyor Engineering Plastic Guide Rail Brackets – Offset

#CGR
Round Bar Conveyor Guide Rails

NEW

#CGV
Round Bar Conveyor Guide Rail Brackets – Standard

NEW

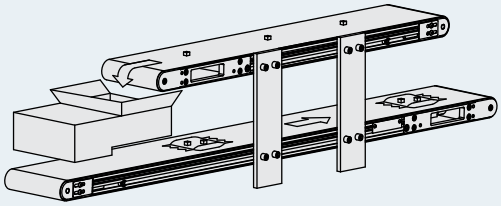
#CGW
Round Bar Conveyor Guide Rail Brackets – Offset

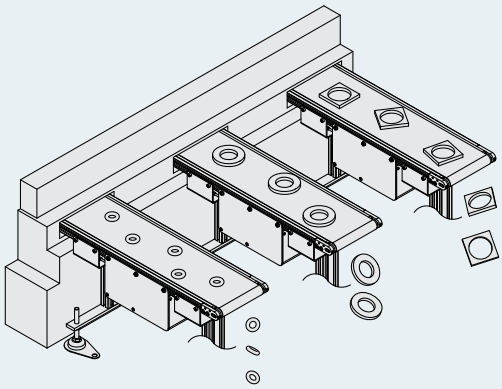
#CGL
Conveyor Guide Rails – L-Shaped

#CGK
Conveyor Guide Rail Brackets – Standard

#CGH
Conveyor Guide Rail Brackets – Offset

Example





Product Name	Friction Power Transmission		Synchronous Power Transmission	
	Flat Belts	Round Belts	Timing Belts	Chains
Usage, Picture				
Torque	Medium	Low	High	High
Speed	High	Medium	Low to High	Low–Medium
Efficiency	94–98%	92–97%	95–99%	91–98%
Advantages	– Flexible (serpentine and twisted drives) – Transmit torque over long distance – Various materials (polyurethane, rubber, stainless steel) and colors – No lubrication	– Flexible (serpentine and twisted drives) – Soft belts (typically don't require additional tensioning) – No lubrication	– Quiet compare to chains – Require less tension than other belts – No stretch – No lubrication – No slippage	– Higher operating temp. than belts – Increased load capacity with multi-strand chains – Long operating life – No slippage
Drawbacks	– Creep and slip – High tension needed – Endless belts can't be repaired – Extreme temp. ranges, high moisture, oil, chemicals, etc can damage belts	– Creep and slip – Endless belts can't be repaired – Extreme temp. ranges, high moisture, oil, chemicals, etc can damage belts	– Tensioning – Vibrations – Endless belts can't be repaired – Extreme temp. ranges, high moisture, oil, chemicals, etc can damage belts	– Noise – Require lubrication – Can elongate due to wear – Limited flexibility – Usually limited to lower-speed applications

Flat Belts / Pulleys

#HBPA
Flanged, Crowned, Press-fit Urethane

★
#HBG
Idlers for Flat Belts – Flanged, Crowned

#ROBA
Centering Groove, Crowned

★
#ROFC
Idlers for Flat Belts – Straight, Centering Groove, Crowned

#RBW
Economy, Straight, Crowned, Centering Groove

#RFW
Idlers for Flat Belts – Economy

#ROBW
Centering Groove, Crowned

#ROF1
Idlers for Flat Belts – Straight, Crowned, Centering Groove

#RWC
With Urethane, Centering Groove, Crowned

#RWBC
With Urethane, Centering Groove, Crowned

#HPCJ
Shaft Pulleys for Round Belts

#ROFA
Idlers for Flat Belts – Straight

#ROFW
Idlers for Flat Belts – Straight

★
#HBLT
Flat Belts – General Purpose

#FLTB
Flat Belts

Round Belts / Pulleys

★
#MBR
Pulleys for Round Belts – Setscrew

#MBRC
Pulleys for Round Belts – Clamping, U-Groove

★
#MBF
Idlers for Round Belts – Narrow

#MBG
Idlers for Round Belts – Wide

#MBWA
Pulleys for Round Belts – Double Grooves

#MBXA
Idlers for Round Belts – Double Grooves

#RNDB
Round Belts

Unit	Imperial Series (inch)				Metric Series (mm)						
Application	General				Light Load Conveyance	Heavy Load Conveyance	High Torque		Super High Torque		High Accuracy Positioning
Belt Type	MXL	XL	L	H	T5, T10	AT5, AT10	S2M–S14M	P2M–P8M	UP5M–UP8M	MTS8M	2GT–EV8YU
Pitch	0.800"	0.200"	0.375"	0.5"	5, 10 mm	5, 10 mm	2, 3, 5, 8, 14 mm	2, 3, 5, 8 mm	5, 8 mm	5 mm	2, 3, 5, 8 mm
Tooth Profile	Trapezoidal				Trapezoidal		Curvilinear Circular (S-Type)	Curvilinear with Dimple (R-Type)	Curvilinear Circular (S-Type)	Curvilinear with Dimple (R-Type)	Circular Round (H-Type)
Backlash	Medium				Medium	Low	Low*		Low*		Very Low
Endless Belt	•				•		•		•		•
Open End Belt	—	•			•		• (selected pitches)		—		—
Belt Material (Tension Cord)	Rubber (Glass Fiber)		—		Polyurethane (Steel Cord)		Chloroprene Rubber (Glass Fiber)		Chloroprene Rubber (Glass Fiber)	Rubber (Glass Fiber)	Chloroprene Rubber (Glass Fiber)
	Polyurethane (Kevlar/Steel Cord)						Polyurethane (Aramid Fiber) (S2M, S3M, S5M only)				
Typical Applications: Conveying	•				•	•	—	—	—	—	—
Typical Applications: Positioning	—				—	•	•	•	•	•	•
Typical Applications: Power Transmission	—				—	—	•	•	•	•	•
Typical Applications: High Speed	•				•	—	•	•	•	•	•

*MISUMI offers Special Zero Backlash S8M pulleys (For use with S-Type belts only)

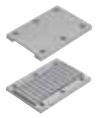
Timing Belts / Pulleys / Idlers / Accessories




★ ✓

#TIMP
Timing Pulleys, Idlers





✓

#TIMP
Timing Pulleys, Idlers

#TIMB
Timing Belts and Accessories

Conveyer Timing Belts


#ATBT
Timing Belts with Attachments – T5/T10

#LTBJ
Long Timing Belts – Configurable No. of Teeth

Keyless Bushing

#MLN
Keyless Bushings – Easy Mounting (Nut)

★

#MLSL
Keyless Bushings – Thin Wall

★ ✓

#MLM
Keyless Bushings – Standard

★

#MLA
Keyless Bushings – Straight

#MLAT
Keyless Bushings – Straight for High Torque

✓

#MLR
Keyless Bushings – Compact

Product Name	Spur Gears	Helical Gears	Bevel Gears	Gear Racks	Worm Gears
Usage, Picture					
Efficiency	94–98%	94–98%	93–99%	98–99%	30–90%
Gear Axis	Parallel	Parallel and Intersecting Axis	Intersecting Axis	Non-Intersecting and Non-Parallel Axis	Non-Intersecting and Non-Parallel Axis
Advantages	– Highly reliable, simplest in design and easiest to manufacture – Offer constant velocity ratio and are more efficient than helical gear of same size – Spur gear teeth are parallel to its axis and do not produce axial thrust – Used in efficient power transfer and low speed application (robotics application, machine tools etc.)	– Run more smoothly and quietly than spur gears due to angled teeth desiged – Highly durable and are ideal for high-load applications – Load is distributed over several teeth, resulting in less wear – Used in high-speed, high-power mechanical systems like car gear boxes, machine tools, etc.	– This gear makes it possible to change the operating angle – Can be with straight or spiral teeth – Miter gears are a special type of bevel gear designed to operate in pairs with identical numbers of teeth and diametral pitches, and a 1:1 ratio – Transmission, Bevel Gear Differencial, Printing, Material Handeling	– Cheap – Compact – Robust – Easiest way to convert rotation motion into linear motion – Often used in traveling gantries and columns, pick and place robots etc.	– Worm gear drives operate silently and smoothly – Self-locking and occupy less space – Have high velocity ratio – Used for reducing speed and increasing torque (gear reduction boxes)
Disadvantages	– Gear teeth experience a large amount of stress – Cannot transfer power between non-parallel shafts – Compared to other gears, generate more noise at high speeds	– More expensive than spur gears – Mashed helical gears create axial trust that need adequate support (like trust bearings) – Lower efficiency due to axial trust generating more heat between sliding teeth	– One wheel of bevel gear is designed to work with its complementary wheel and no other – Must be precisely mounted – The shafts' bearings must be capable of supporting significant forces – Noisy at the higher speeds	– Inherent friction causes constant wear and part replacment after certin time	– Worm gear materials are expensive – Worm drives have high power losses – They produce a lot of heat

Gears

#GEAH
Spur Gears – with Pilot Bore

#GEAB
Spur Gears – Pressure Angle 20 Deg., Module 0.5

#GEA1
Spur Gears – Pressure Angle 20 Deg., Module 0.8

★
#GEA2
Spur Gears – Pressure Angle 20 Deg., Module 1.0

#GEA3
Spur Gears – Pressure Angle 20 Deg., Module 1.5

#GEA4
Spur Gears – Pressure Angle 20 Deg., Module 2.0

#GEA5
Spur Gears – Pressure Angle 20 Deg., Module 2.5

#GEA0
Spur Gears – Pressure Angle 20 Deg., Module 3.0

#GEFB
Spur Gears – Tooth Width, Hub Dimension Configurable, Pressure Angle 20 Deg.

#GEA6
Induction Hardened Spur Gears – Pressure Angle 20 Deg.

#GEYH
Bonded Plastic Spur Gears

#GEAM
Plastic Spur Gears – Pressure Angle 20 Deg.

#GEAL
Keyless Spur Gears – Pressure Angle 20 Deg.

★
#KGHS
Bevel Gears – Pressure Angle 20 Deg.

#NEGH
Helix Gears – Pressure Angle 20 Deg., Helix Angle 45 Deg.

#GEAD
Spur Gears – Bearing Built-in

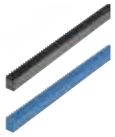
#RGMA
Round Gear Rack – Pressure Angle 20 Deg., Standard L Dimension

#WGEU
Worm Gear

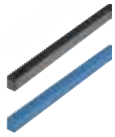
#WGEA
Worm Wheel

#RGEH
Gear Racks – Ground, Pressure Angle 20 Deg.

#RGEL
Gear Racks – Ground, Hole Position Configurable, Pressure Angle 20 Deg.



#RGEA
Gear Racks – Pressure Angle 20 Deg., Standard L Dimension



#LRGE
Gear Racks – Pressure Angle 20 Deg., Configurable L Dimension

Magnetic Transmission

#MDQ
TM Non-Contact Magnetic Transmission Drives

#MEQ
[Economy] TM Non-Contact Magnetic Transmission Drives

Chains / Sprockets

#CHE1
Roller Chains

#SSP1
Sprockets – 11B/15B Series

#JM0C
Joint Links, Offset Links

#SP15
Sprockets – 15B Series

#SP25
Sprockets – 25B Series

#SP35
Sprockets – 35B Series

#SP40
Sprockets – 40B Series

#SP50
Sprockets – 50B Series

#SP60
Sprockets – 60B Series

#SP4S
Sprockets – Double Strand

#SP80
Sprockets – 80B Series

#SP5S
Sprockets – Double Strand

#LFSP
Keyless Sprockets – 35B/40B Series

#DRC
Idler Sprockets – Single Bearing

#DRCB
Idler Sprockets with Hub

#DRCBW
Idler Sprockets with Hub Double Pitch

#SDRC
Small Idlers

#IDP
Idler Pins

#GDCC
Chain Guides – Raised Track, Steel Framed

#GDC
Chain Guides – Raised Track

#GDRC
Chain Guides – Chanel, Flanged Steel Framed, Side Mount

#SGDT
Steel Chain Guides

#STRT
Turnbuckles – Standard, Long

#SRCL
Turnbuckle Components – Tapped Hex

#STBT
Turnbuckles – Threaded

#HSBL
Turnbuckle Components – Threaded Rod

#SJN
Turnbuckle Components – Tapped Hex

Conveyer Chains / Sprockets

#CHEW
Chains – Double Pitch

#SP20
Sprockets – Double Pitch

#JNTW
Joint Links for Double Pitch Chains

#CHEL
Roller Chains with Attachments

#JNTL
Joint Links for Chains with Attachment

#CHET
Roller Chains with Attachments

#WCHE
Free Flow Conveyor Chains

#WESP
Sprockets – Double Speed, Free Flow Conveyor Chains

#WCF
Aluminum Frame for Double Speed – Free Flow Conveyor Chains

#RNG
Return Guides for Double Speed – Free Flow Conveyor Chains

Plastic Chains

#CHEC
Engineering Plastic Block Chains – Single Strand

#CHES
Sprockets – Engineered Plastic Chains, 2-Row

#CHEE
Engineering Plastic Block Chains – Double Strand

#TPCH
Table Top Conveyor Chains

#TPSP
Sprockets – Table Top Conveyor Chains

#TPDR
Idler Sprockets – Table Top Conveyor Chains

Tensioners

#TSUB
Tensioning Unit with an Idler

#TNSN
Tensioning Units without Idler

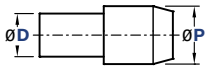
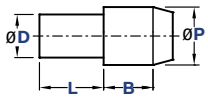
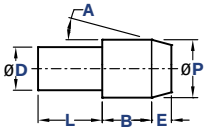
#TNSL
Tensioners without Idlers

#SDPT
Slide Plate for #TNSN Unit

#THBS
Chain Tensioners – Idler Set

#TSBX
Chain Guide Tensioners

LOW ← CONFIGURABILITY LEVEL / COST → HIGH

Product Name	Dowel Pins	Height Adjusting/ Support Pins	Locating Pins	Automotive Style Locating Pins
Usage/Picture	 Pivot & Locate	 Support & Locate	 Jigs & Fixture	
Size (Shank Dia.)	Ø1 to 16 mm	Ø3 to 15 mm	Ø0.5 to 40mm	Ø3 to 35 mm
Max. Level of Configurability	•	•••	•••••	•••••
Pin Configurable Dimensions	**P Selectable Configurability Level •**	**P Configurable Configurability Level •••**	**P, L, B Configurable Configurability Level ••••**	**Fully Configurable Configurability Level •••••**
Picture				
D (Shank Dia.)	Standard	Standard	Standard	Standard
P (Head Dia.)	Standard	0.01 mm increment	0.01 mm increment	0.01 mm increment
B (Head Lg.)	Standard	Standard	0.1 mm increment	0.1 mm increment
L (Shank Lg.)	Standard	Standard	1 mm increment	1 mm increment
E (Lead Lg.)	Standard	Standard	Standard	0.1 mm increment
A (Lead Angle)	Standard	Standard	Standard	15° increment
Cost $	$	$$	$$$	$$$$

Locating Pins / Bushings

#AFPB
Large Head, Tapered, High Hardness Stainless Steel, Press Fit, Tapped, Threaded

#AKFA
High Hardness Stainless Steel, Tapered, Configurable Taper Angle

#AFPQ
High Hardness Stainless Steel, Sphere Head

#AKFQ
High Hardness Stainless Steel, Sphere Large Head, D and P Selectable Tolerance

#AFPD
High Hardness Stainless Steel, Large Flat Head, Press Fit, Tapped, Threaded

#AFPS
High Hardness Stainless Steel, Small Head, Tapered

#ALPS
High Hardness Stainless Steel, Straight, Tapered, Sphere

★ ✓ **#FPBA**
Large Head, P Standard

★ **#FPBT**
Large Head, Round, Tapped, P Standard

#FPNA
Large Head, Threaded, P Configurable

★ **#KFAA**
Large Head, Threaded, P / L / B & Pilot Configurable

#FPNS
Large Head, Threaded, P / L / B Configurable, Hex Socket

#FPTM
Large Head, Standard, P Configurable, C'Bore Hole

★ **#FPQA**
Spherical Large Head, Standard, P Configurable

#FPQT
Spherical Large Head, Tapped, P Configurable

#FPQN
Spherical Large Head, Threaded, P Configurable

★ **#KFQA**
Spherical Large Head, Threaded, P / L / B Configurable

★ **#FPDC**
Large Flat Head, Standard, P Standard

#FPDT
Large Flat Head, Tapped, P Standard

#FPFN
Large Flat Head, Threaded, P Configurable

#KFFA
Large Flat Head, Threaded, P/L/B Configurable

#FPYN
Side Locating – Standard

#JPRB
Large Head, Round Tapered, Standard

#KFPBA
Large Head, Round Tapered, D/P Tolerance Selectable

#LPDE
Selectable Pilot Shape – Standard, p6 Shank

#LPCA
Selectable Pilot Shape – Straight Tapped

#LPAA
Selectable Pilot Shape – Threaded

#LPAL
Selectable Pilot Shape – Threaded, Pilot Length Configurable

#JPNG
Full Thread

#JPLR
Marker Pins Hexagon Socket

#JPLB
Marker Pins

#FPCH
Bullet Nose, Miniature, Press Fit

#JPPH
Large Head, Tapered, Plastic Tip

#JPZA
Resin Locating Pins – Large Head, Sphere, P Configurable, Standard

#HPSF
Locating Pilot Pins – Standard

#WPG
Double Pilot, Standard, Configurable

#CFPL
Locating Pins for Height Adjusting

#AFPM
Large Head Round, Nonmagnetic , Standard

★ ✓

#FPSA
Small Head, Round, Standard, P Standard

#FPST
Small Head, Tapped, P Configurable

★

#KFSA
Small Head, Standard, P/L/B & Pilot Configurable

★

#JPCT
Setscrew Mounting Shank – Circumference Groove

#FPQS
Spherical Small Head – Standard, P Configurable

#FPQ2
Spherical Small Head – Tapped, P Configurable

#KFQS
Spherical Small Head – Standard, P/L/B Configurable

#JPCQ
Spherical Large Head – Setscrew Mounting Shank

#FPDS
Small Flat Head, Standard, P Configurable

#FPD2
Small Flat Head, Tapped, P Configurable

#KFFS
Small Flat Head, Standard, P/L/B Configurable

#JPRS
Small Head, Round Tapered, Standard

#KFPS
Small Head, Round Tapered, Standard, DP Tolerance, R Selectable

#JPZS
Resin Locating Pins – Small Head, Tapered, P Configurable

#PPFJ
Pusher Pins – Straight, Flat

#PPFS
Pusher Pins – Small Head, Flat

#LPST
Locating Pin – Straight, D Tolerance, Tapped

#LPSQ
Straight, Sphere, Standard, Tapped

#FPJA
Shoulder, Standard, P Standard

#FPUA
Shoulder, Tapped, P Standard

#FPTN
Shoulder, Threaded, P Configurable

#KFHA
Shoulder, P/L/B Configurable, Threaded, Pilot Configurable

#FPJAT
Configurable Shoulder Thickness, Standard

#FPJATD ★
Configurable Shoulder Thickness & Diameter, Standard

#JPCJ
Shoulder, Set Screw Mounting Shank, Notch Shape

#LPMB
Selectable Pilot Shape, Configurable Shoulder Thickness, Threaded

#LPZ
Bolt Fixing, Standard

#JPMA
Bolt Fixing with Pilot

#LBNA
Large Bolt Fixing

#JPEA
Eccentric, Standard

#MASA
Flanged Locating Pins, Flat

#FLPA
Flanged Locating Pins, Tapered, Standard

#KKB
Height Adjusting Blocks – Standard

#IPMA
Locating Pins for Grippers – Stepped

#CMPA
Plate Centering Pins

#LPN
With Air Vent, Threaded

#SNPB
Resin Locating Pins – Small Diameter, Sphere, Standard Tolerance

#FPAJ
Resin Locating Pins – Bolt Fixing, Precision Class

#SFKK
Small Diameter Locating Pins – High Hardness Stainless Steel Straight

#SFSK
Small Diameter Locating Pins – High Hardness Stainless Steel Small Head

#SFSZ
Small Diameter with Head, Flat, Standard Tolerance

#SFHH
Small Diameter Height Adjusting Pins

#DSDP
Spring Loaded Small Diameter Pin Units

#SFKS
Small Diameter, Flat, Standard Tolerance

#SFNN
Small Diameter Locating Pins – Small Head

#SFPS
Small Diameter with Shoulde

#SFPN
Small Diameter with Shoulder, Threaded Shank

#FESM
Feed Pins – Standard

#FESG
Feed Pins – Tapped

#FEPS
Feed Pins – Threaded

#FEPM
Feed Pins with Shoulder – Standard

#FEPG
Feed Pins with Shoulder – Tapped

#FEPN
Feed Pins with Shoulder – Threaded

#SDPA
Support Pins – Round, Pilot

#SHFJ
Support Pins – Pilot, Round, Straight, Standard

#LSPA
Support Pins – Tip Shape Selectable

#SRPA
Support Pins – Pilot Shape Selectable, Stepped Pilot

★

#JPRA
Height Adjust Pins – Hex/B/F Standard

#SRTA
Hex, Medium Accuracy, Threaded

#JPRM
Height Adjust Pins – Tapped, Hex

#SRTB
Hex, Medium Accuracy, Tapped

#JPHF
Height Adjust Pins with Shoulder – F Standard

#JPHA
Height Adjust Pins with Shoulder – F Standard

#JPH2
Height Adjust Pins – Tapped, Round

#JPAM
Height Adjust Pins – Press Fit, L Configurable

#JPHU
Height Adjust Pins – Counterbored

#SPFA
Support Pins – Flat, Round, Flat, Threaded

#JPSR
Height Adjusting Pins Small Head Threaded

#JPTU
Height Adjust Pins

#JPTC
Height Adjusting Caps

#LPHB
Compact Flange – Bolt Fixing

★

#JBA
Bushings for Locating Pins – Straight, Standard

★

#JBAU
Bushings for Locating Pins – Straight, Thin Wall

★

#JBAF
Bushings for Locating Pins – Straight, Standard, Configurable

★

#JBAUF
Bushings for Locating Pins – Straight, Thin Wall, Configurable

★

#JBH
Bushings for Locating Pins – Flanged, Standard

#JBHU
Bushings for Locating Pins – Flanged, Thin Wall

★

#JBHF
Bushings for Locating Pins – Flanged, Standard, Configurable

★

#JBHUF
Bushings for Locating Pins – Flanged, Thin Wall, Configurable

#JBAG
Bushings for Locating Pins – Straight, Retaining

#JBHG
Bushings for Locating Pins – Flanged

#JBHY
Bushings for Locating Pins – Notched

#JBEH
Bushings for Locating Pins Oval – Compact Flange

★

#JBE
Bushings for Locating Pins – Oval, Shoulder

#JBAD
Bushings for Locating Pins – Copper Alloy, Straight

#JBHD
Bushings for Locating Pins – Copper Alloy, Shoulder

#JBC
Bushings for Locating Pins – Ceramic

#LCB
Bushings for Locating Pins with Oil Grooves – Hardened

#JBT
Bushings for Locating Pins – Round Flanged, P/L Standard

#JBS
Bushings for Locating Pins – Square Flanged, P/L Standard

#JBOK
Bushings for Locating Pins Compact Flange – Economy

#JBN
Bushings for Locating Pins – Compact Flanged, P/L Standard

★

#ELAN
Standard Grade, Shoulder, Threaded

#ELAT
Standard (h7), Shoulder, Circumference Groove

#SELA
Standard (h7), Shoulder, Threaded, Tip Shape Selectable, Plated

#SELT
Standard (h7), Shoulder, Circumference Groove, Tip Shape Selectable, Plated

#ELNN
Locating Pins for Jigs – Standard (h7), Threaded

#ELNT
Locating Pins for Jigs – Standard (h7), Circumference Groove

#SELN
Standard (h7), Threaded, Tip Shape Selectable, Plated

#SEL4
Standard (h7), Circumference Groove, Tip Shape Selectable, Plated

★

#LANAN
Precision (g6), Shoulder, Threaded

#LATA
Precision (g6), Shoulder, Set Screw

#SLAN
Precision (g6), Shoulder, Threaded, Tip Shape Selectable, Plated

#SLAT
Precision (g6), Shoulder, Set Screw, Tip Shape Selectable, Plated

#LNNAN
Locating Pins for Jigs – Precision (g6), Threaded

#LNTA
Locating Pins for Jigs – Precision (g6), Set Screw Fixing

#SLNN
Precision (g6), Threaded, Tip Shape Selectable, Plated

#SLNT
Precision (g6), Set Screw Fixing, Tip Shape Selectable, Plated

#FLAN
Locating Pins for Jigs – Configurable, Shoulder, Threaded

#FLAT
Configurable, Shoulder, Circumference Groove

#FLNN
Locating Pins for Jigs – Configurable, Threaded

#FLNT
Locating Pins for Jigs – Configurable, Circumference Groove

#ELAS
Standard Grade, Short Set Screw, Shouldered

#ELNS
Standard (h7) Set Screw, Circumference Groove

#ELAC
Locating Pins for Jigs – Standard (h7) Set Screw, Notch Shape

#ELNC
Locating Pins for Jigs – Standard (h7) Set Screw, Notch Shape

#LANAR
Locating Pins for Jigs – Long Head, Shoulder, Threaded, Plated

#LNNAR
Locating Pins for Jigs – Long Head, Threaded

#ELAB
Standard Class (h6), Shoulder, Bolt Fixing

#ELNB
Standard Class (h6), No Shoulder, Bolt Fixing

★

#RANA
Locating Pin for Jig Round Edge Shoulder Nut

#RNNA
Locating Pin for Jig Round Edge No Shoulder Nut

#HATA
Locating Pin for Jigs – Bullet Nose, Shoulder

#HNTA
Bullet Nose, Selectable Shank, No Shoulder

#LANQ
Locating Pins for Jigs – Square Head, Shoulder, Threaded

#LNNQ
Locating Pins for Jigs – Square Head, No Shoulder, Threaded

#NLAN
Locating Pins for Jigs – Oval, Shoulder, Threaded

#NLNN
Locating Pins for Jigs – Oval, Threaded

#ZLA
Insulating Locating Pins for Jigs & Fixtures – Threaded

★
#HUPN
Height Adjusting Pins for Fixtures – Lock Nut

#HUPT
Height Adjusting Pins for Fixtures – Set Screw

#NUTK
Detection Pins for Weld Nuts

NEW
#PICP
Tapered Spring Loaded Locating Pins

Stop Pins / Stopper Blocks

#STMH
Stop Pins – Press-Fit

#USTM
Stop Pins – Press-Fit Urethane

#USTH
Stop Pins – Screw with Urethane

★
#SSTE
Stop Pins – Screw, T Standard

#BSTE
Stop Pins – Spherical, H Standard

#SSTH
Stop Pins – Screw with Wrench Hole

#UPPL
Stoppers with Plates – Urethane, Low Elastic Rubber

#UPWH
Stoppers with Washers – Urethane, Low Elastic Rubber

#SBHB
Stopper Blocks – Straight, Through Hole

#SBNB
Stopper Blocks Tapped Hole Tapped Hole

#SBFB
Stopper Blocks – Plate

#SBUB
Stopper Blocks with Urethane – Block

#SBEB
Stopper Blocks with Urethane – Cylinder

#AST
Round Stoppers – Standard

#ASTM
Round Stoppers Tapped Hole

#ASTC
Shims for Round Stoppers

#FSWJ
Flat Stoppers – Standard

#FSWS
Flat Stoppers with One Hole

#FSWN
Shims for Flat Stoppers

#PDAP
Point Pads – Tapped

Adjusting Screws / Threaded Stopper Blocks

#ANB
Adjusting Stopper Screws – Hexagon Socket, L Configurable, Fine Thread

#ANS
Adjusting Stopper Screws – Wrench Flat, L Selectable, Fine Thread

#HANB
Adjusting Stopper Screws – L Selectable, Fine Thread

#ANH
Adjusting Stopper Screws – Hexagon Bolt, Fine Thread

#ANKB
Adjusting Stopper Screws with Knurled Knob – Fine Thread

#STBB
Locating Bolts – Round Head, Fine Thread

#STBA
Locating Bolts, Round Tip R, Fine Thread

#STRB
Stopper Bolts – Hexagon Socket, Fine Thread

#STSC
Stopper Screws

#TSB
Threaded Stopper Blocks – Counterbore, Fine Thread

#TABB
Threaded Stopper Blocks – Counterbore Tapped Hole, Fine Thread

#PAFN
Brackets for Stopper Screws – Hex, Fine Thread

#PABN
Brackets for Adjustment Screws Bolt Fine Thread

#SNTB
Threaded Stopper Block – Standard

#STBN
Threaded Stopper Blocks – Counterbore, Fine Thread

#AJSN
Threaded Stopper Blocks, Counterbore & Tapped Hole – H Configurable

#AJLT
Threaded Stopper Blocks – L-Shaped, Lengthways Adjustable

#AJTN
Threaded Stopper Blocks – T-Shaped, Fine Thread

#AJLC
Threaded Stopper Blocks – L-Shaped, Widthways Adjustable

#AJFN
Threaded Stopper Blocks – Side Counterbored, Fine Thread

#AJLN
Threaded Stopper Blocks – L-Shaped, Bottom Mounting

#AJWB
Threaded Stopper Blocks – Two Hole

#UST
Stopper Bolts with Bumpers – Standard, Straight Shape

#USS
Stopper Bolts with Bumpers – Straight

#PSCB
Stopper Bolts with Bumpers – Hexagon Socket Head Cap Screw

#UNAM
Stopper Screws Head Hexagon Socket – MC Nylon

#UNAH
Stopper Bolts With Bumpers – Hexagon Socket Head

#UNBH
Stopper Bolts With Bumpers – Hexagon Socket Tip

#UNST
Bolts with Low Elastic Rubber

#UNSH
Head Hexagon Socket Cap Srews with Low Elastic Rubber

#AJST
Adjusting Bolts – Hex, Coarse, Fine

#AJSR
Adjusting Bolts – Hex Head with Hex Socket

#AJKT
Adjusting Bolts – Knurled Head with Hex Socket

#AJSK
Adjusting Bolts – Knurled Knobs

#AJKB
Blocks for Adjusting Bolts – Standard

#AJSB
Blocks for Adjusting Bolts – Side Mounting

#AJLB
Blocks for Adjusting Bolts – L-Shaped, H Selectable

#AJSL
Blocks for Adjusting Bolts – Side Mounting , L-Shaped, H Selectable

#AJP
Adjusting Pins – Retaining Ring

#SJKB
Screw Jacks

#LVW
Leveling Screws – Standard

#LVGB
Leveling Screws Large Holes for Adjustment Wrench Flat

★

#LVB
Leveling Screws – Screw Tip

✓

#LVN
Lock Nuts

★

#RSM
Clamping Screws – Ball

#FSM
Clamping Screws – Angle

#FSMB
Clamping Screws – Non-Reverse

#FSMG
Clamping Screws – Non-Reverse, Serrated

#BALA
High Locked Screws – SR Shape

#BALT
High Locked Screws – Flat Shape

#HRSM
Clamping Screws – Ball

#HFS2
Clamping Screws – Angle

#HFS2
Clamping Screws – Non-Reverse

#HFMG
Clamping Screws – Non-Reverse, Serrated

#BRAS
Clamping Screws – Tip Clamp, Ball

#BFAS
Clamping Screws – Tip Clamp, Angle

#BRSM
Clamping Screws – Head Clamp, Ball

#BFSM
Clamping Screws – Head Clamp, Angle

#SGBS
Grub Screw Sets with Ball Point

#SGTP
Grub Screw Sets with Thrust Point

✓

#SGKS
Grub Screw Sets – Stainless Steel

#SGKG
Grub Screw Sets – Rubber Pads

#SGKA
Grub Screw Sets – Flanged

#PCW
Clamp Plates – Standard

#CPWC
Shims for Clamp Plates – Standard

✓

#CMAJ
Blocks for Shim Adjustment of Welding Jigs – Straight

✓

#CMAC
Blocks for Shim Adjustment of Welding Jigs – Shim Sets

✓

#CMAL
Blocks for Shim Adjustment of Welding Jigs – L-Shaped

#CMA2
Blocks for Shim Adjustment of Welding Jigs – Shim Sets

Locating / Guide Components

#RGP
Basic Guide Pins – Tip Shape Selectable

#RGPE
Rough Guide Pins – Eccentric

#RGPN
Basic Guide Pins – Tip Shape Selectable

#RGH
Rough Guide – Standard

#RGN
Rough Guide – Narrow

#WGHA
Guides – Straight

★
#WGLA
Guides – L-Shaped

#WGDL
Guides – Height Adjusting

#WGDB
Guides – Pedestal

#WGNA
Guides – Angle

#WGVA
Guides – V-Shaped

#WGTB
Guides – Plates

#VBT
V Blocks – Standard, T-Shaped

#VZB
V Blocks – Precision Class

★
#CVTA
Locating Block Sets – V-Shaped, Flat Bottom, Standard

★
#CVTB
Locating Block Sets – V-Shaped, Plate Holding, Standard

#CAT
Locating Block Set – CAT

#TPCA
Tapered Pin Locating Block Sets – Tapped

#TPCZ
Tapered Pin Locating Block Sets – Counterbored

#TPCS
Tapered Pin Locating Block Sets – Short

#GMLH
Rough Guides – Round Pole

#GIRH
Rough Guides – Plate

#RGHK
Rough Guides – Angle

#CPGP
Guide Plates

#RLLP
Roller Pushers – Low Particle Generation

#LPCE
Lift Pins – B Standard

Locating Units

#PCPN
Work Detection Units

★
#ATBJ
Feed Fingers

#ATBE
Feed Fingers – Economy

#ATLA
Auto – Latch

Workpiece Clamps

#BFPP
Absorbing Pusher Pins

#SPCS
Spring Clamps – Small

#SPCP
Spring Clamp – Large

#GPH
Guide Plungers with Hexagon Socket

#GP
Nose Attachments for Guide Plungers – V-Shaped

NEW
#SLDP
Slide Pushers

Plungers / Index Plungers

#BPM
Ball Plungers

★ ✓
#BPW
Ball Plungers – Standard

#BMS
Ball Plungers – Stainless Steel

#BPRJ
Ball Plungers – Roller

#BPCF
Ball Plungers – Load Adjustable

#BNMN
Ball Plungers – Resin

#BMPJ
Ball Plungers – Fine Thread

✓
#BPK
Ball Plungers – Fine Thread

#BPJL
Ball Plungers – Long

#BMSL
Ball Plungers – Stainless Steel, Long

#BPJS
Ball Plungers – Selectable Length

#BSML
Ball Plungers – Stainless Steel, Selectable Length

#BPJG
Wrenches for Ball Plungers

#BPHH
Ball Plungers – Hexagon Socket Head Cap Screw

✓
#FBPJ
Flanged Ball Plungers

#BBT
Ball Buttons

✓
#PFPP
Press Fit Plungers

#PFPR
Press Fit Plungers – Roller

✓
#TBBT
Ball Buttons – Tapped

#CBPJ
Roller Plungers – Compact, Load Adjusting Function

#SBPJ
Roller Plungers – Mounting , Vertical Mount

✓
#RBPJ
Roller Plungers – Bolt

#PJH
Spring Plungers – Standard

★
#PJHK
Spring Plungers – Stainless Steel

#PJG
Wrenches for Spring Plungers – Standard

NEW
#NPSB
Block Plungers

#SPJF
Short Spring Plungers – Short, Standard

#SPJK
Short Spring Plungers – Short, Stainless Steel

#MPFH
Micro Spring Plungers – Sphere, Standard

#MPFS
Micro Spring Plungers Short

#MPFT
Micro Spring Plungers – Flat, Set Screw

#JJPP
Spring Loaded Fixture Pin

NEW

#SPPL
Spring Pins

✓

#PJHT
Spring Plungers with Tapped Nose

#GLPN
Long Sleeve Plungers

✓

#PJLH
Spring Plungers with Hexagon Socket Hole

#PJHR
Spring Plungers with Hexagon Nose

✓

#PJLF
Spring Plungers – Flat Nose

#PJHZ
Spring Plungers for Slope Surfaces

#FPJH
Spring Plungers with Flange

★ ✓

#PXAF
Indexing Plungers – Tip Shape Selectable

#PMXAS
Indexing Plungers – Fine Thread

#FPXA
Indexing Plungers – Flanged

#PXTA
Indexing Plungers – Tip Tapped

✓

#PXRN
Indexing Plungers – Aluminum Knob, Rest Position

✓

#PXRA
Indexing Plungers – Resin Knob

★ ✓

#PMXS
Compacted Indexing Plungers – Return

#PXAL
Indexing Plungers – Long-Return

✓

#PXSH
Indexing Plungers – Precision Pilot, Return, Fine Thread

✓

#SXPP
Indexing Plungers – Press Fit

✓

#NSXP
Knob for Press Fit Indexing Plunger

✓

#PXNA
Indexing Plungers – Knobless, Compact

★ ✓

#PXNK
Indexing Plungers – Knobless

✓

#PMXR
Indexing Plungers – Coarse Thread Lever

#PXVB
Indexing Plungers – Fine Thread Lever Nuts

✓

#PXSR
Indexing Plungers – Switch Lever, Fine Thread

✓

#PMXP
Indexing Plungers – Push

✓

#PXSP
Indexing Plungers – Plate Mount

✓

#PXA
Indexing Plungers – Fine Thread, Return

#BLPF
Ball Lock Pins Spring

★ ✓

#BLP
Ball Lock Pins

Toggle Clamps / Workpiece Clamps

#TCH
Horizontal Handle

#TCV
Vertical Handle

#TCP
Push-Pull Clamps

#TCW
Welded-Heavy Duty Clamps

#TCA
Clamps Accessories

#BFPP
Absorbing Pusher Pins

#SPCS
Spring Clamps – Small

#SPCP
Spring Clamp – Large

#GPH
Guide Plungers with Hexagon Socket

#GP
Nose Attachments for Guide Plungers – V-Shaped

NEW

#SLDP
Slide Pushers

Automotive Inspection Components

#KJPS
Slot Pins for Inspection Components – Straight

#KJ01
Slot Pins for Inspection Components – Straight

#KJPD
Slot Pins for Inspection Components – Stepped, Straight

#KJPZ
Slot Pins for Inspection Components – Stepped, Straight

#KJP2
Slot Pins for Inspection Jigs – Stepped Diamond, Straight

#KJPV
Slot Pins for Inspection Jigs – Stepped Diamond, Straight

#KJP1
Slot Pins for Inspection Jigs – Oval Straight

#KJP3
Slot Pins for Inspection Jigs – Square Straight

#KJPN
Slot Pins for Inspection Jigs – Stepped and Threaded

#KJP8
Slot Pins for Inspection Jigs – Straight Long

#KJPM
Slot Pins for Inspection Jigs – Stepped and Threaded

#KJPL
Slot Pins for Inspection Jigs – Stepped Long

#KJPG
Straight Threaded with Step – 2 Steps

#KJP7
Slot Pins for Inspection Jigs – 1 Stepped, Threadeded End

#KJP4
Slot Pins for Inspection Jigs – Tapered

#KJ02
Slot Pins for Inspection Jigs – Tappeded Ends

#KJP5
Slot Pins for Inspection Jigs – Stepped Diamond and Tapered

#KJP6
Slot Pins for Inspection Jigs – Stepped Diamond, Taper, Configurable

#KJP9
Slot Pins for Inspection Components – Threaded, Tapered

#KJPH
Marking Pins

#KJPC
Slot Pins for Inspection Components – Clamp , Straight

#KJPK
Slot Pins for Inspection Jigs – Taper and Threaded Revolving Diamond-Shaped

#KJPT
Slot Pins for Inspection Jigs – Clamp Design, Staight and Taper and

#KJPR
Pins for Inspection Jigs – GO and NO-GO, Reversible

#KJPB
Slot Pins for Inspection Jig – Check Pin with Groove

★
#KJBA
Bushings for Inspection Jigs – Straight

#KJBP
Bushings for Inspection Jigs – Straight

★
#KJBS
Bushings for Inspection Jigs – Shouldered

★
#KJBF
Bushings for Inspection Jigs – Shouldered

#KJBD
Bushings for Inspection Jigs – Stepped Bore and Optional Shoulder

#KJBM
Bushings for Inspection Components – Stepped and Threaded for Straight Pins

#KJB1
Bushings for Inspection Components – Stepped and Threaded for Straight Pins, Shouldered

#KJBW
Bushings for Inspection Components – Stepped and Threaded for Taper Pins

#KJBT
Bushings for Inspection Components – Stepped and Threaded for Taper Pins

#KJBK
Bushings for Inspection Components – D-Shape

#KJB5
Bushings for Inspection Components – D-Shape, Shouldered

★
#KJBC
Bushings for Inspection Components – Oval

★
#KJB4
Bushings for Inspection Components – Oval, Shouldered

#KJBR
Bushings for Inspection Components – Square

#KJB6
Bushings for Inspection Components – Square, Shouldered

#KJBN
Bushings for Inspection Jigs – Threaded Bore

#KJB2
Locating Blocks for Inspection Components

#KJRB
Round/Oval/Square Opening Shape for Resin Panels

#KJTC
Inspection Jigs – Shim Plates, Square and Round Shape

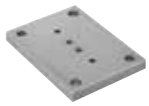
#KJT1
Inspection Jigs – Shim Plates, Square and Round Shape

#KJTP
Inspection Jigs – Shim Plates, Square and Round Shape

#KJTM
Inspection Jigs – Shim Plates, Square and Round Shape

✓
#JHR
Inspection Jigs – Hinge Units, Horizontal Travel

✓
#JSR
Inspection Jigs – Hinge Units, Horizontal Travel

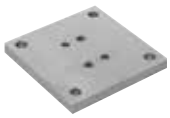


#JHSP
Inspection Jigs – Hinge Units, Horizontal Travel

✓
#JHTS
Inspection Jigs – Hinge Units, Vertical Travel

#JIFL
Inspection Jigs – Angle Plate Units

#JIST
Support Stand for Angle Plate Unit



#JIP
Base Plate for Angle Plate Unit

#KJCS
Clamp Plates for Inspection Components

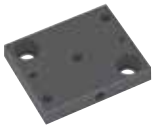
#KJCP
Inspection Jigs – Clamp Angle Plate

#KJL
Components for Inspection Jigs – L Pins

#KJTS
Inspection Jigs – L and T Shape Pin

#KJLP
Inspection Jigs – Locating Kits

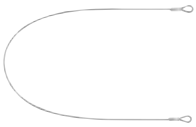
#CRB
Inspection Jigs – Locating Ball



#CRBP
Inspection Jigs – Locating Pad

#CRBC
Inspection Jigs – Locating Pad Bracket

#CLIP
Inspection Jigs – Pin Clips



#KJW
Inspection Jigs – Wires for Pins

#KJWC
Inspection Jigs – Chains For Slot Pins

Contact Probes

#NPT4
[Economy] Contact Probes – NPT038 / NRT038W Series

#RNP2
Double Tipped Probes

#NP26
Contact Probes – NP26 Series

#NP31
Contact Probes – NP31 Series

#NP38
Receptacles – NP38 Series

#NP20
Contact Probes – NP20 Series

#NP58
Contact Probes – NP58 Series

#NRB2
Receptacles with Wire – NRB26 / NRB31 / NRSB31 Series

#NP30
Contact Probes – NP30 Series

#NP72
Contact Probes – NP72 / NP72HD Series

#NR68
Contact Probes – NP68S3SF Series

#NP76
Contact Probes – NP76 Series

#NRB1
Receptacles with Lead Wire

#NP68
Contact Probes – NP68SF Series

#NP88
Contact Probes – NP88 / NP88HD Series

#NR45
Contact Probes – NP45S3SF / NP45S3 Series

#NP45
Contact Probes – NP45SF / NP45 Series

#NRB4
Receptacles with Lead Wire

#NP12
Contact Probes – NP120 / NP120HD Series

#NP64
Contact Probes – NP604 / TP604 Series

#NP60
Contact Probes – NP60HD Series

#NRB6
Receptacles with Wire – NRB120 Series

#NP84
Contact Probes – NP84SF / NP8 Series

#NP90
Contact Probes – NP90SF / NP90 Series

#NP89
Contact Probes – NP89SF / NP89 Series

#NRB8
Receptacles with Lead Wire – NRB84 Series

#NR10
Turn Probes

#GNP6
Contact Probes Assembly – Standard

#FNP1
Contact Probes Assembly – Threaded (FNP10)

#FNP2
Contact Probes Assembly – Resin Sleeve (FNP22)

#FNPS
Contact Probes Assembly – Spring Build-In (FNPS22)

#MNP5
Contact Probes Assembly – Threaded (MNP50)

★
#SNP3
Switch Probes – SNP Series

#TNR8
Terminals for Probes – TNR Series

#FNPL
Terminals for Probes – FNP Series

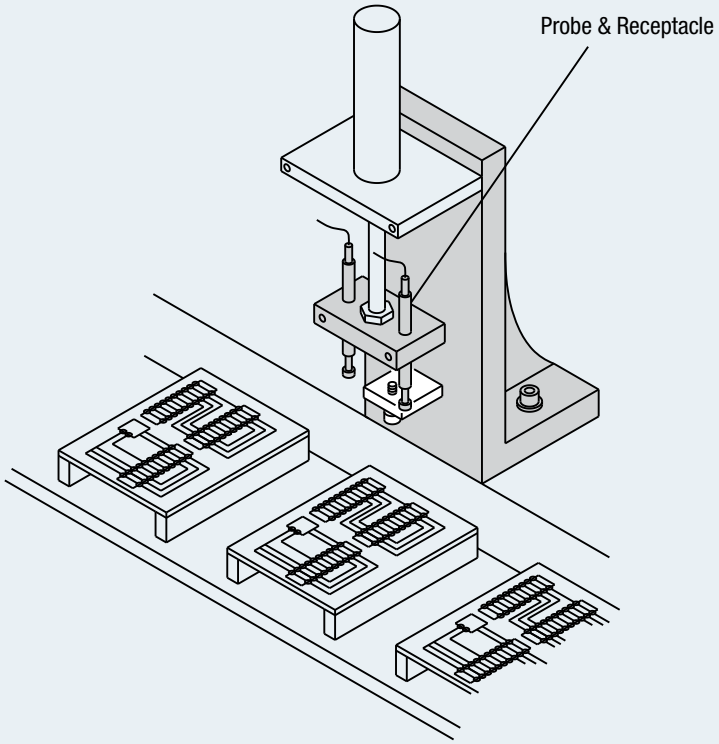
#THUS
Heat Shrink Tubes

#PGPC
Circuit Board Guide Pins – Round Cone

#CPGJ
Circuit Board Pusher Pins – Straight with Hole

✓
#CPRG
Circuit Board Rough Guides

Example



LOW ← ACCURACY/COST → HIGH

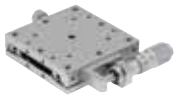
Type		Manual Stages						Motorized Stages	
		Simplified Adjustment Unit		Standard Precision Stages		High Precision Stages			
Usage, Picture									
		Travel Distance (max)	Load Capacity (max)	Travel Distance (max)	Load Capacity (max)	Travel Distance (max)	Load Capacity (max)	Travel Distance (max)	Load Capacity (max)
Linear Motion	X	±75 mm	98 N	±65 mm	39 N	±180 mm	343 N	50 mm	98 N
	Z	±50 mm	98 N	±65 mm	49 N	±65 mm	98 N	~15 mm	49 N
	XY	±25 mm	63 N	±35 mm	34 N	±60 mm	330 N	~15 mm	93 N
	XZ, XYZ	—	—	—		±12.5 mm	49 N	—	—
Rotary		360°	5~2000 N	—		360°	59 N	360°	29.4 N
Goniometer		—		—		±25°	60 N	—	
Multi Axis		—		—		XY: ±35 mm Rotation: 360°	50 N	—	
Feed Mechanism		– Feed Screw – Push Screw	– Rack & Pinion – Post & Clamp	– Rack & Pinion – Micrometer		– Rack & Pinion – Micrometer	– Feed Screw	—	
Guidance Structure		—		– Dovetail – Cross Roller		– Dovetail – Cross Roller	– Linear Ball Guides	– Linear Ball Guides – Deep Groove Ball Bearings	

*Table shows units that are already combined. You can build different multi-axis configurations based on application requirements.

Simplified Adjustment Units




#SIX
X-Axis Units


#SIXY
XY-Axis Units



#SIZ
Z-Axis Units

#SIR
Rotary, Tilt Units

Manual Stages



#MSX ★
X-Axis Stages




#MSX
X-Axis Stages

#MSBP
Base Plates for Manual Stage

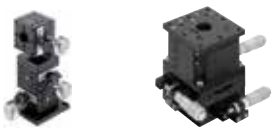
#MSXY
XY-Axis Stages

#MSZ
Z-Axis Stages

#MSRT
Rotary, Tilt Stages

#MSGO
Goniometer

#MSXZ
XZ-Axis Stages

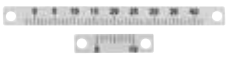


#MSYZ
XYZ-Axis Stages

#MSMA
Multi-Axis Stages

#MHFS
Micrometer Heads, Feed Screws

#SRSC
Rods, Stands, Cross Clamps



#VNIR
Vernier Scales for Stage

#CCDA
CCD Camera Accessories

Motorized Stages

#ACX
X-Axis Stages – Linear Ball Guide

#ACZ
Z-Axis Stages – Linear Ball Guide

#ACXY
XY-Axis Stages – Linear Ball Guide

#ACRT
Revolving Stages

#MHDT
Motorized Stage Accessories

Optical Lenses

#LFSL
Macro Lenses – Low Magnification

#LFSH
Macro Lenses – High Magnification

#LTAB
Objective Lenses for Microscope

#LTAA
Auto Extension Rings for Objective Lenses

#LCV
CCTV Lenses

#LRC
Rear Converter Lenses

#LCK
Setscrews for CCD Cameras

#LCVR
Close-Up Rings for CCTV Lenses

Sensors / Accessories

#SENJ
Brackets and Stands for Sensors

#SENR
Brackets for Sensor Stands/Metal

#SENP
Stands for Sensors

#SENG
Brackets for Sensor Stands – Resin

#SEN5
Sheet Metal Stands for Sensor

#SEN1
Sheet Metal Brackets for Sensor

#SEN2
Plastic Strut Clamps

#KSTB
For Mounting of Photoelectric Sensor

#KBSB
Bases for Sensor Mounting

#CMX
Bases for Sensor Mounting

#PSAM
Proximity Sensors

#PSHM
Proximity Sensors

#PSMM
Proximity Sensors with Built-In Amplifier – Screw, Heat Resistant

#SBRK
Accessories for Rail – T-Bracket

#DGM
Switch Flags – Round Pole

#DSB
Brackets for Switch Flag

#DMG
Switch Flags – Setscrew, Flat with Tapped Hole

#DMS
Switch Flags – Slit, Flat with Tapped Hole

Sensor Rails / DIN Rails

#SENK
Rails for Switches and Sensors – Aluminum, L Dimension Selectable

#SENA
Rails for Switches and Sensors – Aluminum, L Dimension Configurable

#SENF
Rails for Switches and Sensors – Aluminum, L Dimension Configurable

#SENB
Rails for Switch and Sensor – L Dimension, Hole Position Configurable

#SEN3
Rails for Switch and Sensor – Configurable Through Hole, Notched Hole

#SENM
Rails for Switch and Sensor – L Dimension Hole Position Configurable

#SENS
Rails for Switches and Sensors with Scale – L Dimension Configurable

#MPSE
Rails for Microphoto Sensors

#SQN
Bar Nuts

#2RU
Rails for Switches and Sensors – Steel, Standard Length

#2P
Rail Mount Fittings

#RFM5
Nuts for Sensor Rails

#RXM5
Nuts for Sensor Rails

#DNR2
DIN Rails for Switches and Sensors – L Dimension Selectable

#EYST
Simple Stays

#ETB
Grounding Blocks

Switches

#CMSC
Compact Contact Switches – NC

#CMSM
Compact Contact Switches – NO

#MSTK
High Precision Contact Switches – Bolt

#MSTA
High Precision Touch Switches – Tip Shape Selectable

#MSTT
High Precision Touch Switches – Flat, Tapped

#MSTD
Contact Switches – Standard

#NMK
Contact Switches – L-Shaped Cylinder with LED

#MST8
Contact Switches – Bolt, L-Shaped Bolt Switches

#MST3
Contact Switches – Long Stroke

#MST7
Contact Switches – L-Shaped Bolt with LED

#MST6
Contact Switches – Water-Resisting, End Shape Selection

#MST2
Contact Switches with Resin Tip

#MST4
Contact Switches – Tip Shape Selectable

#NMT
Contact Switches – Wide Contact Angle

#MSTW
Switches with Stoppers – Mini Drip-Proof (IP44), Cylinder

#MSTF
Switches with Stoppers – Mini Drip-Proof (IP44), Cylinder with Flange

#MSN7
Switches with Stoppers – Mini Drip-Proof (IP44), Screw

#MSNF
Switches with Stoppers – Mini Drip-Proof (IP44), Screw with Flange

#MSPM
Switches with Stoppers – Mini Drip-Proof (IP44), Ball Contact Screw

#MSWF
Contact Switches with Stoppers – Mini Waterproof, Flanged Cylinder

#MSNW
Switches with Stoppers – Mini Waterproof Screw

#MSN6
Contact Switches with Stoppers – Drip-Proof, Flanged Screw

#MSTB
Switches with Stoppers – Bolt

#MST1
Switches with Stoppers – Hexagon Head

#NMS
Switches with Stoppers – Long Stroke

#MST5
Contact Switches – Heat Resistant (IP65)

#MSPH
Heat-Resisting Ball Plunger Switches

#MSTR
Heat-Resisting Switches with Stopper

#MSNR
Heat-Resisting Switches with Stopper (Mini) Loose Wire Cord

#MSPS
Plunger Switches – Spring Plunger Switches

#MSPB
Positioning Switches – Ball Plunger

Posts / Strut Clamps / Stands

#POST
Posts

#STND
Post Stands and Post Stand Sets

#FGA
Free Guide Arm Sets and Holders

#CLMP
Single Post Strut Clamps

#DCLM
Dual Post Strut Clamps – Perpendicular

#STCA
Strut Clamp Accessories

#PIST
Pipe Stands

#CIST
Rotating Supports

#SPBL
Spacer Blocks

Gussets

★
#RBDA
Gussets – Through Hole, Standard Precision

#RBPD
Gussets – Counterbore Hole, High Precision

★
#RBBA
Gussets – Tapped Holes, Position Fixed, Standard Precision

#RBPA
Gussets – Standard, High Precision

#RACA
Gussets – Reduced Weight, Tapped Hole

#RBJW
Gussets – Bridge, Tapped Hole

#RQDB
[Economy] Gussets – Precision Casting, Through Hole, Hole Position Fixed

Angle Plates

★
#IKD
Angle Plates – Cast Iron, Standard Dimensions, No Holes

★ ✓
#AIKD
Angle Plate – Stainless Steel, Standard Dimensions, No Hole

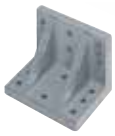
#IK
Angle Plates – Mounting Hole Selectable, Hole Position Fixed

#IKFT
Angle Plates – Mounting Surface Tapped, Mounting Hole Position Configurable

#IKF
Angle Plates – Cast Iron, Aluminum, Stainless Casting, Configurable Hole Position

#IKCD
Angle Plates – Bottom Surface Ground, w/ Thru Holes,

#IKKB
Opposite Angle Dowels – Cast Iron, Aluminum Cast



#WIKD
Angle Plates Wide

★
#BRWB
Welded Angles, Compact Type

#IKYS
Welded Angle Plates – Configurable Hole Position

Welded Standoffs / Metal Boxes

#YSCT
Welded Steel Stands – Configurable Hole Position

★
#YSCF
Welded Steel Stands – Selectable Hole

#YSBP
Welded Steel Stands – Plate

#KBXS
Metal Boxes

#STXS
Mounting Base for Metal Boxes

Metal Materials	Steel			Stainless Steel			Special Steels	Aluminum	Brass
	1018	1045	1045 Hardened	304	316	420 Hardened	01 Tool Steel Hardened	2017	C3604
Corrosion Resistance	P			E		G	P	G	E
Hardness* (Brinell HB / Rockwell HRC)	~125HB	~180HB	~50HRC	~190HB		~50HRC	~55HRC	~105HB	~202HB
Tensile Strength* (MPa)	~410 MPa	~596 MPa	~1600 MPa	~520 MPa		~1780 MPa	~1900 MPa	~300 MPa	~750 MPa
Density (g/cm³)	7.8			7.8			7.8	2.7	8.8

*The provided values are for reference only.

Resin Material	Polyacetal		MC Nylon			Bakelite		Flouro Resin	PEEK	Epoxy Glass	Polycarbonate
			Standard		Conductive	Paper Base	Cloth Base				
Color	White	Black	Blue	Ivory	Black	Brown	Light Brown	White	Gray	Green	Transparent
Tensile Strength* (MPa)	61 MPa		96 MPa		68 MPa	113 MPa	97 MPa	13.7~34.3 MPa	98 MPa	309 MPa	59 MPa
Operating Temperature (°C)	-45~95 °C		-40~120 °C			-50~100 °C		-40~250 °C	-50~250 °C	-150~180 °C	~110 °C
Sliding Properties	G		G		G	A	A	E	G	A	A
Heat Resistance	A		A		A	G	G	G	G	A	G
Insulation	G		G		G	G	G	G	G	E	E
Abrasion Resistance	A		G		A	P	P	G	G	P	P
Dimensional Stability	G		A		A	G	G	P	E	G	G
Machinability	E		G		G	G	G	G	G	A	G

Excellent Good Acceptable Fair Poor

Washers / Collars

#WSF
Washers for Precision Linear Shafts

#PPWT
Metal Washers (Pkg.)

#WSSB
Metal Washers – Thickness Configurable, Precision Grade

#WASB
Metal Washers – Thickness Configurable, Precision Grade

#FWS
Metal Washers – Standard Class, Configurable

#SWMB
Metal Washers – Standard Class, ID & OD Tolerance Selectable

#WASH
Hardened Metal Washers – Thickness Selectable

#FWAS
Hardened Metal Washers – ID / OD & Thickness Configurable

#AWSB
Metal Washers – Standard, Precision Class, Thickness Tolerance Selectable

#FTCB
Metal Washers – Standard Class, Flanged

#WZAB
Metal Washers – Standard Class, Counterbored

#WTAB
Metal Washers – Standard Class, Tapped

#WSRB
Metal Washers – Standard Class, Countersunk

#WBAA
Metal Washers – Standard Class with Clearance Holes

#KWSB
Metal Washers – Standard Class with Selectable Shape

#WLM
Metal Washers – Standard Class, with Slotted Hole and Pilot

#TASC
Thin-Walled Metal Collars

#SGP
Pipe Collars

#SMKB
Spacers

#DWSS
Simultaneous Grinding Spacers

#DCLB
Stepped Spacers

#KNCLB
Metal Collars – Standard Class

#AASC
Metal Collars – Precision Class

#FAC
Collars – Standard & Precision Class, ID / OD & Length Configurable

#SNCB
Collars – Standard & Precision Class, ID & OD Tolerance Selectable

#ASC
Hardened Collars – Standard & Precision Class, Length Configurable

#TCLA
Collars – Standard & Precision Class, Flanged, ID & OD Selectable

#WSJB
Resin Washers – Standard

#SWSP
Extra Thin Resin Washers Abrasion Resistance

#SWSJ
Resin Washers

#FWHJ
Resin Washers – Flanged, Solid, Configurable

#CLJB
Resin Collars – Standard

#CLJH
Resin Collars – Flanged

#WZJB
Resin Washers – Counterbored, Standard

#CLJT
Resin Collars – Tapped

#CLJG
Resin Collars with Guide

#CERC
Ceramic Washers – Sheets, Collars

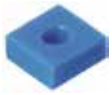
#CERA
Ceramic Collars with Flange

#DJC
Thermal Insulation Washers – Collars

#DJB
Thermal Insulation Collars with Flange

#PKC
Resin Washers – Collars (PEEK, Epoxy Glass, Fluororesin)

#PKB
Resin Collar with Flange – PEEK, Epoxy Glass, Fluororesin



#WSRJ
Square Resin Washers

#LOWA
Standard Metal Washers for Fastening

Shims

#CIMRF
Shim Rings – Standard, Pack

#CIMR
Shim Rings – Standard

#CIMA
Precision Shim Rings – Standard (10 Pcs Pack)

#PWVW
Wave Washers (Pack)

#CIMW
Split Shims – Standard

#ASAF
Square Shims – Slotted Hole, Configurable

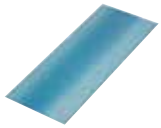
#ASAC
Square Shims – Round Hole, Configurable

#CIMM
Square Shims for Motor Bases

#PCIM
Square Shims for Motor Base for Pillow Block Package

#ASA
Square Shims with Single Slot

#CIRA
Shim Plates – Standard



#CIRK
Shim Plates – SK Hardened Steel, Standard, Configurable

#FGSM
Shim Tapes – 1 m Length

#CMBO
Shim Tape (Box)

Screws / Bolts

#SHCS
Socket Head Cap Screws

#LOHB
Low Head Bolts

#SDHB
Small Diameter Head Bolts

#SCWA
Screw Washer Assembly

#FHS
Flat Head Screws

#PHDS
Pan Head Screws

#MSCW
Precision Micro Screws

#HLDS
Hexalobular Drive Screws

#STSW
Self Tapping Screws

#SHLB
Shoulder Bolts

#HEXB
Hex Head Bolts

#VASW
Vented Screws

#SETS
Set Screws

#TSRB
Threaded Screw Rods and Bolts

#THMB
Thumb Screws

#CAPC
Captive Screws

#EYEB
Eye Bolts, U-Bolts

#CCSW
Cover Caps for Screws

#RESS
Resin Screws

#CME
Hex Wrench

#CMM
Hex Wrench for Low Head Screws

Hooks / Shackles

#TKC
Loss-Prevention Chains – Wires, Mounting Brackets

#SKC
Loss-Prevention Chains – Wires, Metal Joints

#RWS
Loss-Prevention Chains – Wires, Connecting Ring

Screw Washers

#BSLW
Spring Washers (Box)

#BPWF
Flat Washers (Box)

#PWF
Flat Washers

#SLW
Spring Washers

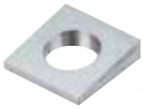
#PPWF
Washers – LOWA

#NLDF
Lock Washers – Small O.D. (Pack)

#PZAS
Tab Washers – One Tab

#GTS
Spring Washers – Conical Disk

#SSRB
Disk Spring Washers

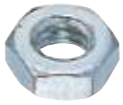


#ZTQ
Tapered Washers – Square

Nuts

#BLBN
Nuts – Right-Hand Thread (Box)

#BKNT
Nuts – Right-Hand Thread (Box)



#ANN
Hex Nuts

#SNTR
Compact Nuts (Pack)

#NT
Tall Nuts

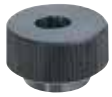
#NTFL
Configurable Length Hex Nuts

#UNUT
U-Nuts (Pack)

#HLN
Double Locking Nuts

#FNT
Domed (Acorn) Nuts

#FRNT
Knurled Thumb Nuts



#QCN
Quick-Lock Nuts – Thumb

#RNLB
Cylindrical Nuts with Hex Socket

#RBNT
Cylindrical Nuts

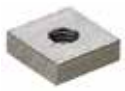
#FRNU
Flanged Nuts

#CRNT
Knurled Thumb Nuts with Side Holes

#NTS
T-Nuts

#ZTN
Tapered Nuts – Square

#NSQ
Rectangular Nuts with Threaded Hole



#FKT
Square Washers & Nuts with One Clearance Hole

#FK2T
Rectangular Washers & Nuts with Two Clearance Holes

Machine Keys

#KED ★
Selectable Length Keys

#KEDF
Configurable Length Keys

#KEDZ
With Counterbores

#KEDY
With Tapped Counterbores

#KEDW
With Counterbores & Tapped Holes

#KEDM
With Tapped Hole

#KETS
Machine Keys – Stainless Steel

#KTH
Tapered Machine Keys with Gib Head

Screw Plugs

#MSW
Screw Plugs – Standard

Dowel, Spring & Stepped Pins

#MS ★
Oversized – One End Chamfered, One End with Radius

#MSCM
Oversized – Both Ends Chamfered

#MSV
Oversized – High Precision

#MSTP
Undersized – Both Ends Chamfered

#THS
Oversized – Pull-out with Thru Hole

#MST
Oversized – Pull-out with Air Vent

#MTT
Oversized – Tapered

#MSH ★
Undersized – One End Chamfered, One End with Radius

#MSHH
Undersized – Both Ends Chamfered

#MSGB
Undersized – General Purpose

#MSHT
Undersized – Pull-Out

#MSTG
Undersized – Pull-Out with Air Vent (g6)

#MSTH
Undersized – Pull-Out with Air Vent (h7)

#KNHN
Dowel Removal Jigs

#MSY
Dual Fit – One End Oversized, One End Undersized

#MSYT
Dual Fit – Pull-Out

#MSFW
Stepped Dowel Pins

#MSIP
Insulating Dowel Pins

#MSIJ
Resin Dowel Pins

#SSPR
Spring Pins

Cotter Pins

#JNPN
Hairpin Cotter Pins

#NPN
Cotter (Split) Pins

Retaining Rings

#STWN
Retaining Rings – External, C-Type

#NETW
Retaining Rings – External, E-Type

#RTWN
Retaining Rings – Internal, C-Type

NEW

#RTWP
Retaining Ring Pliers

#BSTW
Retaining Rings – C-Type, External (Box)

#BNET
Retaining Rings – C-Type, External (Box)

Inserts

#HLSS
Thread Inserts

#HLSX
Taps for Thread Inserts

#HLTP
Thread Insert Installation Tool

#HLTB
Thread Insert Tang Breaking Tool

#HLTN
Thread Insert Removal Tool

#TLTS
Thread Inserts – Tangless

#TLTK
Taps for Tangless Inserts

#TLTN
Tangless Inserts Installation – Removal Tools

#ENT
Self-Tapping Inserts – Slotted

#ENTP
Self-Tapping Inserts Installation Tool

#BHLT
Thread Insert (Box)

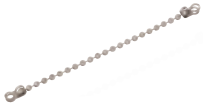
#BTLT
Thread Insert (Box)

Wires / Chains / Metal Fittings / Small Work Pieces

NEW

#CWAB
Fastening Wire-Loop – Dia. Configurable

#SCHS
Loss-Prevention Stainless Steel Chain



#BALL
Loss-Prevention Ball Chains

#CHSP
Loss-Prevention Chain

Grease Fittings

#GPA
Grease Fittings – Straight

#GPB
Grease Fittings – 67.5 degree

#GPC
Grease Fittings – 90 degree

Stickers / Plates

#HH
Temperature Recording Labels

#ARWS
Arrow Stickers – Straight

#APWS
Arrow Plates – Straight

#AWRB
Arrow Stickers – Curved

#KHPT
Open/Closed Sign Plates

#LRM
Warning/Danger Triangular Stickers

#LRDM
Caution/Warning/Danger Mark Stickers

#CHC
Caution/Warning/Danger Stickers

Parts / Small Work Pieces

#TMEL
Scale Tape

#MEAA
Angle Scale – 180 Deg.

#MEAN
Angle Scale with Adhesive Tape

#SMTP
Bubble Level – Flanged Mounting

#SMH
Bubble Level – Press-Fit

#MES
Scale Plates

#PPL
Pointing Plates

NEW
#DW
Retaining Washers

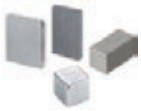
NEW
#PWW
Crimp Brackets (Package)

#WWN
Crimping Tools

#UKC
Attachment for Anchoring Wire

Magnets

#HXN
Magnets – Cylindrical



#MGLF
Magnets – Rectangular, Neodymium

#HXP
Magnets – Flexible, Super Strong

#HXRS
Magnets – Flexible, Rectangular Sheets

#HXR
Magnets – Flexible, Roll

#HXUK
Magnets – Oval Holder with Mounting Holders, Counterbored, Tapped

#HXU
Magnets with Holder – Tapped

#HX
Magnets with Holder – Tapped, Short

#MGN
Magnets with Holder – Tapped, Long

#MGR
Magnets with Holder – Knurled

#HYM
Magnets with Holder – V Groove

#HXBY
Magnets – Threaded

#HXBB
Screw Stoppers with Magnet

#MGE
Electromagnet Holders

#MGEC
Rectifier for Electromagnet

LOW ← ACCURACY → HIGH

Type	Unpolished (Drawn)	Milled Finish	Rotary Griding Finish	Surface Grinding Finish
Finished Surface				
Surface Roughness	—	Side Surface 1.6a, Top-Bottom Surface 6.3a	Top-Bottom Surface 3.2a	Top-Bottom Surface (Iron) 1.6a, (Stainless/Aluminum) 3.2a
Flatness (mm)	—	0.03~0.015 mm	0.012~0.05 mm	0.012~0.05 mm
Parallelism (Top-Bottom)	—	0.05~0.1	0.012	0.012

Material Selection						
Carbon Steel	1018	1018 Annealed	1049	1055 Normalized	1049 Thermaly Refined	
Tool Steel	A2	D2	DC53	M2	01	SKS93
Pre-Hardened Steel	PX5	NAK55	Toolox44	G-Star		
Alloy Steel	4140					
Stainless Steel	430			440C		
Aluminum Alloy	6061	50552	5052 Heigh Precision	2017	ANP79 (7000Series)	7075
Roller Copper Brass Titanium	Tough Pitch Copper C11000		Oxygen Free Copper C10200		Chrome Copper (JIS Z3234 Class 2)	
	Brass (C28000 Brass 1/4)		Titanium (Class 2 TP3240H)			

Metal Materials

★

#MTPB
Metal Plates, Blocks

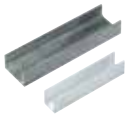
#MTCP
Metal Circular Plates

#MTRD
Metal Rods

#MTHR
Metal Hex Rods

#MTPI
Metal Pipes, Metal Tubes

#MTLA
Metal L-Shaped Angles



#MTUC
U-Shaped Channels

#MTLB
L-Shaped Blocks

#MTUB
U-Shaped Blocks

#MTTB
T-Shaped Blocks

#MTIB
Inclined Blocks

Resin Material	MC Nylon	Polyacetal	UMHW	Flourine Resin	PEEK	PPS	ABS	PBT	Free-Cuting Resin (Unilate)
Tensile Strength	66–96 MPa	42–61 MPa	35–45 MPa	11–34 MPa	75–130 MPa	75–85 MPa	39 MPa	49 MPa	65 MPa (Horizontal) 110 MPa (Vertical)
Operating Temperature	-40~150°C	-45~90°C	-100~80°C	40~260°C	-50~250°C	Room~220°C	Room~50°C	Room~120°C	Room~120°C
Abrasion Resistance	G	E	E	G	G	G	F	F	F
Sliding Properties	G	E	E	E	G	F	F	G	F
Impact Resistance	G	G	E	G	G	F	G	G	G
Dimensional Stability	F	G	F	P	G	E	E	G	G

Excellent Good Fair Poor

Plastic Materials

#RSQP
Resin Plates

#RRPL
Resin Round Plates

#RROD
Resin Rods

#RPI
Resin Pipes

Springs

#AUA
Extra-Light, Light, Light to Medium, Medium Load

#AUT
Tension Springs – Heavy Load

#UFSP
Extension Springs – Configurable Lengths

#LUS
Extension Springs – Long

#HBFK
Plate Hook for Long Extension Spring

#LUSH
Solid Coil Springs Hook Insertion

#AIPO
Spring Anchors – Wrench Flats

#AIPK
Spring Anchors – Wrench Flats with Notch

#ASPL
Spring Anchors – L-Shaped, Hole

#ARPO
Spring Anchors – Socket Head Cap Screw

#DSPO
Spring Anchors – Hexagonal

#BSPO
Spring Anchors – Flat Head Screwdriver with Groove

#YJPO
Posts for Tension Springs – Roller

#SRBN
Disc Springs

#IBN
Flat Springs

#UA90
Torsion Springs

#CFS
Constant Load Spring

#SPGC
Washers for Compression Springs – Standard

#SPGM
Washers for Compression Springs – Tapped

#SSWA
Washers – SW

#WR
Round Coil Springs – WY/WR O.D. Referenced

#WF
Round Coil Springs – WF/WL O.D. Referenced

#WM
Round Coil Springs – WT/WM O.D. Referenced

#WB
Round Coil Springs – WH/WB O.D. Referenced

#VUF
Round Coil Springs – I.D. Referenced

#UF
Round Coil Springs – O.D. Referenced Stainless Steel

#UL
Round Coil Springs – O.D. Referenced Stainless Steel

#UH
Round Coil Springs – O.D. Referenced Stainless Steel

#UBB
Round Wire Springs Spring Constant 4.9~29.4 N/mm

#FUF
Compression Springs – Configurable Length

#SWY
Coil Springs – Ultra-High Deflection SWY

#SWU
Coil Springs – Ultra Deflection SWU

#SWR
Coil Springs – High Deflection SWR

#SWS
Coil Springs – Medium Deflection SWS

#SWF
Coil Springs – Light Load SWF

#SWL
Coil Springs – Light Load SWL

#SWM
Coil Springs – Medium Load SWM

#SWH
Coil Springs – Heavy Load SWH

#SWB
Coil Springs – Ultra-Heavy Load SWB

Shock Absorbers

#MAKC
Shock Absorbers – Non-Adjustable Preset Dampening

#CMA
Shock Absorbers – Adjustable

#EMAC
Shock Absorbers – Economy

#MAC
Shock Absorbers – Adjustable Dampening

#OPCP
Eccentric Angle Adapters – Adjustable Dampening

#STNC
Stopper Nuts – Adjustable Dampening

#MAMS
Shock Absorbers – Compact

#MAMK
Shock Absorbers – Compact Fixed

#MACC
Shock Absorbers – Coolant Resistant

Gas Springs

#FGSS
Gas Springs – Mounting Direction Free, FGSS

#FGS
Gas Springs – Limited Mounting Direction with Rigid Ends, FGS

#GSBR
Mounting Brackets for Gas Springs – FGS/FGSS

★ ✓
#GSS
Gas Springs – Limited Mounting Direction with Floating Ends, GSS

#HFBR
Gas Springs – Gas Reaction Force Configurable

#FRGS
Gas Springs – Stainless Steel

Sound Proofing / Antivibration

#DBGO
Electroconductive Antivibration Rubber Mounts – Both Threaded

#DBGN
Antivibration Rubber Mounts, One End Threaded, One End Tapped

#BGOM
Antivibration Rubber Mounts – Both Ends Threaded

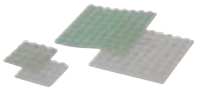
✓
#BGON
Antivibration Rubber Mounts – One End Tapped, One End Stopper Plate

★ ✓
#BGEL
Washers with Antivibration Gel – Both Ends Threaded, Standard

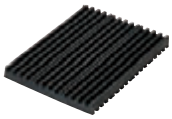
#BGE2
Antivibration Gels – One End Threaded, One End Stopper Plate

#GELB
Antivibration Gel Bushings

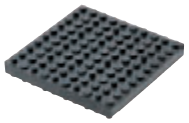
#HBGE
Antivibration Gels – One End Threaded, One End Stopper Plate with Rubber Jacket



#BGEG
Antivibration Gel Sheets without Adhesive



#BPAS
Antivibration Pads – Standard



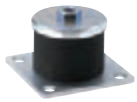
#RUBL
Antivibration Pads – RUBLOCK (for Low Frequency), Standard

#BS2F
Sound Profing Materials – Standard Sizes

★
#FBS2
Vibration Control – Sound Absorption with Adhesive, Configurable

#BMPK
Safety Protection Materials – Rubber Bumper Pads, Square

★ ✓
#FJFV
Adjustment Pads – Antivibration



#KMBS
Antivibration Mounting Plates

#FBF
Antivibration Pads – Light Load

★
#FBR
Antivibration Pads – Heavy Load

#KFJA
Antivibration Mounts – Round

Safety Protection Materials

#BON1
Adhesives for Urethane

#PRGC
Safety Protection Materials – Protection Materials, Shock Absorbtion Material

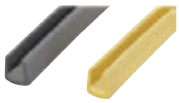
#ADTR
Double-Sided Adhesive Tape for Rubber Standard for Silicon

#TRAT
Trims, Thermoplastic Elastomer (TPE)

#TRIN
Corner Trims

#TRSA
Trim Seals, Thermoplastic Elastomer (TPE)

NEW
#TRSE
Low Rebound Trim Seals – Airtight, Wide Angle


NEW
#CTR2
Compact Trims – Plastic Cover Plates


#CTRT
Compact Edge Trim


#PTRT
Resin Trims


#PRGD
Safety Protection Materials – D Shaped Rubber Bumper


NEW
#PRGM
D Rubber – Bumpers for Corner


#PRTR
Security Symbol Tape


#PRGS
Safety Protection Materials – Small Corner Covers for Edges


#PRGF
Safety Protection Materials – Corner Covers for Edges


#PRG1
Safety Protection Materials – Corner Covers 34mm Width


#PRGL
Safety Protection Materials – Large Corner Covers for Edges


#BOND
Moment Adhesives for Rubber or Silicone

Antistatic Materials


#EPAT
Sponge Tapes


NEW
#ECRC
Electroconductive Rubber Feet with Collar


#ECRK
Electroconductive Rubber Feet


#GOMA
Rubber Feet Receiver Cups


NEW
#RBDL
Antistatic Rubber Sheets – Sheet/Roll


#RBDE
Grounding Plates


#RBDB
Antistatic Rubber Sheets


#LBA
Polyethylene Foam for Antistatic


#LBNC
Antistatic Sponge Sheets – Polyethylene Foam


#EBRS
Neutralization Brushes


#ECTP
Copper Foil Tape


#ELTA
Neutralization Tapes

Industrial Brushes


#URBS
Roll Brush – Interchangable


#BRUN
Roll Brush


#BRUP
Roll Brush – Channel Roll Brush, Pitch Configurable


★
#BRUE
Channel Brush

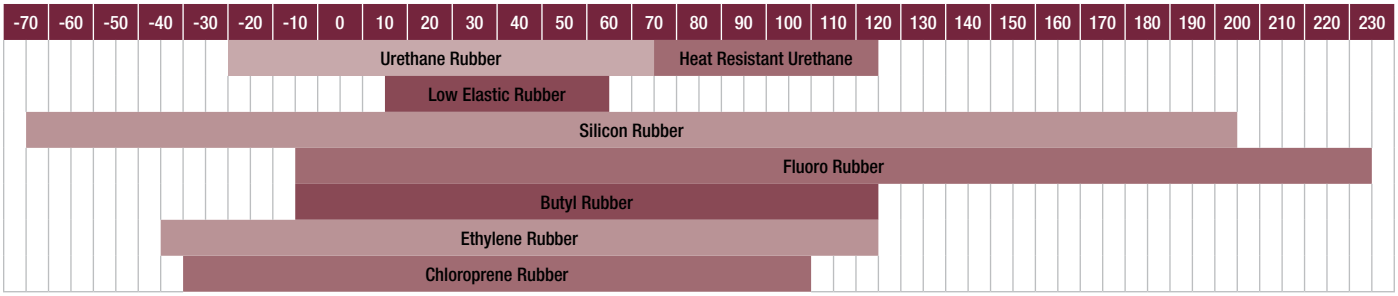

NEW
#BRUA
Attachment Brackets for Channel Brushes – Vertical Mount


NEW
#BRU2
Attachment Brackets for Brushes – Angle Adjustable


#BRUS
Attachment for Channel Brush

	LOW ← PROPERTIES → HIGH							
Mechanical Strength	Silicon	Low Elastic	Butyl	Ethylene	Nitrile	Fluorine	Chloroprene	Urethane
Weather Resistance	Nitrile	Low Elastic	Chloroprene	Urethane	Butyl	Silicon	Ethylene	Fluorine
Abrasion Resistance	Silicon	Low Elastic	Butyl	Ethylene	Chloroprene	Urethane	Nitrile	Fluorine
Heat Resistance	Low Elastic	Urethane	Nitrile	Chloroprene	Butyl	Ethylene	Silicon	Fluorine
Oil Resistance	Butyl	Ethylene	Silicon	Chloroprene	Urethane	Low Elastic	Nitrile	Fluorine

Allowable Operating Temperature [°C]



Urethane / Rubber / Sponge / Felt

NEW

#PURW
Urethane Washers – Rubber Washers (Package)

★

#UAFH
Urethane Washers

NEW

#URWH
Urethane Washers – Adhesive

#WRBA
Rubber Washer

#WSEA
Sponge Washers

#CXH
Urethane Bumpers – Standard Length

#RBXA
Rubber Bumpers

#ASGA
Sponge Bumpers

★

#AAFH
Urethane Bumper – Fully Configurable

#AYFH
Bumpers with Metal Washer – Urethane, Antistatic Polyurethane, Rubber

NEW

#AZKH
Urethane, Rubber Baked Bumpers

#NBBK
Urethane Rubber Bumpers – Threaded

★

#AZCH
Urethane Bumpers – Counterbored

★

#AZAH
Urethane Bumpers – Counterbored, Fully Configurable

#AZC
Collars for Counterbored Urethane Bumpers

#RBZK
Rubber Bumpers – Counterbored Rubber Bumpers, L Dimension Selectable

#RBZA
Rubber Bumpers – Counterbored, Fully Configurable

#UBFF
Urethane and Rubber Bumpers with Spherical Tip

#UTTH
Urethane and Rubber Bumpers with Tapered Tip

#DXFH
Urethane/Rubber Bumpers with Pilot

#RBCA
Urethane/Rubber Bumpers – Cap

#GELM
Shock Absorbing Bumpers – Tapped, Threaded

#UTL
Urethane Sheets – Standard

#UTSL
Urethane Sheets – Standard

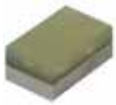
NEW

#UTSC
Ceramic Urethane Sheets

#UTEX
Highly Abrasion Resistant Urethane, Heat Resistant Urethane Sheets

#LUTN
Antistatic Urethane Sheets, Low Rebound Urethane Sheets

#NTUH
Urethane Sheets with Oil-Resistant Adhesives



#UTPF
Metal-Plated Urethane Sheets – Flat, Standard A Dimension

#BUTL
Urethane/Rubber Blocks

#RBNM
Nitrile Rubber Sheets

#RBCM
Chloroprene Rubber Sheets – Standard, Non-Staining

#RBEW
Ethylene Rubber Sheets

#AMSE
Amber Color Rubber Sheets

#RBRM
Butyl Rubber Sheets

#RBFM
Fluoro Rubber Sheets – Standard A/B Dimensions

#RBAM
Silicon Rubber Sheet – Standard A/B Dimensions

#UNLE
Low Elastic Rubber Sheets – Standard A/B Dimensions

#GELH
Shock Absorbing Bumpers Plate – Holder

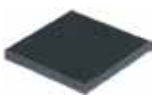
#SUTL
Urethane Sheets – Very Low Hardness (Shore A15)

#GELS
Silicon Gel Sheets

#STHV
Anti-Skid Rubber Sheets

#STPE
Nonskid Rubber Sheets

#LRBA
Low Friction Rubber Sheets



#SGNA
Urethane, Rubber Sponge, Configurable A/B Dimensions

#SNPG
Low Elastic/Antistatic Low Repulsion, Low Strain Sponge Sheets

#POLS
Heat Insulation Polyimide Sheets

#WSPO
Heat Insulation Polyimide Washers

#EPA
Dustproof General – Purpose Sponges

NEW

#SOFR
Special Foam Polyurethane SOFRAS – Sheet

NEW

#SOFS
Special Foam Polyurethane SOFRAS – Rolled

#FELH
Felt Sheets

#BFEL
Felt Bumpers

#EPA2
Sponge Tapes

#RBGE
Round Cord – Sealing Elastomer

#RBWR
Rubber Cord – Round Ring

#RBWF
Rubber Sponge – Round Cords

#RBKW
Rubber Sponge – Square Cords

#KYHF
Rubber – Trapezoidal Dome Cords

#KMHP
Rubber Sponge – Round Dome Cords

★
#FUHA
Urethane Gaskets – Circular

#FUHH
Urethane Gaskets – Square

★
#FRNA
Rubber, Sponge Gaskets – Circular

#FRCH
Rubber, Sponge Gaskets – Square

#HPRI
Heat Insulation Sponges

NEW
#BASO
Heat and Sound Insulation Sponges – Melamine Resin Foam

NEW
#HOPA
Heat Insulation Sponges – High Heat Resistant Polyimide, Foam

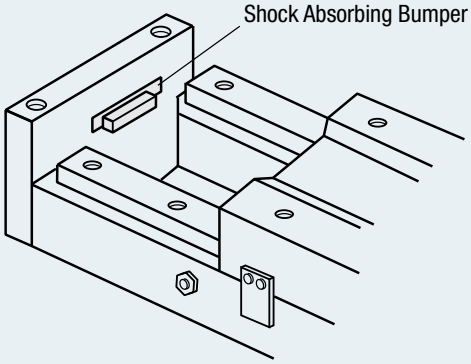
#HOPE
Heat Insulation Sheets

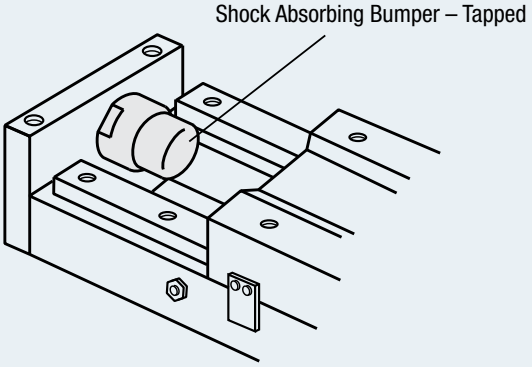
#HOPT
Heat Insulation Tapes

#BONU
Adhesives for Urethane

#ADT2
Double-Sided Adhesive Tape for Rubber Standard for Silicon

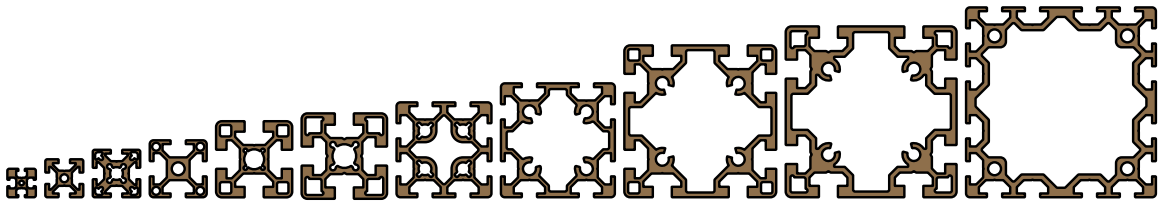
Example





Series	Slot Width (mm)	Basic Sqaure Size (mm)										
		15	20	25	30	40	45	50	60	80	90	100
Series 3	3.4	•										
Series 5	6		•	•		•						
Series 6	8				•			•	•			•
Series 8	10					•				•		
Series 8–45	10						•	•	•		•	•
Other	Cut To Length (no cutting charges)	in 0.5mm increment up to 4000mm										
	Stock Length	1000mm, 4000mm										

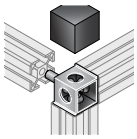
Example Basic Square Sides



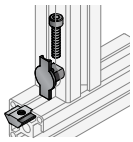
Aluminum Extrusion

#AEXP
Standard Profiles

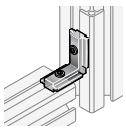
#AEXB
90 Deg. Brackets



#AECB
Corner Brackets

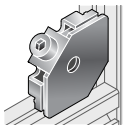


#AEBJ
Blind Joints



#AEBB
Blind Brackets

#AEXG
Estrusion Gussets



#AEB
Post-Assembly Brackets

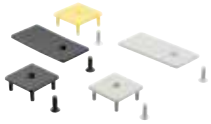
#AEPB
Other Connectors

#AEAB
Angle Brackets

#AESB
Sheet Metal Brackets

#TNUT
T-Nuts, Wsshers

#AES
Extrusion Screws



#ECAP
End Caps

#AEA
Extruded Angles

#FNS
Fence Extrusion

#FLTE
Flat Extrusion

#ALCH
Aluminum Channels

#SFNC
Safety Fence Frames

#SDOR
Extrusion for Slide Doors

#FKIT
Frame Units

#SLOT
Slot Cover

#AEPH
Pull Handles for Extrusion

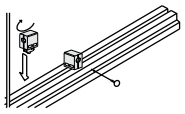
#AEHG
Hinges

#AECL
Catches and Locks

#AECT
Casters for Extrusion

#AEAM
Adjusting Mounts

#AEFU
Foot Bases



#AEP
Panel Mounts

#AECU
Curtains, Sheets

#AEDS
Door Sliders

#AEHH
Clamps, Holders, Hooks

#AECC
Conveyor Parts for Extrusion

#XJIG
Jigs, Maintenance Parts

Pipe Frames

#FFA
Factory Frames

#PFS
Pipe Frames – Configurable Length

#PFSM
Curved Pipe Frames

#PFSA
Aluminum Pipe Frames – Configurable Length

#PFSU
Stainless Steel Pipe Frames

★

#PFOT
Casters – Leveling Mounts for Pipe Frames

#PFJB
Lifting Parts

★

#PCON
Conveyor Parts for Pipe Frames

#FFH
Hinge

#PTOL
Assembly Tools

#PCLM
Clamps, Accessories

#PKIT
Pipe Frame Units

#PJNT
Joints for Pipe Frames

Perforated Metals / Fences / Nets / Panels

★

#PAAL
Aluminum Panels

#PASU
Stainless Steel Panels

#PAST
Steel Panels

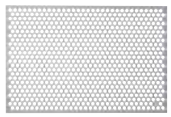
#HFPA
Cover Plates

#PAPD
Painted Panels with Holes

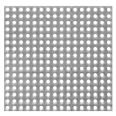
#PAPJ
Painted Panel with Vent Holes

#PAAE
Painted Steel / Aluminum Panels – Selectable Shapes

#PMS
Perforated Metal – Standard



#PMST
Perforated Metals With Frame – Fixed Dimension



#PMLU
Perforated Metal – Round Hole Parallel

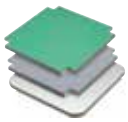
★
#PMSF
Perforated Metal – Framed

#PMC
Perforated Metal – Circular

#PMSL
Perforated Metal – L-Shaped

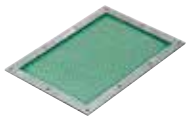
#PBD
Plywood/Particle Boards – Rectangular

#ATBD
Soft-Edge Laminated Plywoods

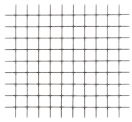


#ALBH
Laminated Plywood with Edge Molding

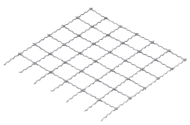
#PACL
Stainless Steel Panels with Protective Sheet



#NETS
Net Plates with and without Frame



#FENM
Fence Nets – Welded



#NETU
Fence Nets – Meshed, Stainless Steel

#EXPM
Folding Nets – No Frame

#EXPF
Folding Nets – Framed

Mesh

#PMTF
Framed Mesh

#PMT
Mesh – Cut to Size

Glass / Mirror

#FGLK
Fused Silica Plates – Square, Configurable

#FGLM
Fused Silica Plates – Round, Configurable

#GLKF
Square Glass Plates – Standard A/B Dimensions

#GLMF
Round Glass Plates – Standard Diameters

#MRA
Mirrored Plate – Acrylic

#GLFB
Flange Base for Observation Port – Standard

#GLFC
Flange Cover for Observation Port – Standard

#GLSE
Observation Port Set – Standard

Ceramics

#CERR
Ceramic Rods

#CEA
Ceramic Plates

#CEMN
Ceramic Plates – Larger Size

#PCEA
Ceramics Circular Plates with Holes

Material	PET			Acrylic			Polycarbonate			Anti-Static PVC	
Available Colors	Smoke Brown	Orange	Transparent	Smoke Brown	Orange	Transparent	Smoke Brown	Smoke Gray	Transparent	Smoke Brown	Transparent
Transmittance (Light/Opacity)	28–30%	45%	77–87%	25–34%	43%	79–93%	35%	33%	86–91%	29%	80%
Operating Temperature	-15~55 °C			-30~80 °C			-30~100 °C			-30~60 °C	
Width [mm]	20~300	20~1000	20~1000	20~300	20~1000	300~900	20~300	20~1000		100~900	
Length [mm]	20~300	20~2000	20~2000	20~300	20~2000	300~1100	20~300	20~2000		100~1100	
Thickness [mm]	0.5, 1.5	1, 2, 3, 4, 5, 8	1, 2, 3, 4, 5, 8	0.5, 1, 1.5, 2	3, 4, 5, 6, 8, 10, 15, 20, 25	3, 5, 8	0.5, 1, 1.5, 2	3, 4, 5, 6, 8, 10		3, 5	
Special Features	– Approx. 4 times stronger impact resistance than acrylic – Environmentally-friendly – Cost-effective			– Curved Panels available – Low-cost panels available – Widest light transmittance (opacity) range – Weather resistant and good for use outdoors – Easily machinable			– Highest impact strength in the group (30 times higher than acrylic plates) – Widest temperature range			– Highly chemical and flame resistant – Anti-static – Cost-effective	
Cost $	$			$$			$$			$$	

Transparent Plastic Covers

#RDJA
Resin Rods – Transparent

#PIJ1
Transparent Resin Hollow Tubes

#PYA
PET Plates

#PYA2H
PET Plates

#ENBT
PVC Plates

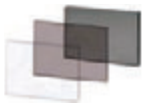
★

#ACA
Acrylic Plates

#ACA2H
Acrylic Plates

#ACAE
[Economy] Acrylic Plates

#ACAM
Acrylic Plates Curved Panels



★

#PCTA
Polycarbonate Plates

★

#PCTA2H
Polycarbonate Plates

#ACSH
Resin Sheets – Resin Films

#ACAL
Plastic Cover Plates – L-Shaped

#ACAU
Plastic Cover Plates – U-Shaped

#ENJA
Resin Circular Plates with Holes

#SAC
Acrylic Cases

LOW ← HARDNESS → HIGH

Wheel Material	Synthetic Rubber	Conductive Rubber	Urethane	Special Reinforced Plastic	MC Nylon	(White) Nylon	PEEK	Phenol	Casting
Abrasion Resistance	E	E	E	F	E	G	G	G	E
Oil Resistance	F	F	G	G	E	E	E	E	E
Water Resistance	E	E	G	G	E	E	G	G	G
Noise	E	E	G	F	F	P	F	F	P
Allowable Load	F	F	E	E	E	F	E	E	E
Moving Resistance	F	F	G	G	E	G	G	E	G
Operating Temp.	-5~60°C	-5~60°C	-20~80°C	-20~80°C	-20~120°C	-10~120°C	-50~250°C	-40~180°C	-40~200°C
Cost $	$	$$	$$	$$	$$$	$	$$$	$$$	$$

Conductive Materials: We offer Conductive Rubber and some MC Nylons

Excellent Good Fair Poor

Casters

#CMPL
Casters – Threaded, Swivel with Plate

#CPHA
Foot Mount Brackets

#CLGJ
Miniature Casters – Swivel

#CNGA
[Economy] Casters – Mounting Bracket

#CHAJ
Casters

#CHAS
Caster Light Load

#CNGJ
[Economy] Casters – Swivel

#CRJD
Casters – Conductive, Swivel

★ ✓
#CMGJ
[Economy] Casters – Swivel

★ ✓
#CJM
Casters – Medium Load, Swivel

#CSPJ
Compatible Casters – Swivel

#CMGV
[Economy] Casters – Swivel, Locking

#CMTW
Casters – Double Lockable

NEW
#CMTY
Casters – Safety Pedal

#CHJF
Casters – Low Floor, Swivel

#CGJF
Casters– Ultra Low Profile, Lightweight

#CGZJ
Casters – Super Heavy Load, Low Profile, Lightweight

#CSHN
Casters – Medium to Heavy Load

★ ✓
#CJH
Casters – Heavy Load, Swivel

#CSHK
Casters – Heavy Load, Swivel

#CKZJ
Casters – Very Heavy Load, Swivel

#CSTU
Casters – Threaded

#CNGN
[Economy] Casters with Insert – Light Load

#CLTU
Casters – Threaded

#CSMN
Casters – Stainless Steel, Screw-in

#CRMN
Casters – Conductive, Screw-in

#HSG1
Screw-In Casters – Light/Medium Load

#CMGN
[Economy] Casters – Screw-in

#CSJT
Casters – Threaded

#CHJN
Casters – Low Floor, Screw-In

#CPHM
Mounting Plates for Side Mount Casters

#CWMP
Casters – Double Wheel, Medium Load

#CKXJ
Casters – Super Heavy Load

#CWMJ
Casters – Double Wheel

#CWG
Casters – Double Wheel, Stainless Steel

#CMAZ
Casters with Adjustment Pads – Ultra Light Load

#CMJZ
Casters with Adjustment Pads – Lightweight

#CMPD
Casters – Threaded

#CLAR
Casters with Adjustment Pads – Antivibration

#CLDK
Casters with Leveling – Antivibration, Heavy Load

#CMAF
Casters with Adjustment Pads – Light Load

#CMAS
Casters with Adjustment Pads – Medium Load

#CGAN
Casters with Adjustment Pads – Heavy Load, Integrated

#CLAM
Casters with Adjustment Pads – Heavy Load

#CDAN
Casters with Adjustment Pads – Large Diameter Wheel

#CAZL
Casters with Integrated Plate and Adjustment Pad – MC Nylon Wheel

#HCFF
Casters and Adjustment Pads Assembly – Custom Mounting Hole

#CMPG
Casters – Vibrations Insulating

#CHEP
Casters for Clean Environment – Plate with Swivel

#CPBK
Cast Casters – Swivel

#CSTK
Cast Casters – Heavy Load, Swivel

#CHAM
Design Casters – Plate

#CTBM
Design Casters

#CTGM
Dual Wheel Casters

#CTEJ
Design Casters

#CTYN
Design Casters

#CPNB
Design Casters – Insert

#CHBF
Ball Casters – Round Flange

✓
#CSJM
Resin Casters

#RVAB
Wheel

#CMHD
Caster Holders

#FLOC
Floor Stoppers – Space Saving

#FLOZ
Floor Stoppers – Height Adjustable

★
#FLOK
Floor Stoppers

#FLOR
Floor Locks

Wheels

#GYUL
Replacement Wheels for Casters

#GYUW
Replacement Wheels for Casters

#RVA
Replacement Wheels for Casters – Rubber Wheel

#KCRB
Wheel Shafts for Casters

Leveling Mounts / Rubber Feet

#NFB
Table-Top Bases

#KFB
Table-Top Bases

#NFJN
Leveling Mount – Standard

#FJGM
Adjustment Pads – Nonslip

#FJKN
Adjustment Pads – Fixed

★
#FJWN
Adjustment Pads – Two Hole

#NFJC
Adjustment Pads – Space Saving

✓
#MAJB
[Economy] Adjustment Pads

★
#FJF2
Leveling Mount – Heavy Load

#FJKT
[Economy] Fixing Plates for Adjustment Pads

#AJKN
Mounting Plates for Adjustment Pads – Thick, Centered Groove

#FJKP
Mounting Plates for Adjustment Pads

#FJTP
Mounting Nuts for Adjustment Pads

#AJCP
Protection Caps for Adjustment Pads

#HNFN
Leveling Mount – Space Saving

#HNFR
Leveling Mount – Rotary

★ ✓
#LEMS
Adjuster Feet – Rotary

✓
#FJRP
Adjuster Feet – Rotary, Short

#LEMN
Adjuster Feet – Tapped Socket

#AJPD
Adjuster Feet – Resin Rubber

#FJLM
Adjuster Feet – Rotary

★
#FJSM
Rubber Base Adjustment Pads

NEW
#NFBG
Tabletop Leveling Mounts – Grip

★
#FJKB
Foot Jack Bolts – Radiused Tip, Square Head

#FJKC
Foot Jack Bolts – Radiused Tip, Hex Head

#FJKF
Foot Jack Bolts – Flanged, Radiused Tip

#FJKM
Foot Jack Bolts – Spherical Tip

#FJKR
Foot Jacks Tip Hexagon Chamfered

#FJK2
Foot Jacks Tip Sphere Head Cap

#FJKA
Foot Jacks Tip SR Head Cap

#SEPF
Seating Plates

NEW
#KHWM
Leveling Mounts

Angle Brackets

#STYU
Angle Brackets – Press-Fit

#STDR
Anchor Brackets

#STRS
Anchor Brackets – Ribbed

Levers

★
#CLDF
Clamp Levers – Threaded

#CLCF
Clamp Levers – Stainless Steel, Threaded, Chrome Plated

#CLCC
Miniature Clamp Levers – Threaded

#CLDT
Flat Clamp Levers

#CLDM
Y-Shaped Clamp Levers

#CLDC
Double Arm Clamp Levers

#CLDS
Clamp Levers – Threaded with Washer

#CLDP
Push Button Clamp Levers

★
#CLRM
Clamp Levers with Pad, Radiused Tip

#CLNP
Resin Clamp Levers – Curved Handle

★
#LNF
Resin Clamp Levers – Straight Handle

#CLNC
Miniature Resin Clamp Levers

#CLN2
Resin Clamp Levers with Push Button

#CLN3
Savety Resin Clamp Levers

#CLRA
Ratcheting Clamp Levers

#CLCK
Cam Lever

#LFTM
Flat Tension Levers

#LFTR
with Hexagonal Socket Head – Threaded

#ALDM
Tension Levers – Safety Tension Levers

#LAG
Stationary Handles – Offset, Spherical Knob

Handles

#CLR
Stationary Levers – Cost Efficient Product

#CGM
Revolving Handles – Cost Efficient Product

#CGRW
Revolving Handles with Hex Socket – Cost Efficient Product

#CGB
Folding Handles – Cost Efficient Product

#CPBG1
Revolving Ball Knobs – Cost Efficient Product

#CLG
Cone Shaped Levers – Cost Efficient Product

#LBG
Stationary Handles – Cylindrical Knob

#BGW
Ball Knobs – Resin

#GRAF
Stationary Handle

#GRMS
Stationary/Revolving Handles – Stainless Steel

#GRMK
Revolving Grips – Ergonomic

#GRM
Revolving Grips – Hexagon Socket Head Cap Screw

#GRC
Revolving Grips – Flat Head Screwdriver

#GRW
Revolving Grips – Hexagonal Socket Head

#GRMB
Revolving Handles – Folding

#GRML
Revolving Handles – Folding

#GRF
Revolving Handles – Short, Threaded

#GRMM
Miniature Revolving Handle – Stainless Steel

#PBG
Revolving Ball Knobs

Crank Handles / Hand Wheels

#CNO
Balance Handles – Cost Efficient Product

#CMB
Revolving Crank Handles – Square/Round Bore, Cost Efficient Product

#CPH
Handwheels – Spoked, Cost Efficient Product

#CAH
Handwheels – Five Spoked, Cost Efficient Product

#CAN
Handwheels – Spoked, No Handle, Cost Efficient Product

#UPF1
Handwheels – Solid Disk, Cost Efficient Product

#CPHS
Handwheels – Solid Disk, Retractable Handle, Cost Efficient Product

#SSCH
Crank Handles – Square Hole, Ribbed

#MBCH
Crank Handles – Square Hole

#NOCH
Crank Handles

#PHLK
Offset Handwheels – Three Spoked

#AHSK
Offset Handwheels – Solid

#SCOL
Collar with Scale

#AHSL
Handwheels – Folding

#AHNF
Handwheels – Flat

#AHLN
Handwheels – Five Spoked

#AHTN
Handwheels – Two Spoked, Stainless Steel

#HBK
Knurled Handwheels – Aluminum

Knobs / Screws

#NKB
Knurled Knobs – L Dimension Standard

#NKBA
Knurled Knobs – Thick, L Dimension Standard

#NKOT
Knurled Knobs with Washer

#NKCR
Stepped Knob (not Knurled)

#NKRD
Knurled Knobs – Large Diameter

#NKBC
Knurled Knobs – Small Diameter

#NKBR
Knurled Knobs – Hexagonal Socket Head

#NKBX
Twill Knurled Knobs

#NKBD
Knurled Knobs – Drop-Proof

#NOOS
Knurled Knobs with Tip Pad

#NKOS
Knurled Knobs – Socket Head Cap Screws

#NOBW
Knurled Knobs – Flat Head Screwdriver

#NRL
Knurled Knob Screws – Short

#NRLS
Knurled Knob Screws – SR Tip

#KNB
Knurled Clamp Knobs

#NPFS
Stainless Steel Knobs – Round

#NPFC
Stainless Steel Knobs – Wingnut

#NPBF
Stainless Steel Knobs – Five Lobed

#NBMS
Plastic Knurled Knobs with Pad

#NBMP
Plastic Knurled Knobs

#NAF
Plastic Clamp Knobs

#NBF
Knurled Knobs – Straight Cut

#NBFX
Knurled Knobs – Diamond Cut

#NKRF
Knurled Knobs – Large Diameter

#NMF
Plastic Knobs – Mushroom Shaped

#NWGM
Plastic Knobs – Tab Shaped

#NWGF
Plastic Knobs – Wingnut

#NTM
Plastic Knobs – Three Lobed

#NKPF
Plastic Knobs – Star

#NCRF
Plastic Knobs – Cross

#NPEF
Plastic Knobs – Five Lobed

#NHF
Plastic Knobs – Six Lobed

#NKSF
Plastic Knobs – Seven Lobed

#SKN
Super Knobs

#ASKN
Adjustment Screws with Knobs

#PPKN
For Socket Head Cap Screws

#DPCH
Drop-Prevention Chains for Knobs

Hanger Hooks

#HHKJ
Hooks

#HKKJ
Hooks

Pull Handles

#UWAN
Handles – Standard Lengths

#UWAF
Handles – L/H Dimensions Configurable

#UWAC
Small Handles

#UWAA
Mounting Plates for Handle – Round Handle

#UWAZ
Round Handles with Washer – Tapped

#UWAL
Round Handles With Rubber, Tapped

#UZB
Washers for Handles

#UHFN
Handles – Offset

#UHF6
Handles – Small Diameter, Offset

#UABL
Handles Tapped Oval Grip

#USAN
Rectangluar, Standard Lengths

#USAK
[Tapped] Square Handles U-Shaped

#USAF
Rectangluar, Configurable Lengths

#UWSY
Designer Handles, Tapped

#UPCF
Handles – Phenol

#UPFN
Handles – Nylon

#HHD4
Pull Handles for Panels

#UGFN
Handles – Rubber

#TSPF
T-Shaped Handles

#UWAS
Round Bar Grip Handles

#UWAG
Handles with Mounting Plates

#USAS
Handles – Welded Rectangular Bar

#UADL
Handles – Oval, Standard Lengths

#HHD2
Aluminum Pull Handles

#UWDS
Handles – Bent Sheet Metal

#UWA5
Handles – U-Shaped, Bent Sheet Metal

#UWSD
Arched Pull Handles

#UWA2
Cast Handles – Stainless Steel

#UWAD
Handles – Stainless Steel Cast

#UWFA
Handles – Folding

#HHD3
Handles with Cap

#UWAP
Aluminum Tube Pull Handles

#UWA6
Aluminum Pipe Handles – Small Diameter

#UHFS
Round Bar Grip Handles Offset

#UHF4
Handles with Plate Offset

#UHFG
Handles with Plate Offset

#HHDN
Handles – Angled

#UWA4
Handles – Cast, Offset

#UHFA
Offset Pull Handles with Mounting Plates – Aluminum Tube

#UHFC
Aluminum Pipe Handles – Small Diameter, Offset

#UPC4
Nylon Handles – Small

#UPCN
Nylon Handles

#UPC3
Mounting Plates for Handle – Nylon Handle

#UPCA
Handles – Phenol, Counterbored

#HHKA
Cantilever Handles – Aluminum

#UPCD
Resin Handles with Cap

#HHPW
Nuts for Pull Handles

#UWA7
Folding Handles

#UWAM
Handles – Threaded

#UWAY
Handles – Side Mount

#TSPM
T-Shaped Handles – Threaded

#UWAW
Handles for Welding

#UWUS
Folding Handles with Spring

#UWAK
Rotary Handles

#UWUA
Embedded Handles – Stainless Steel

#UWUN
Embedded Handles – Offset

#UWAU
Embedded Handles

#UWUF
Folding Embedded Handles

#UWAB
TPE Embedded Pull Handles

#UWAJ
Embedded Pull Handles

Hinges

#HHP5
Nut for Pull Handles with Caps

#SHHP
Steel Hinges – Round Hole

#SHSD
Stainless Steel Hinges – Countersunk Hole

#HHS
Butt Hinges – Stainless Steel

#HHKS
Butt Hinges – Stainless Steel, Long

#HHST
Hinge Nuts

#8F
Aluminum Hinges

#8NT
Aluminum Hinges – Extra Low Head Cap Screws

#HHP2
Hinge Nuts

#8NC
Aluminum Hinges – Short

#8NL
Aluminum Hinges – Long

#8DT
Aluminum Hinges with Tabs

#HHPL
Flag Hinges

#8NH
Stop Hinges

#HHSZ
Hinges for Heavy Load – Stainless Steel

#SHPS
Hinges – Slotted Hole, Stainless Steel

#8NA
Hinges – Slotted Hole, Aluminum

#8J
Plastic Hinges

#8JC
Plastic Hinges – Compact

#HHPG
Low Particulate Generation Hinges – Aluminum

#HHSO
Hinges – Offset Mounting Holes

#8SD
Stepped Hinges – Stainless Steel

#HHSD
Stepped Hinges

#HHSP
Spring Hinges

#HHP3
Torque Hinges – Fixed Torque

#HHP4
Torque Hinges – Adjustable Torque

#HHPR
Damper Hinges

#MSDH
Hinge Dampers

#SHSL
Detachable Hinges – Stainless Steel

#HNS2
Detachable Hinges – Stainless Steel

#HHP1
Detachable Hinges – Aluminum

#HHPK
Detachable Hinges

★ ✓
#HNZL
Detachable Hinges for Heavy Load

#HHS2
Detachable Hinges with Steps

#HHSV
Detachable Hinges – Vertical

#HHSM
Welded Detachable Hinges

#HHS1
Welded Detachable Hinges

#HHSY
Hinges for Welding

#HHS3
Hinges for Welding

#HHS4
Hinges for Welding – Heavy Load

#HHSL
Stainless Steel Hinges – Long

Catches

✓
#MGCE
Magnet Catches with Ferrite Magnet

✓
#MGCB
Magnet Catches – Horizontal with Ferrite Magnet

#MGCP
Magnet Catches with Neodymium Magnet

#MGCS
Magnet Catches – Strong

#MGCJ
Magnet Catches – Selectable Force

✓
#HMET
Magnet Catches – Stainless Steel Body

#HMEP
Magnetic Catches for Panels

#MGCU
Thin Magnet Catches

#MGCM
Ultrathin Magnetic Catches

✓
#AMGC
Magnet Catches – Adjustable

#MGCC
Dust-Proof Magnet Catches

#MGC1
Dust-Proof Magnet Catches – Thin

#JMCG
Resin Catches

★ ✓
#MGSR
Magnet Catches with Sensor – Two Lead Wires

#MGSK
Magnet Catches with Switch

★ ✓
#BCAS
Ball Catches

Fasterners / Draw Latches

#PKBS
Snap Locks with Springs

#PKWS
Snap Locks

#PKCS
Covered Snap Locks

NEW
#PKWA
Stainless Steel Draw Latches – Medium Load

#PKWZ
Snap Locks – Medium Load

#PKWJ
Snap Locks – Adjustable

#PKBK
Corner Snap Locks with Springs

Latch Handles / Locks / Keys

#CPC
Plastic Small Handwheels – Cost Efficient Product

#CCH
Knurled Plastic Handwheels – Cost Efficient Product

#CHBK
Knurled Handwheels – Plastic

#HHMU
Slide Locks – Large Cabinet

#LOCN
Key Locks

NEW
#LCL
Rotating Latches

#LCAL
Airtight Latches

#HHMT
Latch – Sliding Bolt

#HHMS
Latch – Sliding Bolt, Square

Door Stays

#STYF
Stays

#STYT
Canopy Stays

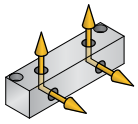
#STYM
Small Canopy Latches

#STYC
Stays with Catch Mechanism

#STYR
Rotary Latches

#STYP
Spring Stays

Manifolds

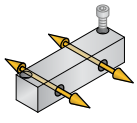


Inlets – 0
Outlets – Top & Side

#BTLN
Terminal Blocks – Hydraulic/ Pneumatic, Outlets 2 Sides, No Inlets, Vertical/Horizontal Mountin

#BTLA
Terminal Blocks – Pneumatic, Outlets 2 Sides, No Inlets, Vertical/Horizontal Mounting

#BTLL
Terminal Blocks – Hydraulic, Outlets 2 Sides, No Inlets, Vertical/Horizontal Mounting

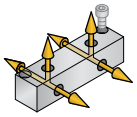


Inlets – 0
Outlets – 2 Sides

#BTS
Terminal Blocks – Hydraulic, Outlets, 2 Sides, No Inlets, Horizontal Mounting

#BTA
Terminal Blocks – Pneumatic, Outlets 2 Sides, No Inlets, Horizontal Mounting

#BTAN
Terminal Blocks – Hydraulic/ Pneumatic, Outlets 2 Sides, No Inlets, Horizontal Mounting



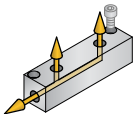
Inlets – 0
Outlets – Top & 2 Sides

#BMAN
Manifold Blocks – Hydraulic/ Pneumatic, Outlets 3 Sides, No Inlets, Vertical/Horizontal Mounting

#BMAF
Manifold Blocks – Hydraulic, Outlets 3 Sides, No Inlets, Vertical/Horizontal Mounting

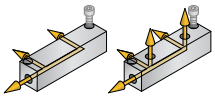
#BMGF
Manifold Blocks – Pneumatic, Outlets 3 Sides, No Inlets, Vertical/Horizontal Mounting

#BMAH
Manifold Blocks – Hydraulic, High Pressure, Space Saving, Outlets on 3 Sides



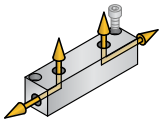
Inlets – 1 Blind
Outlets – Top

#BMZF
Manifold Blocks – Hydraulic/ Pneumatic, Outlets 1 Side, 1 Inlet, Vertical Mounting



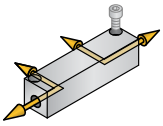
Inlets – 1 Blind
Outlets – Side; Top & Side

#BMZR
Manifold Blocks – Hydraulic/ Pneumatic, Outlets 1 Side/2 Sides, 1 Inlet, Vertical/Horizontal Mount



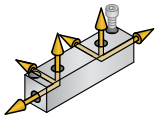
Inlets – 2 Blind
Outlets – Top

#WBMB
Manifold Blocks – Hydraulic/ Pneumatic, Two Circuit, Vertical Mounting



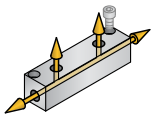
Inlets – 2 Blind
Outlets – Side

#WBMR
Manifold Blocks – Hydraulic/ Pneumatic, Two Circuit, Horizontal Mounting



Inlets – 2 Blind
Outlets – Top & Side

#WBMU
Manifold Blocks – Hydraulic/ Pneumatic, Outlets 2 Sides



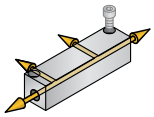
Inlets – Thru
Outlets – Top

#BMBN
Manifold Blocks – Hydraulic/ Pneumatic, Outlets 1 Side, 2 Inlets, Vertical Mounting

#BMSLN
Manifold Blocks – Pneumatic – Outlets on 2 Sides, Horizontal/ Outlets on 1 Side, Vertical, 2 Inlets

#BMBF
Manifold Blocks – Hydraulic, Outlets 1 Side, 2 Inlets, Vertical Mounting

#BMSF
Manifold Blocks – Pneumatic, Outlets 1 Side, 2 Inlets, Vertical Mounting



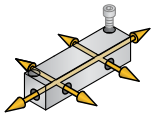
Inlets – Thru
Outlets – 1 Side

#BMRN
Manifold Blocks – Hydraulic, Outlets 1 Side, 2 Inlets, Horizontal Mounting

#BMRF
Manifold Blocks – Hydraulic, Outlets 1 Side, 2 Inlets, Horizontal Mounting

#BMRA
Manifold Blocks – Pneumatic, Outlets 1 Side, 2 Inlets, Horizontal Mounting

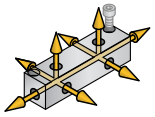
#SBMA
Manifold Block – Pneumatic, Space Saving, 10 x 15, 2 Inlets



Inlets – Thru
Outlets – 2 Sides

#BMIF
Manifold Blocks – Hydraulic/ Pneumatic, Outlets 3 Sides, 2 Inlets, Vertical/Horizontal Mounting

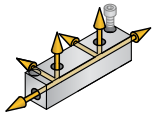
#BTAW
Manifold Blocks – Pneumatic, Double Row, Outlets on 2 Sides, No Inlets, Horizontal Mounting



Inlets – Thru
Outlets – Top & 2 Sides

#BMTF
Manifold Blocks – Hydraulic, Outlets on 3 Sides, 2 Inlets, Vertical/Horizontal Mounting

#BMFR
Manifold Blocks – Hydraulic/ Pneumatic, Outlets 3 Sides, 2 Inlets, Vertical/Horizontal Mounting

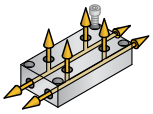


Inlets – Thru
Outlets – Top & Side

#BMUN
Manifold Blocks – Pneumatic, Outlets 2 Sides, 2 Inlets, Vertical/Horizontal Mounting

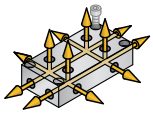
#BMUF
Manifold Blocks – Hydraulic, Outlets 2 Sides, 2 Inlets, Vertical/Horizontal Mounting

#BMUA
Manifold Blocks – Pneumatic, Outlets 2 Sides, 2 Inlets, Vertical/Horizontal Mounting



Multiline Inlets – Thru Outlets – Top

#BMSW
Hydraulic/Pneumatic Manifold Blocks – 2 Pos, Lateral Through Hole/Upper Hole, BMBW Series



Multiline Inlets – Thru Outlets – Top & 2 Sides

#BMUW
Manifold Blocks – Pneumatic, Double Row, Outlets 2 Sides, Vertical/Horizontal Mounting

#PMF
Pipe Manifolds – Outlets, 1 Row/2 Rows, 2 Inlets

#SGFF
Pipe Manifolds – Threaded/Tapped Sockets, Outlets 1 Row, 2 Inlets

#SGMH
Pipe Manifolds – Threaded Sockets, Outlets 1 Row, 2 Inlets

#SGSM
Sockets for Pipe Manifolds – Threaded

#SGSK
Sockets for Pipe Manifolds – Tapped

★
#SGM
Pipe Manifolds – Tapped Sockets, Outlets 1 Row, 2 Inlets

#SGML
Pipe Manifolds – Threaded/Tapped Sockets, Outlets 2 Rows 90 Deg, 2 Inlets

#SSKK
Sockets for Pipe Manifolds – Tapped, 90 Deg Dedicated Sockets

#SGMM
Pipe Manifolds – Tapped Sockets, Outlets 2 Rows 180 Deg, 2 Inlets

#BMRY
Rotary Manifolds – Economy

#BMRT
Rotary Manifolds – Manifold Blocks

#TGPL
Manifold Block Items – Plates with Tapped Socket Fittings

#TGMF
Manifold Blocks – Simplified Manifolds

#TGLB
Manifold Block Items – Brackets with Tapped Socket Fittings

#TGLC
Manifold Block Items – Brackets with One-Touch Coupling Fittings

#HFBM
Manifold Blocks – Aluminum Frame Manifolds, Outlets Configurable, 2 Inlets

#MGM
Manifold Blocks – with Magnets

Steel / Copper / Stainless Steel Pipes

★
#SGGA
Steel Pipes – Plain, Metric Thread

#SSGG
Steel Pipe Fittings – Plain, Metric Thread, Wrench Flat

#HKCP
Steel Pipe Covers – Heat/Cold Retention

#HKCV
Elbow-Heat and Cold Retention Pipe Cover

#HKTP
Tape for Pipe Covers

#PVCH
PVC Pipes

#DKE
Copper Pipes

#DKEN
Annealed Copper Pipes

#SKE
Stainless Steel Pipes

Screw Fittings

#0ST
Steel Pipes for Hydraulic Piping

#SPPS
Low Pressure Fittings – Socket

#SGPR
Low Pressure Fittings – Socket, Parallel Tapped

#SUTP
Low Pressure Fittings – Long Socket

#SGPH
Low Pressure Fittings – 45 Deg. Elbow

#SPPC
Low Pressure Fittings – Cap

#SPPP
Low Pressure Fittings – Plug

#SGPN
Low Pressure Fittings – Nipple

#SGP4
Low Pressure Fittings – Long Nipples

#SPPE
Low Pressure Fittings – 90 Deg. Elbow

#SPEL
Low Pressure Fittings – 90 Deg. Elbow, Threaded and Tapped

#SPPT
Low Pressure Fittings – Tee

#SGP5
Low Pressure Fittings – Nipple, Hexagon

#SGPU
Low Pressure Fittings – Union

#SGPC
Low Pressure Fittings – Cross

#SGPF
Low Pressure Fittings – Flange, Tapped

#SGST
Low Pressure Fittings – 3 Port Elbow

#SPPB
Low Pressure Fittings – Reducer Bushing

#STUN
Low Pressure Fittings – Reducer Nipple

#SGPE
Low Pressure Fittings – Reducer, 90 Deg. Elbow

#SGPD
Low Pressure Fittings – Reducer Tee

#SGPS
Low Pressure Fittings – Reducer Socket

#SPSH
High Pressure Pipe Fittings – Socket

#SGSH
High Pressure Pipe Fittings – Socket, Hexagon

#SPEH
High Pressure Pipe Fittings – 90 Deg. Elbow

#SGP2
High Pressure Pipe Fittings – 45 Deg. Elbow

#SGP1
High Pressure Pipe Fittings – 90 Deg. Elbow, Tapped and Threaded

#SPHT
High Pressure Pipe Fittings – Tee

#SPPJ
High Pressure Pipe Fittings – Plugs

#SGP3
High Pressure Pipe Fittings – Nipple

#SPUJ
High Pressure Pipe Fittings – Union with O-Ring

#SGDJ
High Pressure Pipe Fittings – Reducing Socket

#SGPJ
High Pressure Pipe Fittings – Reducing Nipple

#SGPT
High Pressure Pipe Fittings – Reducing Tee

#SPBJ
High Pressure Pipe Fittings – Reducer Bushing

#SJS1
Brass Fittings for Steel Pipe – Socket

#SJSS
Brass Fittings for Steel Pipe – Socket, Threaded, Tapped

#SJSR
Brass Fittings for Steel Pipe – Nipple

#SJSC
Brass Fittings for Steel Pipe – Caps

#SJSX
Brass Fittings – 90 Deg. Elbow, Threaded, Tapped

#SJSF
Brass Fittings for Steel Pipe – 90 Deg. Elbow

#SJSL
Brass Fittings for Steel Pipe – 90 Deg. Elbow, Threaded

#SJS3
Brass Fittings for Steel Pipe – Tee

#SJSM
Brass Fittings for Steel Pipe – Tee, Threaded

#SJST
Brass Fittings for Steel Pipe – Tee, Threaded, Tapped

#SJSG
Brass Fittings for Steel Pipe – Plug

#SJS2
Brass Fittings for Steel Pipe – Reducer Socket

#SJSD
Reducer Socket – Threaded, Tapped

#SJSN
Brass Fittings for Steel Pipe – Reducer Nipple

#SJSP
Brass Fittings for Steel Pipe – Reducer Bushing

#SGCE
Low Pressure Fittings – Seal Coating, 90 Deg. Elbow, Threaded and Tapped

#SGCP
Low Pressure Fittings – Seal Coating, Plug

#SGCN
Low Pressure Fittings – Seal Coating, Nipple

#SGCR
Low Pressure Fittings – Seal Coating, Hexagon Nipple

#SGC1
Low Pressure Fittings – Seal Coating, Bushing

#APBL
Conversion Pipe Fittings – L-Shape, T-Shape

★
#APMF
Extension Couplings – Length Configurable

#EXFG
Extension Couplings – Length Selectable

#WEJE
Butt-Weld Pipe Fittings – 90 Deg. Elbow, Short

#WEJL
Butt-Weld Pipe Fittings – 90 Deg. Elbow, Long

#WEJT
Butt-Weld Pipe Fittings – Tees

#WEJC
Butt-Weld Pipe Fittings – Cap

#SGPW
Low Pressure Fittings – Flange for Welding

#SGPB
Low Pressure Fittings – Blind Flange for Welding

#PVCS
PVC Pipe Fittings – TS Fittings, Socket

#PVC2
PVC Pipe Fittings – TS Fittings, Socket for Valve

#PVC3
PVC Pipe Fittings – TS Fittings, Reducing Socket

#PVC4
PVC Pipe Fittings – TS Fittings, Tees

#PVCD
PVC Pipe Fittings – Reducing Tee

#PVCE
PVC Pipe Fittings – H1 Fittings, 90 Deg. Elbow

#PVC1
PVC Fittings – H1 Fittings, 45 Deg. Elbow

#PVCC
PVC Pipe Fittings – TS Fittings, Cap

#PVCY
PVC Pipe Fittings – TS Fittings, Elastic Joint

#PVCT
PVC Pipe Fittings – TS Fittings, Ball Valve

#PVCB
PVC Pipe Fittings – TS Fittings, Adhesive

#MCWA
Piping Clamps – Weld Adapter

#BTLF
Piping Terminals – Flanged

★
#BTLH
Piping Terminals – Hexagon

#BTLR
Piping Terminals – Full Thread

★ ✓
#MSWT
Tapered Screw Plugs

★
#DKPT
Copper Pipe Fittings – Union, Threaded End, Selectable Thread

#DKLP
Copper Pipe Fittings – 90 Deg. Elbow, Threaded

#DKUS
Copper Pipe Fittings – Union

#DKUE
Copper Pipe Fittings – 90 Deg. Union Elbow

#DKUT
Copper Pipe Fittings – Union Tee

#DKUP
Copper Pipe Fittings – Union Tee, Threaded Branch

#DKRG
Copper Pipe Fittings – Gland Ring

✓
#DKPR
Copper Pipe Fittings – Pin-Ring Joint

✓
#DKFR
Copper Pipe Fittings – Union, Tapped End

#DKPG
Copper Pipe Fittings – Union, Threaded End

#DKRN
Copper Pipe Fittings – Ring Nut

#DKRK
Copper Pipe Fittings – Lock Nut

#DKVB
Needle Valve – Union End Connectors

#DKNT
Fittings for Annealed Copper Pipes – Union, Threaded End

#DKNL
Fittings for Annealed Copper Pipe Fittings – 90 Deg. Elbow

#DKFG
Fittings for Annealed Copper Pipes – Tapped Connector (G Thread)

#SKTG
Stainless Steel Pipe Fittings – Threaded Union

#SKTL
Stainless Steel Pipe Fittings – 90 Deg. Elbow, Threaded End, Union

#SKUS
Stainless Steel Pipe Fittings – Union

#SKUE
Stainless Steel Pipe Fittings – 90 Deg. Union Elbow

#SKU1
Stainless Steel Pipe Fittings – Stepped Union

#SKUT
Stainless Steel Pipe Fittings – T Union

#SKPC
Stainless Steel Pipe Fittings – Port Connector

#SKIT
Stainless Steel Pipe Fittings – Tube Insert

#SKUF
Stainless Steel Pipe Fittings – Tapped Union

#SKMA
Stainless Steel Pipe Fittings – Threaded Adapter

#SKU2
Stainless Steel Pipe Fittings – T Union, Threaded Branch

#SKUW
Stainless Steel Pipe Fittings – Union for Partition

#SKPG
Stainless Steel Pipe Fittings – Plug

#SKFP
Stainless Steel Pipe Fittings – Ferrule Pack

#KTGS
Bite Hydraulic Pipe Fittings – Connectors, Threaded

#KTGE
Bite Hydraulic Pipe Fittings – Elbow, Threaded

#KTGR
Bite Hydraulic Pipe Fittings – Unions

#KTGL
Bite Hydraulic Pipe Fittings – Elbow

#KTGT
Bite Hydraulic Pipe Fittings – Tees

#KTG1
Bite Hydraulic Pipe Fittings – Reducer

#KTG3
Bite Hydraulic Pipe Fittings – Check Union

#KTGZ
Bite Hydraulic Pipe Fittings – Check Connector

#KTG2
Bite Hydraulic Pipe Fittings – Sleeve

#KTGN
Bite Hydraulic Pipe Fittings – Nuts

#HOSN
Fittings for Hoses – Nipples, Threaded, Barbed

#HOSF
Fittings for Hoses – Nipples, Tapped, Barbed

#HOS5
Fittings for Hoses – Bamboo Shoot Joints

#HOS6
Fittings for Hoses – Nipples, Threaded, Barbed

#HOS8
Fittings for Hoses – Open-Ended Hose Joint

#HOS2
Fittings for Hoses – Bamboo Shoot Joints

#HOS3
Fittings for Hoses – Fitting Sleeve Nut for Hose

#HOSJ
Fittings for Hoses – 90 Deg. Elbow, Threaded, Barbed

#HOS4
Fittings for Hoses – 45 Deg. Elbow, Threaded, Barbed

#HOST
Fittings for Hoses – Tee, Threaded, Barbed

#TCBM
Fittings for Hoses – General Purpose

#SNAM
Arm Lock Coupling – Male Thread Adapter

#SNAF
Arm Lock Coupling – Female Thread Adapter

#SNAH
Arm Locking Couplers – Hose Mounting Adapters

#SNAJ
Arm Locking Couplers – Threaded Sockets

#SNA2
Arm Locking Couplers – Tapped Sockets

#SNA1
Arm Locking Couplers – Hose Mounting Sockets

#SAA
Thread Conversion Adapters

Couplers / One-Touch Couplings

#QCSW
One-Touch Articulated Connector – Male/Female Set

#JCPS
One-Touch Articulated Connector – Connector, Socket

#JCPP
One-Touch Articulated Connector – Connector, Threaded

#MCPC
Air Couplers Standard – Straight Plug

#MCPL
One-Touch Connector – Plug, 90 Deg. Elbow

#MCSC
Air Couplers Standard – One-Touch Coupling, Socket

#MCS1
One-Touch Connector – 90 Deg. Elbow, Socket

#MCSB
One-Touch Connector – Socket, Panel Mount

#MCPM
Air Couplers – Standard, Plug, Threaded

#MCPF
Air Couplers – Standard, Plug, Tapped

#MCPH
Standard – Plug, Tube Connecting

#MCPN
Standard – Plug, Nut Tightening

#MCP8
Air Couplers – Manifold, Swivel, 2 Sockets, 1 Plug

#MCP3
Air Couplers – Rotary, Plug, Threaded

#MCPR
Air Couplers – Rotary, Plug, Tapped

#MCSM
Air Couplers – Standard, Socket, Threaded

#MCSF
Air Couplers – Standard, Socket, Tapped

#MCSH
Standard – Socket, Tube Connecting

#MCSN
Standard – Socket, Nut Tightening

#MCS8
Air Couplers – Manifold, 4 Socket Outlets, 1 Socket Inlet, 1 Plug Inlet

#MCS4
Air Couplers Standard – Tube Connecting Sockets with Lock Mechanism

#MCS5
Air Couplers – Locking, Socket, Threaded

#MCST
Air Couplers – Locking, Socket, Tapped

#KSCM
Air Couplers – Lightweight, Plug, Threaded

#KSCP
Air Couplers – Lightweight, Plug, Tapped

#KSCH
Air Couplers – Lightweight, Plug, Tube Connector

#KSCN
Air Couplers – Lightweight, Plug, Urethane Hose Mounting

#KSC2
Air Couplers – Lightweight, Socket, Threaded

#KSCS
Air Couplers – Lightweight, Socket, Tapped

#KSC1
Air Couplers – Lightweight, Socket, Tube Connector

#KSC3
Air Couplers – Lightweight, Socket, Urethane Hose Mounting

#MCRN
Air Couplers – Manifold, 2 Socket, 1 Plug

#MCRT
Air Couplers – Manifold, 4 Socket Outlets, 1 Socket Inlet, 1 Plug Inlet

#MCLT
Air Couplers – Manifold, Swivel, 2 Sockets, 1 Plug

#MCRE
Air Couplers – Manifold, Swivel, 3 Sockets, 1 Plug

#NMCM
Air Couplers – Miniature, Plug, Threaded

#NMCP
Air Couplers – Miniature, Plug, Tapped

#NMCH
Air Couplers – Miniature, Plug, Tube Connector

#NMCL
Air Couplers – Miniature, Plug, L-Shape Tube Connector

#NMC2
Air Couplers – Miniature, Socket, Threaded

#NMCB
Air Couplers – Miniature, Socket, Panel Mounting Tube Connector

#NMCS
Air Couplers – Miniature, Socket, Tube Connector

#NMC1
Air Couplers – Miniature, Socket, L-Shaped Tube Connector

#MCP2
Air Couplers – Chemical Resistant, Plug, Threaded

#MCPS
Air Couplers – Chemical Resistant, Plug, Tapped

#MCP1
Air Couplers – Chemical Resistant, Plug, Tube Connection

#MCS3
Air Couplers – Chemical Resistant, Socket, Threaded

✓

#MCS2
Air Couplers – Chemical Resistant, Socket, Tube Connector

✓

#QNPF
Quick Couplings – Plug, Tapped, No Valve

✓

#QNSF
Quick Couplings – Socket, Tapped, No Valve

★

#QNPM
Quick Couplings – Plug, Threaded, No Valve

#QNSM
Quick Couplings – Socket, Threaded, No Valve

#QNPH
Quick Couplings – Plug, Hose Barb, No Valve

#QNSH
Quick Couplings – Socket, Hose Barb, No Valve

#QBPF
Quick Couplings – Plug, Tapped, Valve

✓

#QBSF
Quick Couplings – Socket, Tapped, Valve

#QBPH
Quick Couplings – Plug, Tapped, High Pressure Valve (210 Type)

#QBSH
Quick Couplings – Socket, Tapped, High Pressure Valve (210 Type)

#QBPP
Quick Couplings – Plug, Tapped, High Pressure Valve (350 Type)

#QBSP
Quick Couplings – Socket, Tapped, High Pressure Valve (350 Type)

Valves

★

#BSFF
Ball Valves – Stainless Steel, PT Male, PT Female

#BRTW
Ball Valves – Stainless Steel, High Flow Rate, PT Female, PT Female

#BSRC
Ball Valves – Stainless Steel, PT Female, PT Female

#BSGF
Ball Valves – Stainless Steel, PT Female, PF(G) Female

#BFRB
Sanitary Flanged Ball Valve

#GBUC
Globe Valves

#THKB
Check Valves

#STRY
Strainers

#BCKB
Check Valve – Oil Hydraulic

#BBPF
Compact Ball Valves – Brass, PT Threaded, PF Threaded

#BBPT
Compact Ball Valves – Brass, PT Threaded, PF Threaded

#BBPW
Compact Ball Valves – Brass, PT Tapped, PF Tapped

#BBFF
Compact Ball Valves – Brass, PT Tapped, PF Tapped

#BBPH
Compact Ball Valves – Brass, PT Threaded, Hose Barb

#BBPC
Compact Ball Valves – Brass, PT Threaded, Tube Connection

★
#BBPJ
Compact Ball Valves – Brass, PT Threaded, Hose Connection

#BBPP
Compact Ball Valves – Brass, PT Threaded, Peacock

#BBPK
Compact Ball Valves – Brass, PF Tapped, PF Tapped

#BBRF
Compact Ball Valves – Brass, PT Tapped, PT Tapped

#BBRP
Compact Ball Valves – Brass, PT Threaded, PT Tapped

#BBRT
Compact Ball Valves – Brass, PT Threaded, PT Threaded

#BBPL
Compact Ball Valves – Brass, 90 Deg. Elbow, PT Threaded, PF Tapped

#BBP4
Compact Ball Valves – Brass, 90 Deg. Elbow, PT Threaded, Tube Connection

#BBPR
Compact Ball Valves – Brass, Rotary Nut, PT Threaded, PF Tapped

#BBP5
Compact Ball Valves – Brass, Rotary Nut, PT Threaded, Tube Connection

#BBP2
Compact Ball Valves – 90 Deg. Rotary Elbow, PT Threaded, PF Tapped

★
#BBPS
Compact Ball Valves – Stainless Steel, PT Male, PT Male

#BBRC
Compact Ball Valves – Stainless Steel, PT Male, PT Female

#BBCC
Compact Ball Valves – Stainless Steel, PT Female, PT Female

#BBHR
Compact Ball Valves – Stainless Steel, PT Male, Hose Barb

#BBKB
Compact Ball Valves – Brass, Knurled, PT Threaded, Coupler Socket

#BBP3
Compact Ball Valves – Brass, Knurled, PT Male, PF Female

#BBFS
Compact Ball Valves – Brass, Knurled, PT Female, PF Female

#NSB1
Needle Valve – PT Male, Threadeds, Stainless Steel

#NSBP
Needle Valve – PT Male, Tappeds, Stainless Steel

#NSBC
Needle Valve – PT Female, Tappeds, Stainless Steel

#NSBH
Needle Valve – PT Male and Barb , Stainless Steel

#NBPP
Needle Valve – PT Male Threads

#NBPC
Needle Valve – PT Female, Male Threads

#NBCC
Needle Valve – PT Female Threads

#NBP1
Needle Valve – PT Male Threads, Stainless Steel

#NBPS
Needle Valve – PT Male Threads, Stainless Steel

#NBCS
Needle Valve – PT Female Treads, Stainless Steel

Pipe Supports

#SGPL
Steel Pipe Fittings – L-Shaped Angle Brackets, Single, Double Slot

#KBND
Pipe Supports – Verical Pipe Bands

#HGA
Pipe Supports – Paddle Shaped Legs

#TGA
Pipe Supports – T-Shaped Leg

#KSDL
Pipe Supports – Single, Double Saddle Bands

#UB
Steel Pipes Items – U Bolts

#MTC
Piping Clamps – Multi-Port

#MCBM
Piping Clamps – Rubber Bushing

#MCMA
Piping Clamps – Mounting Adapter

#MCKB
Piping Clamps – Coupling Bolt

Resins / Ducts / Flexible Hoses

#SNHT
Silicon Hoses – Standard, Vacuum

#HOJF
Fluororesin Hoses – High Flex

#HOEF
Fluororesin Hoses – Conductive

#HOTR
Resin Hoses for General Purposes – Standard

#HOT1
Resin Hoses for General Purposes – Oil-Proof

#HOTG
Resin Hoses for General Purposes – High Strength

#HOTS
Resin Hoses for General Purposes – High Pressure

#HOS1
Hose Bands – Standard

#HOSS
Hose Bands – Spiral

#HOSB
Hose Bands – Hand Tightening

#HOAB
Hose Bands – Safety Lock, Cap

Duct Hoses / Duct Plumbing Components

#HOSE
Duct Hoses – Lightweight

#HOSK
Duct Hoses – Swivel

#HOSH
Duct Hoses – Friction Resistant, Antistatic

#HOSD
Duct Hoses – Oil-Resistant, No Cuff

#HOSC
Duct Hoses – Oil-Resistant

#DHED
Duct Hose Items – Cuffs

#HOAD
Duct Hoses – Aluminum

#HOFM
Duct Hose Mounting Flange

#HOAE
Aluminum Duct Hose Items – 90 Deg. Elbow

#HOAR
Aluminum Duct Hose Items – Duct Reducers

#HOSY
Duct Hose Items – Hood Cover with Flange

#HOAN
Aluminum Duct Hose Items – Dampers

#HOAM
Aluminum Duct Hose Items – Socket

#HOBU
Aluminum Duct Hose Items – Panel Mounting Flanges

#HOAT
Aluminum Duct Hose Items – Tee

#HOAY
Aluminum Duct Hose Items – Y-Shaped

#HOA1
Plumbing Parts for Aluminum Duct Hoses – Unequal Dia. Y-Shaped

#HOAH
Aluminum Duct Hose Items – Variant Y-Shaped

#HOAF
Plumbing Parts for Aluminum Duct Hoses – 45 Deg. Reducer

#HOAJ
Aluminum Duct Hose Items – Flange

#DBXT
Dust Boxes

Flexible Hoses

#HOSL
Flexible Hoses – High Pressure

★
#HOEM
Flexible Hoses – Medium Pressure

#HOEL
Flexible Hose – Low Pressure, Non-Welded

#HOEJ
Flexible Hose – Low Pressure, Non-Welded

#HOSR
Flexible Hoses – Fluoro Resin

#HOS7
Flexible Hoses – Fluoro Resin, High Flex

#HOFB
Tubes – Flexible Tube, Bellow Shape

Hydraulic Valves

#BKFS
Inline Flow Control Valve – Oil Hydraulic

Hydraulic Hoses / Adaptors

#HOMC
Hydraulic Hoses – Rubber

#HOKT
Hydraulic Hoses – Rubber, Quick Swaging

#SJSA
Swivel Joints – 90 Deg. Elbow, PT Threaded, PT Tapped

#KCLP
Swivel Joints – Straight, 90 Deg. Elbow, PT Threaded, PT, PF Tapped, Threaded

#SKCR
Hydraulic Couplings – Swivel, Straight

#YCPT
Hydraulic Fittings – Straight, PT Threaded, PT Threaded

#YCPF
Hydraulic Fittings – Straight, Female, PT Threaded, PF Threaded

✓
#YCP5
Hydraulic Fittings – Straight, Male, PT Threaded, PF Threaded

#YCPG
Hydraulic Fittings – Straight, Male, PT Threaded, PF Tapped

#YCP4
Hydraulic Fittings – Straight, Female PT Threaded, PF Tapped

#YCP1
Hydraulic Fittings – Straight, Female, PT Tapped, PF Threaded

#YCP2
Hydraulic Fittings – Straight, Male, PT Tapped, PF Threaded

#YCPL
Hydraulic Fittings – Long Straight, Female, PT Threaded, PF Threaded

#YCP3
Hydraulic Fittings – Long Straight, Male, PT Threaded, PF Threaded

#YCWF
Hydraulic Fittings – 45 Deg. Elbow, Female, PT Threaded, PF Threaded

#YCWP
Hydraulic Fittings – 45 Deg. Elbow, Male, PT Threaded, PF Threaded

#YCWT
Hydraulic Fittings – 45 Deg. Elbow, PT Threaded, PT Threaded

#YCL3
Hydraulic Fittings – 90 Deg. Elbow, PT Threaded, PT Threaded

#YCLP
Hydraulic Fittings – 90 Deg. Elbow, Female, PT Threaded, PF Threaded

★

#YCL2
Hydraulic Fittings – 90 Deg. Elbow, Male, PT Threaded, PF Threaded

#YCL1
Hydraulic Fittings – 90 Deg. Elbow, PT Threaded, PF Tapped

Sanitary Pipes

★

#SNPE
Sanitary Pipes – Standard

#SNPW
Sanitary Pipes – Welded, Low Neck

#SNL1
Welded Sanitary Pipes – Standard, Ferrule x Ferrule

#SNLP
Welded Sanitary Pipes – Standard, Ferrule x Pipe

#SNLE
Welded Sanitary Pipes – Standard, Elbow x Pipe

#SNLF
Welded Sanitary Pipes – Standard, Ferrule x 90 Deg. Elbow

#SNLH
Welded Sanitary Pipes – Standard, Ferrule x 45 Deg. Elbow

★

#SNPK
Sanitary Pipes – One Side Welded, Both Sides Welded

#SNFR
Sanitary Pipe Fittings – Ferrule Connector

#SNF1
Sanitary Pipe Fittings – Ferrule, Unequal Diameter, Reducer

#SNFK
Sanitary Pipe Fittings – Ferrule Cap

#SNFE
Sanitary Pipe Fittings – Ferrule One End, Welded Elbow

#SNFH
Sanitary Pipe Fittings – Ferrule x Welded

#SNFD
Sanitary Pipe Fittings – Ferrule x Welded

#SNFY
Sanitary Pipe Fittings – Ferrule x Welded

#SNPA
Sanitary Pipes – Both Ends Ferrule Fixed Dimension

★

#SNBE
Sanitary Pipe Fittings – Ferrule Both Ends, Elbow

#SNBH
Sanitary Pipe Fittings – Double Ferrules, Clamp, Gasket

#SNBT
Sanitary Pipe Fittings – Tees, Ferrule Ends

#SNB2
Sanitary Pipe Fittings – Double Ferrules, Reducing Tees

#SNZP
Sanitary Pipe Fittings – Pipe Hanger

#SNGS
Sanitary Pipe Fittings – Ferrule Gasket

★

#SNCP
Ferrule Connector Clamp – Low Pressure

#SNCH
Ferrule Connector Clamp – Medium, High Pressure

#SNCW
Sanitary Pipe Fittings – One-Touch Clamp

#SNZF
Sanitary Adapter Fittings – Ferrule End and Threaded End

#SNHA
Sanitary Adapter Fittings – Hose, Ferrule

#SNZS
Sanitary Adapter Fittings – Ferrule Tapped Socket Adapter

NEW

#SNSU
Sanitary Adapter Fittings – Swaged Sleeve

#SNZR
Sanitary Adapter Fittings – Flanged, Ferrule

#SNZY
Sanitary Adapter Fittings – Flanged x Thread Sheet

#SNWE
Sanitary Pipe Fittings – 90 Deg. Elbow, Double Weld

#SNWH
Sanitary Pipe Fittings – Welded Thread, L-shaped Gasket

#SNWT
Sanitary Pipe Fittings – Tees, Welded

#SNWD
Sanitary Pipe Fittings – Both Ends Weld-On Reducing Tees

#SNYB
Blind Nuts

#SNYN
Sanitary Pipe Fittings – Threaded Connector

#SNYR
Sanitary Pipe Fittings – Welding Liner

#SNRN
Sanitary Pipe Fittings – Nut Connector

#SNLG
Sanitary Pipe Fittings – Ferrule Gasket, L-Shaped

#SNWZ
Conversion Fittings

#SNWA
Sanitary Pipe Fittings – Ferrule Hose Adapter

#SNGC
Sanitary Pipe Fittings – Cover Cap

#SNGG
Sanitary Pipe Fittings – Gasket for Mounting Accessories

#SNTS
Sanitary Tube Strainers – Standard

★

#SNTL
Sanitary Tube Strainers – L-Shaped

#BFBS
Sanitary Butterfly Valve

★

#SNB1
Sanitary Ball Valves – Small Diameter

#SNBS
Sanitary Ball Valves – Standard

#SNSG
Sanitary Sight Glasses – In-Line

#SNST
Sanitary Sightglasses – View Port

#SNPR
Sanitary Pressure Gauge

#SNSH
Sanitary Cleaning Ball

Tanks

#TANA
Sanitary Items – Standard, Open-Top Tank

#TANH
Open-Top Tanks – Standard, Sealable, Hopper

#TANS
Sanitary Items – Open Lid Kettle with Selectable Spigot Shape

#TANC
Sanitary Items – Lids for Open Lid Kettles

NEW

#TANE
Sanitary Items – Seals for Open Lid Kettles

#TANT
Sanitary Items – Stands for Open Lid Kettles

#TNKR
Sanitary Pipe Fittings – Regulators for Pressure Tank

#TNKF
Sanitary Pipe Fittings – Low Level Float Switch

NEW

#TNKT
Through Fittings

Vacuum Fitting Parts

#FRNW
NW (KF)/ICF/JIS Flanged Flexible Tubes

#FRN5
Vacuum Pipes – Both Sides Welded, Both Sides NW Flanged

★

#FRN1
Vacuum Pipes – Both Sides Welded, NW Flanged x Elbow

#FRN8
Vacuum Pipes – Both Sides Welded, NW Flanged x Tees

#FRN6
Vacuum Pipes – Both Sides Welded, NW Flanged x Threaded

#FRN7
Vacuum Pipes – Both Sides Welded, NW Flanged x Flanged

#FRNV
Vacuum Pipes – NW Flanged x VG Flanged

#FRN4
Vacuum Pipe Fittings – Flanged

#FRNL
Vacuum Pipe Fittings –Long Flanged

#FRNN
Vacuum Pipe Fittings – Nipple

#FRNE
Vacuum Pipe Fittings – 90 Deg. Elbows

#FR03
Vacuum Pipe Fittings – Tee

#FENW
Reducing Tees

#FRNJ
Vacuum Pipe Fittings – Reducer

NEW

#FRN3
Center Rings

#FR02
Vacuum Pipe Fittings – Center Ring with O-Ring Seal

✓

#FRN9
Vacuum Pipe Fittings – Clamp

#FRN2
Vacuum Pipe Fittings – Blind Flanged

#FRVF
Fittings for Vacuum Plumbing – JIS Flanged, VF

#FRVG
Fittings for Vacuum Plumbing – JIS Flanged, GS

NEW

#FRGP
Gage Ports – Single Unit, Welded

#FRNG
Fitting with Gage Port

#FRNF
Vacuum Pipe Fittings – Threaded Male End and Flange End

NEW

#FRNM
Female Adapter

#FRNH
Hose Adapter

#FR01
Duct Adapter

#FRSK
Fittings for Vacuum Plumbing – NW Flanged x Swaged Sleeve Fitting

#FRNB
Fittings for Vacuum Plumbing – NW Flanged x Stainless Steel Pipe, Single Nozzle

#FRND
Fittings for Vacuum Plumbing – NW Flanged x Stainless Steel Pipe, Double Nozzle

#PUVF
Tubes – Vacuum Tubes

Tubes

#HOSP
Coil Hoses – Spiral Tube

#EHOS
Air Hoses – Standard

#ERHO
Air Hose – Sliding

#AHOS
Air Hoses – High-Flex

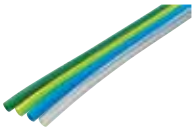
#PUT ★
Tubes – Water Resisting Polyurethane

#PUTY
Tubes – Soft Polyurethane

#PUTN
Tubes – Nylon

#PUTH
Tubes – Pressure Resistance Nylon

#PUT2
Tubes – Soft Nylon Tubes



#PUTM
Tubes – Flat

#PUT3
Tubes – Water Resisting Polyurethane Spiral

#PUT1
Tubes – Multi-Spiral

#PUTP
Tubes – Slit Spriral with Fluoro-Insulated Wire

#PUTS
Tubes – Sputter Resisting

#PUAS
Tubes – Antistatic

#PORF
Tubes – Polyolefin

#PUTF
Tubes – Fluororesin

#PUFN
Tubes – Flexible Fluororesin

#PUJT
Tubes – Soft Fluororesin

#PUSP
Tubes – Spiral Shape

#PUTB
Tubes – Fluoro Rubber, Clear Transparent

#PUTG
Tubes – Fluoro Rubber

#PUTC
Tubes – Silicone

#CUCL ★
Tube Items – Tube Clips

#PUIT
Tube Items – Soft Tube Inserts

#TCK
Tube Cutters

#MPUT
Tubes – Polyurethane for Compressed Air

#JCNL
Compressed Air – Miniature Connector Fittings

Pneumatic Pipe Fittings

#MSC3 ★
One-Touch Couplings – Threaded Connectors

#MSC2
One-Touch Couplings – Threaded Connector with Hexagon Socket

#MSSB
One-Touch Couplings – Tapped Connector

#MSEL ★
One-Touch Couplings – Bulkhead Female Straight

#MSC1
One-Touch Couplings – Male 90 Deg. Elbows

#USST
One-Touch Couplings – Union Straight

#UJDS
One-Touch Couplings – Union, Stepped Diameter

#USEB
One-Touch Couplings – Union Elbow

#USTL
One-Touch Couplings – Union Tee

#USYL
One-Touch Couplings – Y Union

#BSLG
One-Touch Couplings – Blind Plug

#MSEG
One-Touch Couplings – Long Elbow

#MSEF
One-Touch Couplings – 45 Deg. Elbow

#USLC
One-Touch Couplings – L-Connector

#USYE
One-Touch Couplings – Turn Elbow Union

#USTE
One-Touch Couplings – 2 Turn Elbow

#MSTE
One-Touch Couplings – Tee, Threaded

#UNYL
One-Touch Couplings – FY Elbow Unions

#MSBU
One-Touch Couplings – Bulkhead Unions

#MSCA
One-Touch Couplings – Cap

#MSYL
One-Touch Couplings – Y Union, Threaded

#USDY
One-Touch Couplings – Stepped Y Union

#USDT
One-Touch Couplings – Stepped Union Tees

#USCR
One-Touch Couplings – Cross Union

#USRD
One-Touch Couplings – Reducer

#MSPJ
One-Touch Couplings – Nipple

#BSLD
One-Touch Couplings – Irregular Connection Plug

#DSNY
One-Touch Couplings – Manifold, Double Y-Shaped

#DSLY
One-Touch Couplings – Manifold, Double Y-Shaped, Threaded

#DUNL
One-Touch Couplings – Manifold, Triple Single

#DUNW
One-Touch Couplings – Manifold, Triple Double

#JELL
Compressed Air – Miniature Connector Fittings, 90 Deg. Elbow

#JBUL
Compressed Air – Bulkhead Union

#JTEL
One-Touch Coupling – Compressed Air, Union Tee

#JRDS
One-Touch Coupling – Compressed Air, Reducer

#MNCN
Miniature One-Touch Couplings – Connector

#MNCP
Miniature One-Touch Couplings – Connector with Hex Socket

#MNC1
Miniature One-Touch Couplings – 90 Deg. Elbow

#MNCL
Miniature One-Touch Couplings – Union Elbow

#MNUN
Miniature One-Touch Couplings – Union

#MNCY
Miniature One-Touch Couplings – Union Tee

#MNUY
Miniature One-Touch Couplings – Y Union

#SRTG
Miniature Couplings – Barbed Coupler

#SRTN
Miniature Couplings – Hose Nipple

#MNPL
Miniature Couplings – Nipples, Threaded

#MELB
Miniature Couplings – 90 Deg. Elbows

#MPLG
Miniature Couplings – Screw Plugs

#MTEN
Miniature Couplings – Tees

#MBSG
Miniature Couplings – Reducer Bushing

#MUTE
Miniature Couplings – Universal Tees

#MCPT
Couplings for Tubes – Nut and Sleeve Integrated, Straight

#MCLP
Couplings for Tubes – Nut and Sleeve Integrated, Elbows

#MCBU
Couplings for Tubes – Nut and Sleeve Integrated, Panel Mount

#MCTP
Couplings for Tubes – Nut and Sleeve Integrated, Tees

#MCUN
Couplings for Tubes – Nut and Sleeve Integrated, Union

#MCUT
Couplings for Tubes – Nut and Sleeve Integrated, Union Tees

#MCTY
Couplings for Tubes – Nut and Sleeve Integrated, Half Unions

#MCU1
Couplings for Tubes – Nut and Sleeve Integrated, Half Elbows

#MCUE
Couplings for Tubes – Nut and Sleeve Integrated, Union Elbows

#TJBN
Couplings for Tubes – Nut and Sleeve Integrated, Nipples

#TJBS
Couplings for Tubes – Nut and Sleeve Integrated, Sockets

#TCRH
Couplings with Tube Insert – Nut and Sleeve Integrated, Connectors

#TCRL
Couplings with Tube Insert – Nut and Sleeve Integrated, Elbows

#TCRF
Couplings with Tube Insert – Nut and Sleeve Integrated, Union Elbows

#TCRS
Couplings with Tube Insert – Nut and Sleeve Integrated, Union Connectors

#TCRT
Couplings with Tube Insert – Nut and Sleeve Integrated, Union Tees

#RTCN
Rotary Joints – Connector

#RTCL
Rotary Joints – 90 Deg. Elbow

#RHTN
High Rotary Joints – Straight Connector

#RHTL
High Rotary Joints – 90 Deg. Elbow

#RHTC
High Rotary Joints – Bushings

#MLCN
One-Touch Couplings – All Stainless Steel, Miniature Connector

#MLEL
One-Touch Couplings – All Stainless Steel, 90 Deg. Elbow

#UNSL
One-Touch Couplings – All Stainless Steel, Union

#UNTE
One-Touch Couplings – All Stainless Steel, Tee

#UNEB
One-Touch Couplings – All Stainless Steel, Union 90 Deg. Elbow

#MLBU
One-Touch Couplings – All Stainless Steel, Bulkhead Union

#KPMS
Heat Resistant One-Touch Couplings – Straight

#KPML
Heat Resistant One-Touch Couplings – 90 Deg. Elbow

#KPMC
Heat Resistant One-Touch Couplings – Hexagon Socket

#KKMS
High Heat-Resistant One-Touch Couplings – Straight

#KKMC
High Heat-Resistant One-Touch Couplings – Elbow

#PPCN
One-Touch Couplings for Clean Applications, Connectors

#PPC1
One-Touch Couplings for Clean Applications, 90 Deg. Elbow

#PPCR
One-Touch Couplings for Clean Applications – Straight Union

#PPCL
One-Touch Couplings for Clean Applications – 90 Deg. Union Elbows

#PPCE
One-Touch Couplings for Clean Applications – Tees

#PPCY
One-Touch Couplings for Clean Applications, Y Union

#PPCG
One-Touch Couplings for Clean Applications, Reducer

#PPMP
One-Touch Couplings for Clean Applications – Connector

#PPSN
One-Touch Couplings for Clean Applications – Connectors

#PPSL
One-Touch Couplings for Clean Applications – 90 Deg. Elbow

#PPSC
One-Touch Couplings – Tees, Stainless Thread

#PPSY
One-Touch Couplings for Clean Applications – Y Union, Thread

#FECT
Fluororesin Couplings – Threaded Connector, Bore Through Connector

#FEML
Fluororesin Couplings – 90 Deg. Elbow, Threaded

#FETP
Fluororesin Couplings – Unions

#FEUE
Fluororesin Couplings – 90 Deg. Elbow, Union

#FEUT
Fluororesin Couplings – Union Tee

#FEUR
Fluororesin Couplings – Stepped Unions

#FETB
Fluororesin Couplings – Tube Insert

#FBT
Fluororesin Couplings – 2 Way Valve

#FBNB
Fluororesin Couplings – Needle Valve, 90 Deg. Elbow

Vacuum Generators / Vacuum Ejectors

#VUHK
Vacuum Generator – Union, Straight

#VUB
Vacuum Generator – Union, Square

#BDFK
Vacuum Generator with Vacuum Break Function

#BAFP
Vacuum Fall Prevention Valve

Vacuum Filters

#VFLT
Vacuum Filter – Filter, Replacement Element

#VFS
Vacuum Filter – Small, Filter, Replacement Element

#BDFL
Vacuum Filter for Generator with Vacuum Break Function

Vacuum Gauges

#VUSS
Vacuum Pressure Sensor – Union

#BVUS
One-Touch Coupling Ball Valves – Union, Single Handle

#BVCS
One-Touch Coupling Ball Valves – Straight, Single Handle

#BVCB
One-Touch Coupling Ball Valve – 90 Deg. Elbow, Double Handle

#BVCV
One-Touch Couplings Check Valves

#MSFB
Switch Valves – Foot Operated, 3-Port, 4-Port

#MSHP
Small Switching Valves – Button

#MHAM
Hand Switching Valves with Lever

#MSHB
Hand Switch Valve – Toggle Grip

#RGUJ
Regulators – Unions

#MSFR
Air Regulators – With Filter

Manual & Mechanical Valves

#BVHU
One-Touch Coupling – Shut-Off Valves

#BVHV
One-Touch Coupling – Shut-Off Valves

#BVCE
One-Touch Coupling Ball Valve – 90 Deg. Elbow, Single Handle

#BVUB
One-Touch Coupling Ball Valves – Union, Double Handle

#BVC2
One-Touch Coupling Ball Valves – Straight, Double Handle

#BVHB
One-Touch Coupling Change Valves

#NCHB
Switch Valves – Manually Operated, Panel Mount, 2-Port, 3-Port

#MSFF
Switch Valves – Foot Operated, 2-Port

#MSH2
Switch Valves – Manually Operated, Button, Toggle

#MSH1
Small Switching Valves – Actuator Set

#MHAN
Switch Valves – Manually Operated, Lever

#EQUS
Quick Exhaust Valves – Straight, Open to Air

#EQEJ
Union – Open to Air with Exhaust Throttle

#EQXC
Quick Exhaust Valves – Standard, Open to Air with Exhaust Throttle

Pressure / Flow Rate Sensors

#GPCS
Pressure Gauges – Straight

#GPUS
Pressure Gauges – Union Straight

Filters / Regulators / Lubricators

#RGC
Regulators – Elbows

#MSRR
Lubricator

#MSAF
Air Filter

#MSR
Air Regulator

#MDTN
Drain Trap

#MSFA
Service Units – Regulator, Filter, Filter

#MSF1
Service Units – Regulator, Filter, Lubricator

Silencers

#MSSJ
Silencer

Seal Materials

#NPA
O-Rings – P Series

#NSA
O-Rings – S Series

#NGA
O-Rings – G Series

#NVA
O-Rings – V Series, AS Series

#MPPE
P Series – Chemical, Heat Resistant

#DFA
O-Rings – Large Diameter

#GSW
Seal Washers – Bolt Head

#GSWM
Seal Washers – Thread Style, Standard

#GSWC
Seal Washers – SHCS Style, Standard

#FSPS
Seal Plugs

#MFHN
Oil Free Seals – For Rotary Motion

#MUSB
Oil Free Seals – For Rotary Motion

#MUDN
Oil Free Seals – For Rotary Motion

Suction Cups / Suction Components

#SRK
Vacuum Fittings

#SRP
Suction Cups

#MHLD
Holders for Mini Suction Cups

#RBTR
Mini Suction Cups – Round, Square

#MKPE
Vacuum Pens

#NICR
Vacuum Attachments Chip

#NSUS
Vacuum Attachments Fine

#NPUN
Vacuum Attachments Conductive Rubber Suction

#MVFK
Suction Cups – with Fitting, Spring, K-Shape

#MVFT
Suction Cups – with Fitting, Spring, T-Shape

#MVFL
Suction Cups – with Fitting, Spring, L-Shape

#MVFS
Vacuum Fittings – Standard, Deep, Direct Mount Spring, S-Shape

#MVFR
Vacuum Fittings – Standard, Deep, Spring, Long Stroke, R-Shape

#MVPJ
Vacuum Fittings – Small, Direct Mount, J-Shape

#VPFF
Suction Cups – Standard, Deep, Small

#MVBK
Vacuum Fittings – Sponge, Bellows, Fixed

#MVBT
Vacuum Fittings – Sponge, Bellows, Spring, T-Shape

#MVBL
Vacuum Fittings – Sponge, Bellows, Spring, L-Shape

#MVBS
Vacuum Fittings – Sponge, Bellows, Direct Mount Spring, S-Shape

#MVBR
Vacuum Fittings – Sponge, Bellows, Spring, Long Stroke, R-Shape

#VPBE
Suction Cups – Sponge, Bellows

#MVPA
Vacuum Attachments

#MVCK
Vacuum Fittings – Soft/Soft Bellows, Fixed, K-Shape

#MVCT
Vacuum Fittings – Soft/Soft Bellows, Spring, T-Shape

#MVCL
Vacuum Fittings – Soft/Soft Bellows, Spring, L-Shape

#MVCS
Vacuum Fittings – Soft/Soft Bellows, Direct Mount Spring, S-Shape

#MVCM
Vacuum Fittings – Soft, Vacuum Cylinder, M-Shape

#VPCE
Suction Cups – Soft/Soft Bellows

#MVEK
Vacuum Fittings – Oval, Thin Object, Fixed, K-Shape

#MVET
Vacuum Fittings – Oval, Thin Object, Spring, T-Shape

#MVEL
Vacuum Fittings – Oval, Thin Object, Spring, L-Shape

#MVES
Vacuum Fittings – Oval, Thin Object, Direct Mount Spring, S-Shape

#MVER
Vacuum Fittings – Oval, Spring, Long Stroke, R-Shape

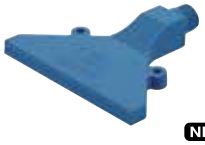
#VPES
Suction Cups – Oval

#VPTS
Suction Cups – For Thin Objects

Nozzles

#AFTF
Flat Air Nozzles – Standard

#AFTS
Flat Air Nozzles – Standard



#AFTW
Flat Air Nozzles – Wide

#AFTC
Air Nozzles – Compact

#AFTA
Flat Air Nozzles – Amplify

#AFTD
Flat Air Nozzles – Amplify

#AFT3
Flat Air Nozzles – Amplify, Wide

#AFT5
Flat Air Nozzles – Amplify, Compact

#AFT4
90 Deg. Air Nozzles – Standard

#AFTR
90 Deg. Air Nozzles

#AFT2
90 Deg. Air Nozzles – Wide

#AFTV
90 Deg. Air Nozzles – Vertical Blow

#AFTH
High Flow Rate Nozzles for Blowers

#AFTB
Flat Air Nozzles Compact for Blowers

#NZAK
Spray Nozzles – Economy

#ALVA
Air Nozzles – De Laval

#ARDA
Spray Nozzles – Round

#ARDD
Spray Nozzles – Circular Spray Pattern, Amplify

#SKNF
Nozzles with Bite Tube Fitting

#PNZR
Air Blow Nozzles – Swivel Point

#PNZC
Point Nozzles – Compact, Screw-In

#PNZV
Point Nozzles – Back Flow Check

#SPNZ
Rotary Nozzles

#AFCS
Flow Rate Control Nozzles

#ACNA
Conical Air Nozzles

#AEDA
Radial Air Nozzles

#ABNK
Air Blow Nozzles – Threaded, Tapped, Knurling Criss-Cross, Terminal Block

#ABNH
Air Blow Nozzles – Threaded, Tapped, 2-Core, Barbed, Hose Nipple

#PNMC
Air Blow Nozzles – Pipe Nozzles

#DKNZ
Air Blow Nozzles – Copper Pipes

#PLNZ
Nozzles with Attachment Plate

#SGPP
Pipe Nozzles – Threaded, Tapped Ends

#SLTF
Pipe Nozzles – Steel with Slit

#PWNZ
Nozzles for Pipe Washing

#AMF
Pipe Nozzles – Steel Pipes for Air Nozzles

#NZTA
Terminals for Nozzles – Clamp

#NZTB
Terminals for Nozzles – Block

#NJFS
Spray Nozzles – Nozzle Joint

#WANR
Spray Nozzles – Two-Fluid Nozzles

#NZRF
Spray Nozzles – Fan-Shape Spray Pattern, 90 Deg.

#NZRV
Spray Nozzles – Fan Shape Spray Pattern

#NZRT
Spray Nozzles – Angular Shape Spray

#NZRK
Spray Nozzles – Annular Shape Spray Pattern, 90 Deg. Nozzle

#NZRC
Spray Nozzles – Full Circular Shape Spray Pattern

#NZRS
Spray Nozzles – Rod Shape Spray Pattern

#NZRA
Spray Nozzles – Variable Shape

#HLAJ
Adjustable Hoses – Standard, L-Shaped, Branch

#HJD
Adjustable Hoses – Hose Only

#AAJD
Adjustable Hoses – Connector Only

#HAKD
Adjustable Hoses – Nozzle Only

#HOSA
Mounting Tool for Adjustable Hoses

Compressors / Blowers

#VBYE
Turbo Blower

Cylinders / Air Grippers

#MPPY
Air Linear Guides – MPPT6Y Series

#MPPT
Air Linear Guides – MPPT8 Series

#MPP1
Air Linear Guides – MPPT10 Series

#MPP2
Air Linear Guides – MPPT12 Series

#MPP6
Air Linear Guides – MPPT26 Series

#MPPU
Air Linear Guides – MPPU10 Series

#MPP3
Air Linear Guides – MPPTU12 Series

★
#MSCC
Compact Cylinders

#MD11
Sensors for Cylinders

#CFKP
Compact Cylinder Brackets – Foot Brackets

#CTKB
Compact Cylinder Brackets – Clevis Mount

#MSCL
Compact Cylinder Brackets – L-Shaped, T-Shaped

#CYPF
Compact Cylinder Brackets – Cylinder Trunnion Plates

#MSCF
Small Cylinders – Sensor Slot Unit

#MSMC
Small Cylinders – Tip Shape Selectable

#MSP1
Air Cylinders – Panel Mount, Single Acting

#MSPC
Air Cylinders – Pen, Double Acting

#MSRC
Sensors For Pen-Shaped Air Cylinder

#MGCL
Cylinders with Twin Guides

#MKRC
Rotary Clamp Cylinders

#MT10
Auto-Switch

#RCLA
Rotary Clamp Cylinder Brackets – Straight

#RCYB
Rotary Clamp Cylinder Brackets – Square

#RCYG
Rotary Clamp Cylinder Brackets – U-Shaped

#ACHE
Air Gripper – Parallel

#ACHA
Attachments for Air Grippers

#YFTB
Fingers for Air Grippers – Direct Mounting, Flat

Cylinder Connecting Components

#FJEB
Coupling Rods for Air Cylinders

NEW

#FJRH
Floating Joints – Tapped Cylinder Connector and Holder Set

#FJSC
Floating Joints – Metal Plate Holders

#FJG
Floating Joints – Tapped Cylinder Connector Fixed

#FJGF
Floating Joints – Tapped Cylinder Connector Configurable

#FJN
Floating Joints – Separate Nut, Washer

#FJCL
Floating Joints – Tapped Circular

NEW

#FJDH
Floating Joints – Threaded Cylinder Connector and Holder Set

#FJD2
Floating Joints – Threaded Connector Only

#FJDL
Floating Joints – Threaded Configurable

#FJCM
Floating Joints – Threaded Circular

#FJNM
Floating Joints – Separate Thread

#FJBR
Floating Joints – Bolt Mount

★

#HLRA
Holders – Side Mount, Flange, T-Fixed

#HLR2
Holders – Bottom Mount, Flange

#HLR1
Holders – Top Mount, Flange

#HLRB
Holders – Side Mount, Bar, Height H-Fixed

#HLRH
Holders – Bottom Mount, Bar

#HLRD
Holders – Top Mount, Bar

#HLRE
Holders – Compact, T-Slot

#HLRL
Holders – L-Shaped

#FJMH
Floating Joints – T-Slots with Pilot, Threaded

#FJH
Floating Joints – T-Slots with Pilot, Tapped

#FJMW
Floating Joints – T-Slots Through Hole, Threaded

#FJW
Floating Joints – T-Slots Through Hole, Tapped

#TCMJ
Tip Connection Joints – Threaded

#TCJ
Tip Connection Joints – Tapped

★

#FJA
Floating Joints – Flange Mounting, Tapped

#FJMA
Floating Joints – Flange Mounting, Cylinder Connector, Threaded

#FJAT
Floating Joints – Cylinder Connectors, Flange, Set, Mount Flange

#FJAZ
Floating Joints – Mount Flange Set, Cylinder Connector

#BPFA
Floating Joint Backing Plates

#FJCF
Floating Joints – Low Hardness, Low Hardness Thin

#BPFJ
Floating Joints – Backing Plates

#FJY
Floating Joints – Slide, Set, Connector, Mounting Flange

#FLCM
Floating Connectors – Miniature

#FLCT
Floating Connectors – Screw-In

#FLCF
Floating Connectors – Flange Mounting

#FLCL
Floating Connectors – Bracket Mouning

#FJX
Floating Joints – Extra Short Threaded Stud Mount, Tapped

#FJMX
Floating Joints – Extra Short Threaded Stud Mount, Threaded

#FJXL
Floating Connectors – Extra Short, Foot Mount, Tapped

#FJML
Floating Connectors – Extra Short, Foot Mount, Threaded

#FJCC
Floating Connectors – Extra Short, Flange Mounting, Tapped

#FJMC
Floating Connectors – Extra Short, Flange Mounting, Threaded

#KPMF
Metal Pushers – Threaded

#KPHF
Metal Pushers – Tapped

#URCP
Urethane Caps

#URLH
Bumpers – Urethane, Silicon, Tapped, Flat, Round

#USLH
Bumpers – Urethane, Silicon, Threaded, Flat, Round

#SLLM
Bumpers – Urethane, Silicon, Fluororubber, Low Hardness Urethane, Tapped

#SSLM
Bumpers – Urethane, Silicon, Fluororubber, Low Hardness Urethane, Threaded

#PSHH
Bumpers – Large Diameter, Polyurethane, MC Nylon, Tapped

#PSHD
Bumpers – Large Diameter, Polyurethane, MC Nylon, Threaded

#PSHE
Bumpers – Small Diameter, Polyurethane, Tapped

#PSH1
Bumpers – Small Diameter, Polyurethane, Threaded

#PSHC
Resin Bumpers – Standard, Tapped

#PSH2
Resin Bumpers – Standard, Threaded

#JPHJ
Resin Bumpers – Round

#JPFJ
Resin Pushers – Flat, Spherical, Tapered

#NJCB
Knuckle Joints – Extra Short

#NJUT
Knuckle Joints – Toolless Unit

#NJT
Knuckle Joints – Fixed, Prong, Notch

#NJSB
Knuckle Joints – Tapped, Selectable

#FNNB
Knuckle Joints – Tapped, Configurable

#FNMB
Knuckle Joints – Threaded, Configurable

Flow Rate Controllers

#JNL
Flow Rate Control Valves – Compressed Air

#SPSN
Flow Rate Control Valves – 90 Deg. Elbow, Standard

#SPJY
Flow Rate Controllers – Union Straight

#MNSP
Flow Rate Control Valves – 90 Deg. Elbow, Miniature

#SPSS
Flow Rate Controller – Straight, Meter Out

#MNSJ
Flow Rate Control Valve – 90 Deg. Elbow, Angled Port

#SPJC
Flow Rate Control Valves – In-Line

#SPJS
Flow Rate Control Valves – In-Line, Miniature

#SPCN
Flow Rate Controllers – Low Height

#NBDY
Flow Rate Control Valves – Valve with Adjusting Dial

#ASPS
Flow Rate Control Valves – 90 Deg. Elbow, Stainless Steel

#KSPS
Flow Rate Control Valves – 90 Deg. Elbow, Heat Resistant

#PJSP
Flow Rate Control Valves – 90 Deg. Elbow

#SEJC
Throttle Valves – 90 Deg. Elbow

#SEJR
Throttle Valves – Union

#RGCM
Regulators – 90 Deg. Elbow with Gauge

#RGUN
Regulators – In-Line with Gauge

Connecting Bars / Link Cables / Wires

#CWP
Link Cables

#LBRB
Rod End Coupling Rods – Both Ends Threaded

#LBMB
Rod End Coupling Rods – Both Ends Tapped

#LBGF
Rod End Coupling Rods – Threaded, Tapped

Rod Ends / Spherical Bearings

#PHSC
Rod End Bearings – Standard

#RBLD
Rod End Bearings – 90 Deg. Link Ball

#RBID
Rod End Bearings – Link Ball with Thread

#RBPB
Spherical Bearings – Standard

#RBPC
Spherical Bearing with Housing – Compact

Hinge Bases / Joint Plates / Bolts

#DNDN
Wing Hinge Screws

#HGBB
Hinge Bolt – Left/Right Hand Thread

#HKNB
Hinge Bases – U-Shaped, Fixed Dimension

#HKNK
Hinge Bases – T-Shaped, Fixed Dimension

#HPAN
Hinge Plates – Standard

#HPE
Hinge Plates – R-Type

#JNPB
Hinge Plates – Economy

#HKPB
Hinge Bases – U-Shaped

#HKTB
Hinge Bases – T-Shaped, Standard, Oil-Free

#HGHH ★
Hinge Bases – T-Shaped, U-Shaped

#HGAA
Hinge Bases – Standard, Miniature

#HGNJ
Thick Hinge Bases – U-Shaped, A Compact, W/H Configurable

#HGNN ★
Thick Hinge Bases – T-Shaped, Standard, W/H Configurable

#HKUB
Hinge Bases – U-Shaped, Bottom Mount

#HGB2
Hinge Bases – T-Shaped, Bottom Mount

#HGSU
Hinge Bases – U-Shaped, Side Mount

#HKSB
Hinge Bases – T-Shaped, Side Mount

#HBNT
Hinge Bases – With Center Hole, Bottom Mount

#HGCC
Hinge Bases – With Center Hole, T-Shape, U-Shape

#HGCN
Hinge Bases – Center Fulcrum

#HGCJ
Hinge Bases – Thick, Center Fulcrum

#HGLN
Hinge Bases – L-Shaped, Standard, Tapped Hole for Stopper

#HGLJ
Hinge Bases – Thick L-Shaped

Links

#LNDB ★
Links – Standard

#LNFT
Links – 3-Hole

#LKBK
Links – Angled, 3-Hole

#LINB
Links – Standard, Squared Edges

#LNBB
Links – Bearing Embedded

#LNMS
Links – Oil-Free Bushing Press-Fit

#LNCB
Links – Notched

#LNDL
Links – Slotted Hole

#LKSF
Link Bars/Threaded/Tapped

#LACF
Links – Both Ends Female Notch

#CLKA
Clamp Links – For Rod End Bearing

#CLKW
Clamp Links – 2 Clamps

Sensor Cams / Flags

#HPSC
Photo Sensor Cams – Solid

#HPJC
Photo Sensor Cams – Resin

#HPS1
Photo Sensor Cams – Clamping

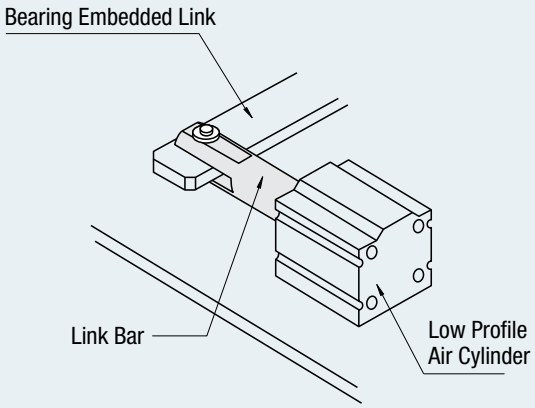
#PSC
Photo Sensor Cams – 180 Deg.

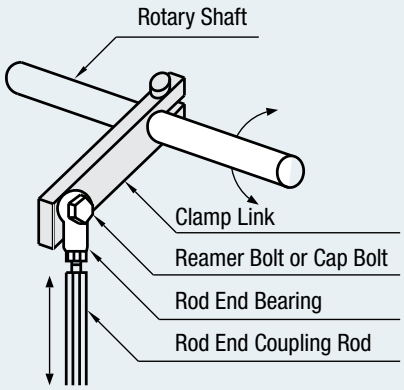
#HPSA
Photo Sensor Cams – Angle Adjustment

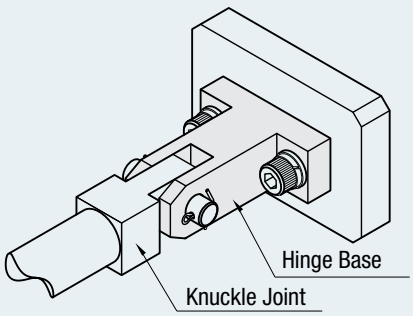
#DGSM
Switch Flags – Setscrew, One Ends Cone with Thru Hole

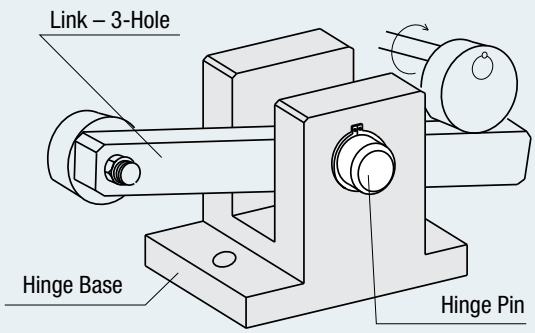
#DGW
Switch Flags – Slit, One End Cone with Thru Hole

Example









LOW ← HEAT INSULATING PLATES — MAX OPERATING TEMPERATURE — HEAT INSULATING SHEETS → HIGH

Product Name	High Strength	High Insulation	Standard	Free-Cutting	Thermal Plates (Circular)	High Temp Resistance	High Temp High Insulation	Heat Resistance	Heat Insulating (Thin) Plates			Very High Temp Resistance	Insulating Papers
Recommended Operating Temperature	Room to 180°C	Room to 180°C	Room to 220°C	Room to 300°C	Room to 350°C	-80–400°C	Room to 400°C	Room to 500°C	-80~800°C			Room to 1000°C	Room to 1300°C
Available Color	Brown	Natural Color	White	Gray	Various	White	White	Gray	Brown	White	Gray	White	White
Base Material	Glass Fiber	Glass Fiber	Glass Fiber	Glass Fiber	Glass Fiber	Glass Fiber	Glass Fiber	Glass Fiber	Glass Fiber*			Calcium Silicate	Ceramic Fiber
Filler Material	Super Heat Resistant Epoxy Resin	ISO Type Unsaturated Polyester	Silicic Acid Base	Cement	Calcium Silicate Base Binder	Calcium Silicate Base Binder	Calcium Silicate Base Binder	Borate Type	—			Calcium Silicate	—
Thermal Conductivity [W/m*K]	0.59	0.13	0.71	0.44	0.07	0.24	0.08	1.21	0.11			0.2	0.07 (at 400°C) 0.16 (at 1000°C)
Thickness [mm]	3–15	3–15	3–15	5–15	3–10	3–15	3–15	3–15	1–2			1/2"–1"	1–3
Sizes [mm x mm]	600 x 800	600 x 800	600 x 800	600 x 800	Ø400	600 x 800	600 x 800	600 x 800	500 x 500			600 x 800	600 x 800
Compression Strength[1] [kgf/mm²]	51-60	31.9	15-20	11	0.12	44.7	18.5	12–15	—			0.45	—
Specific Gravity	1.8–2.0	1.41	2.0–2.2	1.75	0.5	2	1.2	2.0–2.2	—			—	—
Cost $	$$$	$$	$$	$$	$$	$$$$	$$$$	$$	$			$$	$

*Glass Fiber and bonding materials including inorganic mineral and filler 1) Compression Strength-perpendicular to lamination

Heat Insulating Plates

★
#HIPA
Heat Insulating Plates – Standard, Heat Resistant Grade

★
#HIPL
High Strength Grade, High Temperature Resistant Grade

#HIP1
High Temperature Insulating, High Temperature Super Insulating Grade

#HRMB
High Temperature Insulating Grade

#HIPC
Heat Insulating Plates – Free-Cutting Grade, Thermal Plates

#HIFP
Insulating Papers

#HIPK
Heat Insulating Plates – High Temperatue Insulating Grade, With/Without Holes

★
#ENJH
Heat Insulating Plates – Circular

#KJLH
Bakelite – Epoxy Glass, Insulating

Heaters

#HTPL
Cartridge Heaters Items – Hot Plates

#MCKN
Cartridge Heaters Items – Mounting Bolts

#MSH3
Connecting Parts for Heaters – Welding Sockets, PF Threaded

Hot Air Generators

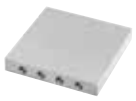
#HOTD
Heat Resistant Duct Hoses – For Hot Air Generating Units

Cooling Related Products

#HEAT
Heatsinks

#HTCH
Heat Radiation Gel Sheets

Temperature Sensors



#HTPC
Cartridge Heater Items – Cooling Plates

#PELT
Peltier Cooling Unit

#MAJC
Jet Air Coolers – Standard, Compact, Low Temperature

#FLOS
Float Switches – Horizotal, Vertical

#MSPL
Connecting Parts for Temperature Sensors – Plugs, Mounting Holders

#MSND ★
Temperature Sensors – Standard, K-Thermocouple

#MSFJ
Temperature Sensors – Terminal Selectable, K-/J-Thermocouple

#MSNL
Temperature Sensors – L-Shape, K-Thermocouple

#MSN5
Temperature Sensors – Lead Wire Protection, K-Thermocouple

#MSNH
Temperature Sensors – Heat Resistant, K-Thermocouple

#TCKC
Temperature Sensors – Compact, K-Thermocouple, Temperature-Resistor

#TCKT
Temperature Sensors – Taper Thread, K-Thermocouple, Temperature-Resistor

#TCKF
Temperature Sensors – Flanged, K-Thermocouple, Temperature-Resistor

#MFSK
Temperature Sensors – Sheath, For Moving Parts, K-Thermocouple

#MCNF
Temperature Sensors – Connector, K-Thermocouple

#MSWK
Temperature Sensors – Double Element, K-Thermocouple

#MFLS
Temperature Sensors – Chemical Resistant, K-Thermocouple

#MSNS ✓
Temperature Sensors – Round Crimp Terminal, K-Thermocouple

#MFMT
Temperature Sensors – Round Crimp Terminal, For Moving Part, K-Thermocouple

#MSNY
Temperature Sensors – Spade Crimp Terminal, K-Thermocouple

#MSNM
Temperature Sensors – Screw Mount, K-Thermocouple

#MFNC
Temperature Sensors – Screw Mount, For Moving Parts, K-Thermocouple

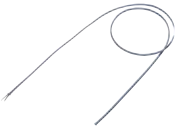
#MSN1
Temperature Sensors – Band Connector, K-Thermocouple

#MSNB
Temperature Sensors – Spring Contact, K-Thermocouple

#MFEK
Temperature Sensors – Temperature Measuirng Surface

#MMGK
Temperature Sensors – Magnetic Connetor

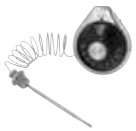
#MSEN
Sheathed Thermocouples



#DSEN
Compensation Lead Wires

#MSN4
K-Thermocouple Connectors

#MBMS
Bimetal Thermostats

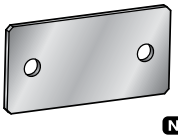


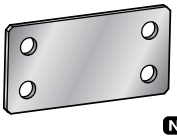
#THRM
Thermostats

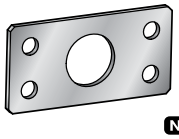
#THRB
Boxes for Thermostats

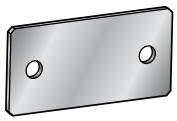
#THRP
Thermostats Items – Protection Pipes

Mounting Plates / Brackets


NEW
#JSDA
Sheet Metal Mounting Plates


NEW
#JSAA
Sheet Metal Mounting Plates


NEW
#JSHD
Sheet Metal Mounting Plates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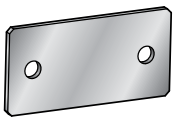
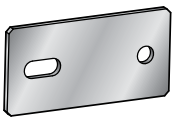
Sheet Metal Mounting Plates


★
#JTDA
Sheet Metal Mounting Plates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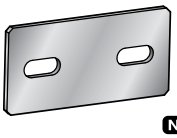
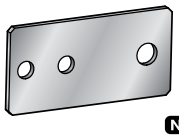
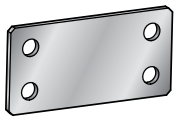

NEW
#JTDC
Sheet Metal Mounting Plates


NEW
#JTMA
Sheet Metal Mounting Plates


#JTAA
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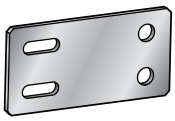
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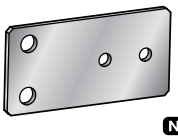
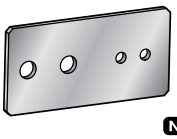

NEW
#JTKA
Sheet Metal Mounting Plates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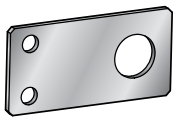
#JTNA
Sheet Metal Mounting Plates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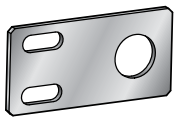
Sheet Metal Mounting Plates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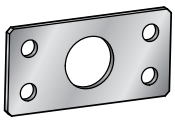
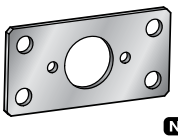
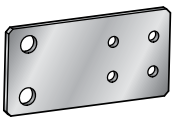
Sheet Metal Mounting Plates


#JTHD
Sheet Metal Mounting Plates


NEW
#JTHE
Sheet Metal Mounting Plates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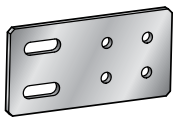
Sheet Metal Mounting Plates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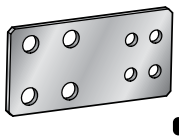
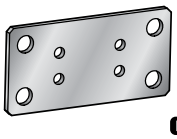
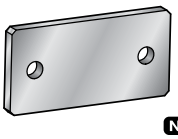
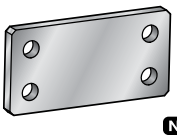
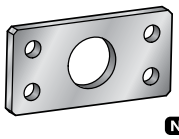
Sheet Metal Mounting Plates

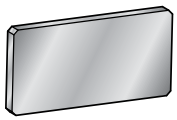

NEW
#JTAC
Sheet Metal Mounting Plates

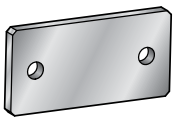

NEW
#JTAD
Sheet Metal Mounting Plates

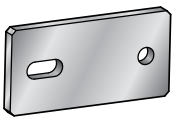

NEW
#HRCZ
Flat Bar Mounting Plates, Brackets – Center Symmetrical


NEW
#HRMZ
Flat Bar Mounting Plates, Brackets – Center Symmetrical


NEW
#HRMCD
Flat Bar Mounting Plates, Brackets – Center Symmetrical


#HRZZ
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


★
#HRMQ
Flat Bars Mounting Plates, Brackets – B Dim. Selectable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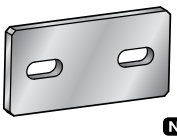
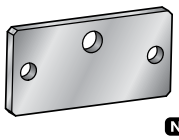
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


NEW
#HRNR
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


NEW
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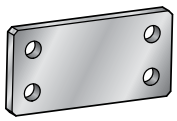
Flat Bars Mounting Plates, Brackets – B Dim. Selectable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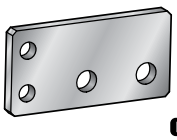
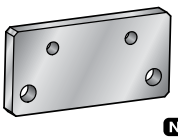
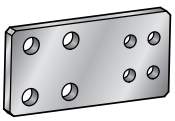
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


NEW
#HRMA
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


NEW
#HRCB
Flat Bars Mounting Plates, Brackets – B Dim. Selectable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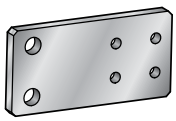
Flat Bars Mounting Plates, Brackets – B Dim. Selectable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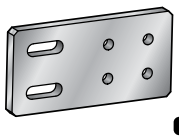
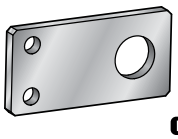
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


NEW
#HRJD
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


NEW
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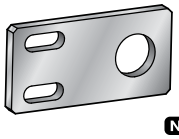
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


NEW
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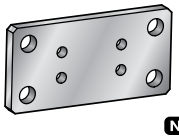
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


NEW
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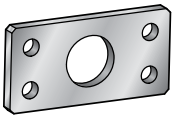
Flat Bars Mounting Plates, Brackets – B Dim. Selectable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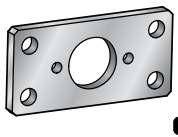
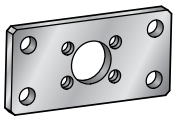
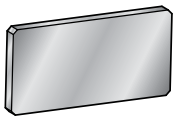
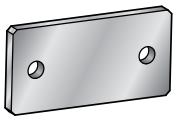
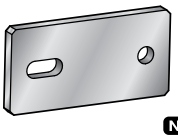
Flat Bars Mounting Plates, Brackets – B Dim. Selectable

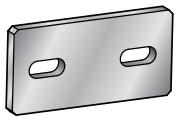

NEW
#HRMS
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


★
#HRMC
Flat Bars Mounting Plates, Brackets – B Dim. Selectable


#HFZZ
6 Surface Milled Mounting Plates – Brackets


★
#HFMQ
6 Surface Milled Mounting Plates – Brackets


NEW
#HFNQ
6 Surface Milled Mounting Plates – Brackets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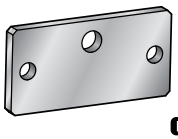
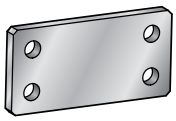
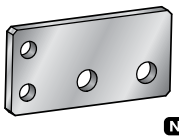
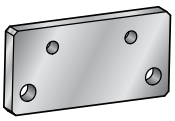
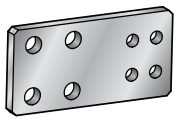
6 Surface Milled Mounting Plates – Brackets

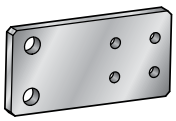

NEW
#HFCM
6 Surface Milled Mounting Plates – Brackets

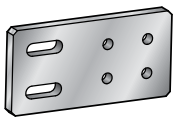

#HFMP
6 Surface Milled Mounting Plates – Brackets

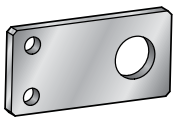

NEW
#HFMS
6 Surface Milled Mounting Plates – Brackets

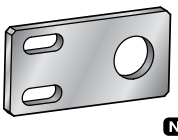

#HFCA
6 Surface Milled Mounting Plates – Brackets

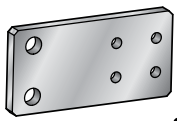

#HFMD
6 Surface Milled Mounting Plates – Brackets

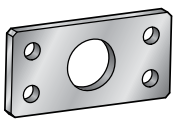

#HFFD
6 Surface Milled Mounting Plates – Brackets

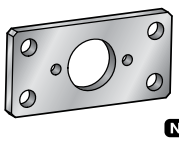

#HFJD
6 Surface Milled Mounting Plates – Brackets

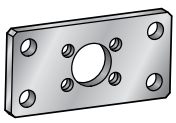

#HFFC
6 Surface Milled Mounting Plates – Brackets

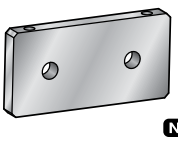

NEW
#HFJC
6 Surface Milled Mounting Plates – Brackets

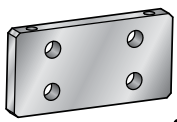

NEW
#HFMA
6 Surface Milled Mounting Plates – Brackets

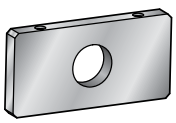

★
#HFMM
6 Surface Milled Mounting Plates – Brackets

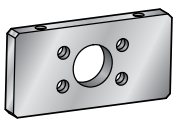

NEW
#HFM1
6 Surface Milled Mounting Plates – Brackets

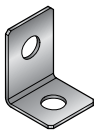

#HFMC
6 Surface Milled Mounting Plates – Brackets

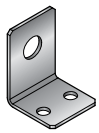

NEW
#VFMQ
6 Surface Milled Mounting Plates Brackets – Side Hole

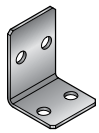

NEW
#VFMP
6 Surface Milled Mounting Plates Brackets – Side Hole

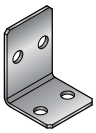

#VFMM
6 Surface Milled Mounting Plates – Brackets - Side Hole

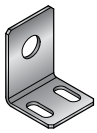

#VFMA
6 Surface Milled Mounting Plates – Brackets - Side Hole

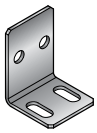

NEW ★
#FSLA
L-Sheet Metal Mounting Plates – Brackets

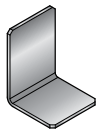

NEW
#FSLB
L-Sheet Metal Mounting Plates – Brackets

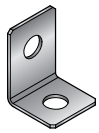

NEW
#FSMA
L-Sheet Metal Mounting Plates – Brackets

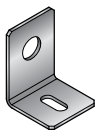

NEW
#FSDA
L-Sheet Metal Mounting Plates – Brackets


NEW
#FSSB
L-Sheet Metal Mounting Plates – Brackets

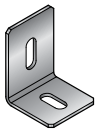

NEW
#FSMC
L-Sheet Metal Mounting Plates – Brackets


#FALZ
L-Sheet Metal Mounting Plates – Brackets


#FALA
L-Sheet Metal Mounting Plates – Brackets

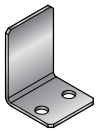


#FALC
L-Sheet Metal Mounting Plates – Brackets



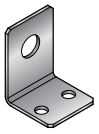
NEW

#FALD
L-Sheet Metal Mounting Plates – Brackets



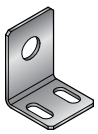
NEW

#FACA
L-Sheet Metal Mounting Plates – Brackets

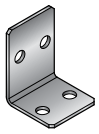


★

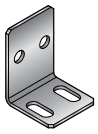
#FALB
L-Sheet Metal Mounting Plates – Brackets



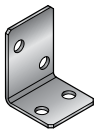
#FASB
L-Sheet Metal Mounting Plates – Brackets



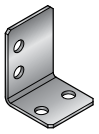
#FAMA
L-Sheet Metal Mounting Plates – Brackets



#FAMC
L-Sheet Metal Mounting Plates – Brackets

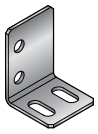


#FAPA
L-Sheet Metal Mounting Plates – Brackets



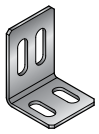
NEW

#FADA
L-Sheet Metal Mounting Plates – Brackets



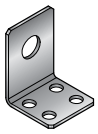
NEW

#FADB
L-Sheet Metal Mounting Plates – Brackets



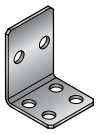
NEW

#FAMD
L-Sheet Metal Mounting Plates – Brackets

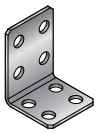


NEW

#FAEA
L-Sheet Metal Mounting Plates – Brackets

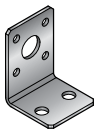


#FAMB
L-Sheet Metal Mounting Plates – Brackets

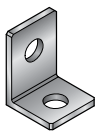


NEW

#FANA
L-Sheet Metal Mounting Plates – Brackets

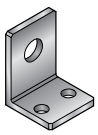


#FATB
L-Sheet Metal Mounting Plates – Brackets



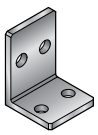
NEW ★

#LRAM
L-Shape Finished Angle Mounting Plates – Brackets



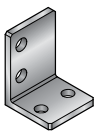
NEW

#LRCT
L-Shape Finished Angle Mounting Plates – Brackets



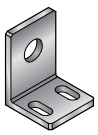
NEW

#LRCF
L-Shape Finished Angle Mounting Plates – Brackets

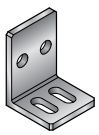


NEW

#LRCD
L-Shape Finished Angle Mounting Plates – Brackets

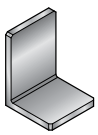


#LRCM
L-Shape Finished Angle Mounting Plates – Brackets



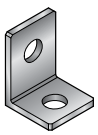
NEW

#LRDD
L-Shape Finished Angle Mounting Plates – Brackets



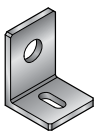
NEW ★

#LAF3
L-Shape Finished Angle Mounting Plates – Brackets



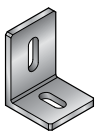
NEW

#LAF2
L-Shape Finished Angle Mounting Plates – Brackets

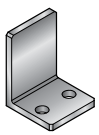


NEW

#LAFS
L-Shape Finished Angle Mounting Plates – Brackets

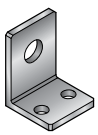


#LAFN
L-Shape Finished Angle Mounting Plates – Brackets



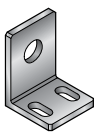
NEW

#LAFZ
L-Shape Finished Angle Mounting Plates – Brackets



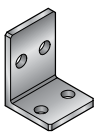
NEW

#LAF4
L-Shape Finished Angle Mounting Plates – Brackets



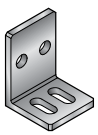
NEW

#LAFW
L-Shape Finished Angle Mounting Plates – Brackets



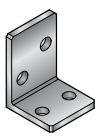
NEW

#LAFD
L-Shape Finished Angle Mounting Plates – Brackets



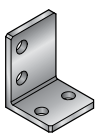
NEW

#LAF1
L-Shape Finished Angle Mounting Plates – Brackets



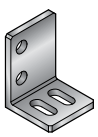
NEW

#LAFB
L-Shape Finished Angle Mounting Plates – Brackets



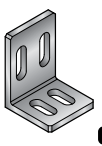
NEW

#LAF6
L-Shape Finished Angle Mounting Plates – Brackets



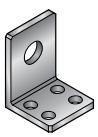
NEW

#LAFC
L-Shape Finished Angle Mounting Plates – Brackets



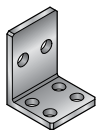
NEW ★

#LAF7
L-Shape Finished Angle Mounting Plates – Brackets



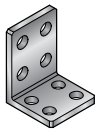
NEW ★

#LAFF
L-Shape Finished Angle Mounting Plates – Brackets



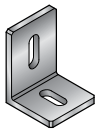
NEW

#LAF5
L-Shape Finished Angle Mounting Plates – Brackets



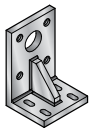
NEW ★

#LFWA
L-Shape Finished Angle Mounting Plates – Brackets



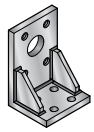
NEW

#LFWD
L-Shape Finished Angle Mounting Plates – Brackets



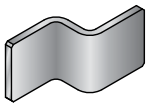
NEW

#WASA
Welded Mounting Plates, Brackets – L-Shaped



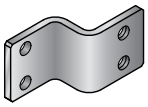
NEW

#WAWA
Welded Mounting Plates, Brackets – L-Shaped

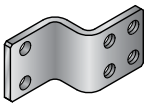


#SWBZ
Sheet Metal Mounting Plates, Brackets – Z-Shaped

#SWCA
Sheet Metal Mounting Plates, Brackets – Z-Shaped

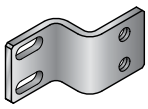


#SWBA
Sheet Metal Mounting Plates, Brackets – Z-Shaped

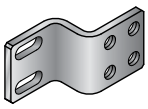


#SWBC
Sheet Metal Mounting Plates, Brackets – Z-Shaped

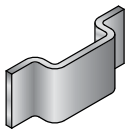
#SWCB
Sheet Metal Mounting Plates, Brackets – Z-Shaped



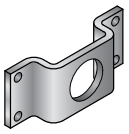
#SWBB
Sheet Metal Mounting Plates, Brackets – Z-Shaped



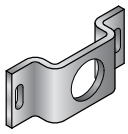
#SWBD
Sheet Metal Mounting Plates, Brackets – Z-Shaped



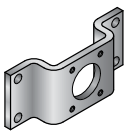
#BLUZ
Sheet Metal Mounting Plates, Brackets – Convex Bent



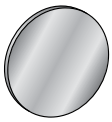
#BLUE
Sheet Metal Mounting Plates, Brackets – Convex Bent



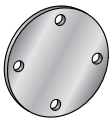
#BLUF
Sheet Metal Mounting Plates, Brackets – Convex Bent



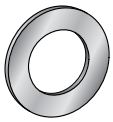
#BLUJ
Sheet Metal Mounting Plates, Brackets – Convex Bent



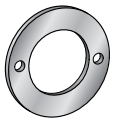
#BFHN
Sheet Metal Round Plates



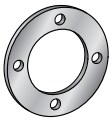
#BFHA
Sheet Metal Round Plates



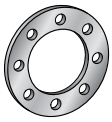
#BFHB
Sheet Metal Round Plates



#BFH2
Sheet Metal Round Plates



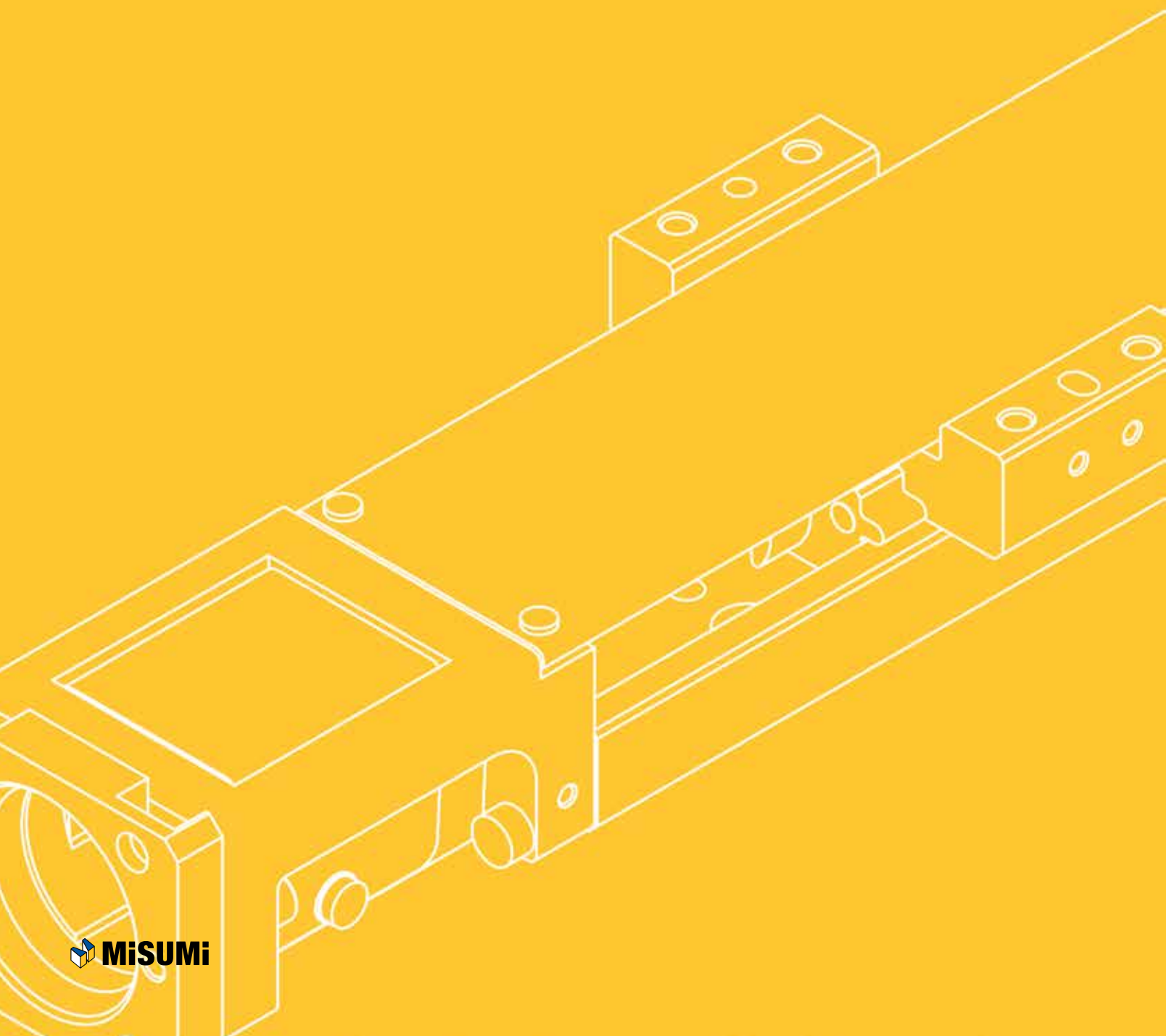
#BFHF
Sheet Metal Round Plates



#BFHE
Sheet Metal Round Plates

REFERENCE INDEX

Use this section to find Machined parts by shape or resin materials, as well as MISUMI USA's actuator product line.

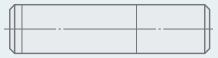


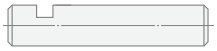
MiSUMi

MACHINED PARTS BY SHAPE / RESIN MATERIALS / ACTUATORS LINEUP

Machined Parts By Shape

Find machined parts based on shapes

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	f8/g6/h5	#SFJ
	—	h9/h7/g6	#HFR
	—	h7/h6 [◎]Precision	#KZAC
	—	0~-0.1	#RDOB
	—	0~-0.1 ±0.1	#RDOA
	Hardened	0~-0.005	#MRS
	Hardened	h7/g6/m6/p6 0~-0.01	#KRSD
	Hardened	h7/g6/p6	#MSY
	High Hardness Stainless Steel	h7/g6/m6/p6	#ALPS
	Hardened	h7/g6/m6/p6	#LPST
	Hardened	+0.005~+0.01	#MS
	Hardened	0~-0.005	#SFKS

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	0~-0.005	#MRSG
	Hardened	0~-0.005	#MRSG
	High Hardness Stainless Steel	0~-0.02	#SFKK
	Hardened	h7/g6/m6/p6	#LPSQ
	Hardened	0~-0.005	#MRSG
	High Hardness Stainless Steel	h7/g6/m6/p6	#ALPS
	Hardened	f8/g6/h5	#SFAQ
	Hardened	f8/g6/h5	#SFAL
	Hardened	g6	#CMG
	Hardened	f8/g6/h5	#SFAK
	Hardened	g6	#CLKG
	Hardened	g6	#CLSG

Machined Parts By Shape

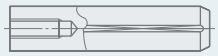
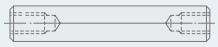
Find machined parts based on shapes

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	f8/g6/h5	#SFAR
	—	h9/h7/g6	#SFRR
	Hardened	g6	#CCG
	—	g6	#CNPR
	Hardened	g6	#SFJQ
	—	g6	#SFRV
	Hardened	g6	#CLSW
	—	h9	#SFMR
	—	g6	#SFRT
	—	h9/h7/g6	#SFGK
	—	h9/h7/g6	#SFGR
	Hardened	0~-0.01	#LPZ

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	g6	#SFDG
	—	g6	#SFR1
	Hardened	f8/g6/h5	#SFJT
	Hardened	g6 Precision	#VFJC
	—	h9/h7/g6	#HFRT
	Hardened	f8/g6/h5	#SFHC
	Hardened	g6 Precision	#VFJC
	—	h9/h7/g6	#HFRT
	—	0~-0.1	#ETK2
	Hardened	f8/g6	#SFHC
	Hardened	g6/h5	#SFLU
	High Hardness Stainless Steel	h7/g6/m6/p6	#ALPS

Machined Parts By Shape

Find machined parts based on shapes

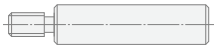
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	h7/g6/m6/p6	#LPST
	High Hardness Stainless Steel	h7/g6/m6/p6	#ALPS
	Hardened	h7/g6/m6/p6	#LPSQ
	Hardened	g6	#SFBH
	—	g6	#SFR1
	Hardened	g6	#LPN
	Hardened	+0.010~+0.005	#MSTP
	Hardened	±0.1	#JPH2
	—	h9/h7/g6	#SFGT
	Hardened	f8/g6/h5	#SFJW
	Hardened	g6 Precision	#VFJW
	—	h9/h7/g6	#HFRW

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	0~-0.1	#BETS
	Hardened	g6	#CLBM
	Hardened	f8/g6/h5	#SFHZ
	Hardened	g6 Precision	#VFJW
	—	h9/h7/g6	#HFRW
	—	0~-0.1	#BETS
	Hardened	f8/g6	#SFHZ
	Hardened	g6	#SFIG
	—	h9/h7/g6	#SFGW
	Hardened	f8/g6/h5	#SFAC
	—	h9/h7/g6	#HFRP
	—	h7/h6 [◎]Precision	#KZBC

Machined Parts By Shape

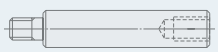
Find machined parts based on shapes

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	g6	#SFRX
	Hardened	f8/g6/h5	#SFAA
	—	h9/h7/g6	#SFRF
	Hardened	f8/g6/h5	#SFAC
	Hardened	g6 [◎]Precision	#VFAG
	—	h9/h7/g6	#SFRG
	Hardened	f8/g6/h5	#SFPG
	Hardened	g6 [◎]Precision	#VFAG
	—	h9/h7/g6	#SFRG
	Hardened	f8/g6/h5	#SFAA
	Hardened	g6 [◎]Precision	#VFAA
	—	h9/h7/g6	#SFRA

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	f8/g6/h5	#SFUP
	Hardened	g6 [◎]Precision	#VFAA
	—	h9/h7/g6	#SFRA
	Hardened	f8/g6/h5	#SFAN
	Hardened	g6 [◎]Precision	#VFBN
	—	h9/h7/g6	#HFRN
	Hardened	f8/g6/h5	#SFAS
	Hardened	g6 [◎]Precision	#VFBN
	—	h9/h7/g6	#HFRN
	Hardened	f8/g6	#SFAS
	Hardened	f8/g6/h5	#SAFN
	Hardened	g6 [◎]Precision	#VAFN

Machined Parts By Shape

Find machined parts based on shapes

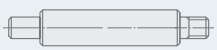
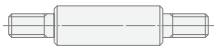
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	h9/h7/g6 Alterations	#HFRN
	Hardened	f8/g6/h5	#SAFS
	Hardened	g6 [◎]Precision	#VAFN
	—	h9/h7/g6 Alterations	#HFRN
	—	0~-0.1	#ETK2
	Hardened	f8/g6	#SAFS
	Hardened	f8/g6/h5	#SFAD
	—	h9/h7/g6	#SFRD
	Hardened	g6 [◎]Precision	#VFAZ
	Hardened	f8/g6/h5	#SFAZ
	Hardened	g6 [◎]Precision	#VFAZ
	—	h9/h7/g6	#SFRD

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	f8/g6	#SFAZ
	Hardened	f8/g6/h5	#SAFD
	Hardened	g6 [◎]Precision	#VAFD
	—	h9/h7/g6 Alterations	#SFRD
	—	0~-0.1	#BETG
	Hardened	f8/g6/h5	#SAFZ
	Hardened	g6 [◎]Precision	#VAFD
	—	h9/h7/g6 Alterations	#SFRD
	—	0~-0.1	#BETG
	Hardened	f8/g6	#SAFZ
	Hardened	f8/g6/h5	#SFAF
	Hardened	g6 [◎]Precision	#VFAD

Machined Parts By Shape

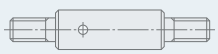
Find machined parts based on shapes

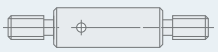
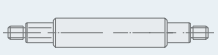
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	f8/g6/h5	#SFAY
	Hardened	g6 [◎]Precision	#VFAD
	—	0~-0.1	#ETKJ
	Hardened	f8/g6/h5	#SFAH
	—	h9/h7/g6	#HFRQ
	—	h7/h6 [◎]Precision	#KZCC
	—	g6	#SFRZ
	Hardened	f8/g6/h5	#SFAH
	Hardened	g6 [◎]Precision	#VFAH
	—	h9/h7/g6	#SFRH
	—	0~-0.1	#ETKJ
	Hardened	f8/g6/h5	#SFHU

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	g6 [◎]Precision	#VFAH
	—	h9/h7/g6	#SFRH
	—	0~-0.1	#ETKJ
	—	g6	#SFRE
	Hardened	f8/g6/h5	#SFAB
	Hardened	f8/g6/h5	#SFAB
	—	g6	#SFRB
	Hardened	f8/g6/h5	#SFAM
	Hardened	g6 [◎]Precision	#VFBM
	—	h9/h7/g6	#HFRM
	—	0~-0.1	#ETKJ
	Hardened	f8/g6/h5	#SFAU

Machined Parts By Shape

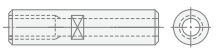
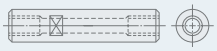
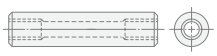
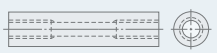
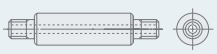
Find machined parts based on shapes

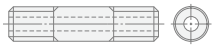
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	g6 [◎]Precision	#VFBM
	—	h9/h7/g6	#HFRM
	—	0~-0.1	#ETKJ
	Hardened	f8/g6	#SFAU
	Hardened	f8/g6/h5	#SAFM
	Hardened	g6 [◎]Precision	#VAFM
	—	h9/h7/g6 Alterations	#HFRM
	—	0~-0.1 Alterations	#ETKH
	Hardened	g6	#CLBN
	Hardened	f8/g6/h5	#SAFU
	Hardened	g6 [◎]Precision	#VAFM
	—	h9/h7/g6 Alterations	#HFRM

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	0~-0.1 Alterations	#ETKH
	Hardened	f8/g6	#SAFU
	—	h7/h6 [◎]Precision	#KZDC
	—	g6	#SFRJ
	Hardened	f8/g6/h5	#SFAF
	Hardened	g6 [◎]Precision	#VFAD
	—	h6 [◎]Precision	#KZEC
	—	hg6 [◎]Precision	#KZFC
	Hardened	g6	#SPJ
	—	g6	#PFR
	Welded Tube	—	#PIPA
	—	0~-0.05	#SPLS

Machined Parts By Shape

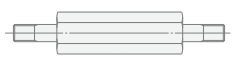
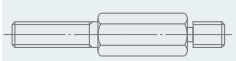
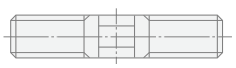
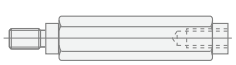
Find machined parts based on shapes

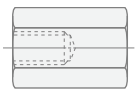
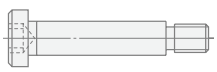
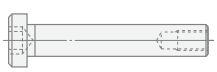
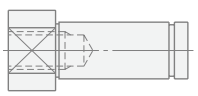
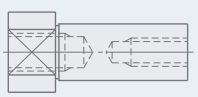
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	±0.01	#SPLN
	—	h8	#PSTS
	Hardened	g6	#SPJ
	—	h8	#PSTT
	Hardened	g6	#SPJ
	Hardened	g6	#SPJN
	Hardened	g6	#SPJN
	—	h8	#PSTT
	Hardened	g6	#SPJN
	Hardened	g6	#SPJN
	—	h8	#PSTN
	Hardened	g6	#SPJM

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	h8	#PSTN
	Hardened	g6	#SPJD
	Hardened	g6	#SPJG
	Hardened	g6	#SPJQ
	Hardened	g6	#SPJA
	Hardened	g6	#STA
	—	—	#RDRA
	—	—	#LSMN
	Small Dia.	—	#SLCB
	—	—	#LSBF
	Right/Left-Hand Thread	—	#LBMB
	—	—	#LSMN

Machined Parts By Shape

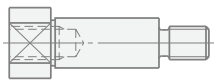
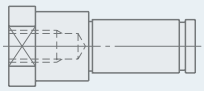
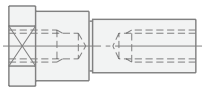
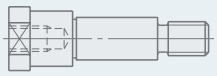
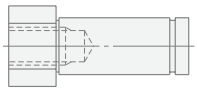
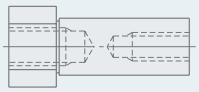
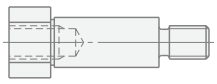
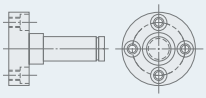
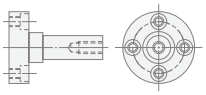
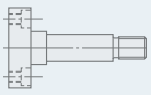
Find machined parts based on shapes

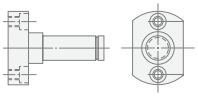
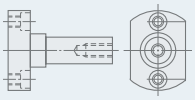
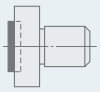
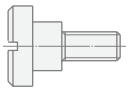
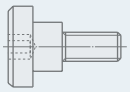
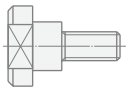
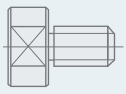
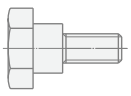
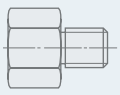
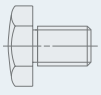
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	—	#LSBG
	—	—	#LSBH
	Right/Left-Hand Thread	—	#LBGF
	Coarse/Fine Thread	—	#FJEB
	Coarse/Fine Thread	—	#SAA
	—	—	#LSBJ
	Right/Left-Hand Thread	—	#LBRB
	—	—	#LSBH
	Right/Left-Hand Thread	—	#LBRB
	—	—	#LSBJ
	—	—	#LSBJ
	—	g6	#SRPA

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	g6	#SRPA
	—	—	#SRPA
	—	—	#JPRM
	Hardened	g6	#HCMG
	Hardened	g6	#HCCG
	Hardened	g6	#CLBD
	Hardened	g6	#CLBR
	Hardened	g6	#HCLB
	Hardened	g6	#CLB2
	Hardened	g6	#HCLS
	—	g6	#FXHA
	—	g6	#FXHB

Machined Parts By Shape

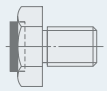
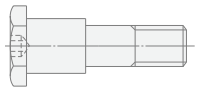
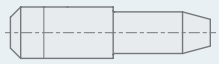
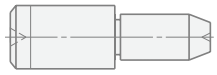
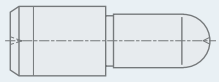
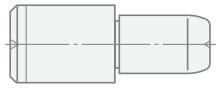
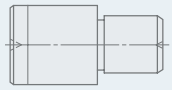
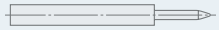
Find machined parts based on shapes

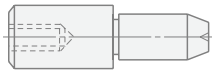
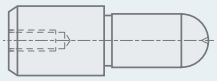
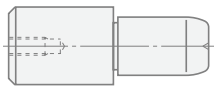
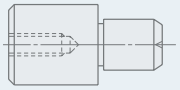
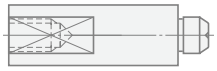
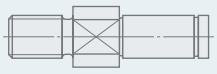
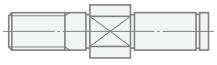
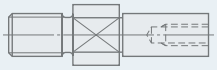
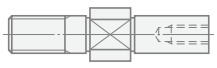
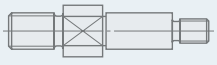
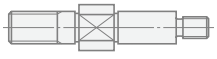
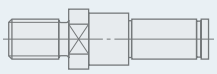
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	g6	#FXHC
	—	g6	#FXJA
	—	g6	#FXJB
	—	g6	#FXJC
	—	g6	#LXHA
	—	g6	#LXHB
	—	g6	#LXHC
	—	g6	#FXEA
	—	g6	#FXEB
	—	g6	#FXFC
	—	—	#MASA
	—	—	#FLPA

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	g6	#FXEA
	—	g6	#FXEB
	Hardened	m6	#STMH
	Hardened, Urethane	m6	#USTM
	Hardened	g6	#CBD
	Hardened	g6	#CBD
	Hardened	g6	#CBD
	Hardened	±0.1	#JPHF
	—	g6	#CBD
	Hardened	—	#JPRA
	Hardened	—	#SSTE
	Hardened	—	#BSTE

Machined Parts By Shape

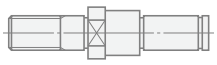
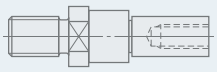
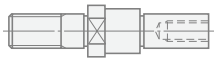
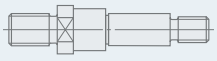
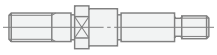
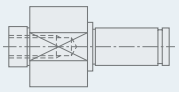
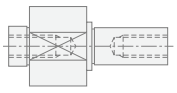
Find machined parts based on shapes

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	—	#SSTH
	Hardened, Urethane	—	#USTH
	Hardened	g6	#CMSG
	High Hardness Stainless Steel	-0.01~-0.03	#AFPS
	—	-0.01~-0.03	#FPSA
	—	-0.01~-0.03	#FPQS
	Hardened	g6/m6/p6	#JPRS
	Hardened	m6/p6	#FPDS
	High Hardness Stainless Steel	0~-0.01	#SFSK
	Hardened	h7/g6/m6/p6	#SFNN
	—	-0.1~-0.2	#SFSZ
	High Hardness Stainless Steel	g6/m6/p6	#AFPS

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	g6	#FPST
	Hardened	g6	#FPQ2
	Hardened	g6	#JPRS
	Hardened	g6	#FPD2
	Hardened	±0.1	#SDPA
	—	g6	#FXAA
	—	g6	#FXCA
	—	g6	#FXAB
	—	g6	#FXCB
	—	g6	#FXAC
	—	g6	#FXCC
	—	g6	#FXBA

Machined Parts By Shape

Find machined parts based on shapes

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	g6	#FXDA
	—	g6	#FXBB
	—	g6	#FXDB
	—	g6	#FXBC
	—	g6	#FXDC
	—	g6	#FXMA
	—	g6	#FXMB
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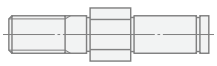
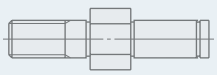
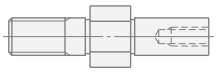
	—	g6	#LXCA
	—	g6	#FXKA
	—	g6	#FXKB
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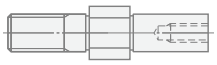
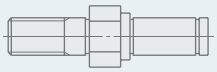
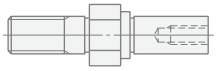
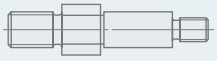
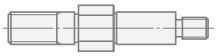
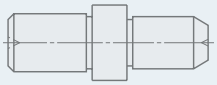
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	g6	#LXCB
	—	g6	#FXKA
	—	g6	#FXKB
	—	g6	#LXAC
	—	g6	#LXCC
	Hardened	m6	#FPJA
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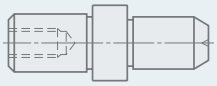
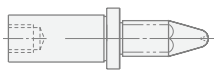
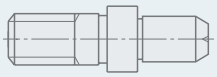
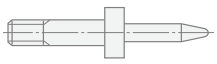
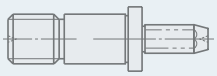
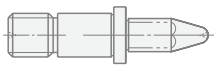
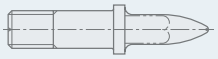
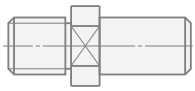
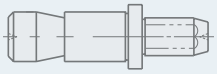
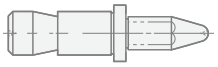
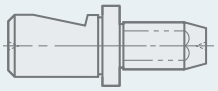
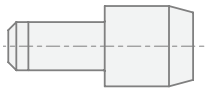
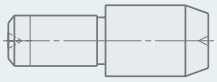
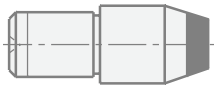
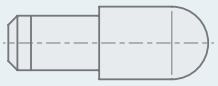
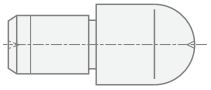
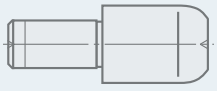
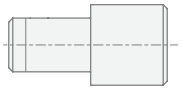
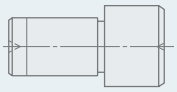
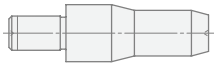
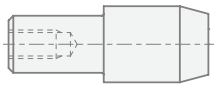
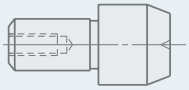
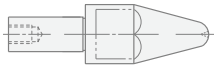
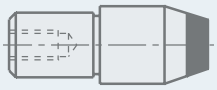
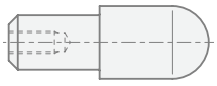
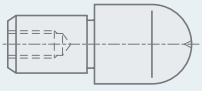
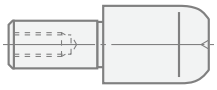
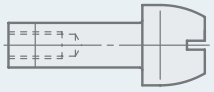
	Hardened	g6	#FPUA
	Hardened	h7	#ELAB
	Hardened	g6	#FPTN
	Hardened	0~-0.005	#SFPN
	Hardened	h7	#SELA

Machined Parts By Shape

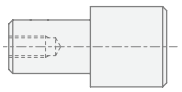
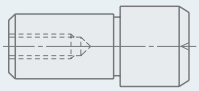
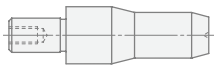
Find machined parts based on shapes

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	h7	#ELAN
	Hardened	h7	#HATA
	Hardened	0~-0.2	#JPHA
	Hardened	h7	#SELT
	Hardened	h7	#ELAT
	Hardened	h7	#ELAC
	High Hardness Stainless Steel	m6/p6	#AFPB
	Hardened	g6/m6/p6	#FPBA
	Hardened, MC Nylon	m6/p6	#JPPH
	High Hardness Stainless Steel	m6/p6	#AFPQ
	Hardened	g6/m6/p6	#FPQA
	Hardened	m6/p6	#JPRB

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	High Hardness Stainless Steel	m6/p6	#AFPD
	Hardened	m6/p6	#FPDC
	Hardened	g6/m6/p6	#WPG
	Hardened	g6/m6	#SHFJ
	High Hardness Stainless Steel	m6/p6	#AFPB
	Hardened	g6	#FPBT
	Hardened	h7	#ELNB
	Hardened, MC Nylon	g6/m6/p6	#JPPH
	High Hardness Stainless Steel	m6/p6	#AFPQ
	Hardened	g6/m6/p6	#FPQT
	Hardened	m6/p6	#JPRB
	Hardened	g6/+0.012~+0.007	#HPSF

Machined Parts By Shape

Find machined parts based on shapes

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	High Hardness Stainless Steel	m6/p6	#AFPD
	Hardened	m6/p6	#FPDT
	Hardened	g6/m6/p6	#WPG
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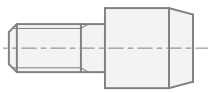
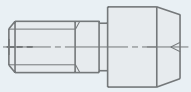
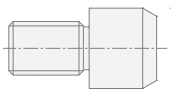
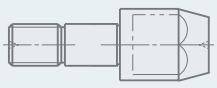
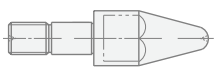
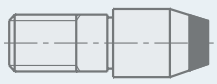
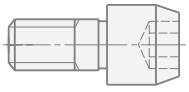
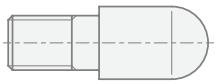
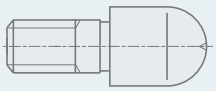
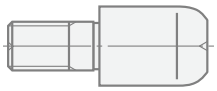
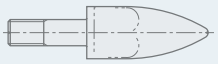
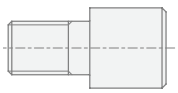
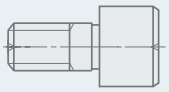
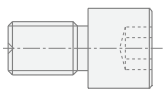
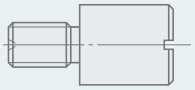
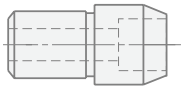
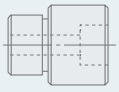
	High Hardness Stainless Steel	m6/p6	#AFPB
	Hardened	g6	#FPNA
	Hardened	0~-0.1	#JPNG
	Hardened	h7	#SELN
	Hardened	h7	#ELNN
	Hardened, MC Nylon	g6/m6/p6	#JPPH
	Hardened	m6/p6	#FPNS
	Hardened	g6	#LPN

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	High Hardness Stainless Steel	g6/m6/p6	#AFPQ
	Hardened	g6	#FPQN
	Hardened	g6/m6/p6	#JPRB
	Hardened	h7	#HNTA
	High Hardness Stainless Steel	g6/m6/p6	#AFPD
	Hardened	g6	#FPFN
	Hardened	g6	#JPLR
	Hardened	g6	#JPLB
	Hardened	±0.1	#SPFA
	Hardened	±0.1	#SDPA
	Hardened	g6	#FPTM
	Hardened	g6	#JPMA

Machined Parts By Shape

Find machined parts based on shapes

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
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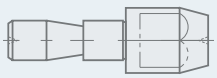
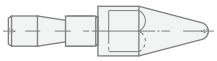
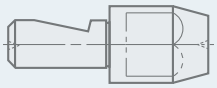
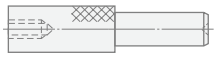
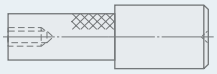
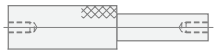
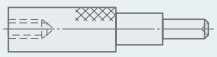
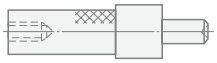
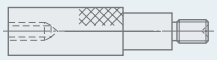
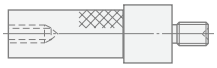
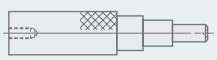
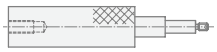
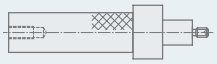
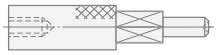
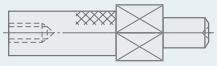
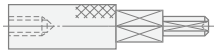
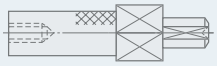
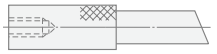
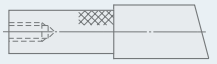
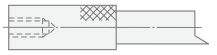
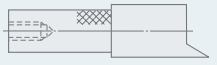
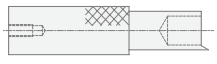
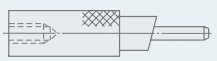
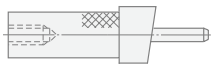
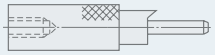
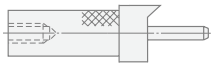
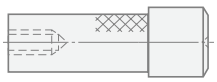
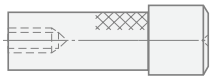
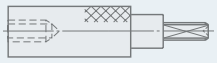
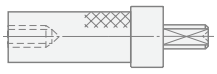
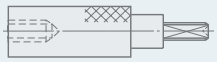
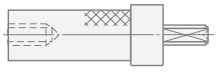
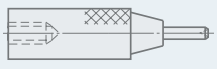
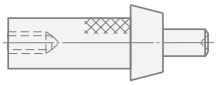
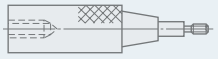
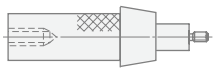
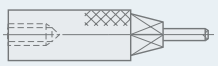
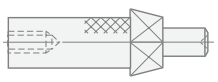
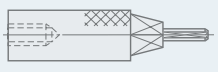
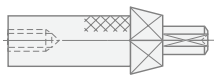
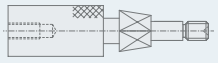
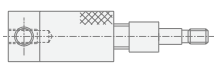
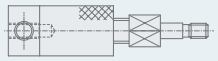
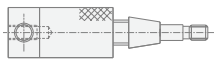
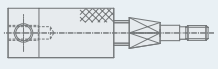
	Hardened	h7	#SEL4
	Hardened	h7	#ELNT
	Hardened	h7	#ELNC
	Hardened	g6/0~-0.02	#KJPS
	Hardened	g6/0~-0.02	#KJPS
	Hardened	—	#KJ02
	Hardened	g6/0~-0.02	#KJPD
	Hardened	g6/0~-0.02	#KJPD
	Hardened	g6/0~-0.02	#KJPM
	Hardened	g6/0~-0.02	#KJPM
	Hardened	g6/0~-0.02	#KJPL

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	g6/0~-0.02	#KJPM
	Hardened	g6/0~-0.02	#KJPM
	Hardened	g6/0~-0.02	#KJPV
	Hardened	g6/0~-0.02	#KJPV
	Hardened	g6/0~-0.02	#KJPV
	Hardened	g6/0~-0.02	#KJPV
	Hardened	g6/0~-0.02	#KJPH
	Hardened	g6/0~-0.02	#KJPH
	Hardened	g6/0~-0.02	#KJPH
	Hardened	g6/0~-0.02	#KJPH
	Hardened	g6/0~-0.02	#KJPH
	Hardened	g6/0~-0.02	#KJPH

Machined Parts By Shape

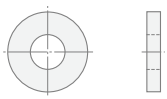
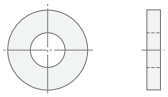
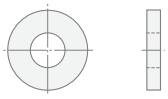
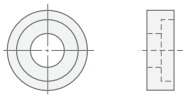
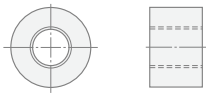
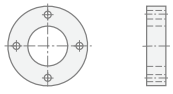
Find machined parts based on shapes

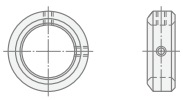
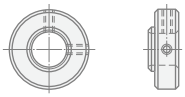
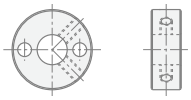
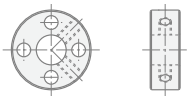
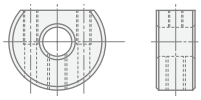
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	g6/0~-0.02	#KJPH
	Hardened	g6/0~-0.02	#KJPH
	Hardened	g6/0~-0.02	#KJPH
	Hardened	g6/0~-0.02	#KJP1
	Hardened	g6/0~-0.02	#KJP1
	Hardened	g6/0~-0.02	#KJP3
	Hardened	g6/0~-0.02	#KJP3
	Hardened	g6/0~-0.02	#KJP1
	Hardened	g6/0~-0.02	#KJP1
	Hardened	g6/0~-0.02	#KJP3
	Hardened	g6/0~-0.02	#KJP3
	Hardened	g6/0~-0.02	#KJP4

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	g6/0~-0.02	#KJP4
	Hardened	g6/0~-0.02	#KJP9
	Hardened	g6/0~-0.02	#KJP9
	Hardened	g6/0~-0.02	#KJP6
	Hardened	g6/0~-0.02	#KJP6
	Hardened	g6/0~-0.02	#KJP6
	Hardened	g6/0~-0.02	#KJP6
	Hardened	g6	#KJPK
	Hardened	g6	#KJPC
	Hardened	g6	#KJPC
	Hardened	g6	#KJPT
	Hardened	g6	#KJPT

Machined Parts By Shape

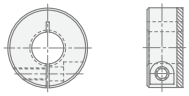
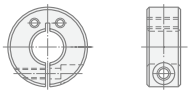
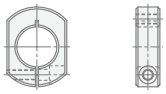
Find machined parts based on shapes

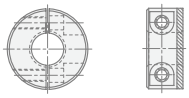
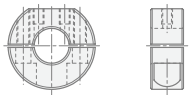
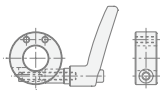
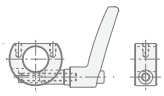
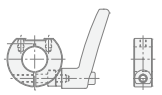
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Plate Thickness Selectable	Plate Thickness Tolerance: ±0.1	#WSSB
	Plate Thickness Configurable	Plate Thickness Tolerance: ±0.01	#WASB
	Hardened, Plate Thickness Selectable	Plate Thickness Tolerance: ±0.01	#WASH
	Dimension Configurable	Plate Thickness Tolerance: ±0.1	#FWS
	Hardened, Dimension Configurable	—	#FWAS
	Shape Selectable	Plate Thickness Tolerance: ±0.1	#KWSB
	Counterbored Hole	Counterbored Hole Tolerance: ±0.1, Overall L Tolerance: ±0.1	#WZAB
	Slotted Hole	Plate Thickness Tolerance: ±0.1	#WLM
	Tapped Hole Dia. Selectable	T Dimension Tolerance: ±0.1	#WTAB
	Countersunk	I.D. +0.1~+0.3	#WSRB
	With Screw Holes	I.D. +0.1~+0.3	#WBAA
	Standard	—	#SCC

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Wide	—	#SCC
	Compact	—	#SCC
	For Bearing Mounting	—	#SCBR
	For Bearing Mounting, Compact	—	#SCBR
	2-Hole	—	#SCMN
	2-Tapped	—	#SCMN
	4-Hole	—	#SCMN
	4-Tapped	—	#SCMN
	Standard	—	#SDN
	Standard	—	#SCS
	Compact	—	#SCS
	For Bearing Mounting	—	#SCBN

Machined Parts By Shape

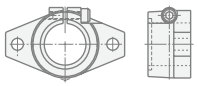
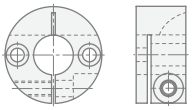
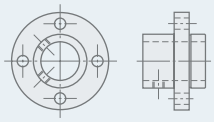
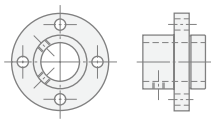
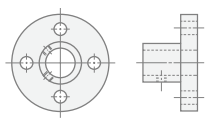
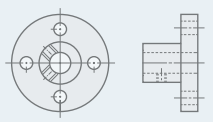
Find machined parts based on shapes

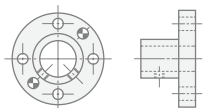
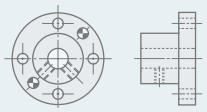
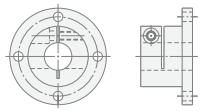
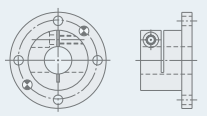
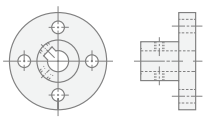
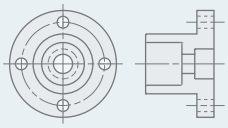
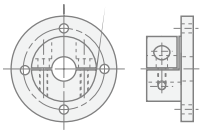
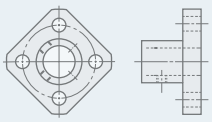
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	For Bearing Mounting, Compact	—	#SCBN
	Urethane, Standard	—	#SCD
	Urethane, Compact	—	#SCD
	Threaded Inserts	—	#SCNP
	2-Hole	—	#SCSM
	2-Tapped	—	#SCSM
	Side Mount Holes	—	#SCJP
	Cylindrical	—	#SAYA
	2-Flats	—	#SCJN
	D Cut	—	#SDN
	Standard	—	#SCSP
	Compact	—	#SCSP

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Balanced	—	#SCSP
	Urethane, Standard	—	#SCD
	Urethane, Compact	—	#SCD
	with Threaded Inserts	—	#SCNP
	D Cut	—	#SDN
	Standard	—	#SCDK
	Wedge, Side Mount Holes	—	#SCWD
	Side Mount Holes	—	#SCDK
	D Cut, Wedge	—	#SCWD
	D Cut	—	#SCDK
	D Cut, Compact	—	#SCDK
	One-Touch	—	#WSC

Machined Parts By Shape

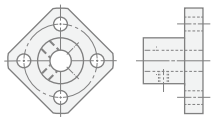
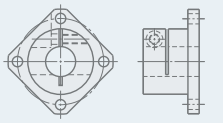
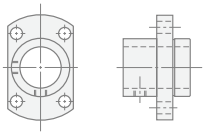
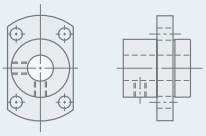
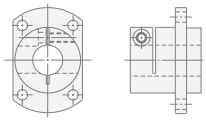
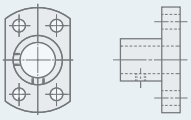
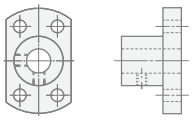
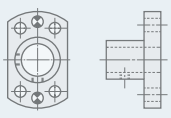
Find machined parts based on shapes

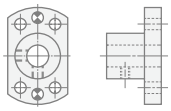
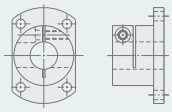
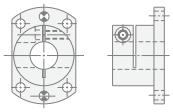
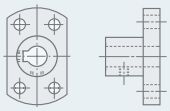
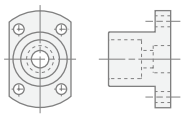
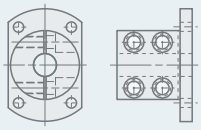
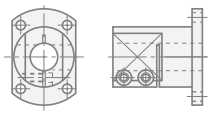
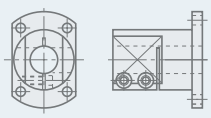
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Cast	—	#SHFL
	Cast	Long Sleeve	#SHF
	Machined	—	#STHM
	Machined	—	#STHI
	Machined	Wide	#STH3
	Machined	—	#STH6
	Machined	—	#ATHC
	Machined	Wide	#STH1

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Machined	—	#STHC
	Machined	Wide	#STH2
	Machined	—	#STHW
	Machined	—	#STH5
	Machined	—	#STH4
	Machined	—	#STHX
	Machined	—	#STHP
	Machined	—	#ATHC

Machined Parts By Shape

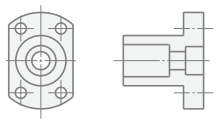
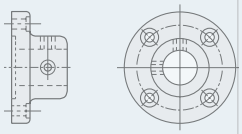
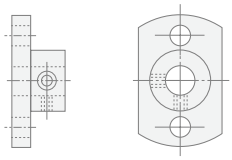
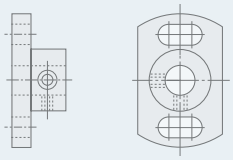
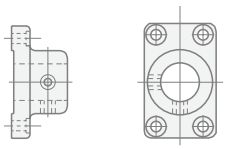
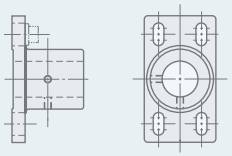
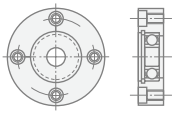
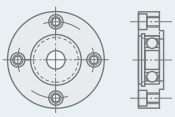
Find machined parts based on shapes

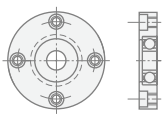
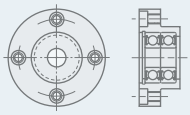
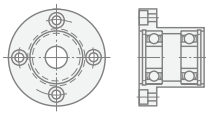
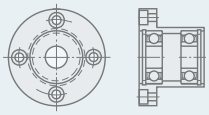
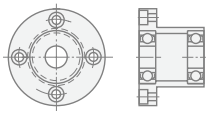
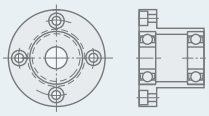
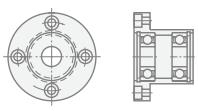
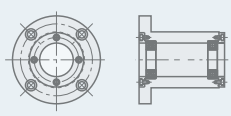
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Machined	Wide	#STH1
	Machined	—	#STHW
	Machined	—	#STHI
	Machined	Wide	#STH3
	Machined	—	#STH6
	Machined	—	#ATHC
	Machined	Wide	#STH1
	Machined	—	#STHC

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Machined	Wide	#STH2
	Machined	—	#STHW
	Machined	—	#STH5
	Machined	—	#STH4
	Machined	—	#STHX
	Machined	—	#STHP
	Machined	—	#CLSB
	Cast	—	#KLSB

Machined Parts By Shape

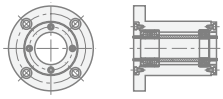
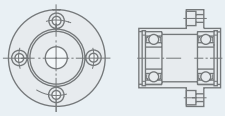
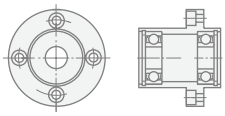
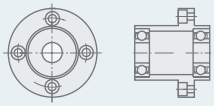
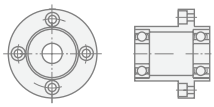
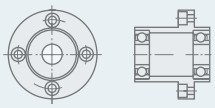
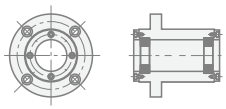
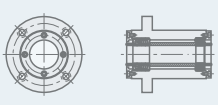
Find machined parts based on shapes

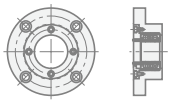
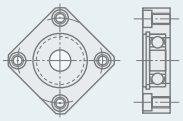
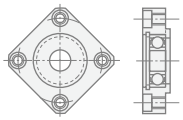
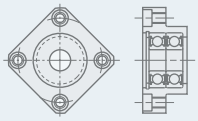
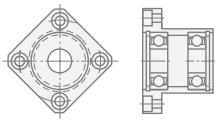
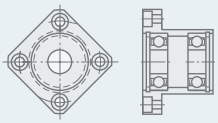
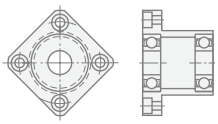
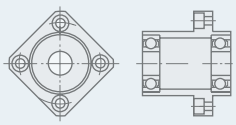
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Machined	—	#KFPB
	—	—	#CSPF
	—	—	#FSBA
	—	—	#LFSB
	—	—	#ASPA
	—	—	#ABFX
	Machined	Retained	#BACA
	Machined	Retained	#BACR

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Machined	Non-Retained	#BACN
	Machined	Retained	#BGCE
	Machined	Overall L Selectable, Retained	#BACB
	Machined	Overall L Selectable, Retained	#BAFC
	Machined	Overall L Selectable, Non-Retained	#BACC
	Machined	Overall L Selectable, Non-Retained	#BAF2
	Machined	Low Dust Generation	#SSB
	Machined	—	#GBGC

Machined Parts By Shape

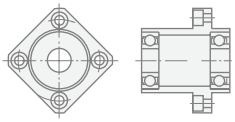
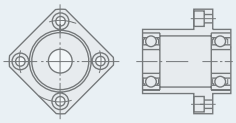
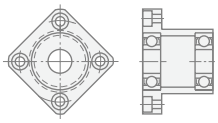
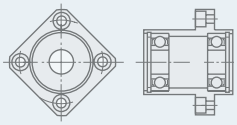
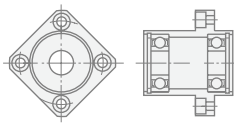
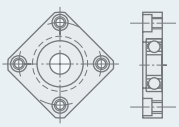
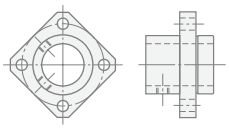
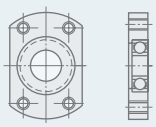
Find machined parts based on shapes

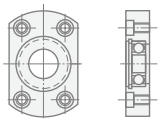
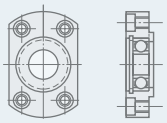
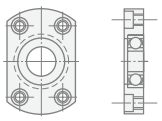
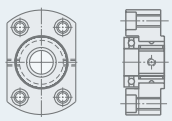
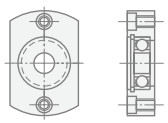
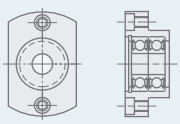
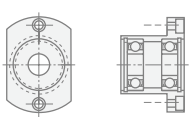
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Machined	Angular Bearing	#ABGC
	Machined	Overall L Selectable, Retained	#BACZ
	Machined	Overall L Selectable, Retained	#BAFR
	Machined	Overall L Selectable, Non-Retained	#BACY
	Machined	Overall L Selectable, Non-Retained	#BAFY
	Machined	Overall L Selectable, Non-Retained	#BGFR
	Machined	—	#GBGY
	Machined	Angular Bearing	#ABGY

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Machined	Angular Bearing	#ABGE
	Machined	Retained	#BACA
	Machined	Retained	#BACR
	Machined	Retained	#BGCE
	Machined	Overall L Selectable, Retained	#BACB
	Machined	Overall L Selectable, Retained	#BAFC
	Machined	Overall L Selectable, Non-Retained	#BACC
	Machined	Overall L Selectable, Non-Retained	#BACY

Machined Parts By Shape

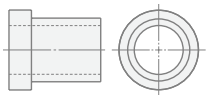
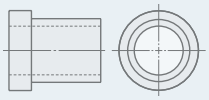
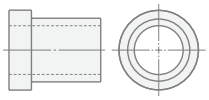
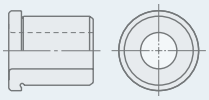
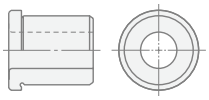
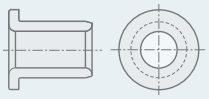
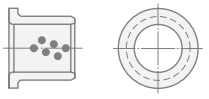
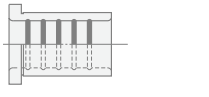
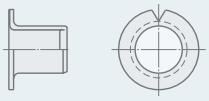
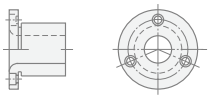
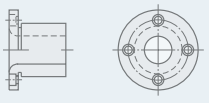
Find machined parts based on shapes

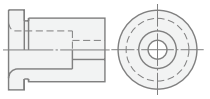
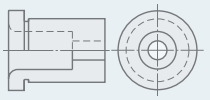
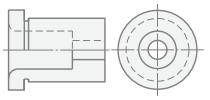
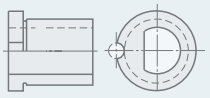
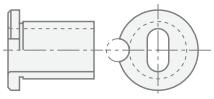
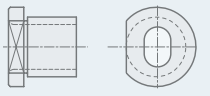
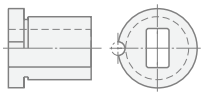
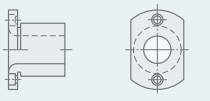
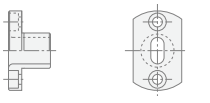
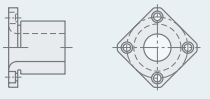
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Machined	Overall L Configurable, Non-Retained	#BAFY
	Machined	Overall L Configurable, Non-Retained	#BGFR
	Machined	Overall L Configurable, Non-Retained	#BAF2
	Machined	Overall L Selectable, Retained	#BACZ
	Machined	Overall L Selectable, Retained	#BAFR
	Machined	Non-Retained	#BACN
	Machined	—	#STHI
	Machined	Non-Retained	#BGTN

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Machined	Retained	#BACA
	Machined	Retained	#BACR
	Machined	Non-Retained	#BACN
	Machined	Thrust Bearing	#BGCS
	Machined	Low Dust Generation	#SSBA
	Machined	Retained	#BGCE
	Machined	Low Dust Generation	#SSB
	—	Shoulder Thickness Tolerance: 0~-0.2, T Dimension Tolerance: 0~-0.3	#FTCB

Machined Parts By Shape

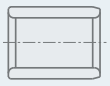
Find machined parts based on shapes

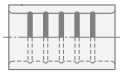
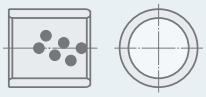
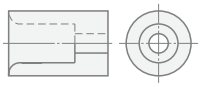
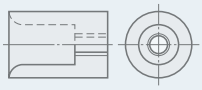
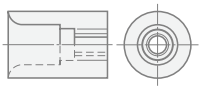
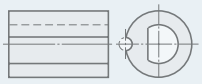
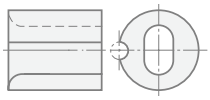
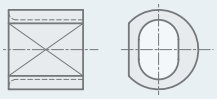
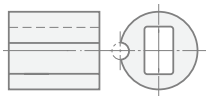
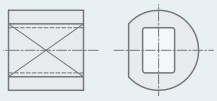
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	—	I.D. Tolerance: +0.1~+0.3	#TCLA
	—	—	#TCLA
	—	I.D. Tolerance: H7, O.D. Tolerance: h7	#DCLB
	Hardened	I.D. Tolerance: G6	#JBH
	Hardened, Thin Wall	I.D. Tolerance: G6	#JBHU
	Maintenance Free	I.D. Tolerance: F7	#SHFZ
	Maintenance Free, Copper	I.D. Tolerance: F7	#MPFZ
	Hardened	I.D. Tolerance: H8	#LCB
	Maintenance Free	I.D. Tolerance: H8	#LCB
	Maintenance Free	Thin Wall, I.D. Tolerance: F7	#MDZB
	Hardened Products Available	I.D. Tolerance: 0~+0.01	#JBT
	Hardened Products Available	I.D. Tolerance: 0~+0.01	#JBT

SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJBD
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJBM
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJBW
	Hardened Products Available	I.D. Tolerance: H7 / +0.01~+0.03	#KJBK
	Hardened Products Available	I.D. Tolerance: H7 / +0.01~+0.03	#JBE
	Hardened Products Available	I.D. Tolerance: H7 / +0.01~+0.03	#KJB4
	Hardened Products Available	I.D. Tolerance: H7 / +0.01~+0.03	#KJB3
	Hardened Products Available	I.D. Tolerance: 0~+0.01	#JBN
	Hardened Products Available	I.D. Tolerance: H7	#JBEH
	Hardened Products Available	I.D. Tolerance: 0~+0.01	#JBS
	—	Overall L Tolerance: ±0.2	#SGP
	Spacer	—	#SMKB

Machined Parts By Shape

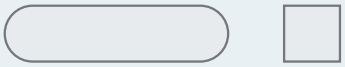
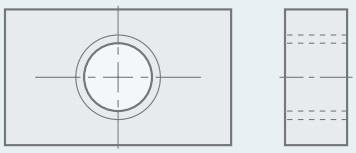
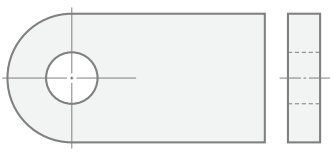
Find machined parts based on shapes

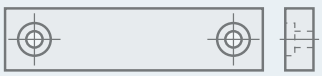
SHAPE	FEATURE 1	FEATURE 2	WEB CODE
	Simultaneous Grinding	Overall L Tolerance: ±0.05	#DWSS
	Overall L Selectable	I.D. Tolerance: +0.3~+0.1, Overall L Tolerance: 0~-0.1	#AASC
	Overall L Selectable	I.D. Tolerance: +0.3~+0.1, Overall L Tolerance: 0~-0.1	#AASC
	Dimension Configurable	I.D. Tolerance: +0.3~+0.1, Overall L Tolerance: 0~-0.1	#FAC
	Hardened	I.D. Tolerance: +0.3~+0.1, Overall L Tolerance: 0~-0.1	#ASC
	Thin-Walled	—	#TASC
	Hardened	I.D. Tolerance: G6	#JBA
	Hardened Products Available, Thin Wall	I.D. Tolerance: G6	#JBAU
	—	Screw Hole	#KJBN
	Maintenance Free	I.D. Tolerance: F7	#SHBR
	Maintenance Free, Thin Wall	I.D. Tolerance: F7	#MDZB
	Hardened	I.D. Tolerance: H8	#LCB

SHAPE	FEATURE	WEB CODE	WEB CODE
	Maintenance Free	I.D. Tolerance: H8	#LCB
	Maintenance Free	I.D. Tolerance: F7	#MPBZ
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJBD
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJBM
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJBW
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJBK
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJB4
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJB4
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJB3
	Hardened	I.D. Tolerance: H7 / +0.01~+0.03	#KJB3

Machined Parts By Shape

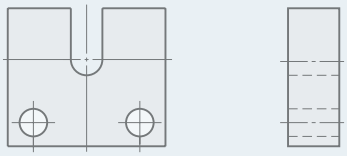
Find machined parts based on shapes

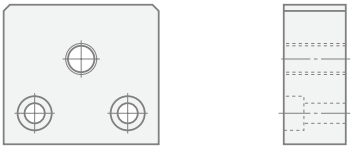
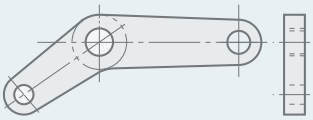
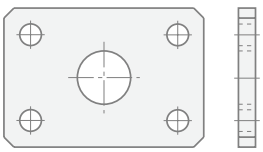
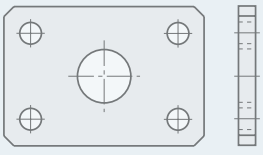
SHAPE	FEATURE	WEB CODE
	Machined	#KED
	Machined	#KED
	Machined	#KED
	Machined	#HRCA
	Sheet Metal	#JTAA
	Machined	#FSWS
	Machined	#HPE
	Machined	#LNCB

SHAPE	FEATURE	WEB CODE
	Machined	#JNPB
	Machined	#HRCZ
	Sheet Metal	#JSAA
	Machined	#LNDB
	Machined	#LNDB
	Machined	#PCW
	Machined	#FSWS
	Machined	#SBFB

Machined Parts By Shape

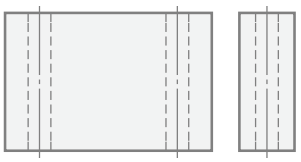
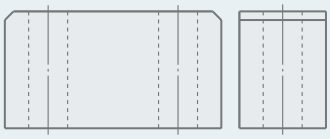
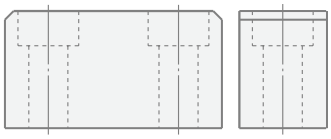
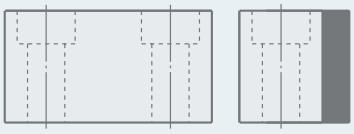
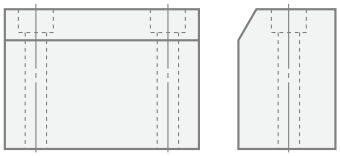
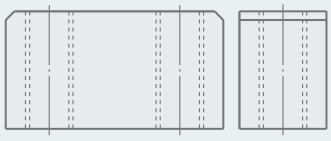
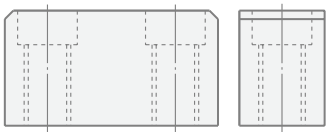
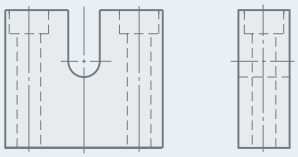
Find machined parts based on shapes

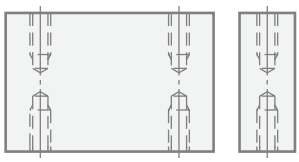
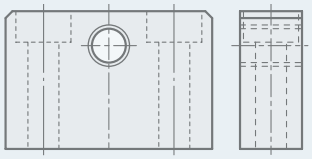
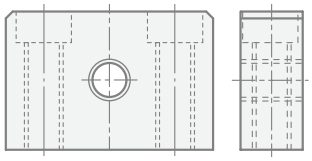
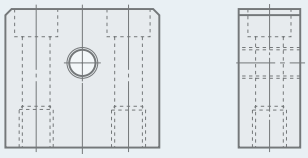
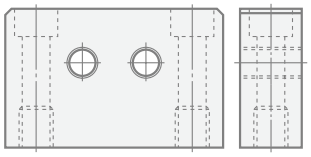
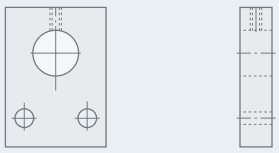
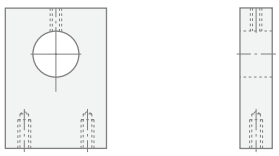
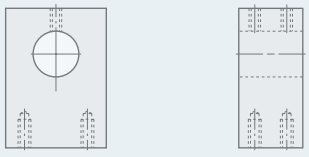
SHAPE	FEATURE	WEB CODE
	Machined	#LNDL
	Machined	#WGTB
	Machined	#GIRH
	Machined, Oil-Free Bushing Press-Fit	#LNMS
	Machined, Oil-Free Bushing Press-Fit	#LNMS
	Machined, with Built-in Bearing	#LNBB
	Machined, with Built-in Bearing	#LNBB
	Machined	#AJSB

SHAPE	FEATURE	WEB CODE
	Machined	#HPAN
	Machined	#LNFT
	Machined	#AJFN
	Machined	#LKBK
	Sheet Metal	#JSAA
	Machined	#HRCZ
	Machined	#HRCZ
	Sheet Metal	#JSAA

Machined Parts By Shape

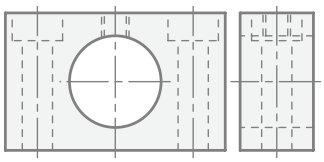
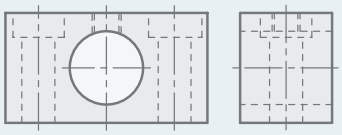
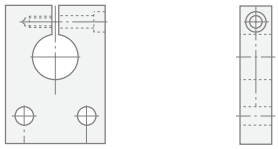
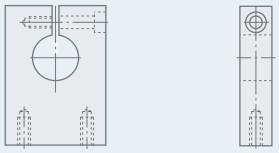
Find machined parts based on shapes

SHAPE	FEATURE	WEB CODE
	Machined	#BLHB
	Machined	#SBHB
	Machined	#SBHB
	Machined, Urethane	#SBUB
	Machined	#WGHA
	Machined	#SBNB
	Machined	#SBNB
	Machined	#AJKB

SHAPE	FEATURE	WEB CODE
	Machined	#BLHB
	Machined	#TSB
	Machined	#TABB
	Machined	#AJSN
	Machined	#AJWB
	Machined	#SHQB
	Machined	#SHBM
	Machined	#SHB2

Machined Parts By Shape

Find machined parts based on shapes

SHAPE	FEATURE	WEB CODE
	Machined	#SHM3
	Machined	#SHMT
	Machined	#SHYA
	Machined	#SHSB
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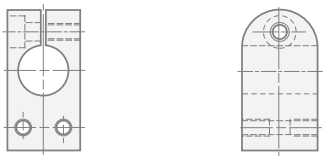	Machined	#AMNC
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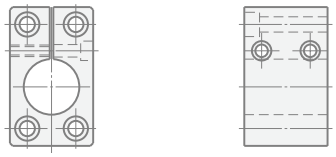
SHAPE	FEATURE	WEB CODE
	Machined	#SAQB
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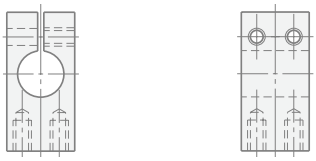
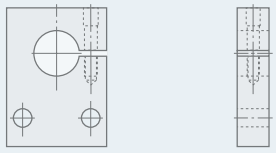
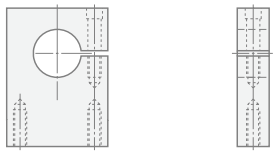
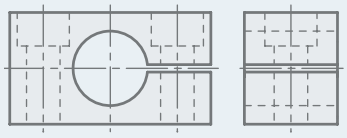
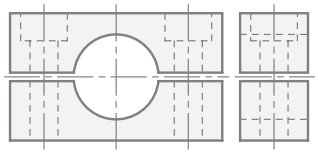
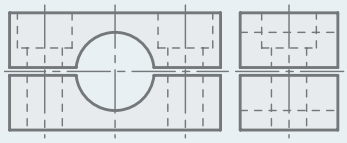
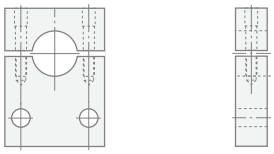
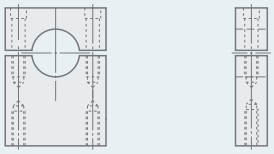
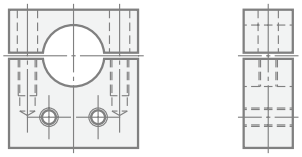
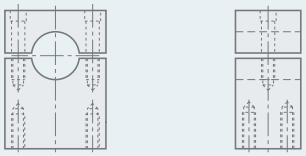
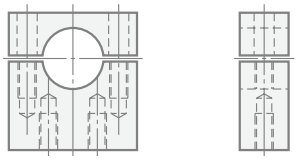
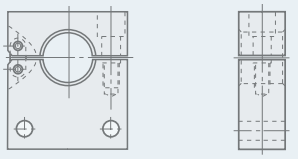
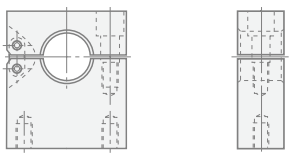
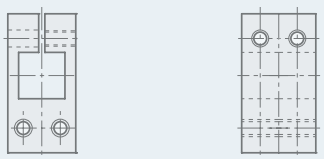
	Machined	#AQL
	Machined	#SHUA
	Machined	#SHSW
	Machined	#SHMW
	Machined	#SHMP
	Machined	#SHM2

Machined Parts By Shape

Find machined parts based on shapes

SHAPE	FEATURE	WEB CODE
	Machined	#SHZA
	Machined	#SHSP
	Machined	#ARPP
	Machined	#SHSN
	Machined	#ARPP
	Machined	#SHKH
	Machined	#SHKH
	Machined	#AMNQ

SHAPE	FEATURE	WEB CODE
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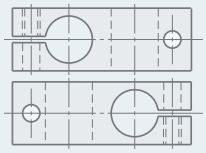
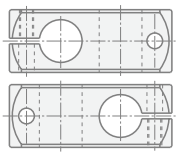
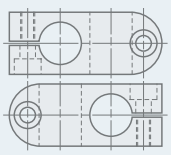
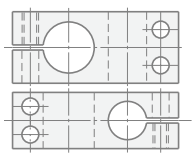
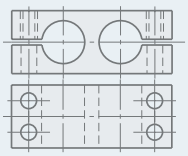
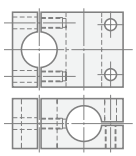
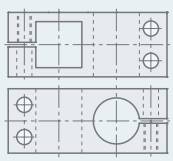
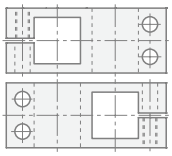
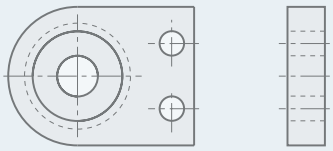
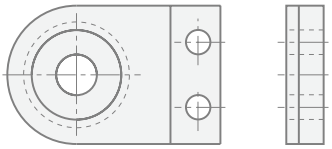
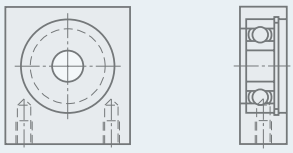
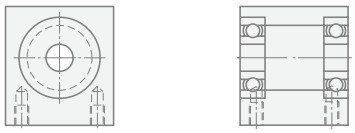
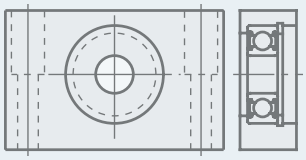
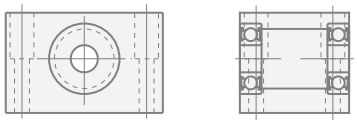
	Machined	#ALKD
	Machined	#ALKR
	Machined	#ALKC
	Machined	#ALKL
	Machined	#AKP
	Machined	#ASBC
	Machined	#ALQD

Machined Parts By Shape

Find machined parts based on shapes

SHAPE	FEATURE	WEB CODE
	Machined	#ALQD
	Machined, With Bearing	#BGSM
	Machined, With Bearing	#BGSN
	Machined, With Bearing	#BGBF
	Machined, With Bearing	#BGBW
	Machined, With Bearing	#BGTK
	Machined, With Bearing	#BGTW
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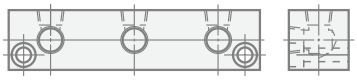
SHAPE	FEATURE	WEB CODE
	Machined	#BTLN
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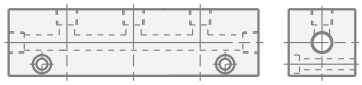
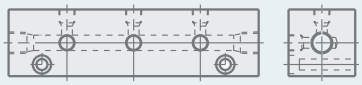
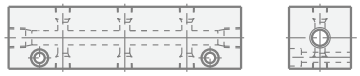
	Machined	#BMRF
	Machined	#BMUF
	Machined	#BMIF
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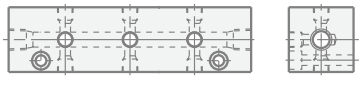
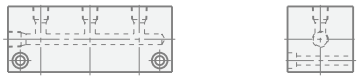
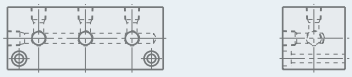
	Machined	#BMTF
	Machined	#BMZF

Machined Parts By Shape

Find machined parts based on shapes

SHAPE	FEATURE	WEB CODE
	Machined	#BMZR
	Machined	#BMZR
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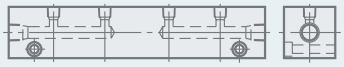
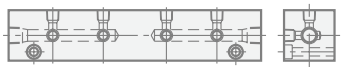
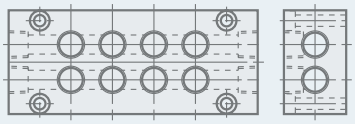
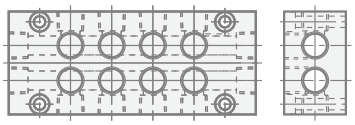
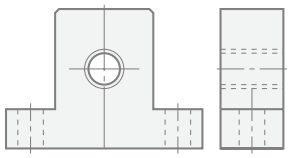
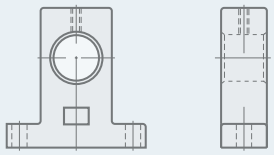
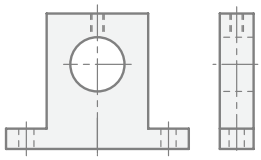
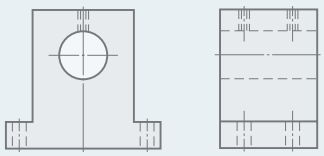
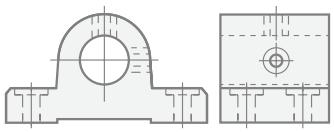
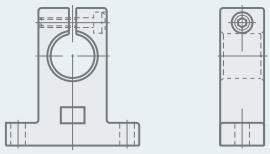
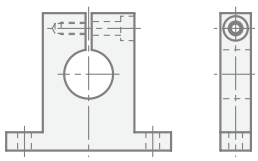
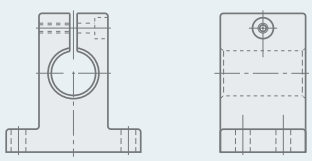
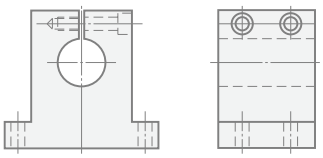
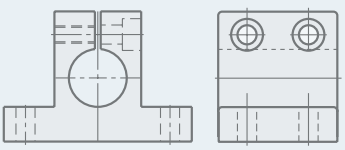
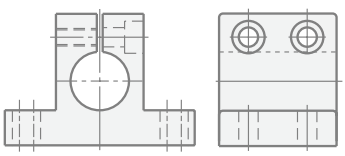
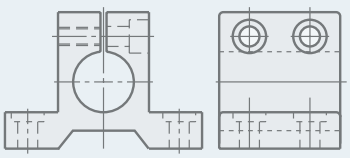
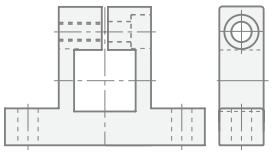
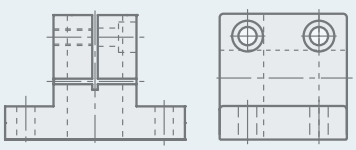
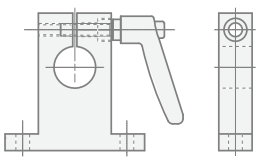
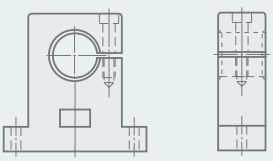
	Machined	#WBMR
	Machined	#WBMU
	Machined	#BMSW
	Machined	#BMUW

Machined Parts By Shape

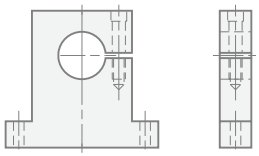
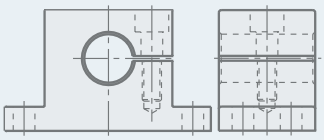
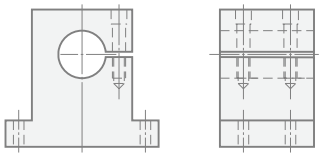
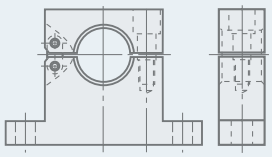
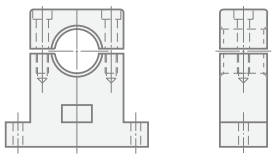
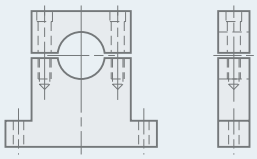
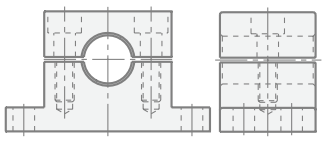
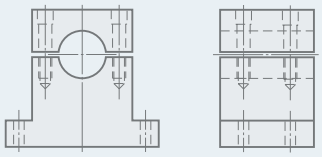
Find machined parts based on shapes

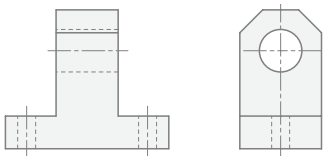
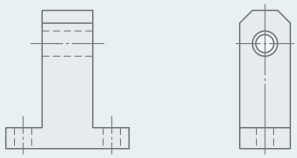
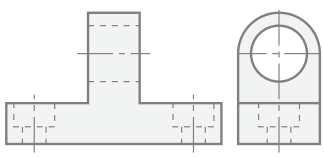
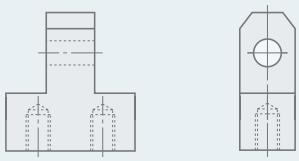
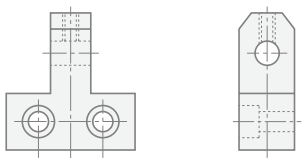
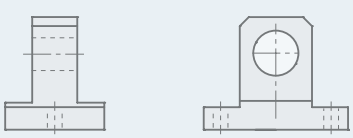
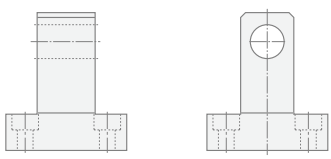
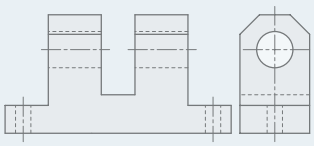
SHAPE	FEATURE	WEB CODE
	Machined	#AJTN
	Cast	#SHT2
	Machined	#SHTA
	Machined	#SHTB
	Cast	#SSTA
	Cast	#SHA
	Machined	#SHST
	Cast	#SHAN

SHAPE	FEATURE	WEB CODE
	Machined	#SHS3
	Machined	#CLPK
	Machined	#CLNA
	Cast	#CLPB
	Machined	#CLTQ
	Machined	#CLQB
	Machined	#SHS4
	Cast	#SHTC

Machined Parts By Shape

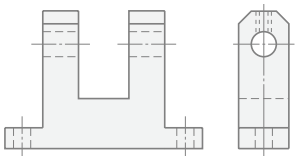
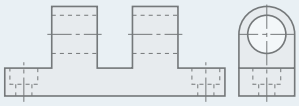
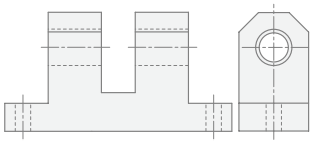
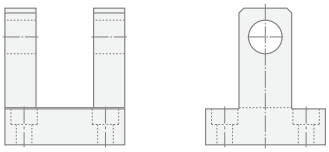
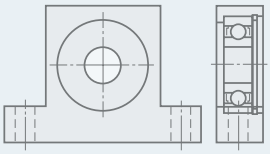
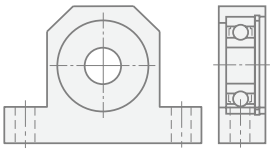
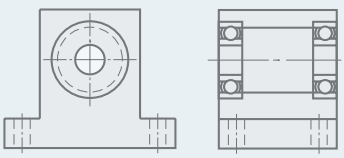
Find machined parts based on shapes

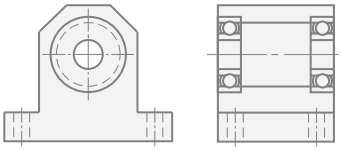
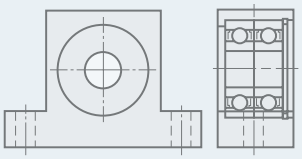
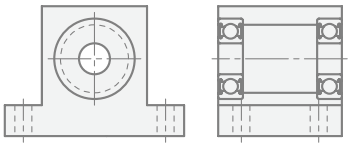
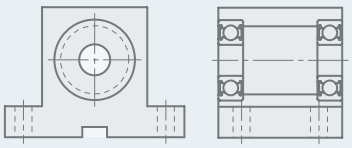
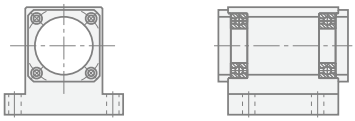
SHAPE	FEATURE	WEB CODE
	Machined	#SHWT
	Cast	#SHT3
	Machined	#SHW2
	Machined	#SHHT
	Cast	#SHTD
	Machined	#SHPT
	Cast	#SHT4
	Machined	#SHP2

SHAPE	FEATURE	WEB CODE
	Machined	#HKNK
	Machined, Maintenance Free	#HKTB
	Machined	#HGHH
	Machined	#HGB2
	Machined	#HKSB
	Machined	#HGCC
	Machined	#HGCN
	Machined	#HKNB

Machined Parts By Shape

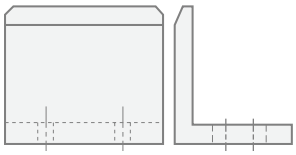
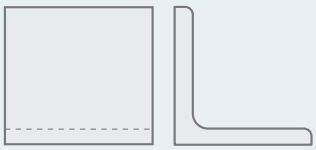
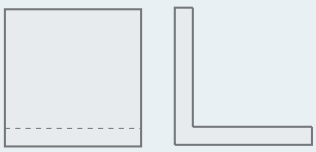
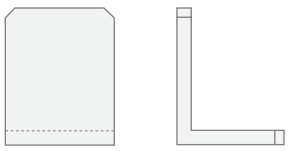
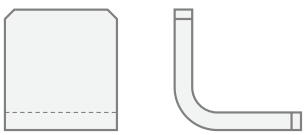
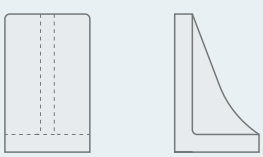
Find machined parts based on shapes

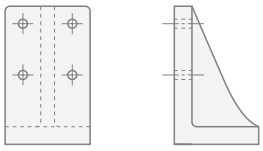
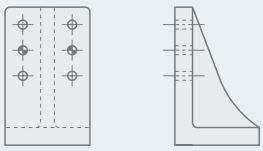
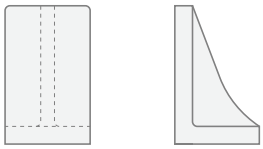
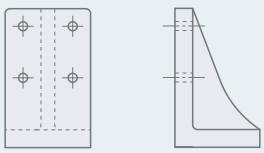
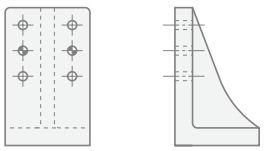
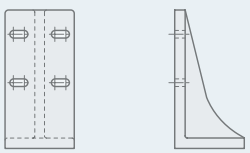
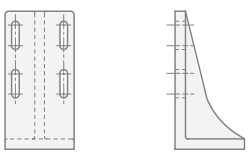
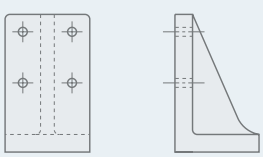
SHAPE	FEATURE	WEB CODE
	Machined	#HKPB
	Machined	#HGHH
	Machined, Maintenance Free	#HGNJ
	Machined	#HGCC
	Machined	#HGCN
	With Bearing, Machined	#BGHF
	With Bearing, Machined	#BGHF
	With Bearing, Machined	#BGHW

SHAPE	FEATURE	WEB CODE
	With Bearing, Machined	#BGHW
	With Bearing, Machined	#BGMW
	With Bearing, Machined	#BKHW
	With Bearing, Machined	#BKHW
	With Bearing, Machined	#GBGW

Machined Parts By Shape

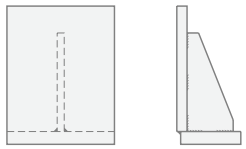
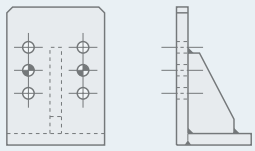
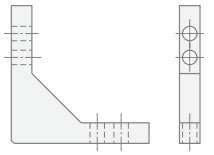
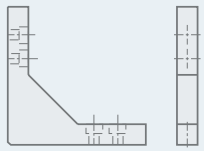
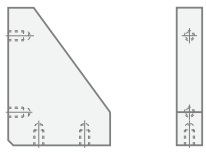
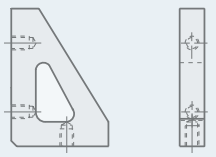
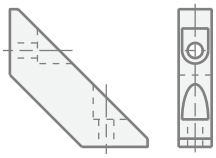
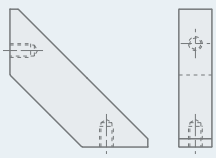
Find machined parts based on shapes

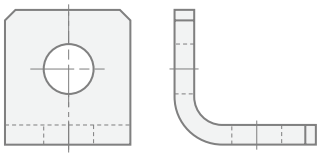
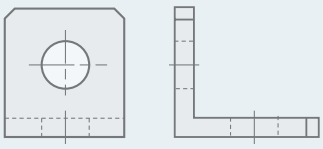
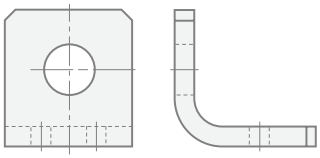
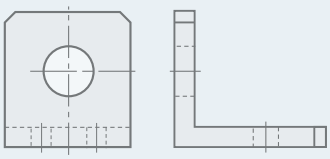
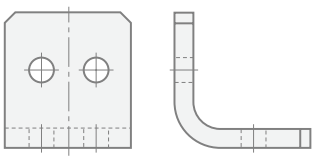
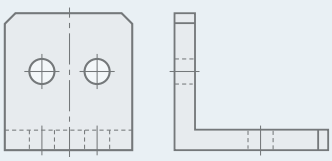
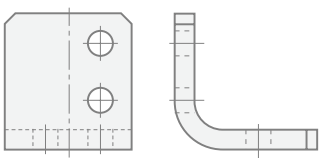
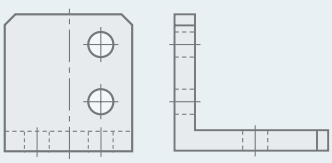
SHAPE	FEATURE	WEB CODE
	Machined	#WGNA
	Cutoff Materials	#LACA
	Cutoff Materials	#LRA
	Machined	#LAHA
	Machined	#LAFD
	Machined	#LSAW
	Sheet Metal	#FACA
	Fe-Cast	#IKD

SHAPE	FEATURE	WEB CODE
	Fe-Cast	#IKD
	Fe-Cast	#IKD
	AL-Cast	#AIKD
	AL-Cast	#AIKD
	AL-Cast	#AIKD
	Cast	#IK
	Cast	#IK
	Cast, Hole Positions Configurable	#IKF

Machined Parts By Shape

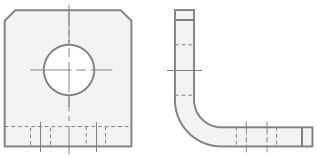
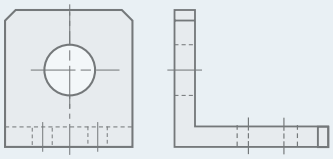
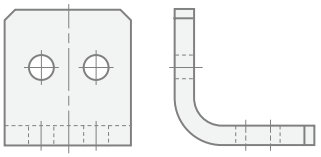
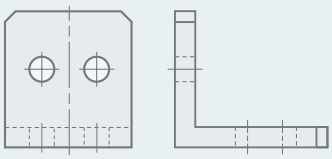
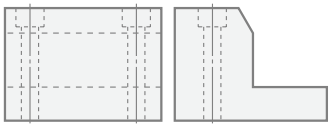
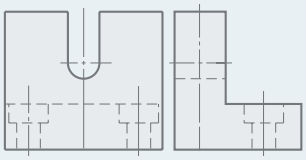
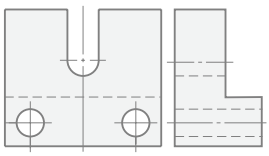
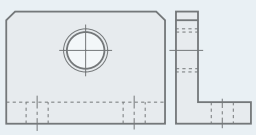
Find machined parts based on shapes

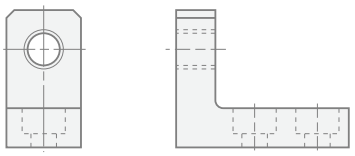
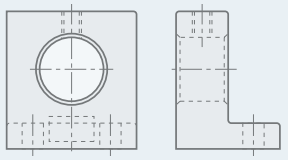
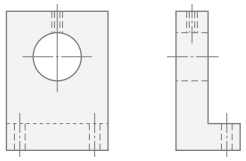
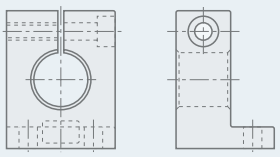
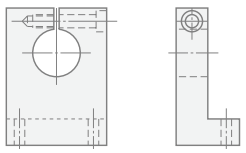
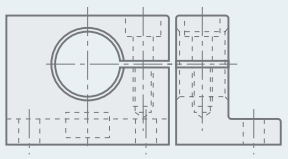
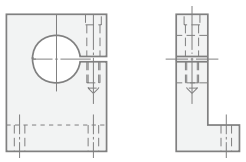
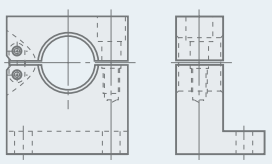
SHAPE	FEATURE	WEB CODE
	Welded	#BRWB
	Welded	#IKYS
	Cast	#RQDB
	Machined	#RBDA
	Machined	#RBBA
	Machined	#RACA
	Machined	#RBJW
	Machined	#RBJW

SHAPE	FEATURE	WEB CODE
	Sheet Metal	#FSDA
	Machined	#LRAM
	Sheet Metal	#FSDA
	Machined	#LRAM
	Sheet Metal	#FSDA
	Machined	#LRAM
	Sheet Metal	#FSDA
	Machined	#LRAM

Machined Parts By Shape

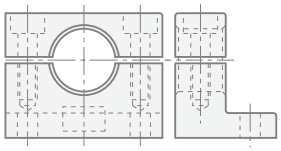
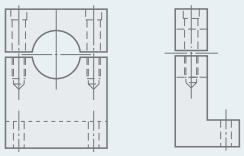
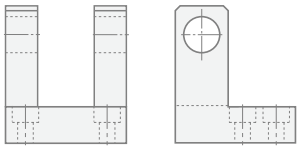
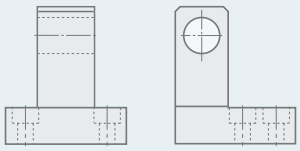
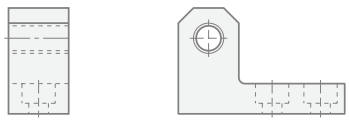
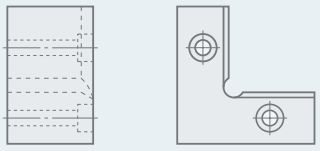
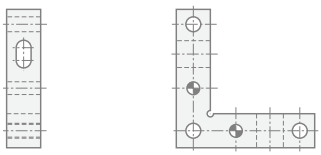
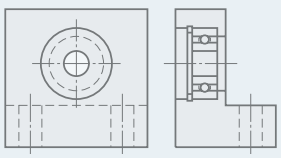
Find machined parts based on shapes

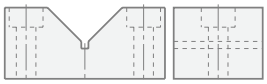
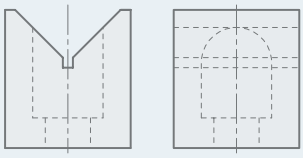
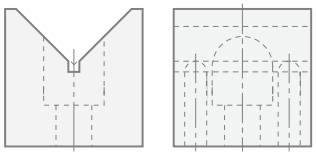
SHAPE	FEATURE	WEB CODE
	Sheet Metal	#FSDA
	Machined	#LRAM
	Sheet Metal	#FSDA
	Machined	#LRAM
	Machined	#WGDB
	Machined	#AJLB
	Machined	#AJSL
	Machined	#AJLC

SHAPE	FEATURE	WEB CODE
	Machined	#AJLC
	Cast	#SHKL
	Machined	#SHK2
	Cast	#SHKS
	Machined	#SHK3
	Cast	#SHKW
	Machined	#SHK4
	Machined	#SHKH

Machined Parts By Shape

Find machined parts based on shapes

SHAPE	FEATURE	WEB CODE
	Cast	#SHKB
	Machined	#SHKP
	Machined	#HGLN
	Machined	#HGLN
	Machined	#AJLC
	Machined	#WGLA
	Machined	#CMAL
	Machined, With Bearing	#BGLF

SHAPE	FEATURE	WEB CODE
	Machined	#WGVA
	Machined	#VBT
	Machined	#VZB
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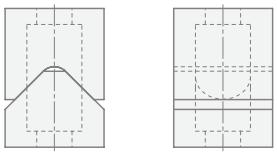
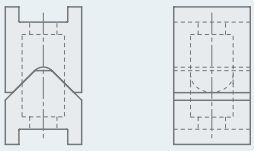
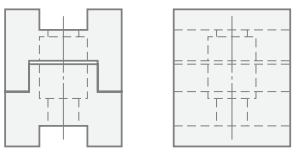
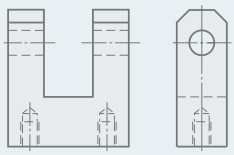
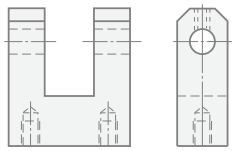
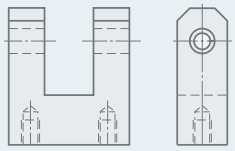
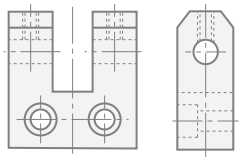
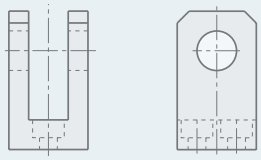
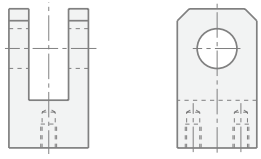
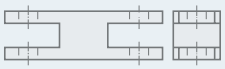
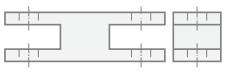
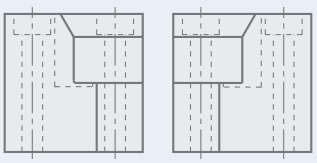
	Machined	#CVTA
	Machined	#CVTB
	Machined	#CAT
	Machined	#HKUB

Machined Parts By Shape

Find machined parts based on shapes

SHAPE	FEATURE	WEB CODE
	Machined	#HKUB
	Machined, Maintenance Free	#HKUB
	Machined	#HGSU
	Machined	#HBNT
	Machined	#HBNT
	Machined	#LACF
	Machined	#LACF
	Machined	#WGDL

Index By Special Material

Find out what MISUMI offers for non-metal materials.

Engineering Plastic

Material	Grade	Color Sample	Color	Properties					WEB CODE					
				Electric Properties	Continuous Use Temperature °C	Dimensional Stability	Abrasion Resistance	Sliding Properties	Plate	Round Bars	Pipes	Collars	Washer	Screw
MC Nylon®	Standard / MC901		Blue	Insulation	-40~120	0	+	+	#MCA	#RDJB	#PIJB	#CLJB	#WSJB	—
	Standard / MC900NC		Ivory	Insulation	-40~120	0	+	+	#MCA	#RDJB	#PIJB	#CLJB	#WSJB	—
	Sliding / MC703HL		Purple	Insulation	-40~120	0	++	++	#MCA	—	—	—	—	—
	High Strength / MC602ST		Dark Brown	Insulation	Room Temp. ~ 150	0	+	+	#MCA	—	—	—	—	—
	Weather Resistance / MC801		Dark Gray	Insulation	Room Temp. ~ 120	0	++	+	#MCA	—	—	—	—	—
	Conductivity MC501CDR2		Black	Conductive	Room Temp. ~ 120	0	0	+	#MCA	#RDJB	#PIJB	#CLJB	#WSJB	—
	Conductivity MC501CDR6		Black	Antistatic	Room Temp. ~ 120	0	0	+	#MCA	#RDJB	#PIJB	#CLJB	#WSJB	—
	Conductivity MC501CDR9		Black	Antistatic	Room Temp. ~ 150	0	+	+	#MCA	—	—	—	—	—
Polyacetal	Standard		White	Insulation	-45~95	+	0	+	#PAA	#RDJB	#PIJB	#CLJB	#WSJB	—
	Standard		Black	Insulation	-45~95	+	0	+	#PAA	#RDJB	#PIJB	#CLJB	#WSJB	—
	Antistatic		Ocher	Antistatic	Room Temp. ~ 80	0	+	+	#PAA	—	—	—	—	—
Bakelite	Paper Bakelite		Natural Color	Insulation	-50~100	+	-~0	-~0	#BLA	#RDJB	#PIJB	#CLJB	#WSJB	—
	Paper Bakelite		Black	Insulation	-50~100	+	-~0	-~0	#BLA	—	—	—	—	—
	Cloth Bakelite		Natural Color	Insulation	-50~100	+	-~0	-~0	#BLA	#RDJB	#PIJB	#CLJB	#WSJB	—
Epoxy Glass	Standard		Green	Insulation	Room Temp. ~ 155	+~++	-~0	-~0	#EPXA	#RDJB	—	#CLJB	#WSJB	—
	High Temperature		Black	Antistatic	Room Temp. ~ 260	+~++	-~0	-~0	#EPXA	—	—	—	—	—
Ultra High-Molecular-Weight Polyethylene	Standard		Milky White	Insulation	-100~80	0	++	++	#UPA	#RDJB	—	—	—	—
	Conductive		Black	Conductive	-100~80	0	+	+	#UPA	—	#PIJB	—	—	—
Fluorine	Standard		White	Insulation	-40~250	-~0	+	++	#UPA	#RDJB	#PIJB	#CLJB	#WSJB	—

++ : Very Strong, + : Strong, 0 : Medium, – : Weak

Index By Special Material

Find out what MISUMI offers for non-metal materials.

Engineering Plastic

Material	Grade	Color Sample	Color	Properties					WEB CODE					
				Electric Properties	Continuous Use Temperature °C	Dimensional Stability	Abrasion Resistance	Sliding Properties	Plate	Round Bars	Pipes	Collars	Washer	Screw
PEEK	Standard		Ash Brown	Insulation	-50~250	+	+	+	#PKA	#RDJB	#PIJB	#CLJB	#WSJB	#PEKB
	Sliding		Black	Insulation & Conductive Mixed: Not measurable	Room Temp. ~ 250	+	+	+	#PKA	—	—	—	—	—
	Conductive		Black	Conductive	Room Temp. ~ 250	+	+	+	#PKA	—	—	—	—	—
PPS	Standard		Natural Color	Insulation	Room Temp. ~ 190	+	0	0	#NPMS	#RDJB	#PIJB	—	—	#PEKB
	Abrasion Resistance		Blue	Antistatic	Room Temp. ~ 220	++	++	+	#NPMS	—	—	—	—	—
Unilate®	Standard		Natural Brown	Insulation	Room Temp. ~ 120	+	0	0	#YCA	—	—	—	—	—
PET	Antistatic		Black	Antistatic	Room Temp. ~ 100	++	+	+	#PYCA	—	—	—	—	—
PBT	Standard		White	Insulation	Room Temp. ~ 120	+	0	0~+	#NPBT	—	—	—	—	—
ABS	Standard		Natural Color	Insulation	Room Temp. ~ 50	++	0	0	#NABS	—	#PIJB	—	—	—

++ : Very Strong, + : Strong, 0 : Medium, – : Weak

Ceramic

Material	Color	Properties			WEB CODE			
		Safety Operating Temperature°C	Volume Specific Resistance Ω•cm	Bending Strength MPa	Plate	Round Bars	Collars	Washer
Alumina 92 Al_2O_3 92%	White	Room Temp. ~ 1200	> 1014	240~340	—	—	#CERC	#CERC
Alumina 96 Al_2O_3 96%	White	Room Temp. ~ 1300	> 1014	300	#CEA	—	—	—
Alumina 99 Al_2O_3 99.7%	Natural Color	Room Temp. ~ 1500	> 1015	340	#CEMN	—	—	—
Alumina 99.5	White	Room Temp. ~ 1200	< 1014	490	—	#CERR	—	—
Steatite SiO2, MgO	White	Room Temp. ~ 1000	> 1014	120	#CEA	—	—	—
Machinable Ceramics SiO2, MgO	Natural Color	Room Temp. ~ 1000	> 1016	94	#CEA	—	—	—

Index By Special Material

Find out what MISUMI offers for non-metal materials.

Transparent Plastic

Material	Grade	Color	Properties		WEB CODE		
			Light Transmittance%	Operating Ambient Temperature°C	Plate	Round Bars	Pipes
PET	Standard	Transparent	87	-15~55	#PYA	—	—
	Standard	Smoke Brown	28		#PYA	—	—
	Standard	Orange	45		#PYA	—	—
	Antistatic	Transparent	77		#PYA	—	—
	Antistatic	Smoke Brown	30		#PYA	—	—
PVC	Antistatic	Transparent	80	-30~60	#ENBT	—	—
	Antistatic	Smoke Brown	29		#ENBT	—	—
Acrylic	Standard	Transparent	93	-30~80	#ACA	#RDJA	#PIJ1
	Standard	Smoke Brown	25		#ACA	—	—
	Standard	Orange	43		#ACA	—	—
	Antistatic	Transparent	79		#ACA	—	—
	Antistatic	Smoke Brown	32		#ACA	—	—
Polycarbonate	Standard	Transparent	90	-30~100	#PCTA	#RDJA	#PIJ1
	Standard	Smoke Brown	35		#PCTA	—	—
	Standard	Smoke Gray	33		#PCTA	—	—
	Antistatic	Transparent	86		#PCTA	—	—
	Antistatic	Smoke Brown	35		#PCTA	—	—
	Abrasion-Resistant	Transparent	91		#PCTA	—	—

Glass

Material	Properties			WEB CODE
	Continuous Use Temperature °C	Max. Operation Temperature °C	Glass Strength	Plate
Quartz Glass	1000	1200	0	#FGLK
Transparent Float Glass (Soda-Lime glass)	80~100	380	0	#GLKF
Heat-resistant Glass (TEMPAX Float)	250	450	–	#GLKF
Reinforced Glass	210	250	++	#GLKF
Heat-Resistant Crystallized Glass (Nextrema)	700	850	+	#GLKF

++ : Very Strong, + : Strong, 0 : Medium, – : Weak

Index By Special Material

Find out what MISUMI offers for non-metal materials.

Urethane

Material	Hardness Shore A	Color	Properties				WEB CODE		
			Heat-resistant Temperature °C	Weather Resistance	Water Resistance	Oil Resistance	Sheets	Bumpers	Washer
Standard	A95	Natural Color	70	+	+	+	#UTL	#CXH	#UAFH
	A90			+	+	+	#UTL	#CXH	#UAFH
	A70			+	–	++	#UTL	#CXH	#UAFH
	A50			+	–	++	#UTL	#CXH	#UAFH
	A30			+	–	++	—	—	#UAFH
Vulkollan®	A92	Beige	80	+	–	++	#UTEX	#AAFH	#UAFH
	A68			+	–	++	#UTEX	#AAFH	#UAFH
Abrasion Resistant	A90	Dark Brown	70	+	–	++	#UTEX	#CXH	#UAFH
	A70			+	–	++	#UTEX	#CXH	#UAFH
Antistatic	A90	Gray	70	+	0	+	#LUTN	#AAFH	#UAFH
	A70			+	–	++	#LUTN	#AAFH	#UAFH
	A50			+	–	++	#LUTN	#AAFH	#UAFH
Heat Resistant	A90	Brown	120	+	+	++	#UTEX	#CXH	#UAFH
Low Rebound	A70	Gray	70	+	0	+	#LUTN	#AAFH	—
Extra Low Hardness	A15	Black	80	+	0	+	—	#CXH	—
Ceramic Urethane	A95	Gray	70	+	+	+	#UTSC	#AAFH	#UAFH
	A90			+	+	+	#UTSC	#AAFH	#UAFH
	A70			+	–	++	#UTSC	#AAFH	#UAFH
	A50			+	–	++	#UTSC	—	—

++ : Very Strong, + : Strong, 0 : Medium, – : Weak

Rubber

Material	Hardness Shore A	Color	Properties				TYPE CODE		
			Maximum Operating Temperature °C	Continuous Use Temperature °C	Abrasion Resistance	Oil Resistance	Sheets	Bumpers	Washer
Nitrile Rubber (NBR)	A70	Black	90	80	++	+	#RBNM	#RBXA	#WRBA
	A50	Black					#RBNM	—	—
	A65	White					#RBNM	—	—
Chloroprene Rubber (CR)	A65	Black	100	80	+	0	#RBCM	#RBXA	#WRBA
	A60	Gray					#RBCM	—	—
	A60	White					#RBCM	—	—
Ethylene Rubber (EPDM)	A65	Black	120	80	0	–	#RBEW	—	#WRBA
		White					#RBEW	—	—
Butyl Rubber (IIR)	A65	Black	120	80	0	–	#RBRM	—	#WRBA
		White					#RBRM	—	#WRBA
Fluororubber (FPM)	A80	Black	230	210	++	++	#RBFM	#RBXA	#WRBA
	A60	Black					#RBFM	—	—
	A70	White					#RBFM	—	—
Silicon Rubber (SI)	A70	Light Gray	200	150	–	+	#RBAM	#RBXA	#WRBA
	A50	Milky White					#RBAM	#RBXA	#WRBA
	A50	Ivory					#RBAM	—	—
Low Elasticity Rubber (Hanenaito®)	A57	Black	60	30	–	+	#UNLE	—	—
	A32	Black					#UNLE	#RBXA	#WRBA

++ : Very Strong, + : Strong, 0 : Medium, – : Weak

Sponge

Material	Hardness Asker C	Color	Air Bubble	Properties			WEB CODE		
				Continuous Use Temperature °C	Abrasion Resistance	Water Resistance	Sheets	Bumpers	Washer
Polyurethane Sponge	Less than C1	Black	Continuous Cell	-10~ 70	++	0	#SGNA	—	—
Chloroprene Rubber Sponge	C25	Black	Independent Cell	-35~130	+	+	#SGNA	#ASGA	#WSEA
	C25	White					#SGNA	—	—
EPDM Sponge	C8	Black	Independent Cell	-40~130	+	+	#SGNA	#ASGA	#WSEA
NBR Sponge	C30	Black	Independent Cell	-10~140	++	+	#SGNA	—	#WSEA
Silicon Rubber Sponge	C25/C35	Orange	Independent Cell	-70~200	0	+	#SGNA	#ASGA	#WSEA
	C15	Orange					#SGNA	—	—
Fluoro Rubber	C35	Black	Independent Cell	-20~230	++	++	#SGNA	—	#WSEA
Low Elasticity Rubber Sponge (Hanenaito® Sponge)	C25	Black	Independent Cell	20~ 60	+	0	#SNPG	—	—
Antistatic Low Rebound Sponge	C27	White	Independent Cell	10~ 50	+	++	#SNPG	—	—
Low Strain Sponge (Silicone Foam)	C15	3mm Thickness: Green 6mm Thickness: White	Independent Cell	-40~150	0	++	#SNPG	—	—
Special Foam Polyurethane SOFRAS®	C11	White	Continuous Cell	10~130	++	++	#SOFR	—	—
EPT Sealer®	C5 or Less	Black	Semi–Closed Cell	20~100	–	–	#EPA	—	#WSEA

++ : Very Strong, + : Strong, 0 : Medium, – : Weak

Product Spotlight – Actuators –

Single Axis Actuators (LX Series) / Single Axis Units (KU Series)

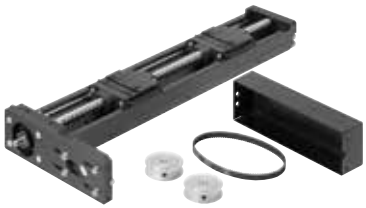
Category View Enter CATEGORY CODE to see category details.

Single Axis Actuators (LX Series)

Catagory Code: #ACLX

Standard Type

Cover Type



Motor Wrap Type

Motor Mounted Type

Oriental Motor α-Step Cable

Motor Adapter Centering Tools

Accessories

Single Axis Units (KU Series)

Catagory Code: #ACKU

Standard Type

Cover Type

Product View Enter WEB CODE to see product details.

Type	Products		Positioning Repeatability (mm)	Max. Stroke (mm)	Max. Velocity (mm/sec)	Basic Dynamic Load Ratings (N)	WEB CODE
LX Series Standard/Cover Type	LX15		High Grade ±0.004 Precision Grade ±0.003	151.9	330	2072	#LX15
	LX20		High Grade ±0.005 Precision Grade ±0.003	236.5	694	3277	#LX20
	LX26		High Grade ±0.005 Precision Grade ±0.003	317	1040	6522	#LX26
	LX30		High Grade ±0.005 Precision Grade ±0.003	529.5	830	Long Block 9732 Short Block 6305	#LX30
	LX45		High Grade ±0.005 Precision Grade ±0.003	497.9	1110	Long Block 18450 Short Block 11826	#LX45
KU Series Standard/Cover Type	KU (Rolled BS)		±0.085 ±0.08 ±0.05 ±0.03	610	1055	—	#KUA
	KU (Precision BS)		±0.003	610	1556	—	#KUA
Motor Wrap	LXR30		±0.005	529.5	830	—	#LXR30
	LXR45		±0.005	497.9	1110	—	#LXR45

Type	Products		Positioning Repeatability (mm)	Max. Stroke (mm)	Max. Velocity (mm/sec)	Max. Horizontal Load Capacity(kg)	WEB CODE
Motor Mounted	LXM20		±0.003	130	250	15	#LXM20
	LXM26		±0.003	210	250	20	#LXM26
	LXM30		±0.003	490	450	32	#LXM30
	LXM45		±0.003	450	450	40	#LXM45

Product Spotlight – Actuators –
Single Axis Robots (RS Series)

Category View Enter CATEGORY CODE to see category details.

Single Axis Robots (RS Series)
Catagory Code: #ACRS


Slider (Straight)


Slider (Motor Folded)


Rod


Rod with Support Guide


Clean Spec. (Straight)

Stepping Motor Type


Ball Screw (Straight)


Ball Screw (Straight / Width Compact)


Belt Driven


Clean Spec. (Straight)

Servo Motor Type


I/O Cable


Handy Terminal


Controller


Connectors


Cables

Accessories

Product View Enter WEB CODE to see product details.

Stepping Motor Type

Type	Motor Position	Products	Positioning Repeatability (mm)	Max. Stroke (mm)	Max. Velocity (mm/sec)	Max. Load Capacity (kg)		Max. Push Force (N)	WEB CODE
						Horizontal	Vertical		
Slider	Straight		±0.02	400	600	6	4	150	#RS1
			±0.02	800	1000	10	2	90	#RS2
			±0.02	800	1000	12	4	120	#RS3
	Motor Folded		±0.02	400	600	6	4	150	#RS1R
			±0.02	800	1000	10	2	90	#RS2R
			±0.02	800	1000	12	4	120	#RS3R
Rod	Straight & Motor Folded		±0.02	200	500	20	8	100	#RSD1
			±0.02	300	500	45	25	600	#RSD2
			±0.02	300	300	60	30	900	#RSD3
Rod with Support Guide			±0.02	200	500	20	7.5	100	#RSDG1
			±0.02	300	500	45	24	600	#RSDG2
			±0.02	300	300	60	28.5	900	#RSDG3
Clean Spec.	Straight		±0.02	400	600	6	4	150	#RS1C
			±0.02	800	1000	10	2	90	#RS2C
			±0.02	800	1000	12	4	120	#RS3C

Servo Motor Type

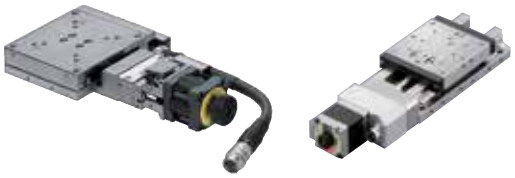
Type	Motor Position	Products	Positioning Repeatability (mm)	Max. Stroke (mm)	Max. Velocity (mm/sec)	Max. Load Capacity (kg)		Rated Force (N)	WEB CODE
						Horizontal	Vertical		
Ball Screw	Straight		±0.02	800	1200	40	8	283	#RSH1
			±0.01	1050	1800	50	16	339	#RSH2
			±0.01	1050	1200	80	—	339	#RSH3
			±0.01	1050	1800	60	20	399	#RSH4
			±0.01	1050	1800	80	20	399	#RSH5
	Straight / Width Compact		±0.01	1050	1800	80	20	399	#RSF4
Belt Driven	6-Mounting Positions		±0.04	2550	1875	10	—	—	#RSB1
			±0.04	3050	1875	20	—	—	#RSB2
Clean Spec.	Straight		±0.02	800	1000	40	8	283	#RSH1C
			±0.01	1050	1000	50	16	339	#RSH2C
			±0.01	1050	1000	80	—	339	#RSH3C

Product Spotlight – Actuators –
Motorized Stages

Category View Enter CATEGORY CODE to see category details.

Linear / X-Axis
Catagory Code: #ACX

On Request



Linear / XY-Axis
Catagory Code: #ACXY

On Request

Linear / Z-Axis
Catagory Code: #ACZ

On Request

Rotary
Catagory Code: #ACRT

On Request

Goniometer
Catagory Code: #ACGN

On Request

Cables
Catagory Code: #ACCB

On Request

On Request Contact MISUMI for details

Control Parts
Catagory Code: #ACCP

On Request

DC24V Input Driver

Product View Enter WEB CODE to see product details.

Linear

On Request

Type	Products	Positioning Repeatability (mm)	Max. Stroke (mm)	Max. Velocity (mm/sec)	Load Capacity (N)	WEB CODE
X-AXIS		±0.0005 or Less	50	10	98	#XMSG
		±0.0005	75	35	117.6	#XCVL30
		±0.0005	300	45	117.6	#XCVL100
XY-AXIS		±0.0005 or Less	15	10	93.1	#XYMSG
		±0.0005	75	35	98	#XYCVL
Z-AXIS		±0.0005 or Less	15	10	49	#ZMSG
		±0.0005	75	20	68.6	#ZCVL
		±0.0005 or Less	12	≒3.7	196	#ZLMPG

Rotary

On Request

Motion Image	Products	Positioning Repeatability (°)	Max.Stroke (°)	Max. Velocity (°/sec)	Max. Horizontal Load Capacity (N)	WEB CODE
		±0.003 or Less	±8.5	102	58.8	#RMBG
		±0.01 or Less	±360	30	29.4	#RMPG
		±0.005 or Less	±360	25	294	#RMWG
		—	±360	72	9.8	#RMDG

Goniometer

On Request

Type	Moving Mechanism	Stage Surface Size	Products	Positioning Repeatability (°)	Max. Stroke (°)	Max. Velocity (°/sec)	Max. Horizontal Load Capacity (N)	Rotation Center (mm)	WEB CODE
Single Axis	Worm Gear	40x40		±0.005 or Less	±8	15	29.4	40 · 60	#GMPG40
		50x50		±0.005 or Less	±10	7.8	29.4	50 · 68 · 86	#GMPG50
		60x60		±0.003 or Less	±10	22.5	49	50 · 75 · 100 · 125	#GMPG40
		70x70		±0.003 or Less	±9	7.6	49	70 · 96 · 122	#GMPG50
	Ball Screw			±0.003 or Less	±5	23	49	70 · 96 · 122	#GMPBG70
2-Axis	Worm Gear	40x40		±0.005 or Less	±8/±6	15	24.5	40	#GMPG40
		50x50		±0.005 or Less	±10/±8	7.8	22.5	50 · 68	#GMPG50
		60x60		±0.005 or Less	±10/±8	22.5	44.1	50 · 75 · 100	#GMPG40
		70x70		±0.003 or Less	±9/±7	7.6	39.2	70 · 96	#GMPG50
	Ball Screw			±0.003 or Less	±5/±4	23	39.2	70 · 96	#GMPBG70

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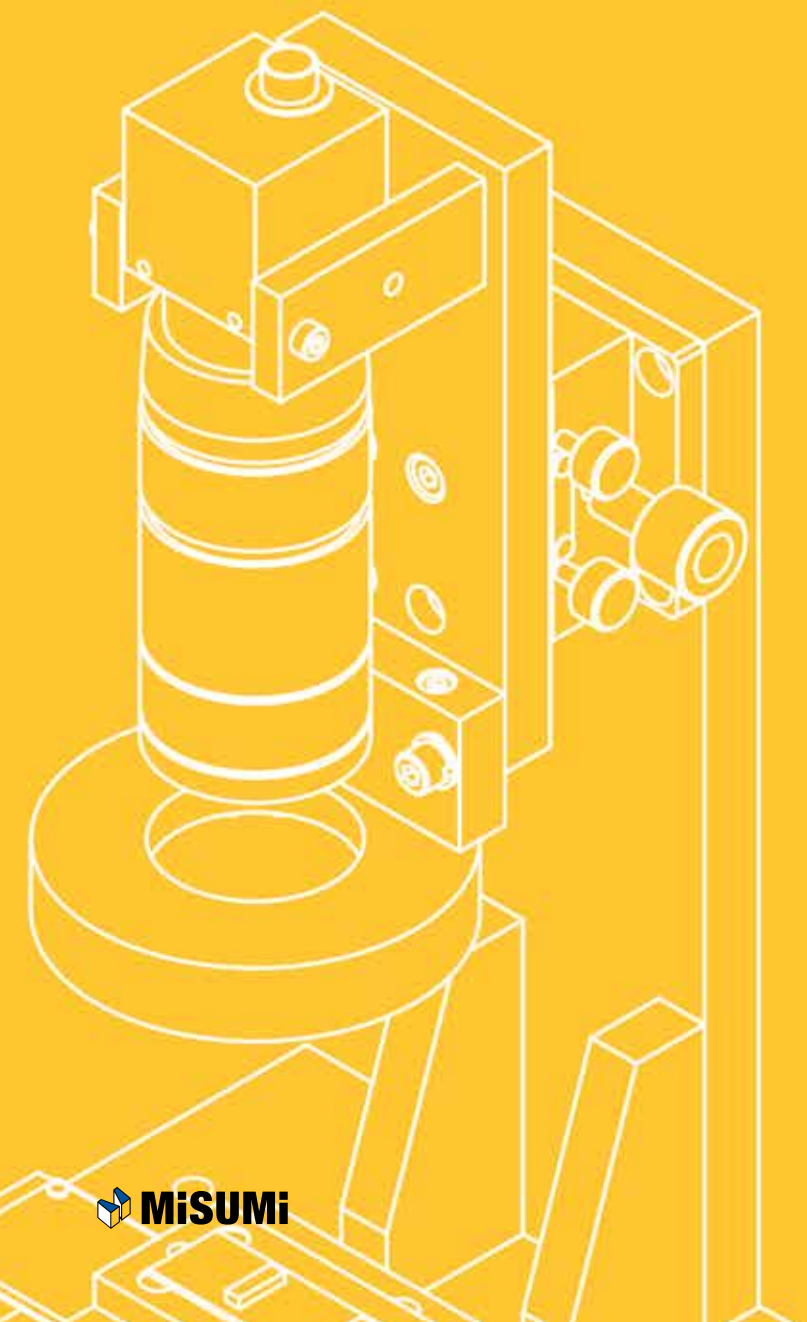


MiSUMi

IDEA NOTE

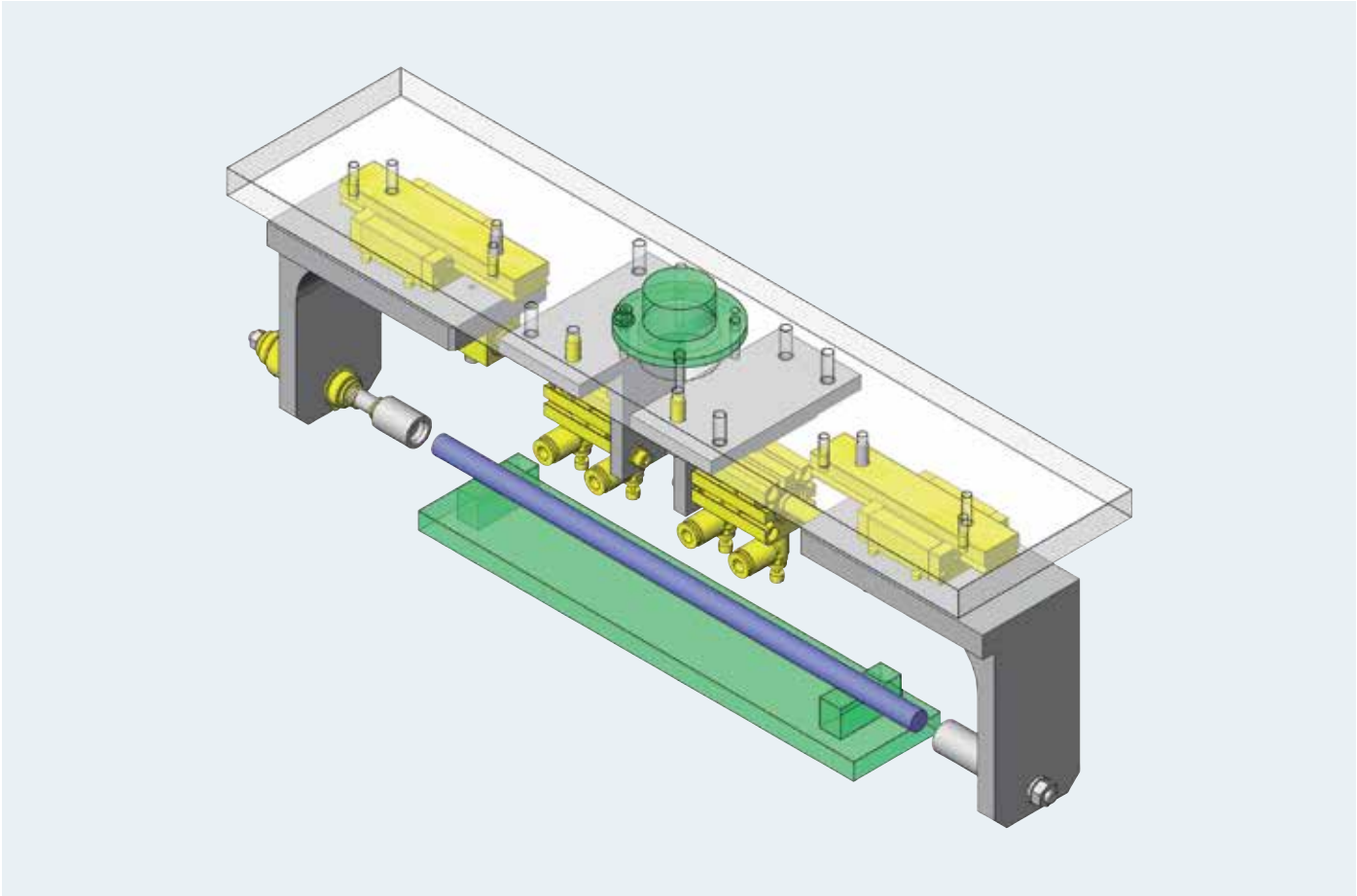
Application Example

Transfer / Moving

#IN141

Long Workpiece Retention Mechanism

Lengthy workpiece held together by spring mechanism



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	Miniature Linear Guides Standard Blocks	SSEB20-100	2
2	Compact Cylinders	MSCCA16-20	2
3	Sensors – For Cylinders, Grippers	MD11L1	4
4	Flow Rate Control Valves	SPJNLS6-M5-B	4
5	Floating Connectors	FJXLS6-1.0	2
6	Round Wire Springs	WT10-20	1
7	Linear Bushings – Single Type	SLMUW8G	1
8	Retaining Rings – External, C-Type	STWN15	2
9	Collars (Standard/Precision Class)	FAMSC-V15-D19-L22.9	1
10	Metal Washers (Standard Class)	WSSM12-5-3	1
11	Metal Washers (Standard Class)	WSSM12-8-2	1
12	Dowel Pins Straight Type	MS4-10	8
13	Socket Head Cap Screws	SCBS4-16	8
14	Socket Head Cap Screws	SCBS6-20	8

Application Overview

Purpose

- Secure and release lengthy workpieces without causing deformation.

Points for Use

- Cylinder employing automatic mechanism
- Workpiece is transferred and release to operation.

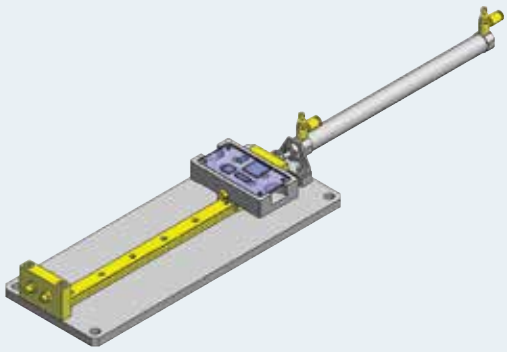
Target Workpiece

- Outer Dimensions: Ø10 x 275
- Material: POM
- Weight: 30 g

IDEA NOTE

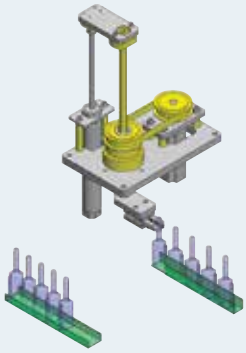
#IN35 Cylinder Linear Motion Mechanism

Table slide with stroke end adjustment



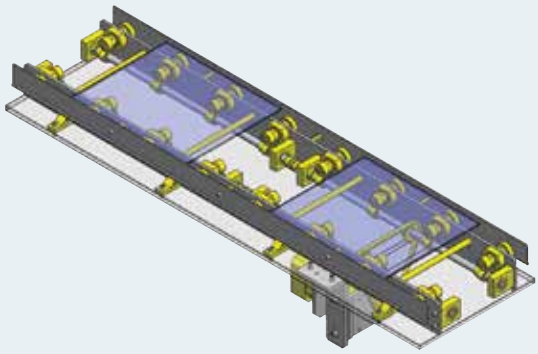
#IN32 Pick and Place Mechanism with Ball Spline

Compact design utilizing ball spline



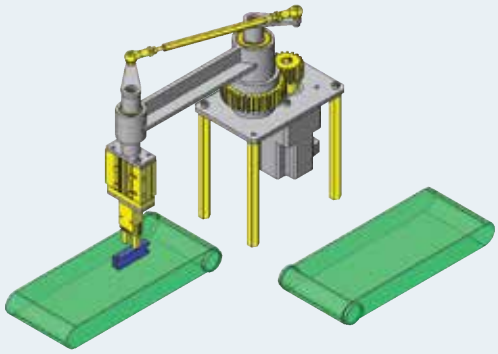
#IN40 Non-Contact Drive Transfer Mechanism

A non-contact drive transfer mechanism with TM Magnets



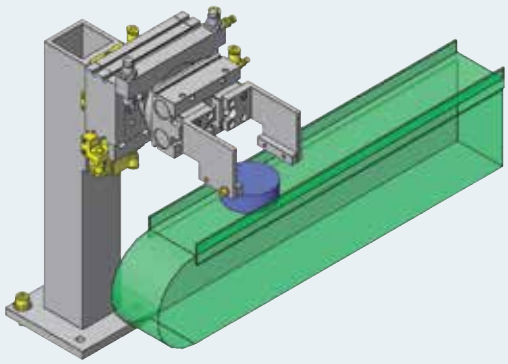
#IN75 Workpiece Inversion and Transfer Mechanism

Motor and gear system rotates the arm and gripper simultaneously



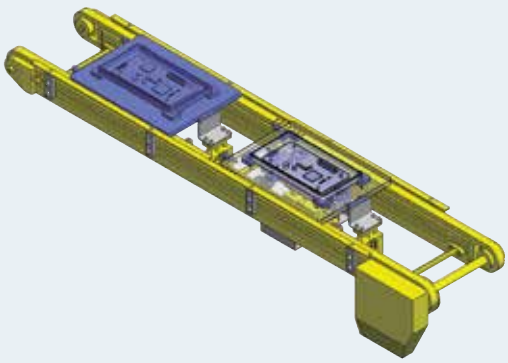
#IN20 Rotating Gripper Unit

Using MISUMI standard components eliminates the need for custom parts



#IN38 Positioning and Stopper Mechanism for Pallet Transfer

Stopper + lifter positioning mechanism



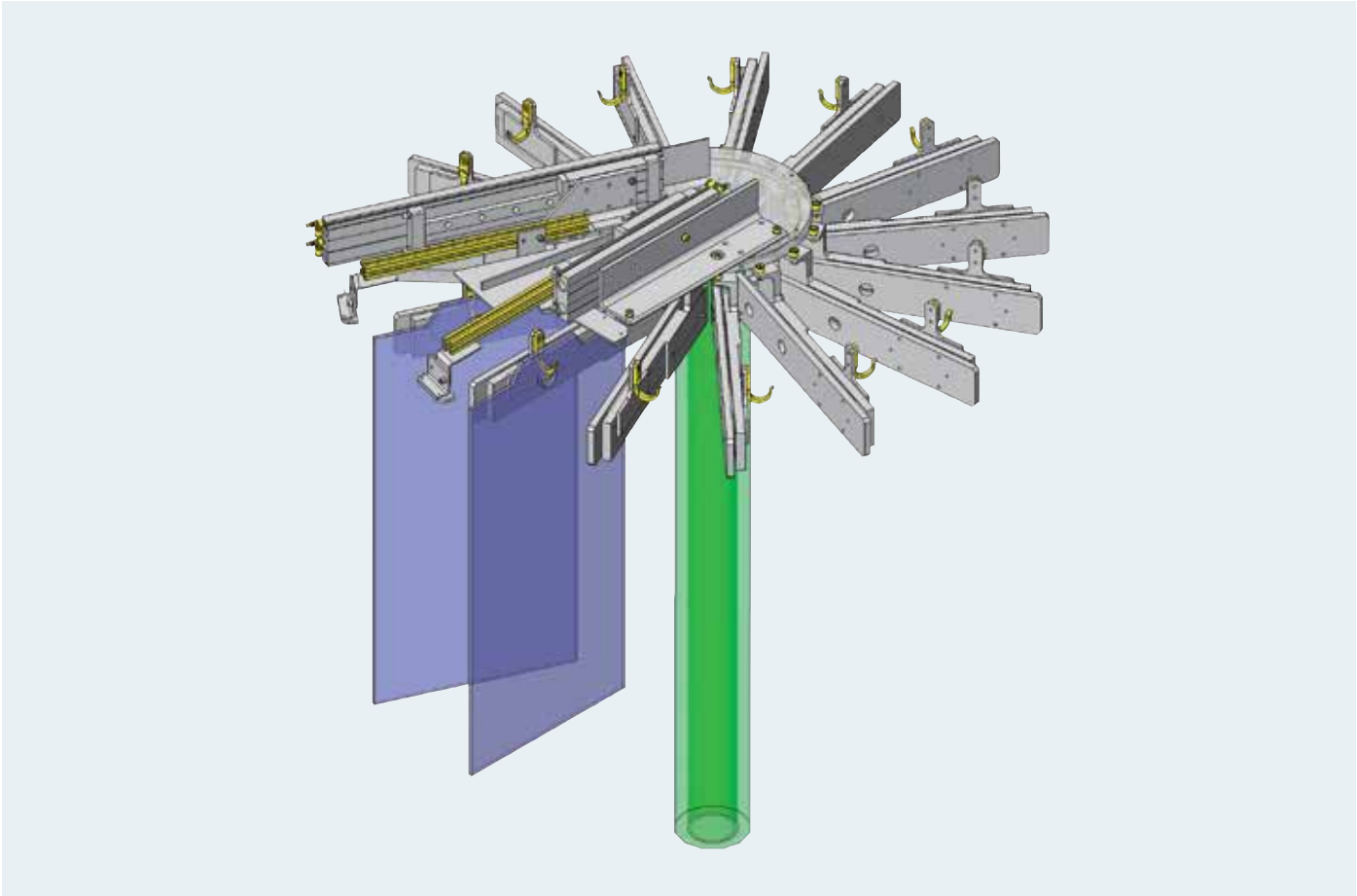
Application Example

Feed / Discharge

#IN169

Workpiece Input / Discharge

Mechanism that moves radially aligned workpieces to necessary positions one by one



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	Aluminum Frames	NFS5-2020-330	2
2	Pre-Assembly Insertion Short Nuts	HNTT5-5	12
3	Cam Followers – Flat Type, No Seal	CFR5-13	30
4	Hooks	HKKJ	15
5	Flow Rate Control Valves	SPSNL6-M5	4
6	Socket Head Cap Screws	SCBZ6-16	19
7	Socket Head Cap Screws	SCBZ5-10	7
8	Socket Head Cap Screws	SCBZ5-12	5
9	Socket Head Cap Screws	SCBZ3-8	8
10	Socket Head Cap Screws	SCBZ5-20	30
11	Cross Recessed Flat Head Machine Screws	SFBJ5-10	30
12	Socket Head Cap Screws	SCBZ5-15	4
13	Socket Head Cap Screws	SCBZ4-12	60

Application Overview

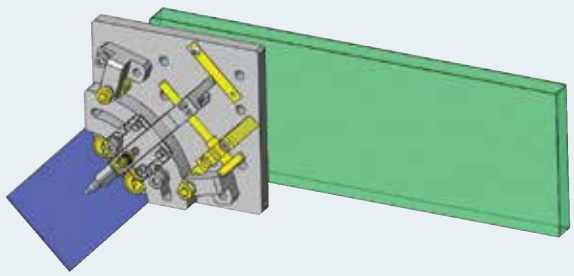
Purpose

- Device in which workpieces are stored radially with their positions retained by the cam followers and retaining rails and necessary workpieces are moved in rotation to the supply and discharge position for input and output of the workpieces. Structure in which the retaining rails are disconnected at the input/output position and the cam followers come off the retaining rails to move to the movable rails.

IDEA NOTE

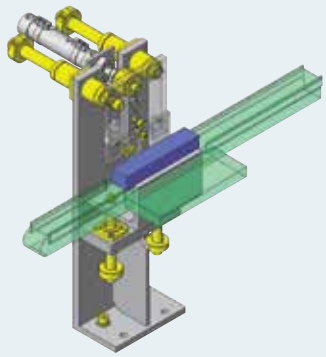
#IN50 Adjustment of Angle at Offset Center Point

Adjustment of angle at offset center point



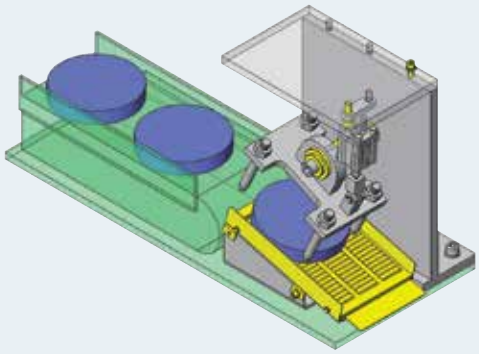
#IN23 Workpiece Escaping Unit

Double acting cylinder mechanism with cam follower the cylinder performs two actions by using a cam



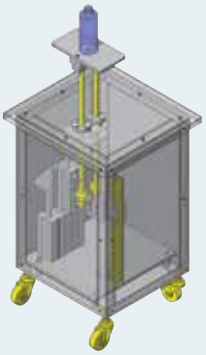
#IN67 Escapement Unit

Double acting cylinder using an oscillating mechanism



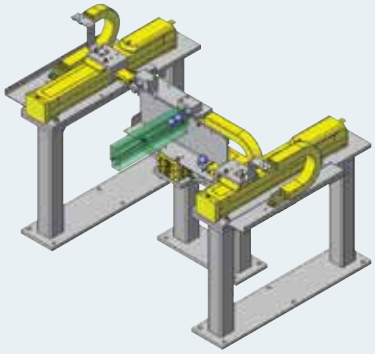
#IN142 Stroke Lift Device

Lift device utilizing two cylinders



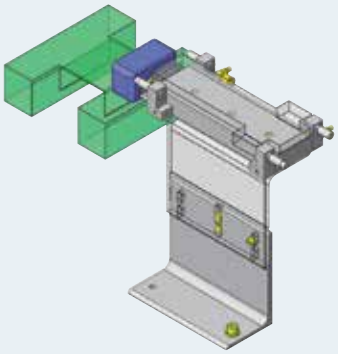
#IN128 Sorting Mechanism

Reduce cycle time by utilizing right / left sorting mechanism



#IN144 Workpiece Pusher

A buffering mechanism that utilizes a flat spring



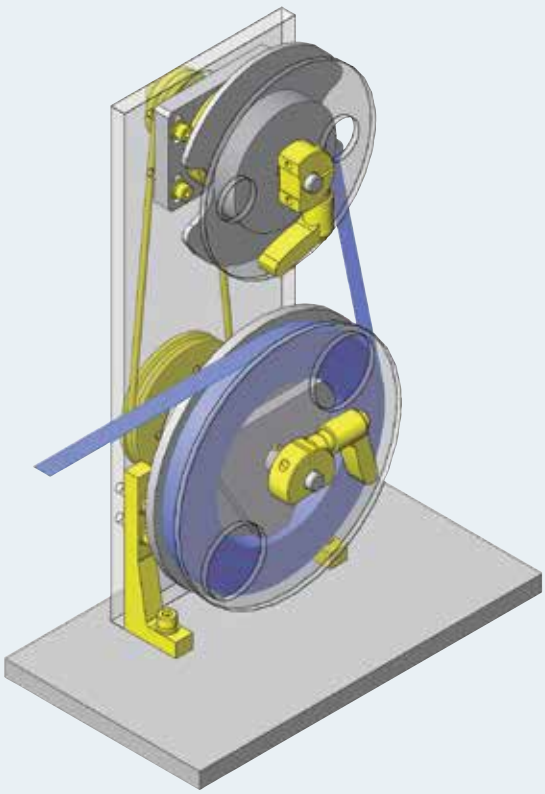
Application Example

Ejection / Collection

#IN12

Tape Spool-Up Fixture

A mechanism that automatically spools the paper backing from doubly sided tape



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	Pulleys for Round Belts – Setscrew	MBRA60-1.5-P10	1
2	Pulleys for Round Belts – Setscrew	MBRDA30-1.5-P8	1
3	Polyurethane Round Belts – Rope Type	MBT3-425	1
4	One-Way Clutches	BHFL10	1
5	Deep Groove Ball Bearings	SB6900ZZ	1
6	Bearings with Housings	SBARB628ZZ-25	1
7	Shaft Collars – Set Screw with 2 Holes	SSCTW12	1
8	Shaft Collars	SSCDKJM8-B	2
9	Economy Gussets (Precision Casting)	RQDW30-80	2
10	Parallel Keys	KESS4-8	1
11	Parallel Keys	KESS3-8	1
12	Metal Washers (Standard Class)	WSSS14-10-8	1
13	Metal Washers (Standard Class)	WSSS14-6-1	1
14	Metal Washers (Standard Class)	WSSS14-5-1	1
		WSSS12-8-6	1

Application Overview

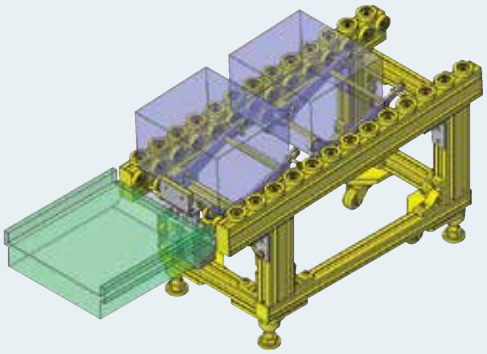
Purpose

- A machine that automatically spools the paper backing from double sided tape as the tape is dispensed.
- As the tape is pulled out, the lower pulley holds the tape in place while the upper pulley spools the paper backing.
- Through the use of a belt, the upper and lower pulleys are coupled together to absorb rotational speed differences.

IDEA NOTE

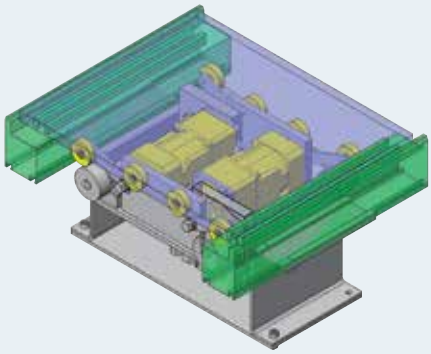
#IN68 Conveyor with Escapement

Escapement mechanism for gravity conveyor



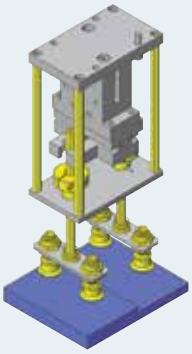
#IN143 Branching / Merging Mechanism

Provides branching and merging of workpieces in various work stations



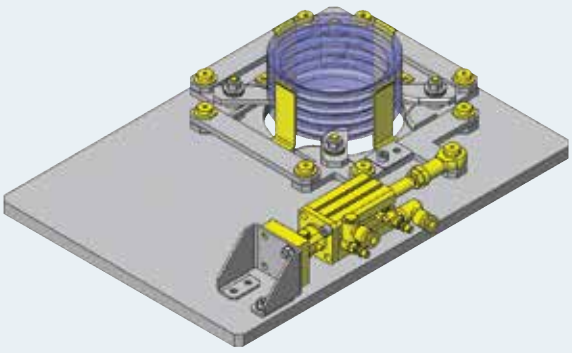
#IN175 Workpiece Gripper Unit with Suction Cups

Fixing the sliding suction cup at hands



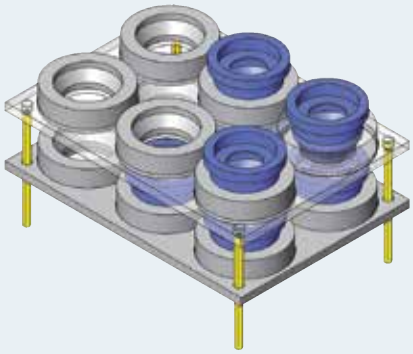
#IN161 Workpiece Separation / Feed Mechanism

Separation and unloading of circular workpieces with a single cylinder



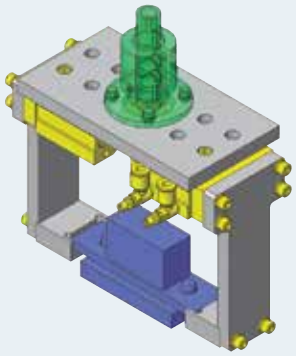
#IN7 Stacking Fixture

Stackable workpiece holding fixture



#IN81 No Load Gripping Mechanism

No load gripping with a cylinder



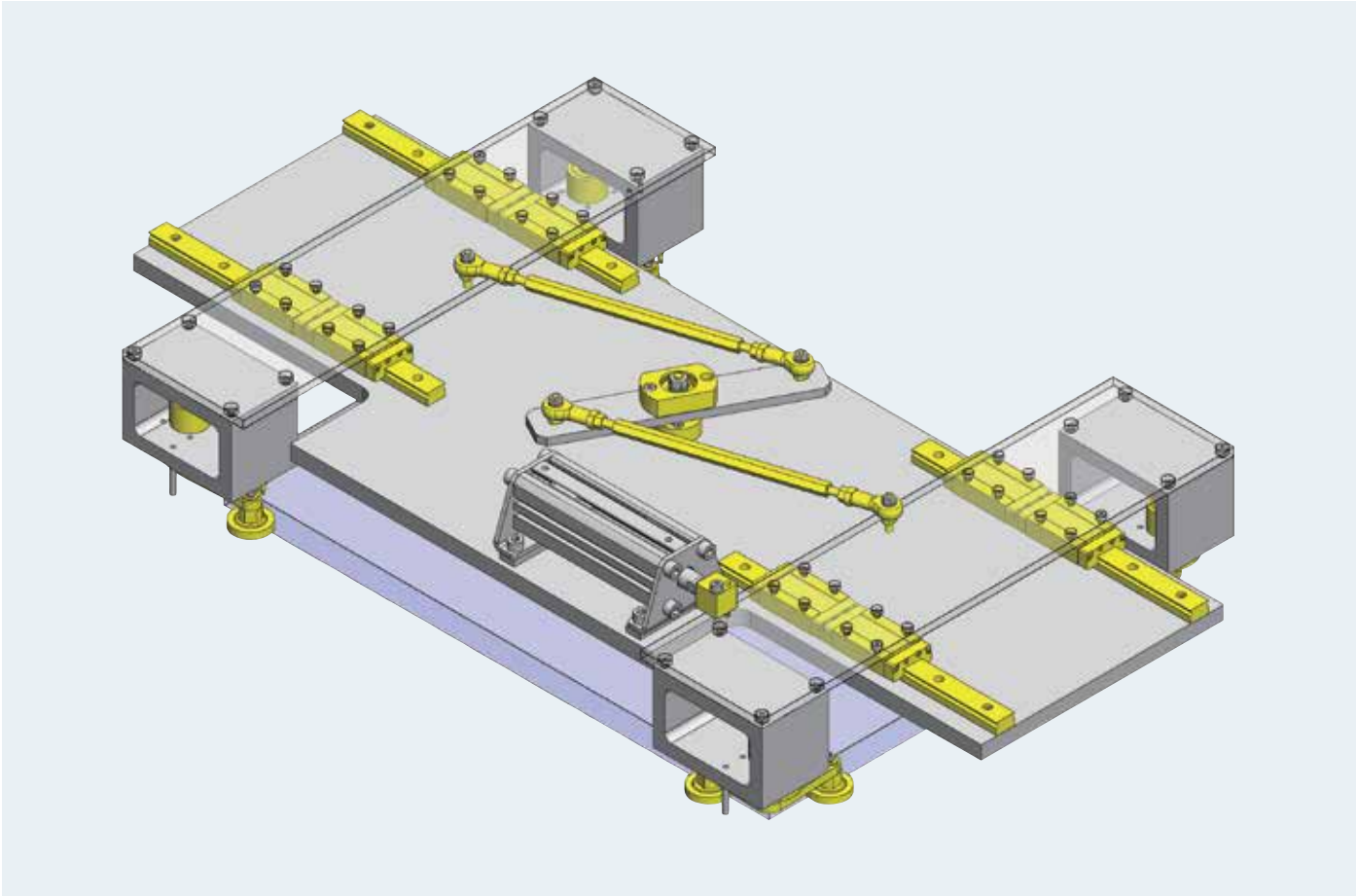
Application Example

Positioning / Clamp

#IN76

Pallet Centering Mechanism

4 direction simultaneous clamping with a cylinder and a linkage mechanism



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	Miniature Linear Guides – Long Blocks	SSELB16-230	4
2	Cantilever Shafts – Flanged	PFXFC8-24-F6-M6	1
3	Bearings with Housings	BGCA608ZZ	1
4	Rod End Bearings (Standard)	PHSCM5	2
5	Rod End Bearings (Standard)	PHSCLM5	2
6	Rod End Coupling Rods	LBRFN5-190	2
7	Cantilever Shafts	PFXAC5-5-F7-MA4	4
8	Bearings with Housings	BARC626ZZ-35	4
9	Cantilever Shafts	PFXMB6-10-F35-T1-MA3	4
10	Collars (Standard/Precision Class)	NCLM6-10-23	4
11	Metal Washers (Standard Class)	WSSM10-3-1	24
12	Links – Angled, 3 Hole	LKBM6-L50-S50-Q90-H...	4
13	Cantilever Shafts	PFXMB6-10-F5-T1-MA3	8
14	Silicon Rubber/Urethane Molded Bearings	UMBB6-28	8
		FJMXL6-1.0	1

Application Overview

Purpose

- (Objective) One cylinder clamps in four directions.
- (Operation) Pallets transferred on a roller conveyor are centered at working position.

Points for Use

- Production line where the pallets are detected by photomicrosensor and stopped on the conveyor.
- Pallet evacuation mechanism is not needed.

Target Workpiece

- Shape: Pallet
- Size (mm): 450 W x 300 D x 20 H
- Weight: 5 kg

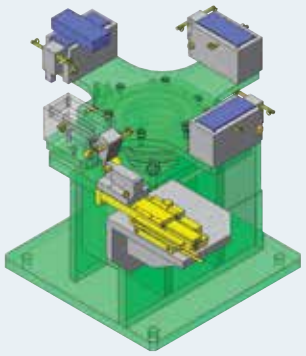
IDEA NOTE

#IN152 XY Floating Mechanism

Simplified floating mechanism

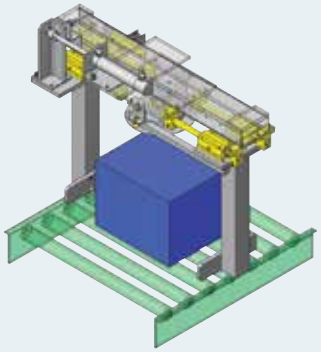
#IN139 Workpiece Clamp Station

Clamp mechanisms operated by pneumatic linear actuator



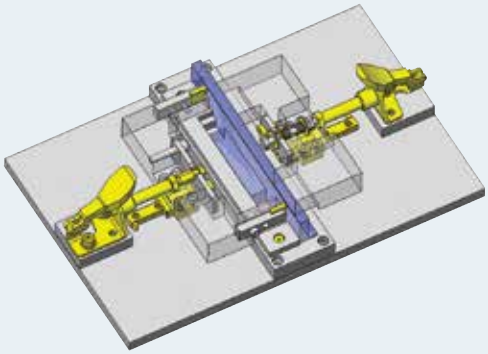
#IN27 Centering Unit

Align scattered workpieces on a conveyor



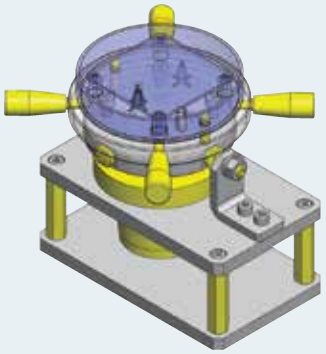
#IN5 Soldering Fixture

Soldering fixture that can accommodate different size workpieces



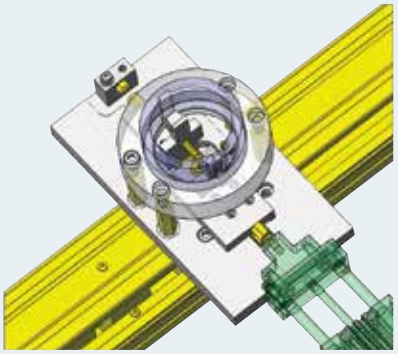
#IN42 Manually Indexed Rotary Table

Ball Buttons are used to prevent wear on the outside of the housing



#IN79 Linkage Operated Gripping Mechanism

Linkage operated grip mechanism controlled and released by an external force



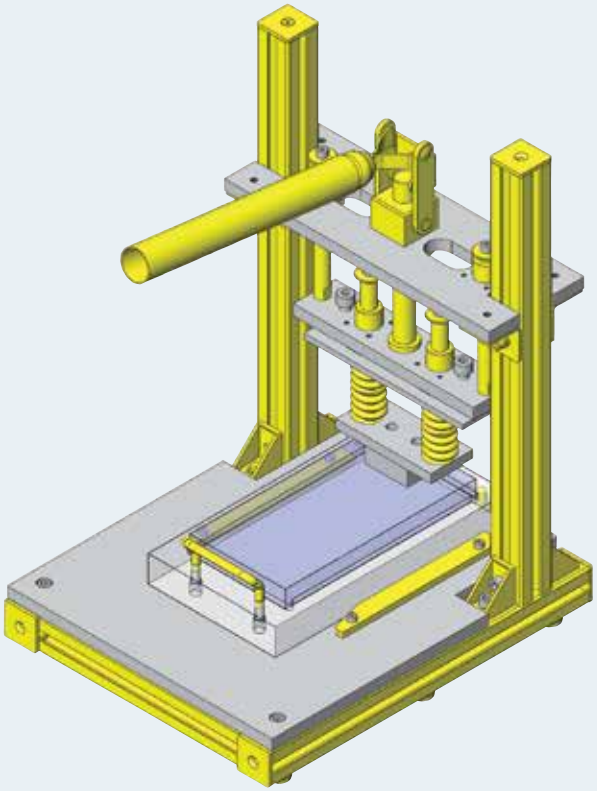
Application Example

Assembly / Machining

#IN10

Film Press Bonding Device

Height adjustable with Aluminum Extrusion frame



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	Toggle Clamps (Free Attachable)	MC02-3	1
2	Aluminum Frames	NEFS6-3030-190	2
3	Aluminum Frames	NEFS6-3030-350	2
4	Aluminum Frames	NEFS6-3030-300	2
5	Brackets	HBLFSN6	8
6	Flanged Linear Bushings	LHSK12	4
7	Precision Linear Shafts	SFJZ12-116-M5-N5-SC0	4
8	Floating Joints – Separate Thread	FJTM10-1.5-10	1
9	Round Wire Springs	UM20-70	2
10	Extrusion End Caps (For HFS6 Series)	HFCB6-3030-B	6
12	Guides Plates	WGTJ16-B8-L150-T5	2
13	L-Shaped Sheet Metal	FSLAS-SUD-T2-A30-B3...	4
14	Stainless Steel Pipe Frames	PFSUS28-200	1
15	Handles – Small Diameter, Offset	UHFNSC60	1
		MSC8-20	2

Application Overview

Purpose

- A manual mechanism for pressure bonding of film to aluminum case.

Points for Use

- Use guide to position the workpiece into correct position.
- Mechanism for pressure bonding is operated with toggle clamp.

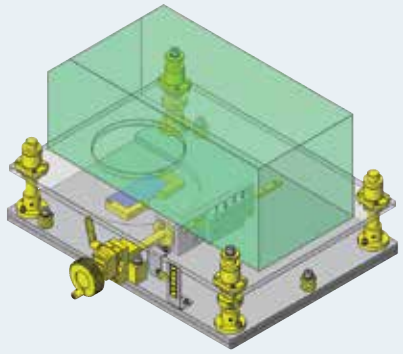
Target Workpiece

- Aluminum case
- External Dimensions (mm): 90 W x 180 D x 16 H
- Weight: 700 g
- Thin film
- Dimensions (mm): 35 W x 30 D x 0.5 t

IDEA NOTE

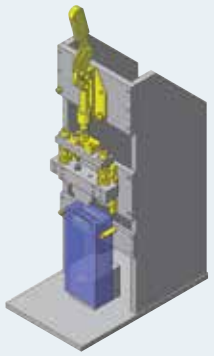
#IN111 Z-Axis Elevating Mechanism

An elevating mechanism with slant mounted Linear Guide



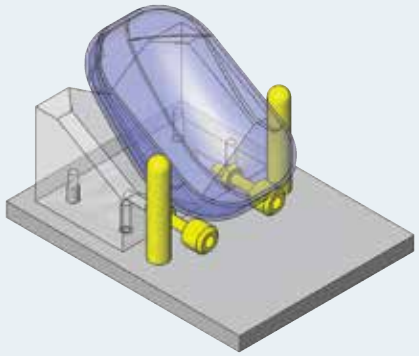
#IN2 Film Press Bonding Device

Press bonding mechanism with uniform load adjustment mechanism



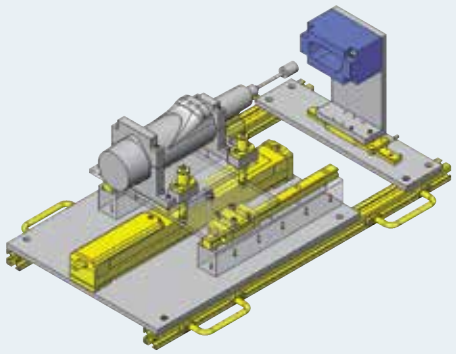
#IN9 Fixture with Adjustable Positioning

Workpiece angle can be adjusted by Stopper Bolts



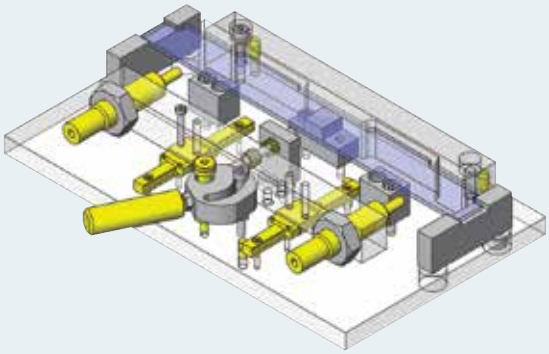
#IN24 Semi-Automatic Grinding Device

A Single Axis Robot with vertical movement controlled by hand



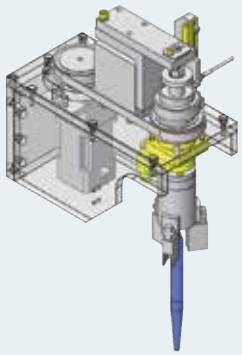
#IN8 PC Board Fixture

Retention using eccentric cam



#IN176 Revolving Pneumatic Gripper

Pneumatic gripper capable of transmitting revolution



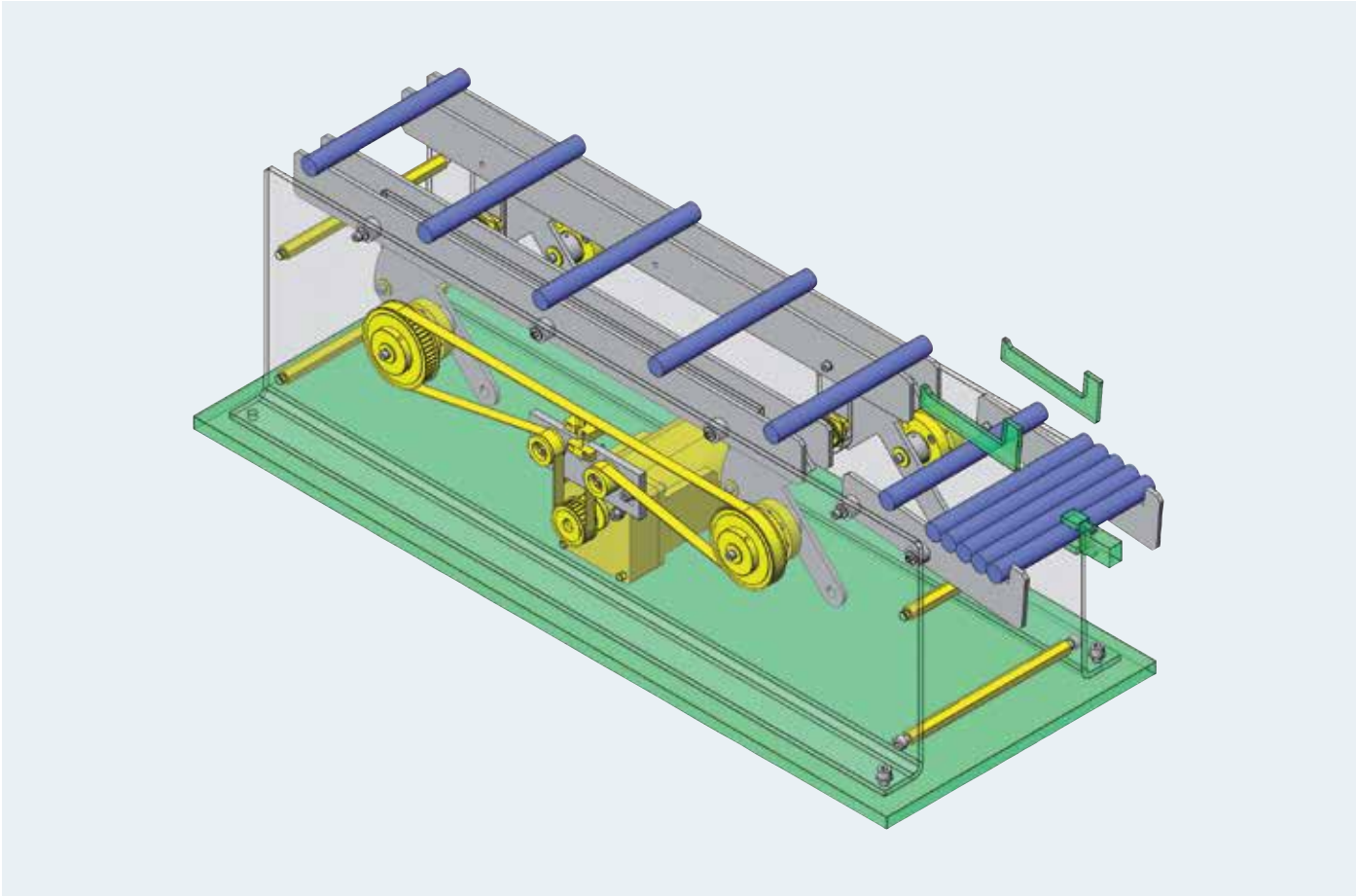
Application Example

Inspection / Measurement

#IN149

Film Press Bonding Device

Height adjustable with Aluminum Extrusion frame



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	Rotary Shafts	PSFHKRW15-76-M5-N5-...	2
2	Rotary Shafts	PSFHKRW15-47-M5-N5-...	2
3	Rotary Shafts	PSFRHH15-100-F24-P1...	2
4	Bearings with Housings	BGRR6002ZZ	8
5	Deep Groove Ball Bearings	B6001ZZ	4
6	Metal Washers (Standard Class)	FWSSM-D21-V15-T6	4
7	Metal Washers (Standard Class)	FWSSM-D21-V15-T4	6
8	Metal Washers (Standard Class)	WSSM20-5-2	8
9	Metal Washers (Standard Class)	WSSM16-5-2	4
10	Collars (Standard/Precision Class)	FNCLM-V12-D16-L12	4
11	High Torque Timing Pulleys – 5GT	GPA50GT5120-A-N15	2
12	High Torque Timing Pulleys – 5GT	GPA25GT5120-B-N12	1
13	Super High Torque Timing Belts	GBN1330EV5GT-120	1
14	Motors with Electromagnetic Brake	PACMB90-W40-V100	1
		PACMGX90-10	1

Application Overview

Purpose

- To feed cylinder-shaped workpieces at a fixed rate

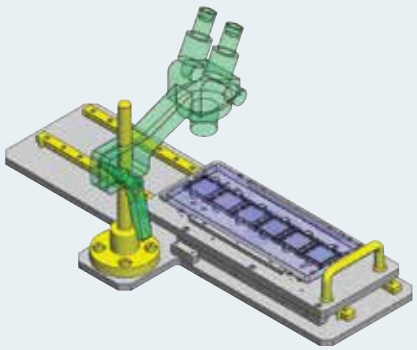
Target Workpiece

- Shape: aluminum cylinder part
- Size: Ø20 x 200 mm
- Weight: 0.15 kg

IDEA NOTE

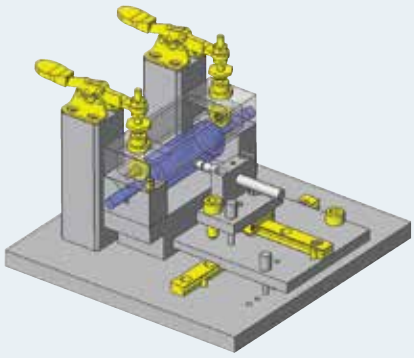
#IN44 Slide Positioning Mechanism

Slide positioning mechanism indexed with a Ball Plunger



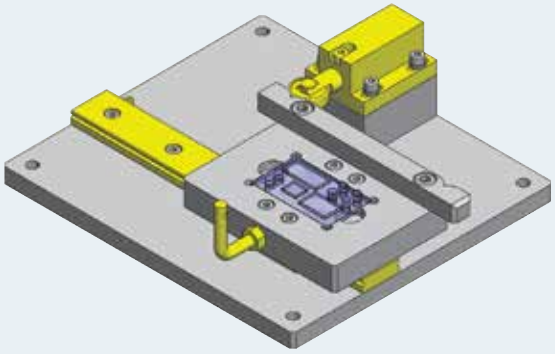
#IN3 Roller Runout Inspection

The workpiece is held with V Blocks and Urethane Molded Bearings, enabling highly accurate runout inspection



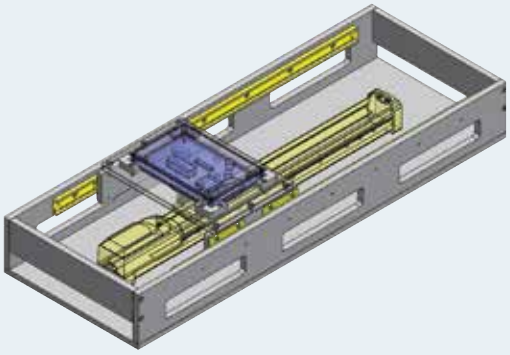
#IN43 Simple Slide Positioning

Simple indexing slide mechanism using Roller plunger



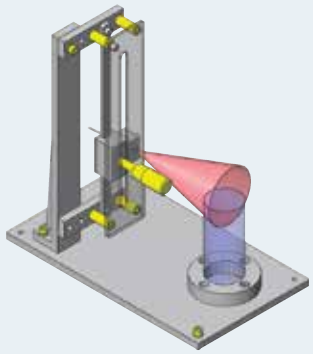
#IN36 Multi-Point Position Slide Unit

A multi-position slider with a Single Axis Robot



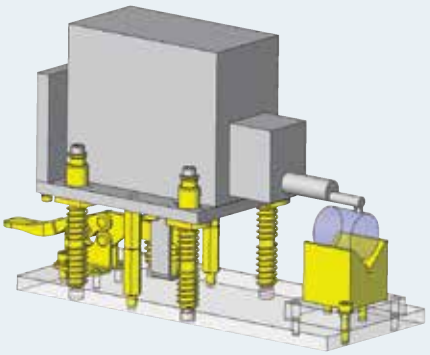
#IN147 Laser Height Adjustment Mechanism

Simplified height adjustment



#IN15 Surface Inspection Fixture

Surface inspection fixture with Toggle Clamp for quick setup



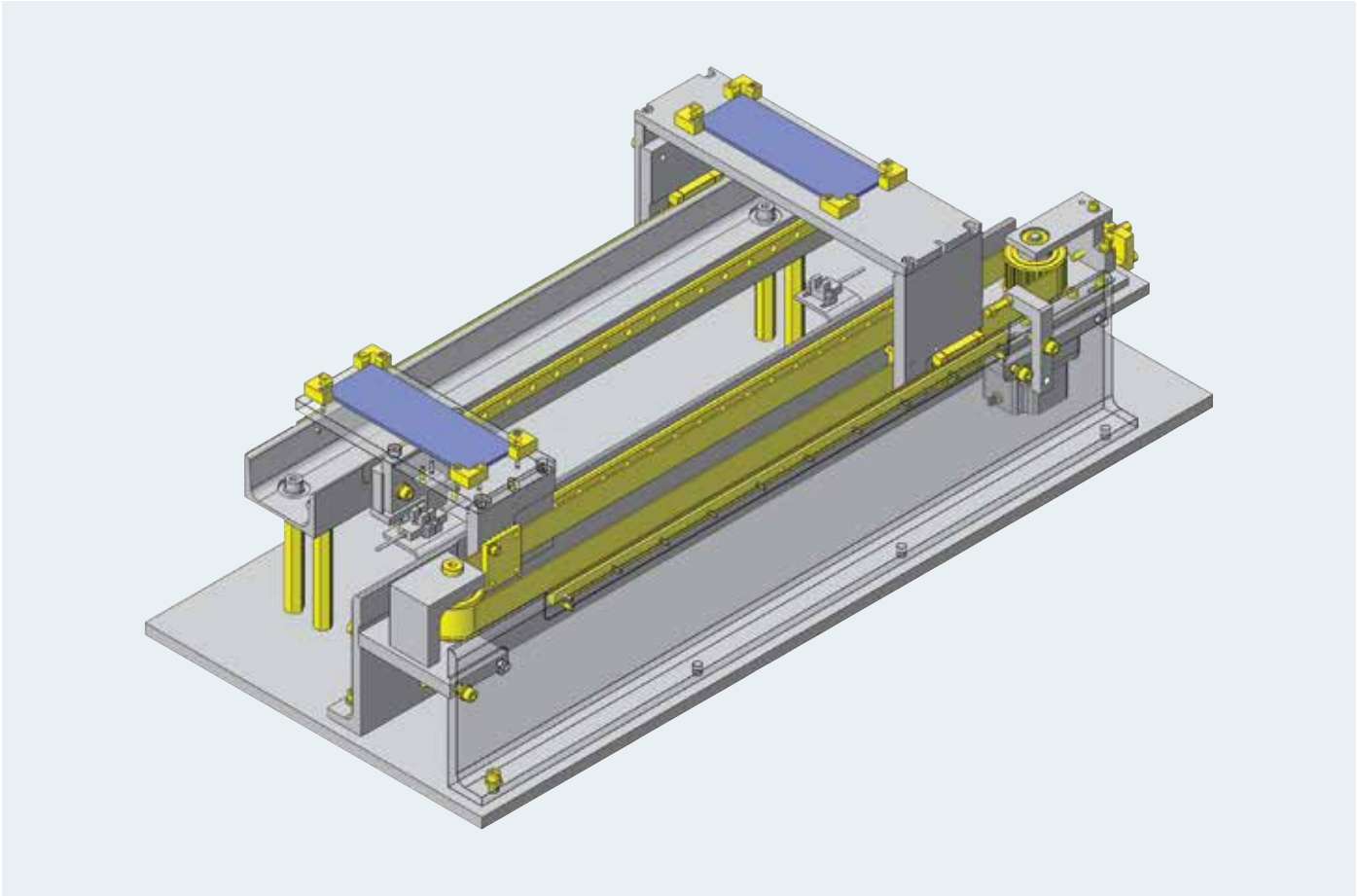
Application Example

Drive

#IN140

Shuttle Transfer Mechanism

Two workpieces are transferred simultaneously through a belt mechanism



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	High Torque Timing Pulleys S5M Type	HTPA28S5M250-A-P8-Q...	1
2	Flanged Idlers with Teeth	AHTFW28-S5M250-10	1
3	High Torque Timing Belts	HTBN1350S5M-250	1
4	Timing Belt Clamp Plate	TBCR-S5M250	2
5	Small Deep Groove Ball Bearings	FL608ZZ	1
6	Precision Pivot Pins	CLBRU10-66.0	1
7	Bearing Spacers	CLBU10-17-5	1
8	Bearing Spacers	CLBU10-17-7	1
9	Blocks for Adjusting Bolts	AJSLCM5-25	1
10	Hex Posts	LSBWF13-100	4
11	Miniature Linear Guides – Long Blocks	SSELB13-470	4
12	Stopper Bolts With Bumpers	UST5-25	2
13	Adjusting Bolts – Hexagon Type, Standard	AJSTM5-35	1
14	Dowel Pins	MSC4-12	6
		WGLBC-20-10-10	8

Application Overview

Purpose

- A single driving mechanism to simultaneously transfer two workpieces in opposite directions.

Points for Use

- Automatic mechanism in which a single driving mechanism drives two tables

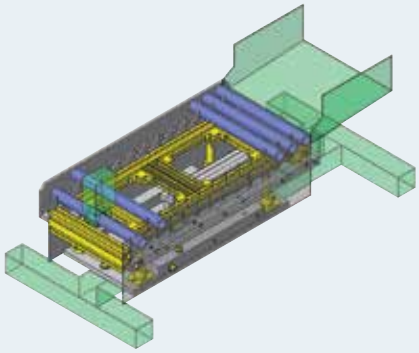
Target Workpiece

- Workpiece: printed circuit board
- Outer Dimensions (mm): 150 W x 50 D x 3 H
- Workpiece Weight: 50 g

IDEA NOTE

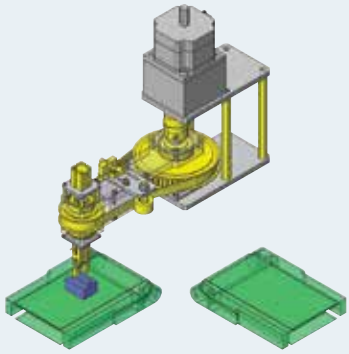
#IN80 Feeding Mechanism for Round Bars

Transfer workpieces with a saw tooth mechanism



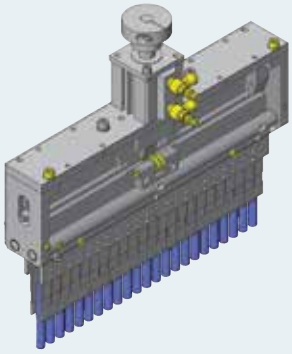
#IN127 Workpiece Inversion and Transfer Mechanism

Rotate and transfer but workpiece orientation in direction of travel remains the same



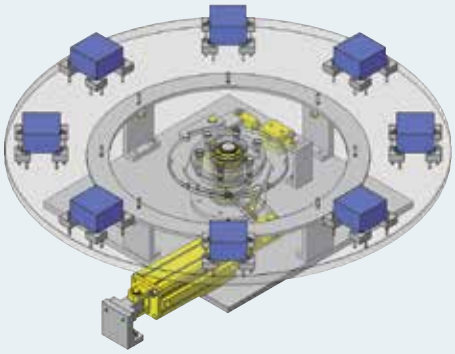
#IN167 Collective Chuck

Flat spring structure at the tips of the chuck to prevent stress on workpieces



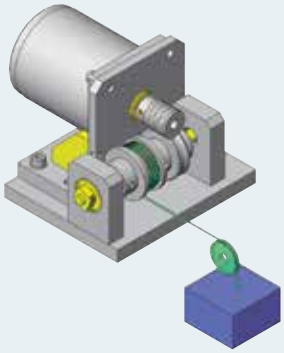
#IN148 Intermittent Rotation Mechanism

Cylinder-driven index table



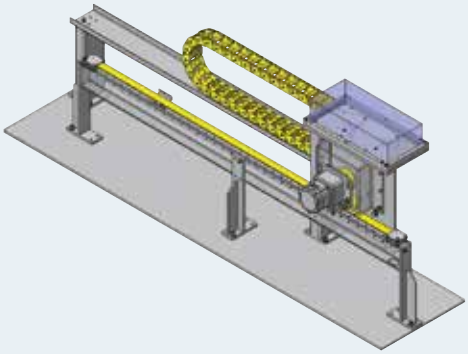
#IN181 Reduces the Thrust Load of a Small-Size Motor Shaft

Reducing the thrust load without using a coupling



#IN84 Long Stroke Slide Mechanism

Belt driven self propelled mechanism

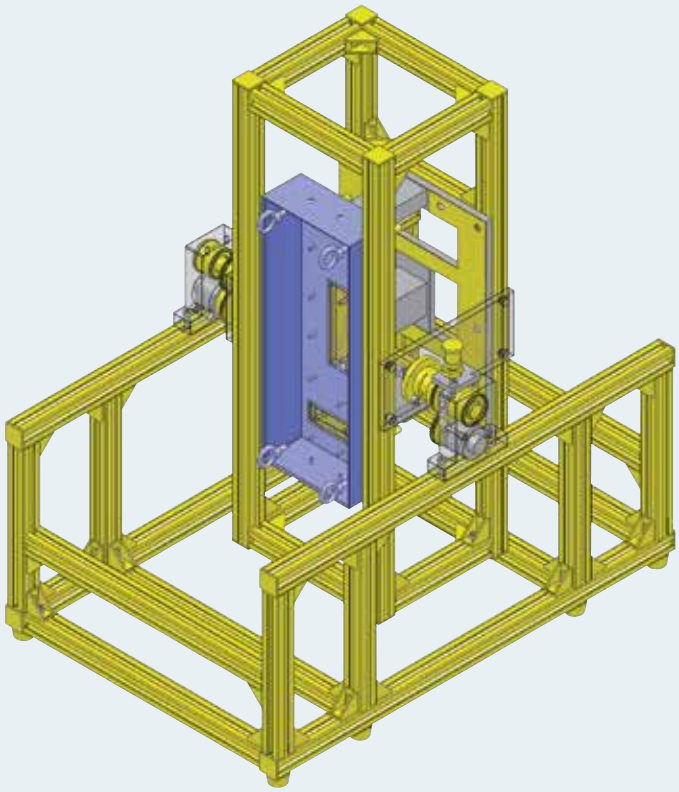


Application Example
Workpiece Treatment

#IN25

Rotating Fixture Mechanism

Slow rotation of fixture is controlled by rotary damper



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	Indexing Plungers – Tip Shape Selectable	SXPKN16L	1
2	Shaft Supports	SSTHWIR20	2
3	Spur Gears	GEAS1.0-50-10-B-8	2
4	Spur Gears	GEAS1.0-50-10-B-22	2
5	Deep Groove Ball Bearings	B6004ZZ	4
6	Retaining Rings – Internal, C-Type	RTWS42	2
7	Retaining Rings – External, C-Type	STWS20	1
8	Rotary Shafts – End Shape Selectable	SSFRGD-D22-L39-F29-...	1
9	Rotary Shafts – End Shape Selectable	SSFRDD-D22-L29-F39-...	1
10	Aluminum Extrusions	HFS6-3030-170	4
11	Aluminum Extrusions	HFS6-3030-200	6
12	Aluminum Extrusions	HFS6-3030-250	8
13	Aluminum Extrusions	HFS6-3030-420	6
14	Aluminum Extrusions	HFS6-3030-700	8
		HBLFSN6	60

Application Overview

Purpose

- A fixture to assemble a heavy cover on a workpiece with screws on multiple surfaces.

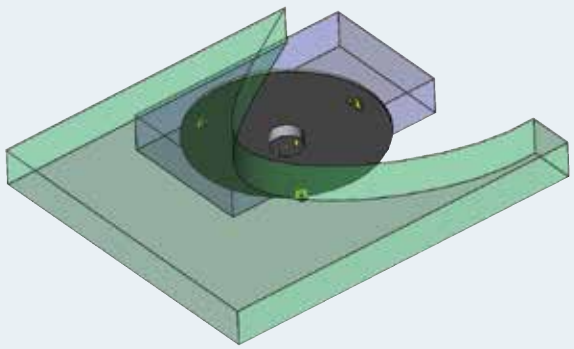
Operation Procedure

1. Set up the cover and the main body (workpiece) on the fixture.
2. Temporarily fix the main body on the fixture by hand-tightening bolts.
3. Turn the fixture 90º and assemble the cover and the main body with the screws (top, bottom, front, and back).
4. Turn the fixture back to the original position and remove the bolts.

IDEA NOTE

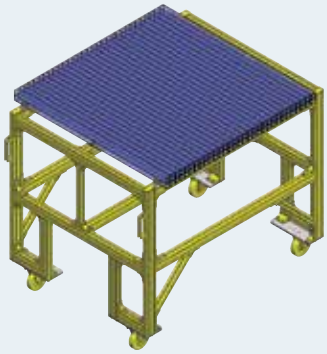
#IN183 Removable Turntable

Bottom view of removable turntable



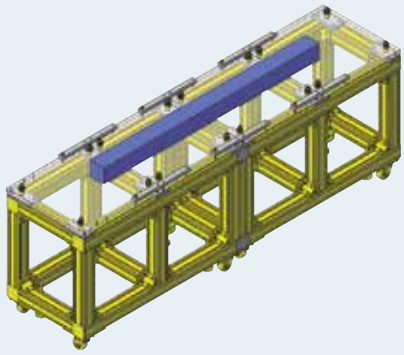
#IN55 Material Transport Cart

Transport cart made of aluminum extrusion



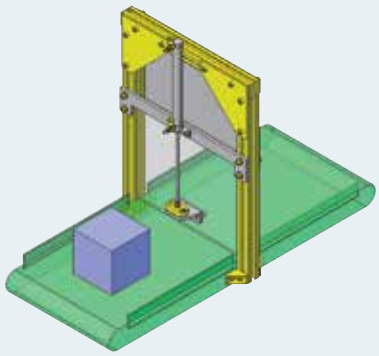
#IN63 Long Length Precision Table

Long table constructed from configurable components



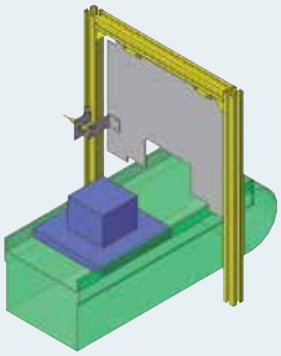
#IN93 Guided Shutter Mechanism

Aluminum Extrusion slots are utilized as shutter guides



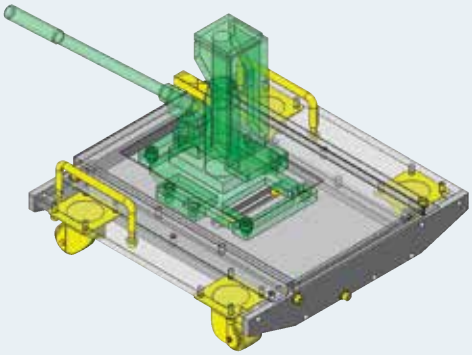
#IN94 Detection Curtain

Curtain style detection



#IN106 Adjustable Low Profile Cart

XY adjustment using flat rollers

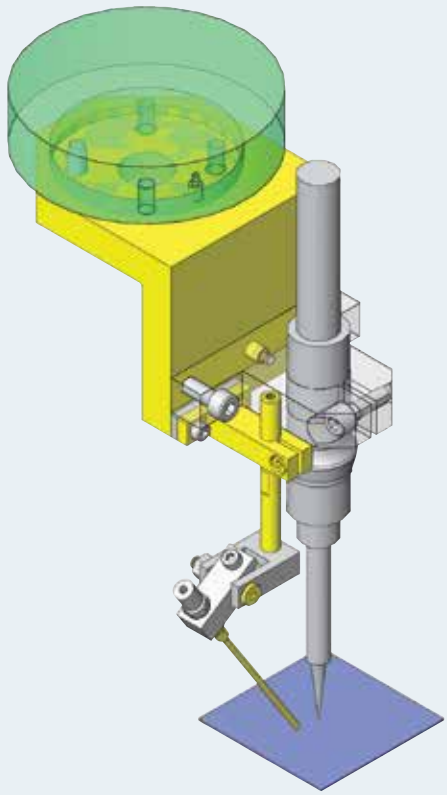


Application Example
Workpiece Treatment

#IN95

Soldering Hand with Air Purge

Simple nozzle and distance adjustments



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	Angles – Extruded	LRA12-A75-B60-L65	1
2	Shaft Supports – T-Shaped, Slit Type	SHSTS6-25	1
3	Precision Linear Shafts	PSSFGZ6-55-M3-N3-SC...	1
4	Air Blow Nozzles	ABNZL5-2.0-65	1
5	Bearing Shaft Screws	BGPSL4-7-L22-F7	1
6	Dowel Pins Straight Type	MS4-10	1
7	Dowel Pins Straight Type	MS5-10	1

Application Overview

Purpose

- Air purge nozzle removes post-solder oxidation material from soldering iron tip.

Points for Use

- The air purge should be done away from the work piece. A suction component should also be used to prevent secondary contamination.
- Adjust the nozzle position for most effective air purging of oxidation.

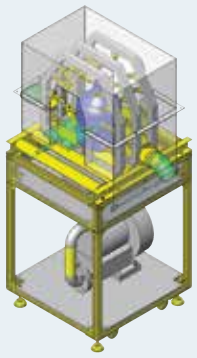
Target Workpiece

- Electronic PC board
- Dimensions: 50 W x 50 H x 1 t
- Weight: 0.1kg

IDEA NOTE

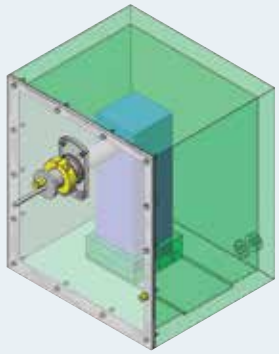
#IN122 Air Blow Device

An air blow device that blows air from all directions



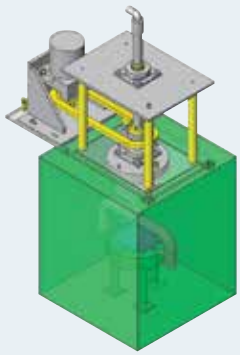
#IN204 Camera Adjustment Device with Air Blower

Camera with air blower



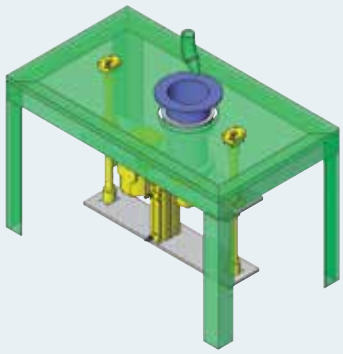
#IN233 Rotary Part Cleaning Unit

Cleans workpiece exterior with a rotary arm nozzle



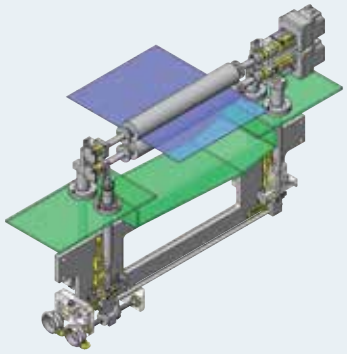
#IN260 Rotation / Lift Device

Rotation and lift device



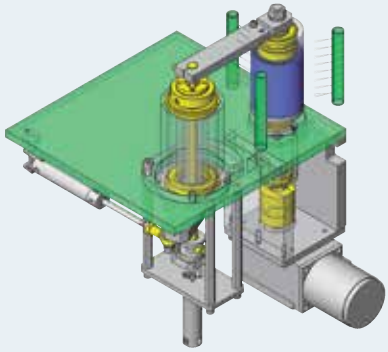
#IN225 Brush Cleaning

Glass circuit board cleaning device



#IN229 Swing Clamp

Clamps and rotates workpiece in a swing motion



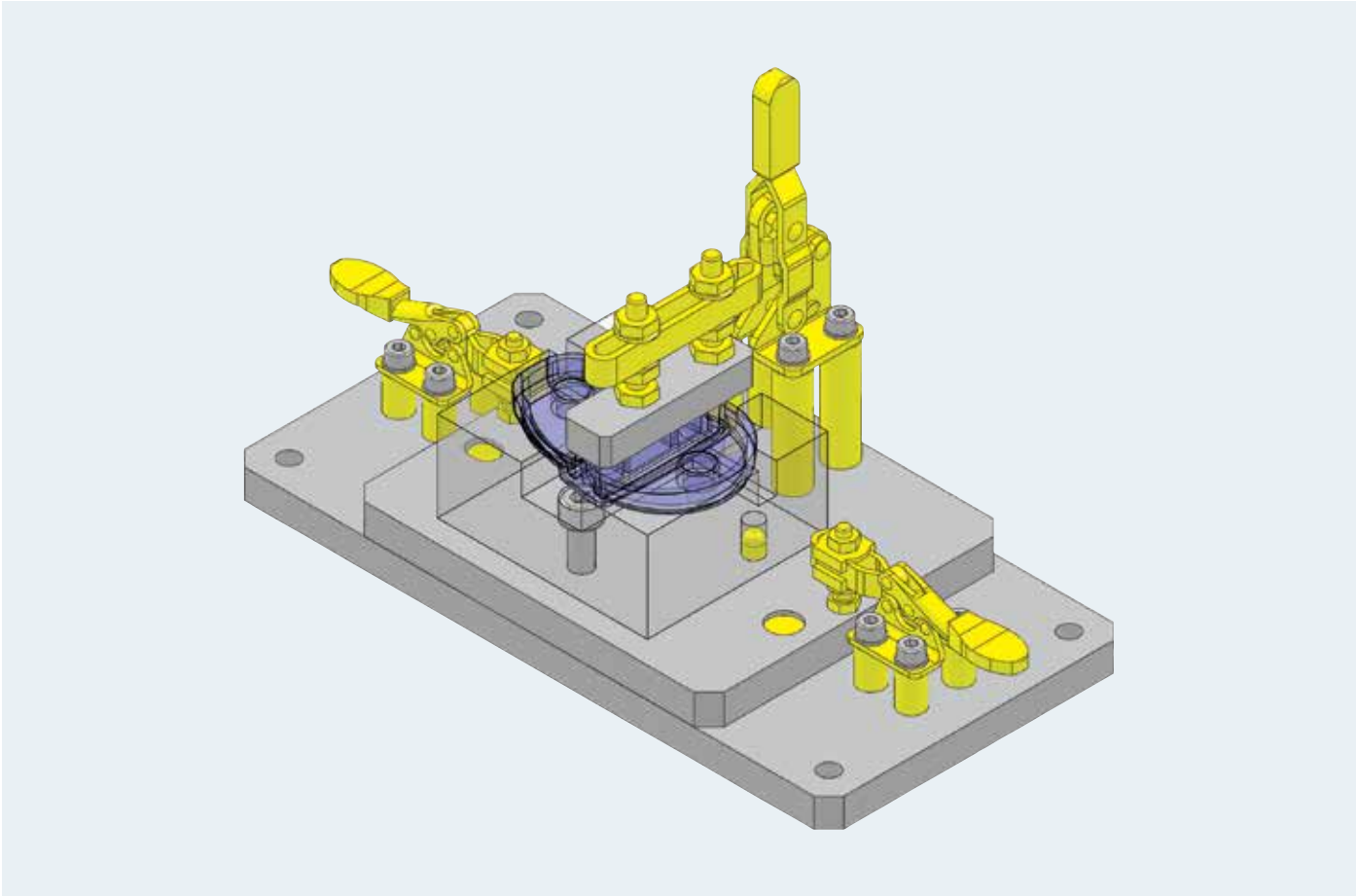
Application Example

Positioning / Clamping

#IN48

Workpiece Clamp Fixture

Choosing clamps based on setup frequency



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	Toggle Clamps – Horizontal Handle	MC01-2	2
2	Collars (Standard/Precision Class)	NCLB4-8-12	8
3	Dowel Pins Straight Type	MS10-20	2
4	Dowel Pins Straight Type	MS8-20	2
5	Locating Pins – Straight, Sphere	SLPSQAG6-L15	4
6	Toggel Clamps	MC04-1L	2
7	Collars – Standard/Precision Class	NCLB4-10-35	8
8	Miniature Clamp Levers – Threaded	CLDMC6-12-B	2

Application Overview

Purpose

- Fixture for press-fitting insertion nuts into various workpieces

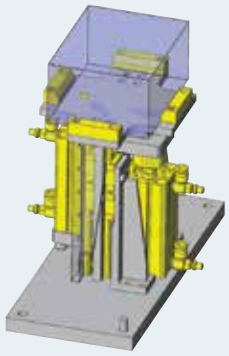
Target Workpiece

- Plastic cases
- Approximate Workpiece Size (mm): 45 W x 62 D x 10 H

IDEA NOTE

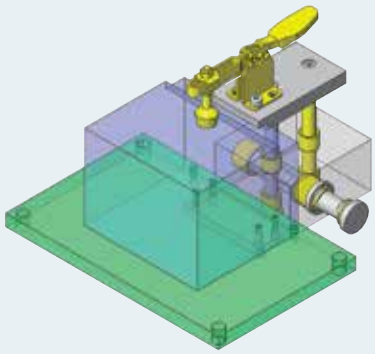
#IN172 Space-Saving and Long-Stroke Device

Speeding up with long stroke



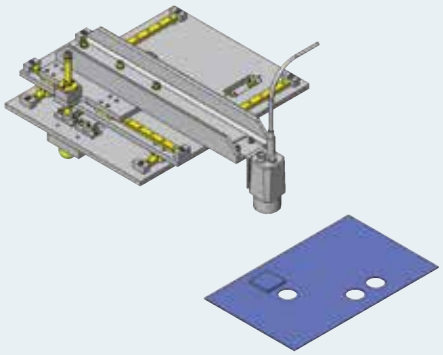
#IN137 Adjustable Height Clamping Mechanism

Simple switching by manual operation



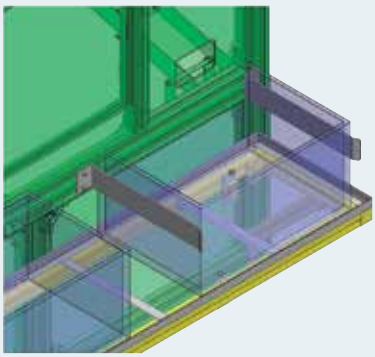
#IN275 Mult-Position Setup Device

Setup by means of shift lever groove



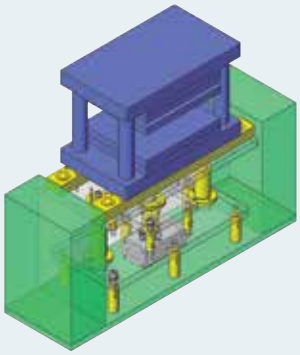
#IN51 Tray In-Position Confirmation Process

Workpiece detection with diagonally placed detection units



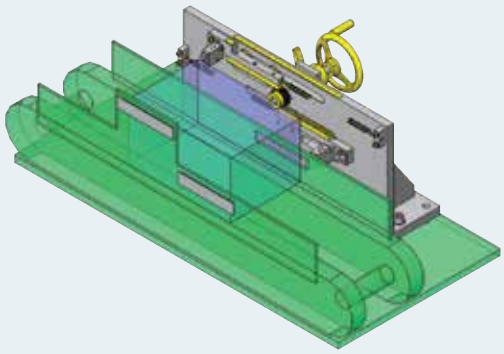
#IN108 Linear Movement Mechanism

Slowly strokes for a short distance



#IN301 Width Change Mechanism

Right and left movement synchronization using center of the workpiece as the reference



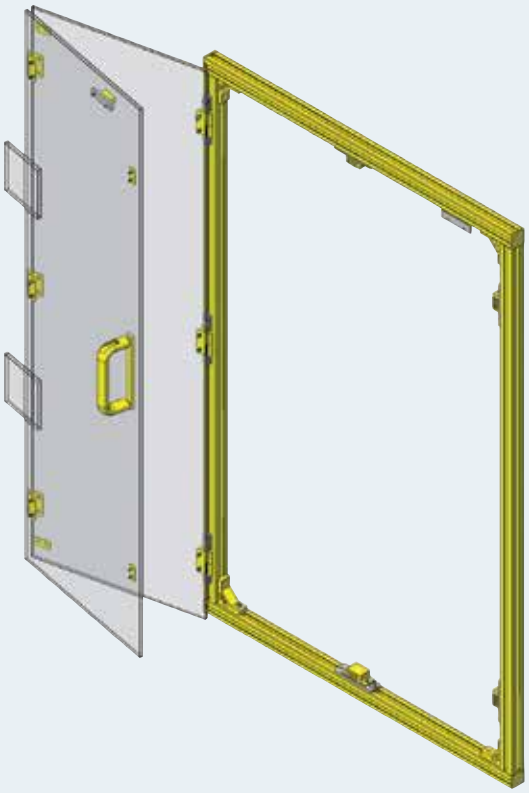
Application Example

Human and Workpiece Safety

#IN102

Aluminium Folding Door with Sensor

Simple construction and space saving with a folding door



MISUMI Part List

No.	Part Name	MISUMI Part Number	Qty
1	Aluminum Frames	NEFS6-3030-1090	2
2	Aluminum Frames	NEFS6-3030-734	2
3	Frame End Caps – 6 Series	HFC6-3030-S	4
4	Brackets	HBKTS6	4
5	Pre-Assembly Insertion Short Nuts	HNTT6-6	24
6	Magnet Catches with Ferrite Magnet	MGCE1	4
7	Door Limit Switches	BCWS1	1
8	Detachable Hinges (Stainless Steel)	SHHPSLC6-2	3
9	Handles – Oval, Standard Lengths	UADS132	1
10	Rectangular Washers & Nuts	FK2TS16-A150-P132	1
11	Cross Recessed Low Flat Head Screws	TSARA3-6	8
12	Flat Head Cap Screws (Pack)	SFB4-8	6
13	Flat Head Cap Screws (Pack)	SFB4-15	18
14	Thread Inserts	HLTS3-6	10
15	Detachable Hinges (Stainless Steel)	SHHPSRC6-2	3

Application Overview

Purpose

- A transparent door with a open / closed confirmation function

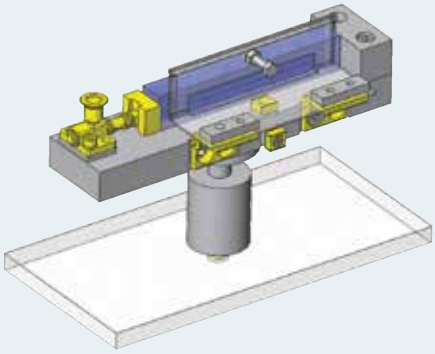
Points for Use

- A door limit switch is used to indicate if the door is open or closed.
- The door rotates 180° at the base and 180° at the center hinges. A magnetic catch is used to hold the door closed.

IDEA NOTE

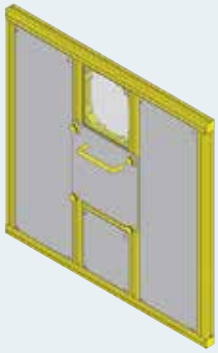
#IN4 Free Angle Soldering Fixture

Easy one-touch workpiece holding mechanism



#IN54 Removable Window Panel

Removable window panel with knobs and keyholes

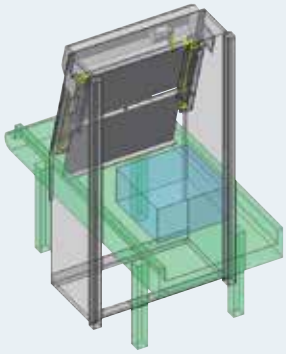


#IN87 Aluminum Extrusion Frame Door

Simple open / close detection structure

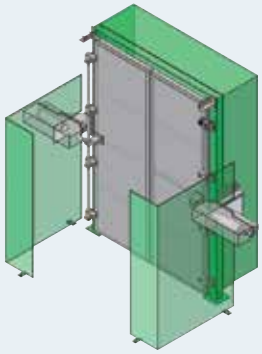
#IN85 Shutter Mechanism

A shutter utilizing pulley / belt + bevel gear



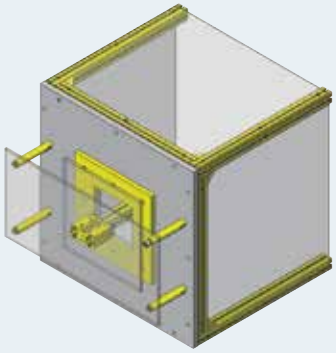
#IN91 Automated Door

A cylinder powered mechanism used to open a door

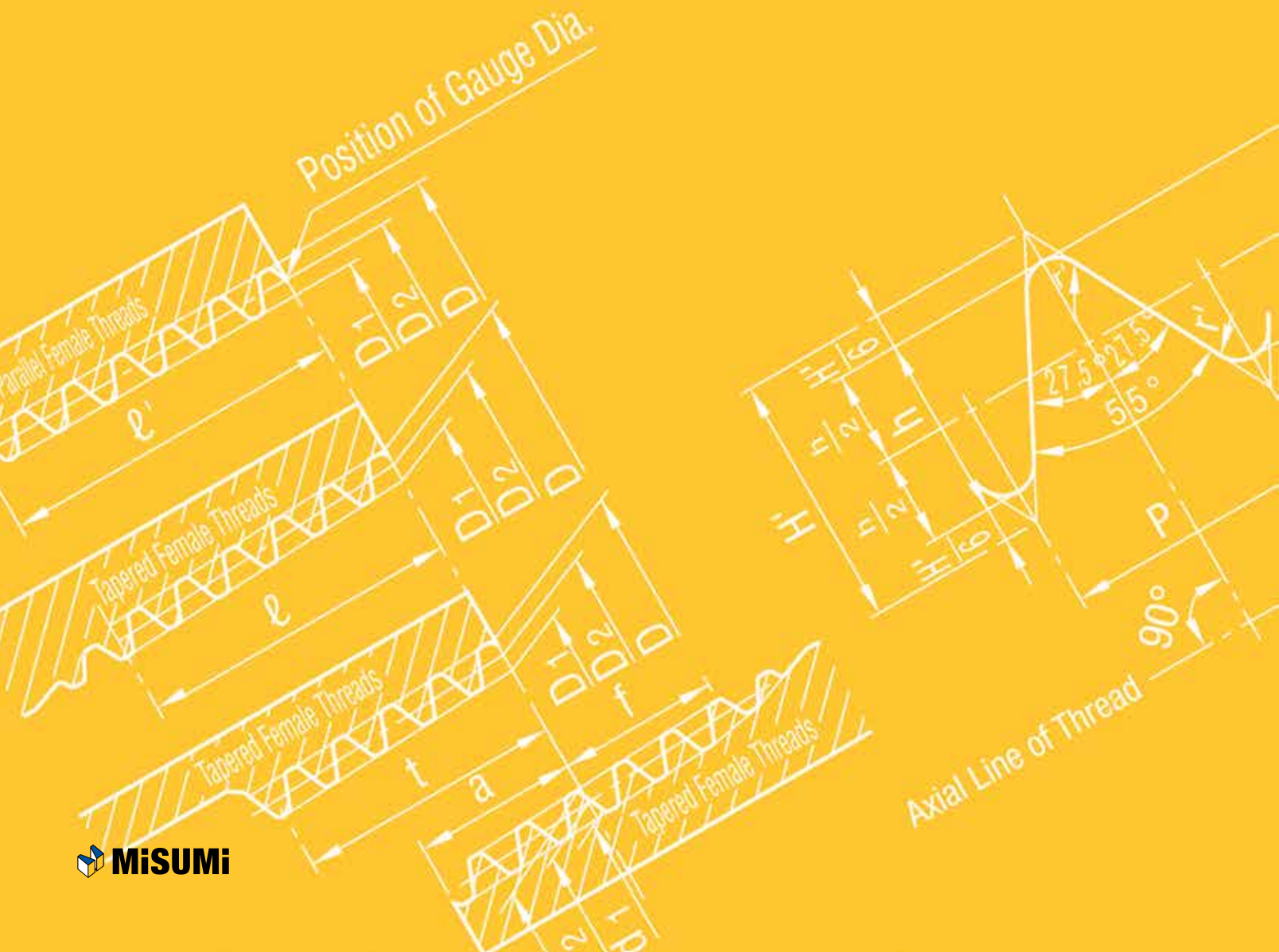


#IN104 Automated Ventilation Mechanism

Rapid Cooling Mechanism



MISUMI USA TECHNICAL DATA AT YOUR FINGERTIPS. This technical reference section contains information on tolerances, allowances, calculations, sizing and more.



MiSUMi

TECHNICAL DATA

Technical Data

Excerpt from JIS Z 8203(2000)

SI (International System of Units)

1. International System of Units (SI) and Usage

1-1. Scope of Application This standard specifies how to use the International System of Units(SI)and other international unitary systems, as well as units used in correlation with units from international systems, and other units which may be used.

1-2. Terms and Definitions Terminology used in this specification and definitions thereof are as follows.

(1) International System of Units(SI) Coherent system of units adopted and recommended by the International Committee on Weights and Measures. It contains base units and supplementary units, units derived from them and their integral exponents to the 10th power.

(2) SI Unit Generic term used to describe base units, supplementary units or derived units of the International System of Units(SI).

(3) 1 Base Unit Those units are given in **Table 1**.

(4) 2 Supplementary Units Those supplementary units are given in **Table 2**.

Table 1. Base Units

Base Quantity	Unit	Symbol	Definition
Length	Meter	m	A meter is the length of the path traveled by light in a vacuum during a time interval of $\frac{1}{299\ 792\ 458}$ of a second.
Mass	Kilogram	kg	A kilogram is a unit of mass(neither weight nor force), it is equal to the mass of the international prototype of the kilogram.
Time	Second	s	A second is the duration of 9 192 631 770 periods of radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom.
Current	Ampere	A	An ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 meter apart in a vacuum, would produce between these conductors a force equal to 2×10^{-7} Newton per meter of length.
Thermodynamic Temperature	Kelvin	K	Kelvin, a unit of thermodynamic temperature, is the fraction $\frac{1}{273.16}$ of the thermodynamic temperature of the triple point of water.
Amount of Substance	Mole	mol	A mole is the amount of substance of a system that contains as many elementary particles(1) or aggregation of elementary particles as there are atoms in 0.012 kilogram of carbon 12 and when the mole is used, the elementary particles must be specified.
Luminance Intensity	Candela	cd	A candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of $\frac{1}{683}$ watt per steradian.

Note(1) The elementary particles here must be atoms, molecules, ions, electrons or other particles.

Table 2. Supplementary Units

Base Quantity	Unit	Symbol	Definition
Plane Angle	Radian	rad	A radian is the plane angle between two radii of a circle that cuts off an arc on the circumference equal in length to the radius.
Solid Angle	Steradian	sr	A steradian is the solid angle which, having its vertex in the center of a sphere, cuts off an area of the surface of the sphere equal to that of a square with sides equal in length to the radius of the sphere.

(5)3 Derived Units The supplementary units algebraically expressed using mathematical symbols such as plus, minus, etc. The SI derived units with special names and symbols are given in Table 3.

Examples of SI Derived Units Expressed in Terms of Base Units

Base Quantity	Base Quantity	
	Name	Symbol
Area	Square	m^2
Volume	Cubic Meter	m^3
Velocity	Meter/Second	m/s
Acceleration	Meter/Second×2	m/s^2
Wave Number	Every Meter	m^{-1}
Density	Kilogram Every Cubic Meter	kg/m^3
Current Density	Ampere Every Square Meter	A/m^2
Magnetic Field Strength	Ampere Every Meter	A/m
Concentration (of Substance)	Mole Every Cubic Meter	mol/m^3
Specific Volume	Cubic Meter Every Kilogram	m^3/kg
Luminance	Candela Every Square Meter	cd/m^2

Table 3. SI Derived Units with Special Names and Symbols

Base Quantity	Base Quantity		Expression in Terms of Base Units or Supplementary Units, Supplementary Units or Other SI Units
	Name	Symbol	
Frequency	Hertz	Hz	1 Hz =1 s^{-1}
Force	Newton	N	1 N =1 $kg{\cdot}m/s^2$
Pressure, Stress	Pascal	Pa	1 Pa =1 N/m^2
Energy, Work, Heat Quantity	Joule	J	1 J =1 N·m
Work Rate, Process Rate, Power, Electric Power	Watt	W	1 W =1 J/s
Electric Charge, Quantity of Electricity	Coulomb	C	1 C =1 A·s
Electric Potential, Potential Difference, Voltage, Electromotive Force	Volts	V	1 V =1 J/C
Electrostatic Capacity, Capacitance	Farad	F	1 F =1 C/V
Electric Resistance	Ohm	Ω	1 Ω =1 V/A
Conductance	Siemens	S	1 S =1 Ω^{-1}
Magnetic Flux	Weber	Wb	1 Wb =1 V·s
Magnetic Flux Density	Tesla	T	1 T =1 Wb/m^2
Inductance	Henry	H	1 H =1 Wb/A
Celsius Temperature	Degree Celsius or Degree	℃	1 t℃ =(t+273.15)k
Luminous Flux	Lumen	lm	1 lm =1 cd·sr
Illuminance	Lux	lx	1 lx =1 lm/m^2
Radioactivity	Becquerel	Bq	1 Bq =1 s^{-1}
Absorbed Dose	Gray	Gy	1 Gy =1 J/kg
Dose Equivalent	Sievert	Sv	1 Sv =1 J/kg

1-3. Multiples of 10 of SI Units

(1)Prefix The multiples and the names and symbols of prefixes to express integer multiples of 10 of SI Units are shown in Table 4.

Table 4. Prefix

Multiples of Unit	Prefix		Multiples of Unit	Prefix		Multiples of Unit	Prefix	
	Name	Symbol		Name	Symbol		Name	Symbol
10^{18}	Exsa	E	10^{2}	Hecto	h	10^{-9}	Nano	n
10^{15}	Peta	P	10^{1}	Deca	da	10^{-12}	Pico	p
10^{12}	Tera	T	10^{-1}	Deci	d	10^{-15}	Femto	f
10^{9}	Giga	G	10^{-2}	Centi	c	10^{-18}	Atto	a
10^{6}	Mega	M	10^{-3}	Milli	m			
10^{3}	Kilo	k	10^{-6}	Micro	μ			

2. Conversion Tables for SI and Conventional Units

(The units enclosed by thick lines are the SI units.)

	N	lbf	kgf
Force	1	0.22481	$1.019\,72\times10^{-1}$
	4.448	1	0.4536
	9.806 65	2.205	1

	Pa·s	cP	Lb/ft.S
Viscosity	1	1×10^{3}	0.0672
	1×10^{-3}	1	0.000672
	14.88	1488	1

Note: $1P=1dyn\cdot s/cm^2=1g/cm\cdot s$
$1Pa\cdot s=1N\cdot s/m^2$, $1cP=1mPa\cdot s$

	Pa or N/m²	**MPa or N/mm²**	PSI (lbf/in²)	kgf/cm²
Stress	1	1×10^{-6}	0.000145	$1.019\,72\times10^{-5}$
	1×10^{6}	1	145	$1.019\,72\times10$
	6894.76	0.006894	1	0.0703
	$9.806\,65\times10^{4}$	$9.806\,65\times10^{-2}$	14.22	1

Note: $1Pa=1N/m^2$, $1MPa=1N/mm^2$

	m²/s	cSt	in²/s
Kinematic Viscosity	1	1×10^{-3}	1550.0031
	1×10^{-6}	1	0.00155
	0.000645	645.16	1

Note: $1St=1cm^2/s$, $1cSt=1mm^2/s$

	Pa	**kPa**	**MPa**	bar	kgf/cm²	PSI (lbf/in²)	mmH_2O	mmHg or Torr
Pressure	1	1×10^{-3}	1×10^{-6}	1×10^{-5}	$1.019\,72\times10^{-5}$	0.000145	$1.019\,72\times10^{-1}$	$7.500\,62\times10^{-3}$
	1×10^{3}	1	1×10^{-3}	1×10^{-2}	$1.019\,72\times10^{-2}$	0.145	$1.019\,72\times10^{2}$	$7.500\,62$
	1×10^{6}	1×10^{3}	1	1×10	$1.019\,72\times10$	145	$1.019\,72\times10^{5}$	$7.500\,62\times10^{3}$
	1×10^{5}	1×10^{2}	1×10^{-1}	1	1.019 72	14.5	$1.019\,72\times10^{4}$	$7.500\,62\times10^{2}$
	$9.806\,65\times10^{4}$	$9.806\,65\times10$	$9.806\,65\times10^{-2}$	$9.806\,65\times10^{-1}$	1	14.22	1×10^{4}	$7.355\,59\times10^{2}$
	6894.76	6.894	0.006894	0.06894	0.0703	1	703.07	51.715
	9.806 65	$9.806\,65\times10^{-3}$	$9.806\,65\times10^{-6}$	$9.806\,65\times10^{-5}$	1×10^{-4}	0.001422	1	$7.355\,59\times10^{-2}$
	$1.333\,22\times10^{2}$	$1.333\,22\times10^{-1}$	$1.333\,22\times10^{-4}$	$1.333\,22\times10^{-3}$	$1.359\,51\times10^{-3}$	0.01934	$1.359\,51\times10$	1

Note: $1Pa=1N/m^2$

	J	ft-lbs	kgf·m	kcal
Work, Energy, Heat Quantity	1	0.7376	$1.019\,72\times10^{-1}$	$2.388\,89\times10^{-4}$
	1.356	1	0.1391	0.0003
	9.806 65	7.188	1	$2.342\,70\times10^{-3}$
	$4.186\,05\times10^{3}$	3088	$4.268\,58\times10^{2}$	1

Note: $1Pa=1N/m^2$, $1MPa=1N/mm^2$

	W	fl-lbs	hp	kcal/h
Power Heat Flow	1	0.7376	0.00136	$8.600\,0\times10^{-1}$
	1.356	1	0.001843	1.166
	735.5	542.5	1	632.4
	1.162 79	0.00136	0.001581	1

Note: Note1W=1J/s,

	W/(m·K)	kcal/(h·m·°C)
Thermal Conductivity	1	$8.600\,0\times10^{-1}$
	1.162 79	1

	W/(m²·K)	kcal/(h·m²·°C)
Coefficient of Heat Transfer	1	$8.600\,0\times10^{-1}$
	1.162 79	1

	J/(kg·K)	kcal/(kg·°C) cal/(g·°C)
Specific Heat	1	$2.388\,89\times10^{-4}$
	$4.186\,05\times10^{3}$	1

Technical Data

Excerpts from JIS Z 8202

Quantifiers, Unit Symbols, Chemical Symbols and Symbols of Elements Calculation of Cubic Volume and Weight / Physical Properties of Materials

■ Greek Symbols

Uppercase	Lowercase	Pronunciation	Conventional Usage
A	α	alpha	Angle, Coefficient
B	β	beta	Angle, Coefficient
Γ	γ	gamma	Angle, Weight Per Unit Area, Relationship (Uppercase)
Δ	δ	delta	Small Change, Density, Displacement
E	ε	epsilon	Small Amount, Distortion
Z	ζ	zeta	Variable
H	η	eta	Variable
Θ	θ	theta	Angle, Temperature, Time
I	ι	iota	
K	κ	kappa	Radius of Gyration
Λ	λ	lambda	Wavelength, Characteristic Value
M	μ	mu	Friction Coefficient 10^{-6}(Micro)
N	ν	nu	Frequency
Ξ	ξ	xi	Variable
O	ο	omicron	
Π	π	pi	Circle Ratio (3.14159...) Angle Symbol of Product (Uppercase)
P	ρ	rho	Radius, Density
Σ	σ	sigma	Stress, Standard Deviation Summation (Uppercase)
T	τ	tau	Time Constant, Time, Torque
Υ	υ	upsilon	
Φ	φ, φ	phi	Angle, Function, Diameter
X	χ	chi	
Ψ	ψ	psi	Angle, Function
Ω	ω	omega	Angular Verocity=2πf Ohm:Unit of Electric Resistance (Uppercase)

Reference unless otherwise specified, lowercase letters are the norm.

■ Characteristics of Materials

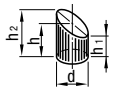
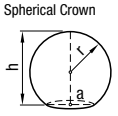
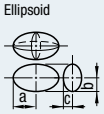
Material	Specific Gravity	Thermal Expansion Coefficient	Young's Modulus
		×10^{-6}/°C	{Kgf/mm^2}
Mild Steel	7.85	11.7	21000
NAK80	7.8	12.5	20500
SKD11	7.85	11.7	21000
SKD61	7.75	10.8	21000
SKH51	8.2	10.1	22300
Carbide V30	14.1	6.0	56000
Carbide V40	13.9	6.0	54000
Cast Iron	7.3	9.2~11.8	7500~10500
SUS304	8.0	17.3	19700
SUS440C	7.78	10.2	20400
Oxygen Free Coppers C1020	8.9	17.6	11700
6/4 Brass C2801	8.4	20.8	10300
Beryllium Copper C1720	8.3	17.1	13000
Aluminum A1100	2.7	23.6	6900
Duralumin A7075	2.8	23.6	7200
Titanium	4.5	8.4	10600

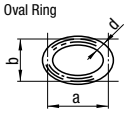
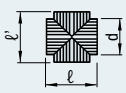
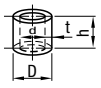
■ Name of Elements and Atomic Symbols

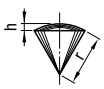
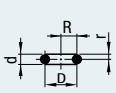
Atomic Number	Name	Symbol	Atomic Number	Name	Symbol
1	Hydrogen	H	53	Iodine	I
2	Helium	He	54	Xenon	Xe
3	Lithium	Li	55	Cesium	Cs
4	Beryllium	Be	56	Barium	Ba
5	Boron	B	57	Lanthanum	La
6	Carbon	C	58	Cerium	Ce
7	Nitrogen	N	59	Praseodymium	Pr
8	Oxygen	O	60	Neodymium	Nd
9	Fluorine	F	61	Promethium	Pm
10	Neon	Ne	62	Samarium	Sm
11	Sodium	Na	63	Europium	Eu
12	Magnesium	Mg	64	Gadolinium	Gd
13	Aluminum	Al	65	Terbium	Tb
14	Silicon	Si	66	Dysprosium	Dy
15	Phosphorous	P	67	Holmium	Ho
16	Sulfur	S	68	Erbium	Er
17	Chlorine	Cl	69	Thulium	Tm
18	Argon	Ar	70	Ytterbium	Yb
19	Potassium	K	71	Lutetium	Lu
20	Calcium	Ca	72	Hafnium	Hf
21	Scandium	Sc	73	Tantalum	Ta
22	Titanium	Ti	74	Tungsten	W
23	Vanadium	V	75	Rhenium	Re
24	Chromium	Cr	76	Osmium	Os
25	Manganese	Mn	77	Iridium	Ir
26	Iron	Fe	78	Platinum	Pt
27	Cobalt	Co	79	Gold	Au
28	Nickel	Ni	80	Mercury	Hg
29	Copper	Cu	81	Thallium	Tl
30	Zinc	Zn	82	Lead	Pb
31	Gallium	Ga	83	Bismuth	Bi
32	Germanium	Ge	84	Polonium	Po
33	Arsenic	As	85	Astatine	At
34	Selenium	Se	86	Radon	Rn
35	Bromine	Br	87	Francium	Fr
36	Krypton	Kr	88	Radium	Ra
37	Rubidium	Rb	89	Actinium	Ac
38	Strontium	Sr	90	Thorium	Th
39	Yttrium	Y	91	Protactinium	Pa
40	Zirconium	Zr	92	Uranium	U
41	Niobium	Nb	93	Neptunium	Np
42	Molybdenum	Mo	94	Plutonium	Pu
43	Technetium	Tc	95	Americium	Am
44	Ruthenium	R	96	Curium	Cm
45	Rhodium	Rh	97	Berkelium	Bk
46	Palladium	Pd	98	Californium	Cf
47	Silver	Ag	99	Einsteinium	Es
48	Cadmium	Cd	100	Fermium	Fm
49	Indium	In	101	Mendelevium	Md
50	Tin	Sn	102	Nobelium	No
51	Antimony	Sb	103	Lawrencium	Lr
52	Tellurium	T			

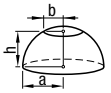
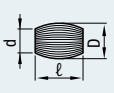
Reference This table is based on Appendix A (Names and Symbols of Elements)of ISO 31/8-1980 (Amounts and Units of Physical Chemistry and Molecular Physics) and Appendix C (Names and Symbols of Radionuclides) of ISO 31/9-1980 (Amounts and Units of Atomic Physics and Nuclear Physics).

■ How to Calculate the Volume

Solid	Volume V
Turncated Cylinder 	$V=\frac{\pi}{4}d^2h$ $=\frac{\pi}{4}d^2\left(\frac{h_1+h_2}{2}\right)$
Pyramid 	$V=\frac{h}{3}A=\frac{h}{6}arn$ A=Area of Base r=Radius of inscribed circle a=Length of a side of a regular polygon n=Number of the sides of a regular polygon
Spherical Crown 	$V=\frac{\pi h^2}{3}(3r-h)$ $=\frac{\pi h}{6}(3a^2+h^2)$ a is the radius.
Ellipsoid 	$V=\frac{4}{3}\pi abc$ In case of spheroid (b=c) $V=\frac{4}{3}\pi ab^2$

Solid	Volume V
Oval Ring 	$V=\frac{\pi^2}{4}d^2\frac{\sqrt{a^2+b^2}}{2}$
Cross Cylinder 	$V=\frac{\pi}{4}d^2(\ell+\ell'-\frac{d}{3})$
Hollow (Cylinder) 	$V=\frac{\pi}{4}h(D^2-d^2)$ $=\pi th(D-t)$ $=\pi th(d+t)$
Turncated Pyramid 	$V=\frac{h}{3}(A+a+\sqrt{Aa})$ A.a=Area of both ends

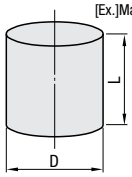
Solid	Volume V
Spherical Segment 	$V=\frac{2}{3}\pi r^2h$ $=2.0944r^2h$
Torus 	$V=2\pi^2Rr^2$ $=19.739Rr^2$ $=\frac{\pi^2}{4}Dd^2$ $=2.4674Dd^2$
Circular Cone 	$V=\frac{\pi}{3}r^2h$ $=1.0472r^2h$
Sphere 	$V=\frac{4}{3}\pi r^3=4.1888r^3$ $=\frac{\pi}{6}d^3=0.5236d^3$

Solid	Volume V
Spherical Belt 	$V=\frac{\pi h}{6}(3a^2+3b^2+h^2)$
Barrel 	When the circumference makes a curve equal to the circular arc, $V=\frac{\pi\ell}{12}(2D^2+d^2)$ When the circumference makes a curve equal to a parabolic line, $V=0.209\ell(2D^2Dd+1/4d^2)$

■ How to Calculate the Weight

Weight W[g]= Volume[cm^3]× Specific Gravity

[Ex.]Material:Mild Steel



D=Ø16 L=50mm the weight is:

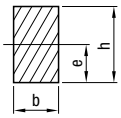
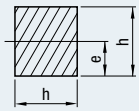
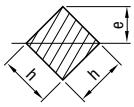
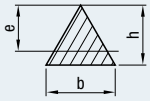
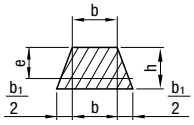
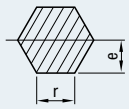
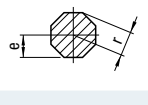
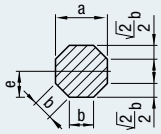
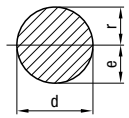
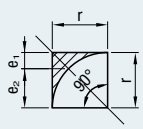
The specific gravity of W= $\frac{\pi}{4}D^2\times L\times W$

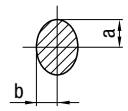
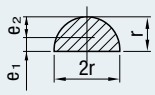
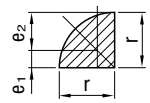
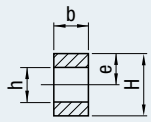
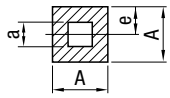
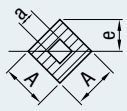
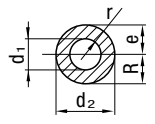
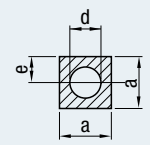
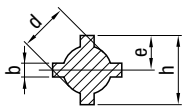
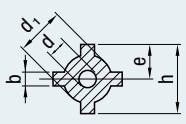
$=\frac{\pi}{4}\times1.6^2\times5\times7.85$

≈79[g]

Technical Data

Calculation of Area, Center of Gravity and Geometrical Moment of Inertia

Cross Section	A	e	I	Z=I/e
	bh	$\frac{h}{2}$	$\frac{bh^3}{12}$	$\frac{bh^2}{6}$
	h^2	$\frac{h}{2}$	$\frac{h^4}{12}$	$\frac{h^3}{6}$
	h^2	$\frac{h}{2}\sqrt{2}$	$\frac{h^4}{12}$	$0.1179h^3=\frac{\sqrt{2}}{12}h^3$
	$\frac{bh}{2}$	$\frac{2}{3}h$	$\frac{bh^3}{36}$	$\frac{bh^2}{24}$
	$(2b+b_1)\frac{h}{2}$	$\frac{1}{3}\times\frac{3b+2b_1}{2b+b_1}h$	$\frac{6b^2+6bb_1+b_1^2}{36(2b+b_1)}h^3$	$\frac{6b^2+6bb_1+b_1^2}{12(3b+2b_1)}h^2$
	$\frac{3\sqrt{3}}{2}r^2$ $=2.598r^2$	$\sqrt{\frac{3}{4}}r=0.886r$ r	$\frac{5\sqrt{3}}{16}r^4=0.5413r^4$	$\frac{5}{8}r^3$ $\frac{5\sqrt{3}}{16}r^3=0.5413r^3$
	$2.828r^2$	$0.924r^2$	$\frac{1+2\sqrt{2}}{6}r^4$ $=0.6381r^4$	$0.6906r^3$
	$0.8284a^2$	$b=\frac{a}{1+\sqrt{2}}$ $=0.4142a$	$0.0547a^4$	$0.1095a^3$
	$\pi r^2=\frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64}=\frac{\pi r^4}{4}$ $=0.0491d^4$ $\approx 0.05d^4$ $=0.7854r^4$	$\frac{\pi d^3}{32}=\frac{\pi r^3}{4}$ $=0.0982d^3$ $\approx 0.1d^3$ $=0.7854r^3$
	$r^2\left(1-\frac{\pi}{4}\right)$ $=0.2146r^2$	$e_1=0.2234r$ $e_2=0.7766r$	$0.0075r^4$	$\frac{0.0075r^4}{e_2}$ $=0.00966r^3$ $\approx 0.01r^3$

Cross Section	A	e	I	Z=I/e
	πab	a	$\frac{\pi}{4}ba^3=0.7854\,ba^3$	$\frac{\pi}{4}ba^2=0.7854\,ba^2$
	$\frac{\pi}{2}r^2$	$e_1=0.4244r$ $e_2=0.5756r$	$\left(\frac{\pi}{8}-\frac{8}{9\pi}\right)r^4$ $=0.1098r^4$	$Z_1=0.2587r^3$ $Z_2=0.1908r^3$
	$\frac{\pi}{4}r^2$	$e_1=0.4244r$ $e_2=0.5756r$	$0.055r^4$	$Z_1=0.1296r^3$ $Z_2=0.0956r^3$
	$b(H-h)$	$\frac{H}{2}$	$\frac{b}{12}(H^3-h^3)$	$\frac{b}{6H}(H^3-h^3)$
	A^2-a^2	$\frac{A}{2}$	$\frac{A^4-a^4}{12}$	$\frac{1}{6}\frac{A^4-a^4}{A}$
	A^2-a^2	$\frac{A}{2}\sqrt{2}$	$\frac{A^4-a^4}{12}$	$\frac{A^4-a^4}{12A}\sqrt{2}$ $=\frac{0.1179(A^4-a^4)}{A}$
	$\frac{\pi}{4}(d_2^2-d_1^2)$	$\frac{d_2}{2}$	$\frac{\pi}{64}(d_2^4-d_1^4)$ $=\frac{\pi}{4}(R^4-r^4)$	$\frac{\pi}{32}\left(\frac{d_2^4-d_1^4}{d_2}\right)$ $=\frac{\pi}{4}\times\frac{R^4-r^4}{R}$
	$a^2-\frac{\pi d^2}{4}$	$\frac{a}{2}$	$\frac{1}{12}\left(a^4-\frac{3\pi}{16}d^4\right)$	$\frac{1}{6a}\left(a^4-\frac{3\pi}{16}d^4\right)$
	$2b(h-d)$ $+\frac{\pi}{4}d^2$	$\frac{h}{2}$	$\frac{1}{12}\left\{\frac{3\pi}{16}d^4+b(h^3-d^3)+b^3(h-d)\right\}$	$\frac{1}{6h}\left\{\frac{3\pi}{16}d^4+b(h^3-d^3)+b^3(h-d)\right\}$
	$2b(h-d)+$ $\frac{\pi}{4}(d_1^2-d^2)$	$\frac{h}{2}$	$\frac{1}{12}\left\{\frac{3\pi}{16}(d_1^4-d^4)+b(h^3-d_1^3)+b^3(h-d_1)\right\}$	$\frac{1}{6h}\left\{\frac{3\pi}{16}(d_1^4-d^4)+b(h^3-d_1^3)+b^3(h-d_1)\right\}$

A : Sectional Area
e : Distance of Center of Gravity
I : Geometrical Moment of Inertia
Z=I/e : Cross Section Coefficient

Technical Data

Roughness Ranges by Various Processes

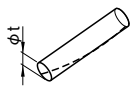
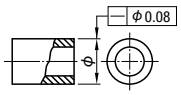
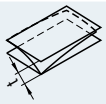
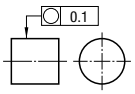
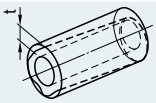
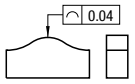
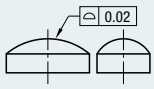
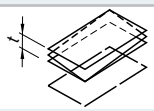
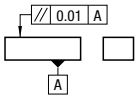
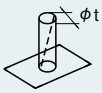
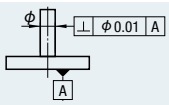
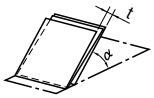
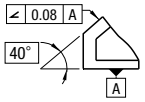
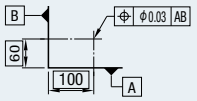
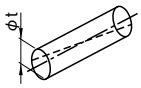
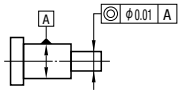
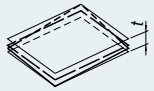
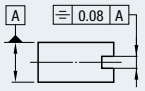
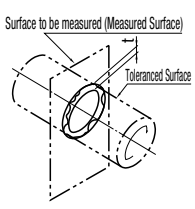
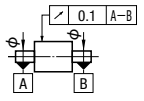
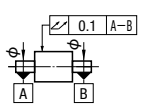
Arithmetic Average Roughness Ra		0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50	100
Traditional Roughness Notations	Maximum Height Rmax.	0.1 –S	0.2 –S	0.4 –S	0.8 –S	1.6 –S	3.2 –S	6.3 –S	12.5 –S	25 –S	50 –S	100 –S	200 –S	400 –S
	Reference Value of Standard Length (mm)	0.25				0.8			2.5		8		25	
	Finish Symbol	▽▽▽▽				▽▽▽			▽▽		▽		–	
Processes	Forging								Precise					
	Casting								Precise					
	Die Casting													
	Hot Rolling													
	Cold Rolling													
	Drawing													
	Extruding													
	Tumbling													
	Sand Blasting													
	Rolling													
	Face Milling						Precise							
	Planing													
	Carving / Slotting													
	Milling						Precise							
	Precision Boring													
	Filing						Precise							
	Round Turning			Precise			Fine		Medium		Course			
	Boring						Precise							
	Drilling													
	Reaming					Precise								
	Broaching					Precise								
	Shaping													
	Milling			Precise	Fine		Medium		Course					
	Honing			Precise										
	Stone Lapping	Precise												
	Buff Finishing		Precise											
	Fine Sanding			Precise										
	Lapping	Precise												
	Hydro Honing			Precise										
	Burnishing													
	Roller Finishing													
	Sinker EDM													
	Wire EDM													
	Chemical Polishing						Precise							
	Electropolishing		Precise											

Technical Data

Excerpts from JIS B0021(1984)

Geometric Tolerance Indications

■ Geometric Tolerances and Symbols

Tolerance Types		Symbols	Definition of Tolerance Zones		Illustrated Examples and Interpretations	
Form Tolerance	Straightness	—		If the tolerance value is preceded by a Ø symbol, this tolerance zone is the range within a cylinder of diameter t.		If a tolerance frame is connected to a dimension that indicates the diameter of a cylinder, the axis line of the cylinder shall be contained within a cylinder of 0.08mm diameter.
	Flatness	▱		The tolerance zone is the area between two parallel planes separated by distance t.		This surface shall be contained within two parallel planes separated by 0.08mm.
	Circularity	○		The tolerance zone in the subject plane is the area between two concentric circles separated by distance t.		The circumference of arbitrary axis perpendicular cross sections shall be contained between two concentric circles separated by 0.1mm on the same plane.
	Cylindricity	⌭		The tolerance zone is the range contained between two coaxial cylinder surfaces separated by distance t.		The subject surface shall be contained between two coaxial cylinder surfaces separated by 0.1mm.
	Profile of Line	⌒		The tolerance zone is the range contained between the two enveloping lines formed by a circle with diameter t with the center located on the theoretically correct profile curve.		On arbitrary cross-sections parallel to the projection plane, the subject profile shall be contained between the two envelope lines formed by a 0.04mm diameter circle with the center located on the theoretically correct profile curve.
	Profile of Surface	⌓		The tolerance zone is the range contained between the two enveloping surfaces formed by a sphere with diameter t with the center located on the theoretically correct profile surface.		The subject surface shall be contained between the two enveloping surfaces formed by a 0.02mm diameter sphere with the center located on the surface containing the theoretically correct profile.
Orientation Tolerance	Parallelism	//		The tolerance zone is the range contained between two planes parallel to the datum plane separated by distance t.		The surface indicated by the arrow leader shall be contained between two planes parallel to the datum plane A separated by 0.01mm in the direction of the arrow leader.
	Perpendicularity Tolerance	⊥		If the tolerance value is preceded by a Ø symbol, the tolerance zone is the range contained within a cylinder of diameter t perpendicular to the datum plane.		The axis of the cylinder indicated by the arrow leader shall be contained within a 0.01mm cylinder perpendicular to the datum plane A.
	Angularity	∠		The tolerance zone is the range contained between two parallel planes inclined at a specified angle to the datum plane and separated from each other by distance t.		The surface indicated by the arrow leader shall be contained between two parallel planes inclined theoretically exactly by 40 degrees to the datum plane A, and separated by 0.08mm in the direction of the arrow of the leader.
Positional Tolerance	Positional Tolerance	⌖		The tolerance zone is the range contained within a circle or sphere of diameter t with its center located at theoretically true location of the subject point (True Position).		The point indicated by the arrow leader shall be contained within a 0.03mm diameter circle with its center located at the true location 60mm from the datum line A, and 100mm from the datum line B.
	Coaxiality or Concentricity	◎		If the tolerance value is preceded by a Ø symbol, the tolerance zone is the range within a cylinder of diameter t with axis coinciding matching the datum axis line.		The axis of the cylinder indicated by the arrow leader shall be contained within a cylinder of diameter 0.01mm with axis coinciding the datum axis line A.
	Symmetry	⌯		The tolerance zone is the range contained between two parallel planes separated by distance t and located symmetrically with relation to the datum plane.		The central plane indicated by the arrow leader shall be contained between two parallel planes separated by 0.08mm and located symmetrically in relation to the datum plane A.
Runout Tolerance	Runout Tolerance	↗		The tolerance zone is an arbitrary surface perpendicular to the datum axis between two concentric cylinders with centers common with the datum axis, separated in radial direction by the distance t.		The radial run-out of the cylinder surface indicated by the arrow leader shall not exceed 0.1mm on any measuring plane perpendicular to the datum axis line when the cylinder is rotated about the datum axis A-B.
	Total Runout	⌰		The tolerance zone is between two concentric cylinders with centers common with the datum axis, separated in radial direction by distance t.		The total radial runout of the cylinder surface indicated by the arrow leader shall not exceed 0.1mm at any point on the cylinder surface when the cylinder is rotated about the datum axis A-B.

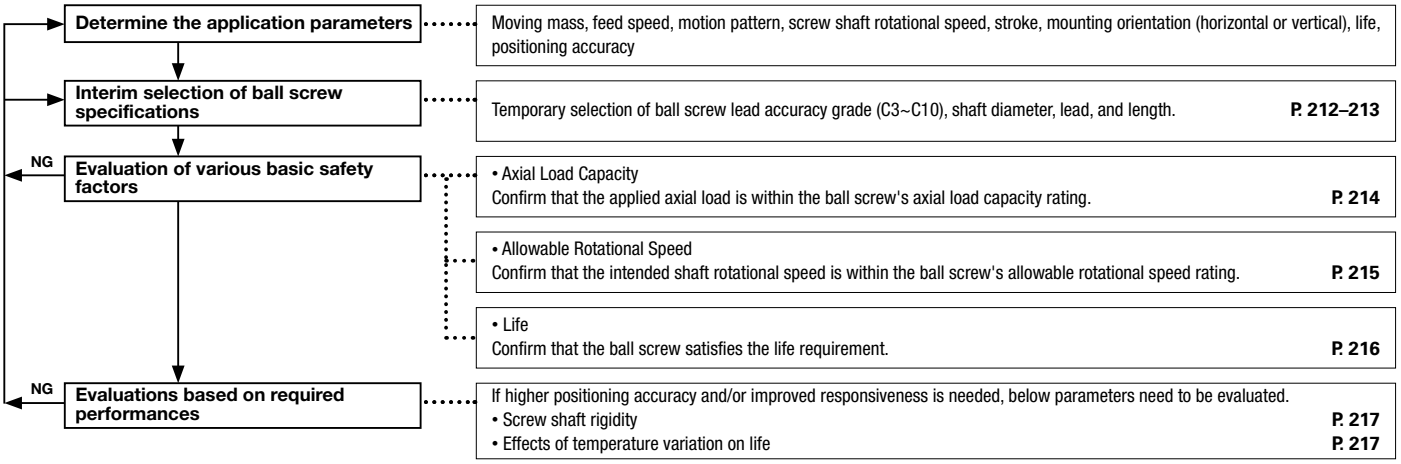
The lines used in the Tolerance Zone definitions mean the following.
Thick solid or broken line: Shape Thin dash-dot line: Center line Thick dash-dot line: Datum Thin alternating long and two short dashed line: Supplementary projection plane or cross section plane
Thin solid or broken line: Tolerance range Thick alternating long and two short dashed line: Projection of shape onto supplementary plane or cross section plane

Technical Data

Selection of Ball Screws 1

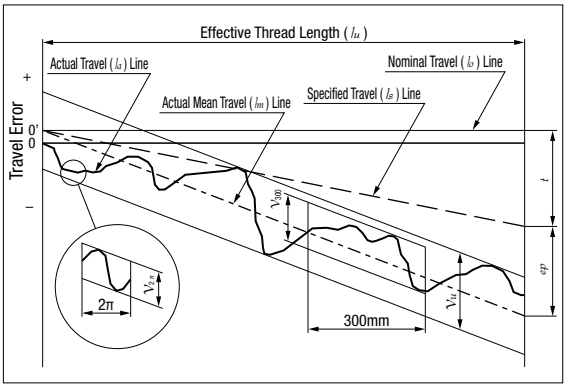
1. Ball Screw Selection Procedure

Basic ball screw selection procedure and required evaluation items are shown below.



2. Ball Screw Lead Accuracy

Ball screw lead accuracy is defined by JIS Standards property parameters (ep, vu, v300, v2π).
Parameter definitions and allowable values are shown below.
In general, a ball screw lead accuracy grade is selected by evaluating if the Actual Mean Travel Error of a candidate is within the allowable positioning error.



Terms	Symbols	Meaning
Actual Mean Travel Error	ep	A value that is Specified Travel subtracted from Actual Mean Travel.
Variation		The maximum difference of the actual travel contained between two lines drawn parallel to the actual mean travel, and is defined by three parameters below.
	v_u	Variation for the effective thread length of screw shaft.
	$v300$	Variation for an arbitrarily taken length of 300mm within the effective thread length of screw shaft.
	$v2\pi$	Variation for an arbitrary one revolution (2πrad) taken within the effective thread length of screw shaft.
Specified Travel	l_s	Axial travel compensated for temperature rise and loading conditions, in relation to the Nominal Travel (Lead).
Specified Travel Target Value	t	A value that is Nominal Travel subtracted from Specified Travel, over the effective thread length. This value is set to compensate for possible screw shaft expansion and contraction due to temperature changes and applied loads. The value is to be determined based on experiments or experiences.
Actual Travel	l_a	Actually measured travel distance
Actual Mean Travel	l_m	A straight line representing the actual travel trend. A straight line obtained by the least-squares method or other approximation methods from the curve representing the actual travel.

■ **Table 1. Positioning Screw (C Class) Actual Mean Travel Error (±ep) and Variation (u) allowances** Unit : μm

Thread Effective Length (mm)		Accuracy Grade			
		C3		C5	
Over	or Less	Actual Mean Travel Error	Variation	Actual Mean Travel Error	Variation
	315	12	8	23	18
315	400	13	10	25	20
400	500	15	10	27	20
500	630	16	12	30	23
630	800	18	13	35	25
800	1000	21	15	40	27
1000	1250	24	16	46	30
1250	1600	29	18	54	35

■ **Table 2. Positioning Screws (C Class) variation per 300mm (300) Variation per rotation (2π) standard values** Unit : μm

Accuracy Grade	C3		C5	
Parameters	V300	V2π	V300	V2π
Standard Values	8	6	18	8

■ **Table 3. Transfer Screw (Ct Class) variation per 300mm (300) Standards** Unit : μm

Accuracy Grade	Ct7	Ct10
V300	52	210

Actual Mean Travel Error (ep) for Transfer Screws (Ct Class) is calculated as ep=2·Lu/300·V300

3. Axial Clearances of Ball Screws

Axial clearance does not affect positioning accuracy if the feed is unidirectional, but will generate backlash and negatively affect on positioning accuracy if the direction or the axial load is reversed.

■ **Table 4. Axial Clearances of Rolled Ball Screws**

Types	Prod. Example	Screw Shaft Dia.	Lead	Axial Clearance (mm)
Standard Nut Accuracy Grade C7	BSST	8	2	0.03 or less
		10	4	
		12	4	
		15	5	
			10	
			20	
		20	5	
			10	0.05 or less
			20	0.03 or less
		25	5	
			10	0.07 or less
Standard Nut Accuracy Grade C10	BSSZ BSSR	8	2	0.05 or less
			4	
		10	2	
			4	
			10	
		12	4	
			10	
		14	5	
		15	5	0.10 or less
			10	
			20	
		20	5	
			10	0.15 or less
			20	0.10 or less
		25	5	
			10	0.20 or less
			25	0.12 or less
		28	6	0.10 or less
		32	10	0.20 or less
			32	0.15 or less
Compact Nut Accuracy Grade C10	BSSC	8	2	0.05 or less
		10	2	
		12	4	
		15	5	0.10 or less
			10	
		20	5	
			10	
		25	5	
Block Nut Accuracy Grade C10	BSBR	15	5	0.10 or less
		20		
		25		
		15	10	
		20		
		25		

■ **Table 5. Axial Clearances of Precision Ball Screw**

Types	Prod. Example	Screw Shaft Dia.	Lead	Axial Clearance (mm)
Standard Nut Accuracy Grade C3	BSX	6	1	0 (Preloaded)
		8	1	
			2	
		10	2	
		12	2	
			5	
		15	5	
Standard Nut Accuracy Grade C5	BSS (BSL)	8	2	0.005 or less
		10	2	
			4	
			10	
		12	2	
			4	
			5	
			10	
		15	5	
			10	
			20	
			40	0.010 or less
		20	5	0.005 or less
			10	
			20	
			40	
		25	5	
			10	
			20	
Standard Nut Accuracy Grade C7	BSSE	8	2	0.030 or less
		10	2	
			4	
		12	2	
			5	
			10	
		15	5	
			10	
			20	
		20	5	
			10	
			20	
		25	10	
			20	

Selection Example of Lead Accuracy

<Requirements>
- Ball screw diameter Ø15, lead 20
- Stroke 720mm
- Positioning accuracy ±0.05mm / 720mm

<Selection Details>
Select an appropriate lead accuracy grade based on the application requirements.

(1) Evaluating the screw thread length
Stroke+Nut Length+Margin=720+62+60=842
*The Margin shown above is an overrun buffer, and normally determined as 1.5~2 times the screw lead.
Lead 20 x 1.5 x 2 (both ends)=60

(2) Evaluating the lead accuracy
P. 212 Table 1. is referenced and an Actual Mean Travel Error ±ep for 842mm ball screw thread.
C3 · · · ±0.021mm / 800~1000mm
C5 · · · ±0.040mm / 800~1000mm

(3) Determining the lead accuracy
It can be determined that a C5 grade (±0.040 / 800~1000mm) ball screw can satisfy the required positioning accuracy of ±0.05 / 720mm.

Selection Example of Axial Clearance

<Requirements>
- Ball screw diameter Ø15, lead 5.
- Allowable backlash ±0.01mm

<Selection Details>
From Table 5., it can be determined that C5 grade with 0.005mm or less axial clearance satisfies the allowable backlash amount of 0.01mm for the Ø15 group.

Technical Data

Selection of Ball Screws 2

4. Allowable Axial Load

Allowable Axial Load is a load with a safety margin built-in against a shaft bucking load.

Axial load that applies to a ball screw needs to be less than Allowable Maximum Axial Load.

Allowable Axial Load can be obtained by the following formula.

Additionally, approximate Allowable Axial Load can be obtained from Table 1. Allowable Axial Load Graph.

Allowable Axial Load (P)

$$P = \frac{n\pi^2 EI}{\ell^2}\alpha = m\frac{d^4}{\ell^2}\times 10^4 (N)$$

Where:

P: Allowable Axial Load (N)

ℓ: Distance between Points of Buckling Load (mm)

E: Young's Modulus (2.06×10^5N/mm^2)

I: Min. Geometrical Moment of Inertia of Across Root Thread Area (mm^4)

$$I = \frac{\pi}{64} d^4$$

d : Thread Root Diameter (mm)

n, m : Coefficient Determined by Method of Screw Support

Method of Screw Support	n	m
Support – Support	1	5
Fixed – Support	2	10
Fixed – Fixed	4	19.9
Fixed – Free	0.25	1.2

α : Safety Factor = 0.5

For higher safety, a higher safety factor should be required.

Allowable Axial Load Calculation Example

Find the Allowable Axial Load for Figure 1.

<How to Use>

- Thread shaft diameter Ø15, Lead 5
- Mounting method Fixed – Support
- Distance between Points of Buckling Load ℓ_1 820mm
- Screw Shaft Root Diameter d 12.5

<Calculations>

g=15.1 since the mounting method is Fixed – Supported, the Allowable Rotational Speed (Nc) is,

$$P = m\frac{d^4}{\ell^2}\times10^4 = 10\times\frac{12.5^4}{820^2}\times10^4 = 3630(N)$$

Therefore, the rotational speed will need to be 3024min^{-1} or less.

Table 1.

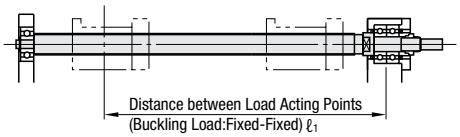
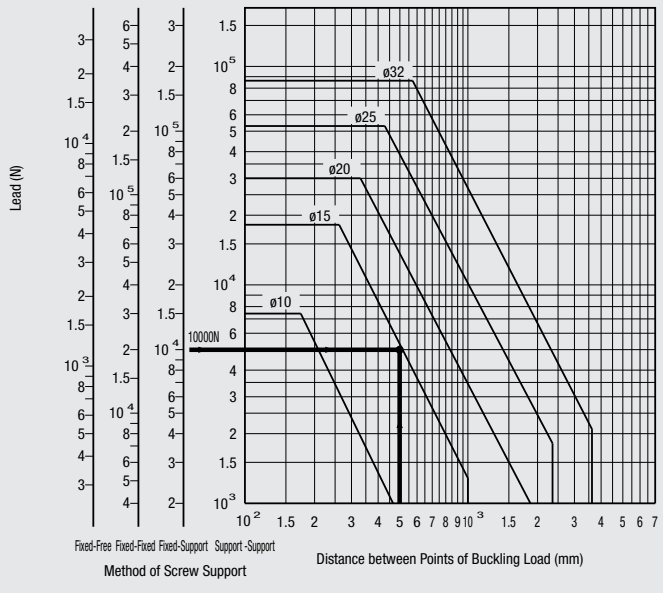


Figure 1. Allowable Axial Load Curve



Screw Shaft Dia. Calculation Example

<Requirements>

- Distance between Points of Buckling Load 500mm
- Mounting method Fixed – Support
- the max. axial load 10000N

<Calculations>

(1) Find the intersection between a distance of 500mm between load acting points and the axial load of 10000daN (from the fixed-support graduation). Figure 1.

(2) Read the shaft diameter of the diagonal line nearest to the intersection on the outside. The shaft diameter can be a min. 15 mm.

5. Allowable Rotational Speed

Ball screw rotational speed is determined by required feed speed and the given screw lead, and needs to be less than the Allowable Maximum Rotational Speed.

Ball screw rotational speed is evaluated based on the shaft's critical speed and ball recirculation speed limitation DmN value.

5-1. Critical Speed

Allowable rotational speed is defined as a speed 80% or less of the Critical Speed where the rotational speed coincides with a natural resonant frequency of the screw shaft.

The Allowable Rotational Speed can be obtained by the following formula.

Additionally, approximate Allowable Rotational Speeds can be obtained from Table 2. Allowable Maximum Rotational Speed Graph.

Allowable Rotational Speed (min^{-1})

$$N_c = fa \frac{60\lambda^2}{2\pi\ell^2}\sqrt{\frac{EI\times10^3}{\gamma}} = g\frac{d}{\ell^2}10^7\ (min^{-1})$$

Where:

ℓ: Distance of Supports (mm)

fa: Safety Factor (0.8)

E: Young's Modulus ($2.06\times10^5 N/mm^2$)

I: Min. Geometrical Moment of Inertia of Across Root Thread Area (mm^4)

$$I = \frac{\pi}{64}d^4$$

d: Thread Root Diameter (mm)

γ: Specific Gravity ($7.8\times10^{-6} kg/mm^3$)

A: Root Thread Section Area (mm^2)

$$A = \frac{\pi}{4}d^2$$

g, λ: Coefficient Determined by Method of Screw Support

Method of Screw Support	g	λ
Support – Support	9.7	π
Fixed – Support	15.1	3.927
Fixed – Fixed	21.9	4.73
Fixed – Free	3.4	1.875

Allowable Rotational Speed Calculation Example

Find the Allowable Maximum Rotational Speed for Figure 2.

<How to use>

- Thread shaft diameter ø15, Lead 5
- Mounting method Fixed – Support
- Distance between Points of Buckling Load ℓ_1 790mm

<Calculations>

g=15.1 since the mounting method is Fixed-Supported, the Allowable Rotational Speed (Nc) is,

$$Nc = g\frac{d}{l^2}10^7(min^{-1}) = 15.1\times\frac{12.5}{790^2}\times10^7(min^{-1}) = 3024(min^{-1})$$

Therefore, the rotational speed will need to be $3024min^{-1}$ or less.

Table 2.

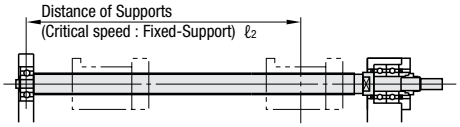
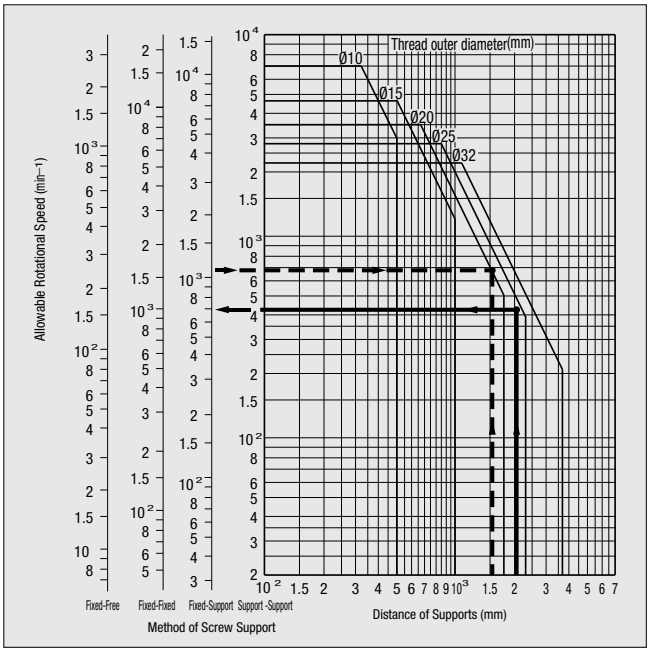


Figure 2. Allowable Rotational Speed Graph



Allowable Rotational Speed Calculation Example

<Requirements>

- Thread outer diameter 20
- Distance of Supports 1500mm
- Mounting method Fixed – Support

<Calculations>

(1) From Table 2., find a intersection of a vertical line from Supported Span Distance 1500mm and Screw Shaft O.D. Ø20 line.

(2) The value $1076min^{-1}$ on the Fixed-Supported scale (Y-Axis) that corresponds to the intersection of (1) above is the Allowable Maximum Speed.

Screw Shaft Dia. Calculation Example

<Requirements>

- Distance of Supports 2000mm
- Maximum Revolution Frequency $1000min^{-1}$
- the max. axial load Fixed – Fixed

<Calculations>

(1) From Table 2., find a intersection of a vertical line from Supported Span Distance 2000mm and a horizontal line from Fixed-Fixed max. speed scale (Y-Axis) at $1000min^{-1}$.

(2) A line that reaches down to the intersection in (1) is the Ø25 ball screw that satisfies the required speed of $1000min^{-1}$.

Allowable Rotational Speed (min^{-1})

$D_mN \leqq 70000$ (Precision Ball Screws)
$D_mN \leqq 50000$ (Rolled Ball Screws)

Where:

D_m: Thread outer diameter(mm)+A Value

N: Maximum Revolution Frequency(min^{-1})

Ball Dia.	A Value
1.5875	0.3
2.3812	0.6
3.175	0.8
4.7625	1.0
6.35	1.8

5-2. DmN Value

The DmN value represents a ball recirculation (orbit) speed limit within a ball nut.

If this vale is exceeded, the recirculation components will be damaged.

Technical Data

Selection of Ball Screws 3

6. Life Span

Ball screw's life is defined as: Total number of rotations, time, or distance where either the ball rolling surfaces or the balls begin to exhibit repetitive stress caused flaking. Ball screw's life can be calculated based on Basic Dynamic Load Rating with the following formula.

6-1. Life Hours (Lh)

$$L_h = \frac{10^6}{60N_m}\left(\frac{C}{P_m f_w}\right)^3 (hrs)$$

Where:
L_h: Life Span Hours (hrs)
C: Basic Dynamic Load Rating (N)
P_m: Mean Axial Load (N)
N_m: Mean Revolution Frequency (min^{-1})
f_w: Work Factor

Impactless Run	f_w = 1.0~1.2
Normal Run	f_w = 1.2~1.5
Run with Impact	f_w = 1.5~2.0

• Basic Dynamic Load Rating: C
Basic Dynamic Load Rating (C) is defined as: An axial load which a group of same ball screws are subjected and 90% of the specimen will reach 1 million rotations (10^6) without experiencing any flaking of the rolling surfaces. See product catalog pages for the Basic Dynamic Load Ratings.

*Setting life span hours longer than what is actually necessary not only requires a larger ball screw, but also increases the price.
In general, the following standards are used for life span hours:

Machine Tools: 20,000hrs	Automatic Control Equipment: 15,000hrs
Industrial Machinery: 10,000hrs	Measuring Instruments: 15,000hrs

*The basic dynamic load rating that satisfies the set life span hours is expressed by the following formula.

$$C = \left(\frac{60L_hN_m}{10^6}\right)^{\frac{1}{3}} P_m f_w (N)$$

Life Calculation Example

<Requirements>

- Ball Screw Model BSS1520(Ø15 Lead 5)
- Mean Axial Load Pm 250N
- Mean Revolution Frequency Nm 2118 (min^{-1})
- Work Factor fw 1.2

<Calculations>

Since Basic Dynamic Load Rating C for BSS1520 is 4400N,

$$L_h = \frac{10^6}{60\times2118}\left(\frac{4400}{250\times1.2}\right)^3 = 24824(hr)$$

Therefore, Life will be 24824 hours.

6-2. Axial Load

Axial loads that apply on the screw shafts will vary depending on applicable motion profile such as acceleration, constant velocity, and deceleration phases. Following formula can be used.

-Axial Load Formula-

Constant Velocity · · · Axial Load (Pb)=μWg
Acceleration · · · Axial Load (Pa)=Wα+μWg
Deceleration · · · Axial Load (Pc)=Wα-μWg

* Omit the "μ" for vertical applications.
μ: Linear bearing friction coefficient (0.02 or Linear Guides)
W: Load Mass N
g: Gravitational Acceleration 9.8m/s^2
α: Acceleration (*)

(*) Acceleration (α)=(Vmax/t)x10^{-3}
Vmax: Rapid Feed Rate mm/s
t: Acceleration/Deceleration Time s

6-3. Formulae for Average Axial Load and Average Rotational Speed

Average Axial Load and Average Rotational Speed are calculated based on proportions of motion profiles. Average Axial Load and Average Rotational Speed for Motion profiles in Table 1. can be calculated with the Formula 2.

Table 1. Motion Profile ($t_1+t_2+t_3$=100%)

Motion Profile	Axial Load	Rotational Speed	Hours Ratio
A	P_1N	N_1min-1	$t_{1\%}$
B	P_2N	N_2min-1	$t_{2\%}$
C	P_3N	N_3min-1	$t_{3\%}$

[Formula 2. Average Axial Load Calculation]

$$P_m = \left(\frac{P_1^3N_1t_1+P_2^3N_2t_2+P_3^3N_3t_3}{N_1t_1+N_2t_2+N_3t_3}\right)^{\frac{1}{3}} (N)$$

$$N_m = \frac{N_1t_1+N_2t_2+N_3t_3}{t_1+t_2+t_3} (min^{-1})$$

For case of a machine tool application, Max. Load (P1) would be for the heaviest cutting cycles, Regular Load (P2) is for the general cutting conditions, and Minimum Load (P3) is for the non-cutting rapid feeds during positioning moves.

Average Axial Load and Average Rotational Seed Calculation Example

<Requirements>

Motion Profile	Axial Load	Rotational Speed	Hours Ratio
A	343N	1500min	29.4%
B	10N	3000min	41.2%
C	324N	1500min	29.4%

<Calculations>

(1) Average Axial Load

$$Pm = \left(\frac{343^3\times1500\times0.294+10^3\times3000\times0.412+324^3\times1500\times0.294}{1500\times0.294+3000\times0.412+1500\times0.294}\right)^{\frac{1}{3}} = 250(N)$$

Therefore, the Average Axial Load Pm will be 250N.

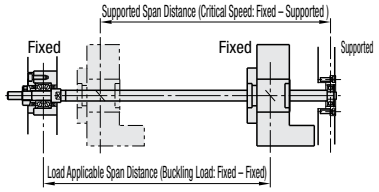
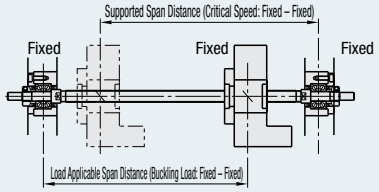
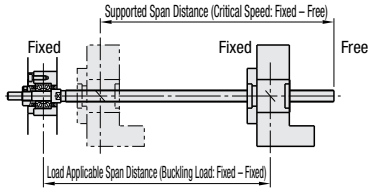
(2) Average Rotational Speed

$$Nm = \frac{1500\times0.294+3000\times0.412+1500\times0.294}{0.294+0.412+0.294} = 2118(min^{-1})$$

Therefore, the Average Rotational Speed Nm will be 2118min.

7. Screw Shaft Mounting Arrangements

Representative ball screw mounting arrangements are shown below.

Mounting Methods	Application Example
	• Typical method • Medium ~ High Speeds • Medium ~ High Accuracy For Support Units, Standard Type BRW / BUR is selected
	• Medium Speeds • High Accuracy • For Support Units, Standard Type BRW is selected
	• Low Speeds • For Short Screw Shafts • Medium Accuracy • For Support Units, Economy Type BRWE is selected

8. Temperature and Life

When ball screws are continuously used at 100°C or higher, or used momentarily at very high temperatures, Basic Dynamic/Static Load Ratings will be reduced according to the temperature rise due to changes in material compositions.

However, there will be no effects up to 100°C. Basic Dynamic Load Rating C" and Basic Static Load Rating Co" at 100°C or higher with the temperature factors ft and ft' can be expressed with the following formula.

$C'' = ftC(N)$
$C_0'' = ft'C_0(N)$

Temperature °C	100 or less	125	150	175	200	225	250	350
ft	1.0	0.95	0.90	0.85	0.75	0.65	0.60	0.50
ft'	1.0	0.93	0.85	0.78	0.65	0.52	0.46	0.35

Normal usage range is -20~80°C. For application in high temperature, use of heat resistant grease as well as heat resistivity of other components should be evaluated.

9. Rigidity

In order to improve accuracies and system response of precision machinery and equipment, feed screw related component rigidity must be evaluated. Rigidity of feed screw system can be expressed with the following formula.

$$K = \frac{P}{\delta} \text{ (N/μm)}$$

Where:
P: Axial Loads Applied on Feed Screw System (daN)
δ: Elastic Deformation of Feed Screw System (μm)
Additionally, the following relationship exists between the feed screw system rigidity and other various construction element rigidity.

$$\frac{1}{K} = \frac{1}{K_\ell} + \frac{1}{K_n} + \frac{1}{K_b} + \frac{1}{K_h}$$

Where:
K_ℓ: Screw Shaft Compressive/Tensile Rigidity
K_n: Nut Rigidity
K_b: Support Bearing Rigidity
K_h: Nut and Bearing Mount Rigidity

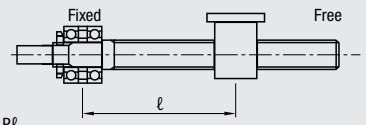
Screw Shaft Compressive/Tensile Rigidity : Kℓ

$$K_\ell = \frac{P}{\delta_\ell} \text{ (N/μm)}$$

Where:
P: Axial Load (N)
δ_ℓ: Screw Shaft Expansion/Contraction (μm)

The expansion and contraction are expressed in the following formula. The expansion and contraction will directly appear as ball screw backlash.

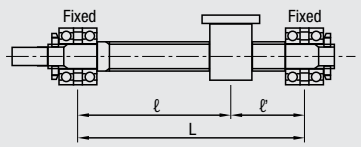
(1) Fixed-Free Arrangement



$$\delta_\ell = \frac{4P\ell}{E\pi d^2} \times 10^3 (\mu m)$$

Where:
P: Axial Load (N)
E: Young's Modulus ($2.06 \times 10^5 N/mm^2$)
d: Screw Shaft Root Diameter (mm)
ℓ: Load Applicable Span Distance (mm)

(2) Fixed-Fixed Arrangement



$$\delta_\ell = \frac{4P\ell\ell'}{E\pi d^2 L} \times 10^3 (\mu m)$$

Where:
P: Axial Load(N)
E: Young's Modulus ($2.06 \times 10^5 N/mm^2$)
d: Screw Shaft Root Diameter (mm)
ℓ,ℓ': Load Applicable Span Distance (mm)
L: Mounting Span Distance (mm)

The formula produces the max. value when $\ell = \ell' = \frac{L}{2}$

$$\left(\delta_\ell = \frac{PL}{E\pi d^2} \times 10^3 \right)$$

Therefore, the max. shaft expansion and contraction will be 1/4 of Fixed-Free arrangement.

Technical Data

Selection of Ball Screws 4

10. Driving Torque

This selection provides a guide for selecting ball screw frictional properties and the driving motor.

10-1. Friction and Efficiency

Ball screw efficiency can be expressed in the following formulas; wherein μ is the coefficient of friction and β is the screw's lead angle. Variables are determined through analysis of a dynamic model.

When rotational force is converted into axial force (Forward Action)

$$\eta = \frac{1-\mu \tan\beta}{1+\mu/\tan\beta}$$

When axial force is converted into rotational force (Reverse Action)

$$\eta' = \frac{1-\mu/\tan\beta}{1+\mu \tan\beta}$$

10-2. Load Torque

The load torque (constant speed driving torque) required in drive source design (motors,etc.) is calculated as follows.

(1) Forward Action

Torque required when converting rotational force into axial force

$$T = \frac{PL}{2\pi\eta} \ (N \cdot cm)$$

Where:
- T: Load Torque (N·cm)
- P: External Axial Load (N)
- L: Ball Screw Lead (cm)
- η: Ball Screw Efficiency (0.9)

(2) Reverse Action

External axial load when converting axial force into rotational

$$P = \frac{2\pi T}{\eta' L} \ (N)$$

Where:
- P: External Axial Load (N)
- T: Load Torque (N·cm)
- L: Ball Screw Lead (cm)
- η': Ball Screw Efficiency (0.9)

(3) Friction Torque Caused by Preloading

This is a torque generated by preloading. As external loads increase, the preload of the nut is released and therefore the friction torque by preloading also decreases.

Under No load

$$T_P = K\frac{P_L L}{2\pi} \ (N \cdot cm)$$

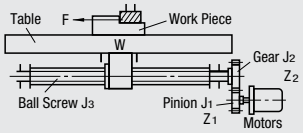
$$K = 0.05(\tan\beta)^{-\frac{1}{3}}$$

Where:
- P_L: Preload (N)
- L: Ball Screw Lead (cm)
- K: Coefficient of Internal Friction
- β: Lead Angle $\beta \fallingdotseq \tan^{-1}\left(\frac{L}{\pi D}\right)$
- D: Thread Outer Diameter

11. Selecting the Driving Motors

When selecting a driving motor, it is necessary to satisfy the following conditions:

1. Ensure a marginal force sufficient to counter the load torque exerted on the motor's output thread.
2. Enable starting, stopping at prescribed pulse speeds, sufficiently powered to counter the moment of inertia exerted on the motor's output thread.
3. Obtain the prescribed acceleration and deceleration constants, sufficient to counter the moment of inertia exerted on the motor's output thread.



(1) Constant Speed Torque Exerted on the Motor Output Thread

This is the amount of torque required to drive the output thread against the applied external load, at a constant speed.

$$T_1 = \left(\frac{PL}{2\pi\eta} + T_P\frac{(3P_L-P)}{3P_L}\right)\frac{Z_1}{Z_2} \ (N \cdot cm)$$

Where: $P \leqq 3P_L$
- T_1: Driving Torque at Constant Speed (N·cm)
- P: External Axial Load (N)
  P=F+μMg
- F: Thrust Reaction Produced in Cutting Force (N)
- M: Masses of Table and Work Piece (kg)
- μ: Coefficient of Friction on Sliding Surfaces
- g: Gravitational Acceleration (9.8m/s^2)
- L: Ball Screw Lead (cm)
- η: Mechanical Efficiency of Ball Screw or Gear
- T_P: Friction Torque Caused by Preloading (N·cm) Referto Formula 10-2-(3)
- P_L: Preload (N)
- Z_1: Number of Pinion's Teeth
- Z_2: No. of Gear's Teeth

(2) Acceleration Torque Exerted on the Motor Output Thread

This is the amount of torque required to drive the output shaft against the external load during acceleration.

$$T_2 = J_M\omega = J_M\frac{2\pi N}{60t}\times 10^{-3} \ (N \cdot cm)$$

$$J_M = J_1 + J_4 + \left(\frac{Z_1}{Z_2}\right)^2\left\{(J_2+J_3+J_5+J_6)\right\} \ (kg \cdot cm^2)$$

Where:
- T_2: Driving Torque in Acceleration (N·cm)
- ω: Motor Thread Angular Acceleration (rad/s^2)
- N: Motor Thread Revolutions (min^{-1})
- t: Acceleration (s)
- J_M: Moment of Inertia Exerted on the Motor (kg·cm^2)
- J_1: Moment of Inertia Exerted on Pinion (kg·cm^2)
- J_2: Moment of Inertia Exerted on Gear (kg·cm^2)
- J_3: Moment of Inertia Exerted on Ball Screw (kg·cm^2)
- J_4: Moment of Inertia Exerted on Motor's Rotor (kg·cm^2)
- J_5: Moment of Inertia of Moving Body (kg·cm^2)
- J_6: Moment of Inertia of Coupling (kg·cm^2)
- M: Masses of Table and Work Piece (kg)
- L: Ball Screw Lead (cm)

Moment of inertia exerted on cylinders as screws and cylinders such as Gears

(Calculation of $J_1 \sim J_4$, J_6)

$$J = \frac{\pi\gamma}{32}D^4\ell \ (kg \cdot cm^2)$$

Where:
- D: Cylinder Outer Diameter (cm)
- ℓ: Cylinder Length (cm)
- γ: Material Specific Gravity
  $\gamma = 7.8\times10^{-3}$ (kg/cm^3)

$$J_5 = M\left(\frac{L}{2\pi}\right)^2 \ (kg \cdot cm^2)$$

(3) Total Torque Exerted on the Motor Output Thread

Overall torque can be obtained by adding results from formulas (1) and (2).

$$T_M = T_1+T_2 = \left(\frac{PL}{2\pi\eta} + T_P\frac{(3P_L-P)}{3P_L}\right)\frac{Z_1}{Z_2} + J_M\frac{2\pi N}{60t}\times10^{-3} \ (N \cdot cm)$$

Where:
- T_M: Total Torque Exerted on the Motor Output Thread (N·cm)
- T_1: Driving Torque at Constant Speed (N·cm)
- T_2: Driving Torque at In Acceleration (N·cm)

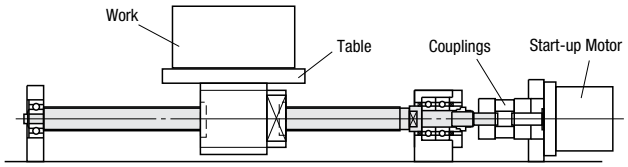
Once you have temporarily found the type of motor you need, check

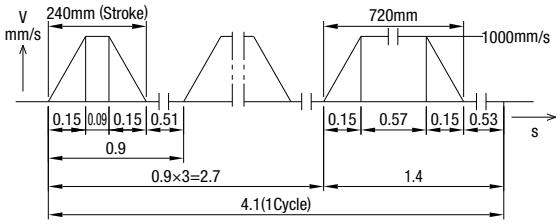
1. effective torque,
2. acceleration constant and
3. motor overload properties and heat tolerance during repeated starting, stopping.
   It is necessary to ensure a sufficient margin for these parameters.

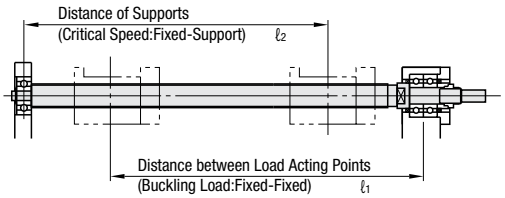
12. Example of Selection of Ball Screws

Condition of Use

• Work & Table Mass	• Life Span	W=50(kg)	±0.01(mm)
• Maximum Strokes	• Direct Acting Guide	Smax.=720(mm)	Lh=30000Hours
• Threading Speed	Coefficient of Friction	Vmax.=1000(mm/s)	μ=0.02
• Acceleration Constant	• Driving Motor	t=0.15(s)	Nmax.=3000(min^{-1})
• Positioning Precision	• Duty Cycle Model Diagram	±0.1/720(mm)	
• Repeat Accuracy			







1. Setting Lead (L)

Set lead based on maximum motor revolutions and threading speed. Use the following formula.

$$L \geqq \frac{Vmax \times 60}{Nmax} = \frac{1000 \times 60}{3000} = 20$$

Required lead is 20mm or higher.

2. Nut selection

(1) Calculating Axial Load

P. 216, 6-2. Axial Load calculation formula is used to obtain the axial loads for each segment of a motion profile.

- At Constant Speed: Axial Load (Pb) =μWg=0.02×50×9.8≒10 (N)
- In Acceleration: Acceleration(α) = (Vmax/t)×10^{-3} = (100/0.15)×10^{-3}=6.67 (m/s^2)
  Axial Load (Pa) =Wα+μWg=50×6.67+0.02×50×9.3≒343 (N)
- In Deceleration: Axial Load (Pc) Wα-μWg=50×6.67-0.02×50×9.8≒324 (N)

(2) Actual moving time during each segment in a motion profile

Below derived from Duty Cycle Model Diagram.

Operating Pattern	In Acceleration	At Constant Speed	In Deceleration	Total Operating Time
Operating Time	0.60	0.84	0.60	2.04

(3) Summary of Axial Loads, Rotational Speeds, and Operation Time for Each Motion Profile

Operating Pattern	In Acceleration	At Constant Speed	g Pattern In Deceleration
Axial Load	343N	10N	324N
Revolutions Frequency	1500min^{-1}	3000min^{-1}	1500min^{-1}
Operating Time Ratio	29.4%	41.2%	29.4%

(4) Calculating the Average Axial Load with a formula in **P. 216**, 6-3.

$$\text{Mean Axial Load(Pm)} = \left(\frac{P_1^3N_1t_1+P_2^3N_2t_2+P_3^3N_3t_3}{N_1t_1+N_2t_2+N_3t_3}\right)^{\frac{1}{3}} = 250(N)$$

(5) Calculating the mean turns

$$\text{Mean Turns (Nm)} = \frac{N_1t_1+N_2t_2+N_3t_3}{t_1+t_2+t_3} = 2118(\text{min}^{-1})$$

(6) Calculation of the required basic dynamic load rating

(1) Calculating Continuous Operational Life (Lho)

A Continuous Operational Life which is derived by subtracting Resting time from Desired Life while a motion profile of 4.01s with a moving time of 2.04s can be calculated as follows.

$$\text{Lho=Desired Life (Lh)} \times \left(\frac{2.04}{4.1}\right) = 14927 \text{ (Hours)}$$

(2) Calculating Required Basic Dynamic Load Rating

P. 216 6-1. contains a formula for calculating a Basic Dynamic Load Rating for continuous operational life.

$$C = \left(\frac{60L_{ho}N_m}{10^6}\right)^{\frac{1}{3}} \times P_m \times f_w = \left(\frac{60 \times 14927 \times 2118}{10^6}\right)^{\frac{1}{3}} \times 250 \times 1.2 = 3700(N)$$

(7) Tentative Ball Screw Selection

A ball screw to satisfy the requirements of Lead 20 and Basic Dynamic Load Rating of 3700N, BSS1520 is tentatively selected.

3. Accuracy Evaluation

(1) Evaluating Accuracy Grades and Axial Clearances

P. 212 2. "Ball Screw Lead Accuracy" section shows a table for accuracy values of various Accuracy Grades.

From the lead accuracy value table, it can be confirmed that the C5 Grade with Actual Mean Travel Error ±ep 0.040/800~1000mm will satisfy the requirement of ±0.1/720mm, and a BSS1520 is suitable.

Additionally, the Precision Screws axial clearance table on shows that axial clearance of BSS1520 is 0.005 or less.

The required positioning repeatability is ±0.01mm, and it can be confirmed that BSS1520 satisfies the requirement.

4. Screw Shaft Selection

(1) Determining the Overall Length

Screw Shaft O.A.L. (L)=

Max. Stroke+Nut Length+Margin+Shaft End Terminations (both sides). Therefore,

Max Stroke: 720mm
Nut Length: 62mm
Margin: Lead×1.5=60mm
Shaft End Termination Dims.: 72
Screw Shaft O.A.L. (L)=720+62+60+72=914mm

*The Margin is provided as a countermeasure in case overruns, and the amount is typically set as 1.5~2 times the screw lead.

Lead 20×1.5×2(Ends)=60

(2) Evaluating the Allowable Axial Load

Load Applicable Span Distance l1 is 820mm, and the Axial Load can be obtained by the formula on **P. 214**, "4. Allowable Axial Load" as below.

$$P = m\frac{d^4}{\ell^2}10^4 = 10 \times \frac{12.5^4}{820^2} \times 10^4 = 3660N$$

The above formula produces an Axial Load value of 343N which is well within the Allowable Max. Axial Load 3660N, and suitability is confirmed.

(3) Evaluating the Allowable Max. Rotational Speed

Shaft supported span is 790mm, and the formula in "5-1. Critical Speed" on produces a value for the Critical Speed Nc as **P. 215**

$$Nc = g\frac{d}{\ell^2}10^7 = 15.1 \times \frac{12.5}{790^2} \times 10^7 = 3024\text{min}^{-1}$$

The max. speed requirement of 3000min^{-1} is within the Critical Speed of 3024min^{-1}, and the suitability is confirmed.

Additionally, the DmN value can be evaluated with the formula in **P. 215**, "5-2. DmN Value" as...

DmN=(Shaft O.D.+A value)×Max Rotational Speed=15.8×3000=47400≤70000 and the suitability is confirmed.

5. Selection Result

From the above, it is determined that a suitable ball screw model is BSS1520-914.

Technical Data

Calculation of Life Span of Linear Systems 1

■ Allowable Load

- Basic Dynamic Load Rating (C)
  Basic dynamic load rating is a constant load applied in a constant direction that enables each linear system of the same series to travel 50×103m under the same conditions, without 90% of the material suffering damage from rolling contact fatigue.
- Basic Static Load Rating (Co)
  Basic static load rating is the static load exerted on contacting parts under maximum stress, at which the sum of the permanent deformation in the rolling element and rolling contact surface equals 0.0001 times the diameter of the rolling element.
- Allowable Static Moment (M_P, M_Y, M_R)
  Allowable static moment is a critical static moment load that acts upon a system at the loading moment. It is set in accordance with the permanent deformation as in basic static load rating Co.
- Static Safety Factor (f_S)
  Static safety factors are given in Table 1. When a linear system is still or moving at low speed, basic static load rating Co must be divided by fs in accordance with the conditions of use.

Table 1. Static Safety Factor (Lower Limit of f_s)

Condition of Use	Lower Limit of f_s
Under Normal Operating Conditions	1~2
When Smooth Travel is Required	2~4
When Subjected to Vibrations, Impacts	3~5

Allowable Load (N) ≤ Co/f_S

Allowable Moment (N·m) ≤ $(M_P, M_Y, M_R)/f_S$

f_S : Static Safety Factor

Co : Basic Static Load (N)

M_P, M_Y, M_R : Static Allowable Moment (N·m)

■ Life Span

When a load is applied to a linear system, the system moves back and forth in a linear direction. In the process, repeated stress acts upon rolling elements and rolling contact surfaces, causing damage referred to as flaking from material fatigue.

The life span of a linear system is measured in terms of the total travel distance covered by the system up until initial flaking occurs.

- Rated Life Span (L)

  Rated life span is the total travel distance that each linear system of the same series can endure under the same conditions, without the occurrence of flaking in 90% of the system.

  Rated life span can be obtained as follows from the basic dynamic load rating and various loads exerted on the linear system.

For Ball Bearings $L=\left(\frac{C}{P}\right)^3 \cdot 50$

For Roller Bearings $L=\left(\frac{C}{P}\right)^{10/3} \cdot 50$

L : Rated Life Span (km)

C : Basic Dynamic Load Rating (N)

P : Acting Load (N)

- When actually using a linear system, the first thing you must do is to calculate the load. It is necessary to consider load also in terms of vibration and impact that occur during operation, as well as its distribution across the entire linear system as it moves back and forth in a linear direction. Calculations are not simple. Operating temperature also significantly influences useful life. When these parameters are taken into consideration, the above formula is transformed as follows:

For Ball Bearings $L=\left(\frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P}\right)^3 \cdot 50$

For Roller Bearings $L=\left(\frac{f_H \cdot f_T \cdot f_C}{f_W} \cdot \frac{C}{P}\right)^{10/3} \cdot 50$

L : Rated Life Span (km)

f_H : Hardness Coefficient (See Fig.1)

C : Basic Dynamic Load Rating (N)

f_T : Temperature Coefficient (See Fig.2)

P : Acting Load (N)

f_C : Contact Coefficient (See Table 3)

f_W : Load Coefficient (See Table 4)

The Life span can be computed as a number of hours by obtaining the travel distance for a unit of time.

It can be obtained by using the following formula, in which stroke length and stroke cycles are assumed to be constant.

$$L_h = \frac{L \cdot 10^3}{2 \cdot \ell s \cdot n_1 \cdot 60}$$

L_h : Life Span Hours (hr)

ℓs : Stroke Length (m)

L : Rated Life Span (km)

n_1 : Reciprocating Times per Minute (cpm)

■ Friction Resistance and Required Thrust

Using the following formula, the friction resistance (required thrust) can be obtained from the load and the seal resistance specified by the system.

Table 2. Dynamic Friction Coefficient

Type	Dynamic Friction Coefficient (μ)
Miniature Slide Guides	0.004~0.006
Medium Load Slide Guides	0.002~0.003
Slide Ways	0.001~0.003
Slide Tables	0.001~0.003
Linear Bushings	0.002~0.003
Linear Ball Bushings	0.0006~0.0012

F : Friction Resistance (N)

μ : Dynamic Friction Coefficient

W : Weight Loaded

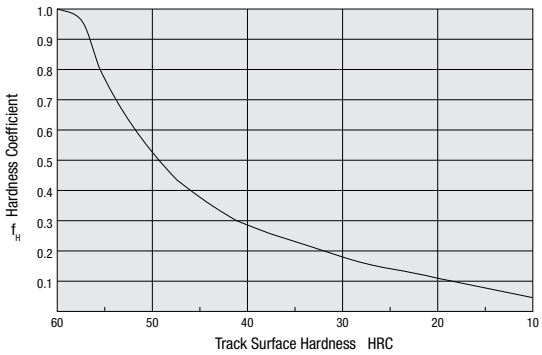
f : Seal Resistance (2N~5N)

• Hardness Coefficient (f_H)

In a linear system, the shaft must be hard enough to withstand contact with the ball bearings. Unless sufficient hardness is provided, the allowable load can decrease, resulting in a short useful life.

Compensate the rated life span with the hardness coefficient.

Figure 1. Hardness Coefficient



• Contact Coefficient (fC)

In general, two or more linear systems are used with each shaft. Depending on the machining precision, the load exerted on each of the respective systems can vary. In this case, the load applied on each linear system changes depending on the machining precision, therefore it cannot be uniformly applied. As a result, allowable load per linear system changes depending on the number of linear systems on one axis.

Compensate the rated life span with the contact coefficient in Table 3.

• Load Coefficient (f_W)

When calculating the load that acts on a linear system, it is necessary to work with precise figures for material weight, the force of inertia resulting from operating speed, load moment, various changes that occur over time, and so on. However, it is difficult to have accurate calculation for oscillating movement as beside the normal repetition of start and stop, other factors such as vibration and impact also need to be considered.

Therefore, the life span calculation needs to be simplified using the load coefficient in Table 3.

■ Linear Bushings

Rated life span can be obtained as follows from the basic dynamic load rating and the load to the linear bushing.

$$L=\left(\frac{f_H \cdot f_T \cdot f_C}{fw} \cdot \frac{C}{P}\right)^3 \cdot 50$$

L : Rated Life Span (km)
C : Basic Dynamic Load Rating (N)
P : Working Load (N)
fw : Load Coefficient (See Table 4.)
f_H : Hardness Coefficient (See Figure 1.)
f_T : Temperature Coefficient (See Figure 2.)
f_C : Contact Coefficient (See Table 3.)

The Life span can be computed as a number of hours by obtaining the travel distance for a unit of time. It can be obtained using the following formula, in which stroke length and stroke cycles are assumed to be constant.

$$L_h=\frac{L \cdot 10^3}{2 \cdot \ell s \cdot n_1 \cdot 60}$$

L_h : Life Span Hours (hr)
ℓs : Stroke Length (m)
L : Rated Life Span (km)
n_1 : Reciprocating Times per Minute (cpm)

• Temperature Coefficient (f_T)

When temperature in a linear system exceeds 100˚C, the hardness of the system and the shaft become degraded. This decreases the allowable load to a greater extent than when the system is used at ambient temperature, and can shorten the life span.

Compensate the rated life span with the temperature coefficient.

Figure 2. Temperature Coefficient

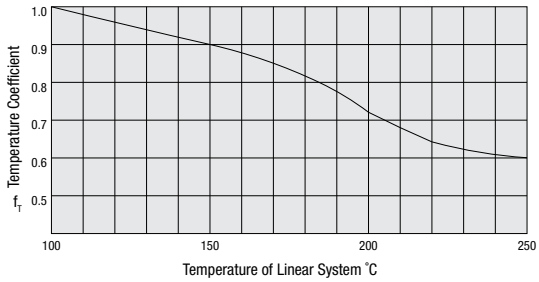


Table 3. Contact Coefficient

Number of Bearings per Shaft	Contact Coefficient fc
1	1.00
2	0.81
3	0.72
4	0.66
5	0.61

Table 4. Load Coefficients

Condition of Use	fw
Low speed with no external vibration or impact (Max. 15m/min)	1.0~1.5
Middle range speed with no exerted vibration or impact of considerable force (Max. 60m/min)	1.5~2.0
High speed with no external vibration or impact (Over 60m/min)	2.0~3.5

■ Linear Ball Bushings

Rated life span can be obtained as follows from the basic dynamic load rating and the load to the linear ball bushing.

$$L=\left(\frac{f_H \cdot f_T \cdot f_C}{fw} \cdot \frac{C}{P}\right)^3 \cdot 50$$

L : Rated Life Span (km)
C : Basic Dynamic Load Rating (N)
P : Working Load (N)
fw : Load Coefficient (See Table 4)
f_H : Hardness Coefficient (See Fig.1)
f_T : Temperature Coefficient (See Fig.2)
f_C : Contact Coefficient (See Table 3)

Life Span Hours

• For revolution and reciprocating motion

$$L_h=\frac{10^6 \cdot L}{60\sqrt{(dm \cdot n)^2+(10 \cdot S \cdot n_1)^2}/dm}$$

• For reciprocating motion

$$L_h=\frac{10^6 \cdot L}{600 \cdot S \cdot n_1/(\pi \cdot dm)}$$

L_h : Life Span Hours (hr)
n : Revolutions per Minute (rpm)
dm : Pitch Diameter of Ball (mm)≈1.15dr
S : Stroke Length (mm)
n_1 : Strokes Per Minute (cpm)

• Revolution and reciprocal motion allowable values

$$DN \geq dm \cdot n+10 \cdot S \cdot n_1$$

Technical Data

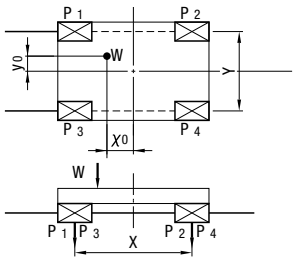
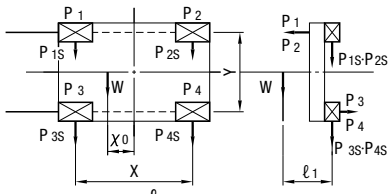
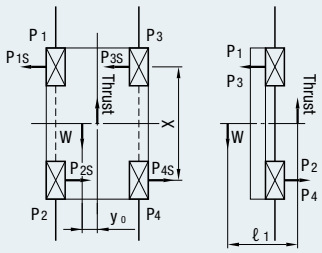
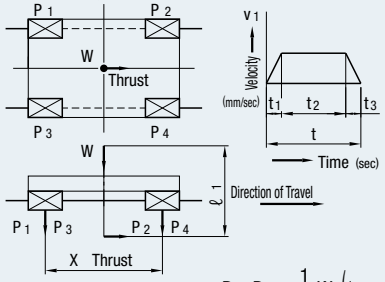
Calculation of Life Span of Linear Systems 2

■ Load Calculations

Since a linear system bears the weight of the work while it performs a reciprocating linear motion, the load exerted on the system can vary depending on the work's center of gravity, thrust acting position change, and the speed changes by starting, stopping and acceleration, deceleration.

It is necessary to take these conditions into consideration when selecting a linear system.

Table 5. Use Conditions and Load Calculation Formulas

Type	Condition of Use and Load	Type	Condition of Use and Load
1	Horizontal Axis  $P_1=\frac{1}{4}W+\frac{X_0}{2X}W+\frac{y_0}{2Y}W$ $P_2=\frac{1}{4}W-\frac{X_0}{2X}W+\frac{y_0}{2Y}W$ $P_3=\frac{1}{4}W+\frac{X_0}{2X}W-\frac{y_0}{2Y}W$ $P_4=\frac{1}{4}W-\frac{X_0}{2X}W-\frac{y_0}{2Y}W$	3	Perpendicular to Horizontal Axis  $P_1=P_2=P_3=P_4=\frac{\ell_1}{2X}W$ $P_{1S}=P_{3S}=\frac{1}{4}W+\frac{X_0}{2X}W$ $P_{2S}=P_{4S}=\frac{1}{4}W-\frac{X_0}{2X}W$
2	Vertical Axis  $P_1=P_2=P_3=P_4=\frac{\ell_1}{2X}W$ $P_{1S}=P_{2S}=P_{3S}=P_{4S}=\frac{y_0}{2X}W$	4	In Acceleration, Deceleration  • Acceleration at Starting $P_1=P_3=\frac{1}{4}W\left(1+\frac{2V_1\cdot\ell_1}{g\cdot t_1\cdot X}\right)$ $P_2=P_4=\frac{1}{4}W\left(1-\frac{2V_1\cdot\ell_1}{g\cdot t_1\cdot X}\right)$ • Deceleration at Stopping $P_1=P_3=\frac{1}{4}W\left(1-\frac{2V_1\cdot\ell_1}{g\cdot t_3\cdot X}\right)$ $P_2=P_4=\frac{1}{4}W\left(1+\frac{2V_1\cdot\ell_1}{g\cdot t_3\cdot X}\right)$ • Constant Speed $P_1=P_2=P_3=P_4=\frac{1}{4}W$ g: Gravitational Acceleration=9.8×10^3mm/sec^2

W: Acting Load(N) P_1,P_2,P_3,P_4: Load applied to the Linear System(N) X,Y: Linear System Span(mm) V: Moving Speed(mm/sec) t_1: Acceleration Time(sec) t_3: Deceleration Time(sec)

Fig 3. Stepped Load Fluctuation

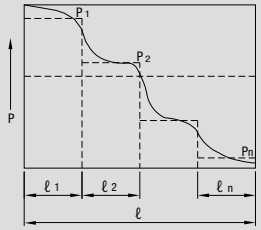


Fig 4. Flat Fluctuation Load

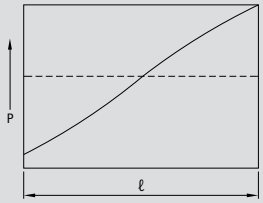
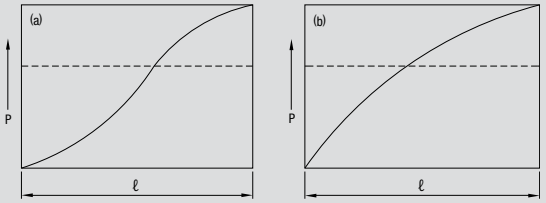


Fig 5. Sinusoidal Load Fluctuation



• Mean Load Derived from Fluctuating Loads

In general, the load acting upon a linear system can change according to how the system is used.This happens for example when the reciprocating motion is started, stopped as compared to constant speed motion, and whether or not work is present during transfer, etc. Therefore, in order to correctly design the life span under various conditions and fluctuating loads, it is necessary to obtain a mean load and apply it to the life span calculations.

(1) When load changes in steps by a travel distance (Fig 3.)
Travel distance ℓ_1 subjected to load P_1
Travel distance ℓ_2 subjected to load P_2
⋮ ⋮
Travel distance ℓn subjected to load Pn
Mean load Pm can be obtained by using the following formula:

$$P_m = \sqrt[3]{\frac{1}{\ell}\left(P_1^3\ell_1 + P_2^3\ell_2 \cdots + Pn^3\ell n\right)}$$

P_m : Mean Load Derived from Fluctuating Loads (N)
ℓ : Total Travel Distance (m)

(2) When load changes almost linearly (Fig 4.)
Mean load P_m can be approximated by the following formula:

$$P_m \approx \frac{1}{3}\left(P_{min} + 2\cdot P_{max}\right)$$

P_{min} : Min. Fluctuating Load (N)
P_{ma} : Max. Fluctuating Load (N)

(3) When the load change resembles a sinusoidal curve as shown in Fig 5.
(a), (b), Mean Load Pm can be approximated by the following formula:

Fig 5.(a) $P_m \approx 0.65P_{max}$
Fig 5.(b) $P_m \approx 0.75P_{max}$

■ Slide Guides

Rated life span is the total travel distance each linear guide of the same series can endure under the same conditions, without the occurrence of flaking in 90% of the system.
Rated life span can be obtained as follows from the basic dynamic load rating and the load to the slide guide.

$$L = \left(\frac{f_T}{f_w}\cdot\frac{C}{P}\right)^3\cdot 50 \qquad (1)$$

L : Rated Life Span (km)
f_T : Temperature Coefficient (See Fig 2.)
fw : Load Coefficient (See Fig 4.)
C : Basic dynamic load rating (N)
P : Acting Load (N)

The life span hours can be computed as a number of hours by obtaining the travel distance for a unit of time. It can be obtained by using the following formula, in which stroke length and stroke cycles are assumed to be constant.

$$Lh = \frac{L\cdot 10^3}{2\cdot \ell s\cdot n_1\cdot 60} \qquad (2)$$

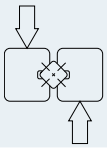
Lh : Life Span Hours (hr)
L : Rated Life Span (km)
ℓs : Stroke Length (m)
n_1 : Reciprocating Times per Minute (cpm)

■ Slide Ways

Rated load for slide ways is determined by the rolling elements(numbers of rollers). It can be calculated by using the following formulas:

One shaft is used

Load Direction



Dynamic Load Rating

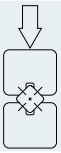
$$(N)\quad C = \left(\frac{Z}{2}\right)^{3/4}\cdot C_1$$

Static Load Rating

$$(N)\quad C_0 = \left(\frac{Z}{2}\right)\cdot C_{01}$$

One shaft is used vertically

Load Direction



Dynamic Load Rating

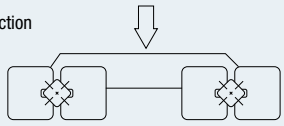
$$(N)\quad C = \left(\frac{Z}{2}\right)^{3/4}\cdot C_1\cdot 2^{7/9}$$

Static Load Rating

$$(N)\quad C_0 = \left(\frac{Z}{2}\right)\cdot C_{01}\cdot 2$$

Two shafts are used in parallel

Load Direction



Dynamic Load Rating

$$(N)\quad C = \left(\frac{Z}{2}\right)^{3/4}\cdot C_1\cdot 2^{7/9}$$

Static Load Rating

$$(N)\quad C_0 = \left(\frac{Z}{2}\right)\cdot C_{01}\cdot 2$$

C_1 : Basic Dynamic Load Rating per Roller (N)
C_{01} : Basic Static Load Rating per Roller (N)
Z : Number or Rolling Elements

The life span for slide ways is calculated by using the following formula.

$$L = \left(\frac{f_T\cdot C}{fw\cdot P}\right)^{10/3}\cdot 50$$

L : Life Span Hours (km)
f_T : Temperature Coefficient (See Fig 2.)
fw : Load Coefficient (See Fig 4.)
C : Dynamic Load Rating (N)
P : Acting Load (N)

Life Span Hours

$$L_h = \frac{L\cdot 10^3}{2\cdot \ell s\cdot n_1\cdot 60}$$

L_h : Life Span Hours (hr)
L : Life Span Hours (km)
ℓs : Stroke Length (m)
n_1 : Reciprocating Times per Minute (cpm)

Technical Data

Selection of Single Axis Actuators 1

Select the nominal LX actuator from the travel and the rating list below. ➡ Determine the ball screw lead so that the operation speed will be within the maximum speed shown in (Table 4). At this stage, the selection is temporary. ➡ Examine the load applied to the rail and put it in formulas (1) and (2) on **page 225**. Obtain the equivalent load Fe for each process and put it in formula (3) on **page 225**. Obtain the average load Fm and calculate the lifetime. ➡ Examine the load applied to the ball screw and the support bearing. Put it in formula (3) on **page 225**, obtain the average load Fm and calculate the lifetime.

■ Rated load (Table 1)

Item			LX2001	LX2005	LX2602	LX2605	LX3005	LX3010	LX4510	LX4520
Rail	Dynamic load rating Ca (N)		3277		6522		9732	6305	18450	11826
	Static load rating Coa (N)		6199		11871		17218	9271	32441	17175
	Radial clearances		−3~0		−4~0		−4~0		−6~0	
Ball screw	Dynamic load rating Ca (N)	Advanced	482	822	1712	1600	1831	1129	4167	2499
	Static load rating Coa (N)	Advanced	642	1026	2251	2097	2389	1386	5945	3381
	Thread shaft diameter (mm)		6	6	8	8	10	10	15	15
	Lead (mm)		1	5	2	5	5	10	10	20
	Core diameter		5.3	4.918	6.4	6.46	8.2		11.7	
	Ball center diameter		6.15	6.3	8.3	8.3	10.3	10.3	15.5	15.75
Bearing (fixed side)	Axial load	Dynamic load rating Ca (N)	730		1637		2702		4335	
		Static load rating Coa (N)	461		1205		2197		4106	

■ Moment equivalent coefficient at rail (Table 2)

Type	Block	Kp	Ky	Kr
LX20_ _	1 piece	0.228	0.228	0.0667
	Close contact between 2 pcs.	0.144	0.144	0.0667
LX26_ _	1 piece	0.17	0.17	0.0527
	Close contact between 2 pcs.	0.114	0.114	0.0527
LX30_ _	1 piece	0.137	0.137	0.0445
	Close contact between 2 pcs.	0.0917	0.0917	0.0445
LX45_ _	1 piece	0.1115	0.1115	0.0334
	Close contact between 2 pcs.	0.0840	0.0840	0.0334

■ Rail geometrical moment of inertia (Table 3)

Type	Lx (mm^4)	Ly (mm^4)	Mass (kg/100mm)	Center of Gravity h (mm)
LX2001	3.2×10^3	5.2×10^4	0.22	4.4
LX2606	1.0×10^4	1.4×10^5	0.37	6.1
LX30_ _	2.5×10^4	3.1×10^5	0.6	7.8
LX45_ _	8.8×10^4	10.4×10^5	1.10	11.0

■ Allowable Static Load / Allowable Static Moment (Table 4)

Type	No. of blocks	Allowable Static Load (kg)	Allowable Static Moment (N·m)		
		Horizontal	Ma	Mb	Mc
LX20_ _	B1	6199	27	27	93
	B2	12398	353	353	186
LX20_ _C	B1	6199	27	27	93
	B2	12398	353	353	186
LX26_ _	B1	11871	70	70	225
	B2	23742	902	902	450
LX26_ _C	B1	11871	70	70	225
	B2	23742	902	902	450
LX3005	B1	17218	126	126	387
	B2	34436	1515	1515	774
LX3005C	B1	17218	126	126	387
	B2	34436	1515	1515	774
LX3010	B1	17218	126	126	387
	B2	34436	1515	1515	774
LX3010C	B1	17218	126	126	387
	B2	34436	1515	1515	774
LX4510	B1	32441	291	291	972
	B2	64882	3945	3945	1944
LX4520	B1	32441	291	291	972
	B2	64882	3945	3945	1944

■ Allowable Static Load / Allowable Static Moment (Short Block) (Table 5)

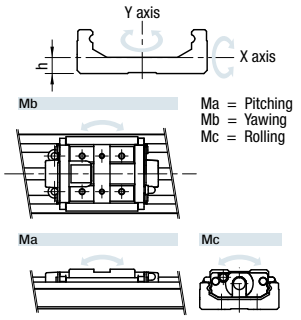
Type	No. of locks	Allowable Static Load (kg)	Allowable Static Moment (N·m)		
		Horizontal	Ma	Mb	Mc
LX3005	S1	9271	63	63	208
	S2	18542	579	579	417
LX3010	S1	9271	63	63	208
	S2	18542	579	579	417
LX4510	S1	17175	145	145	515
	S2	34350	1444	1444	1029
LX4520	S1	17175	145	145	515
	S2	34350	1444	1444	1029

■ Maximum travel speed (Table 6)

Type	Lead	L (mm)	Maximum Travel Speed (mm/s) Advanced
LX20_ _	01	–	190
	05	–	690
LX26_ _	02	–	290
	05	–	520
LX30_ _	06	150	410
		200	410
		300	410
		400	410
		500	370
		600	250
	10	150	830
		200	830
		300	830
		400	830
		500	740
		600	500
LX45_ _	10	340	550
		390	550
		440	550
		490	550
		540	550
		590	550
	20	340	1110
		390	1110
		440	1110
		490	1110
		540	1110
		590	1110

■ Load coefficient fw (Table 7)

Vibration/ Impact	Speed	fw
Subtle	Super-low speed V≤ 0.25m/s	1~1.2
Small	Low speed 0.25m/s<V≤ 1m/s	1.2~1.5
Medium	Medium speed 1m/s <V≤ 2m/s	1.5~2
Large	High speed 2m/s<V	2~3.5

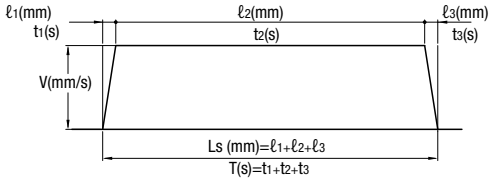


Selection is easy with Single Actuator calculation tool available at:
http://fawos.misumi.jp/FA_WEB/unit/web/misumi_LX_en.html

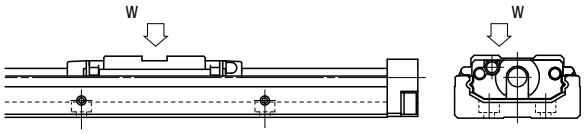
Life Span

For the LX actuator, calculate the life span of the rail, ball screw and support bearing. The actuator life span is determined to be the smallest value from among these results.

Load Mass	: W kg
Stroke	: Ls mm
Acceleration	: a mm/s^2
Maximum Speed	: v mm/s
Gravity	: g=9.81m/s^2
Acceleration	: Horizontal
Speed Diagram	: (Fig 1.)
Operating Conditions	: (Fig 2.)



Speed diagram (Fig. 1)



Status of load applied (Fig. 2)

Examination Selection

Select the temporary model number based on the load mass W (kg) and the maximum speed V (mm/s). Then prepare a speed diagram based on the acceleration, maximum speed and travel. The conditions that can develop this speed diagram will serve as the basis for the selection calculation.

Calculation Lifetime Calculation Example

Examine the status of the load applied (Fig. 2) to the rail of the LX actuator. Put each load in the formula below (formula (1) for single nut block specifications and formula (2) for double nut block specifications), and obtain the equivalent load Fe.

Equivalent Load

• In the case of single block

$$Fe=Y_HF_H+Y_VF_V+YpKpMa+YyKyMb+YrKrMc \quad -(1)$$

• In the case of double block

$$Fe=Y_HF_H/2+Y_VF_V/2+Y_RK_RMa+Y_PK_PMb+Y_YK_YMc \quad -(2)$$

F_e : Equivalent Load
F_H : Horizontal load acting on blocks
F_V : Vertical load applied to the block
Ma : Pitching direction moment applied to the block
Mb : Yawing direction moment applied to the block
Mc : Rolling direction moment applied to the block
Kp : Equivalent coefficient for pitching direction moment
Ky : Equivalent coefficient for yawing direction moment
Kr : Equivalent coefficient for rolling direction moment
Y_H,Y_V,Yp,Y_Y,Y_R:1.0 or 0.5

When the actuator is used under moment loads, calculate the load by multiplying the guide moment equivalent coefficient in Table 2. In formulas (1) and (2), in order to obtain the equivalent load Fe, the maximum value among FH, Fv, KpMa, KyMb and KrMc is determined to be 1.0, and the remaining items are set at 0.5.

Average Load

As Ma and Mb for the LX actuator vary with acceleration and deceleration, obtain the average load Fm from formula (3).

$$Fm=\sqrt[3]{\frac{1}{L_S}(Fe_1^3\cdot L_1+Fe_2^3\cdot L_2+Fe_3^3\cdot L_3\cdot\cdot Fen^3\cdot Ln)} \quad -(3)$$

Fm: Average load for fluctuating loads (N) L: Total travel distance (km)

Rail Life Span

Obtain the rail life span for the LX actuator from formula (4).

$$L=La\times\left(\frac{C}{fw\cdot Fm}\right)^3 \quad -(4)$$

L: Rail lifetime (km) La: Travel distance (km) fw: Load coefficient
C: Basic dynamic load rating (N)

When the travel length and the number of reciprocal motions per minute are constant, the number of life span hours can be calculated from formula (5).

$$Lh=\frac{L\times10^6}{2\cdot\ell s\cdot n1\times60} \quad -(5)$$

Lh: Life span hours (h) ℓs: Travel (mm) n1: Reciprocal motions per minute

Life span of ball screw and support areas

Obtain the average load from the load applied in the axial direction. Calculate life span for both ball screws and bearings from formula (6). Obtain the average load from formula (3).

$$Lr=\left(\frac{Ca}{fw\cdot Fm}\right)^3\cdot\ell\times10^6 \quad -(6)$$

Lr: Life span of ball screw (km) ℓ: Ball screw lead (mm)
fw: Load coefficient Ca: Basic dynamic load rating of screw and support (N)

Technical Data

Selection of Single Axis Actuators 2

Rated lifetime calculation example

1 Model number for examination

Operating conditions : LX26

Rail : C (Basic dynamic load rating)=6522N Co (Basic static load rating)=11871N

Ball screw : Ca (Basic dynamic load rating)=1712N Coa (Basic static load rating)=2251N

Support bearings : Ca (Basic dynamic load rating)=1637N Poa (Basic static load rating)=1205N

Load mass : 10kg

Maximum speed : 250mm/s

Acceleration : 833mm/s^2

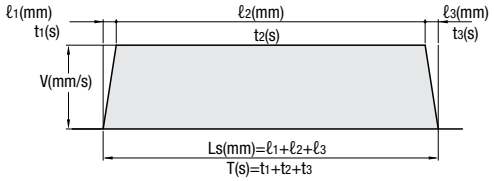
Stroke : 200mm

Gravity : g=9.81m/s^2

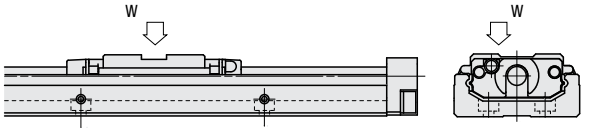
Position : Horizontal

Speed diagram : (Fig. 1)

Operating Conditions : (Fig. 2)



Speed diagram (Fig. 1)



Status of load applied (Fig. 2)

2 Examination

Temporary selection

Use a travel distance of 200 mm with an acceleration of 833 mm/s^2 and a maximum speed of 250 mm/s. Based on these conditions, assume that the LX26 series is used.
(The selection software can be used on the Misumi website after customer registration has been completed.)

3 Calculation

3–1 Examination of rail

Multiply the moment equivalent coefficient in the table with the load according to the condition in which one nut block is used.

Load for Nut Block

1) At constant speed

$Fe_1=Yv\ \ Fv=Yv\cdot W\cdot g=1\cdot 10\cdot 9.81=98.1(N)$

2) At acceleration

$Fe_2=YvFv+Yp\ \ Kp\ \ Ma=0.5\cdot 98.1+1\cdot 0.17\cdot 70\cdot 0=60.95(N)$

3) At deceleration

$Fe_3=Yv\ \ Fv+Yp\ \ Kp\ \ Ma=0.5\cdot 98.1+1\cdot 0.17\times 70\cdot 0=60.95(N)$

Static safety coefficient

$$fs=\frac{Co}{Femax}=\frac{Co}{W\cdot g}=\frac{11871}{98.1}=121.1$$

Rated Life Span

Axial average load

$$Fm=\sqrt[3]{\frac{1}{Ls}\left(Fe_1^{\,3}\cdot L_1+Fe_2^{\,3}\cdot L_2+Fe_3^{\,3}\cdot L_3\cdot\cdot Fen^3\cdot Ln\right)}=87.72(N)$$

Rated life span

$$L=\left(\frac{C}{fw\cdot Fm}\right)^3\times 50=11.89\times 10^6$$

fw : Load coefficient 1.2
La : Travel distance

3–2 Examination of ball screw

Obtain the axial loads for the parts and the average load from the speed diagram.

Lifetime of Ball Screw

Axial load

1) At constant speed

$Fe_1=\mu\cdot W\cdot g=0.01\times 10\times 9.81=0.981(N)$

2) At acceleration

$Fe_2=Fe_1+W\cdot a\times 10^{-3}=0.981+10\cdot 0.833=9.311(N)$

3) At deceleration

$Fe_3=Fe_1-W\cdot a\times 10^{-3}=7.352(N)$

Static safety coefficient

$$fs=\frac{Coa}{Femax}=\frac{Coa}{Fe_2}=\frac{2251}{9.311}=241.76$$

Selection is easy with Single Actuator calculation tool available at:
http://fawos.misumi.jp/FA_WEB/unit/web/misumi_LX_en.html

Buckling Load

$$P_1=\frac{n\cdot\pi^2\cdot E\cdot I}{\ell a^2}\times 0.5=5562.02(N)$$

P_1 : Buckling load
ℓa : Distance between mounting points 250(mm)
E : Young's modules $2.06\times10^5(N/mm^2)$
n : Coefficient according to mounting method
0.5 : Safety factor
I : Minimum geometrical moment of inertia of screw shaft

$$I=\frac{\pi\cdot d_1^{\,4}}{64}=85.49(mm^4)$$

d1 : Root diameter of screw shaft 6.46(mm)

Allowable tension/compression load

$$P_2=\frac{\delta\cdot\pi\cdot d_1^{\,2}}{4}=4818.06$$

P_2 : Allowable tension/compression load (N)
δ : Allowable tension/compression stress $147(N/mm^2)$
d_1 : Root diameter of screw shaft 6.46(mm)

Critical Speed

$$N1=\frac{60\cdot\lambda^2}{2\pi\cdot\ell b^2}\cdot\sqrt{\frac{E\times10^3\cdot I}{\gamma\cdot A}}\times 0.8=12485(min^{-1})$$

N1 : Critical speed
ℓb : Distance between mounting points
E : Young's modules $2.06\times10^5(N/mm^2)$
λ : Coefficient according to mounting method (Fixed-Support 3.927)
γ : Density $(7.85\times10^{-6}kg/mm^3)$
0.8 : Safety factor

DN value

DN=62250(≤70000)

D : Ball center to center diameter (8.3mm)
N : Maximum number of operating revolutions (min^{-1})

Rated Life Span

Axial average load

$$Fm=\sqrt[3]{\frac{1}{Ls}\left(Fe_1^{\,3}\cdot L_1+Fe_2^{\,3}\cdot L_2+Fe_3^{\,3}\cdot L3\cdot\cdot Fen^3\cdot Ln\right)}=6.096(N)$$

Rated life span

$$L=\left(\frac{Ca}{fw\cdot Fm}\right)^3\cdot\ell\times10^6=25.64\times10^6(km)$$

fw : Load coefficient 1.2
ℓ : Ball screw lead 2 (mm)

3–3 Examination of support bearing

Axial load

$Fe_1=0.981(N)$
$Fe_2=9.311(N)$
$Fe_3=7.352(N)$

Static safety coefficient

$$fs=\frac{Poa}{Femax}=\frac{Poa}{Fe_2}=129.42$$

Equivalent Load

Axial average load

$$Fm=\sqrt[3]{\frac{1}{L_S}\left(Fe_1^{\,3}\cdot L_1+Fe_2^{\,3}\cdot L_2+Fe_3^{\,3}\cdot L_3\cdot\cdot Fen^3\cdot Ln\right)}=6.096(N)$$

Rated lifetime

$$L=\left(\frac{Ca}{fw\cdot Fm}\right)^3\cdot\ell\times10^6=22.41\times10^6(km)$$

fw : Load coefficient 1.2
ℓ : Ball screw lead 2 (mm)

LX2602	Rail	Ball Screw	Support Bearing
Static safety factor	121.1	241.76	129.42
Buckling load (N)	—	5562.02	—
Allowable tension/compression load (N)	—	4818.06	—
Critical speed (min^{-1})	—	12485	—
DN value	—	62250	—
Rated lifetime (km)	11.89×10^6	22.31×10^6	19.505×10^6
Maximum axial load (N)	—	9.311	—
Maximum number of operating revolutions	—	7500	—

Technical Data

Excerpts from JIS B 1514

Radial Bearing (Class 0) Tolerances and Allowances

About IP Codes for Sensor Switches

Radial Bearing (Class 0) Tolerances and Allowances. (JIS Class 0 is equivalent to ABEC-1)

(1) Inner Wheel

Unit : μm

d(mm) Nominal Inner Diameter of Bearing		$\triangle_{dmp}$		Diameter Series 9 V_{dp}	Diameter Series 0,1 V_{dp}	Diameter Series 2,3,4 V_{dp}	V_{dmp}	K_{ia}	Single Bearing $\triangle_{Bs}$		Bearings in Combinations $\triangle_{Bs}$		V_{Bs}
More	or Less	Above	Below	Max.			Max.	Max.	Above	Below	Above	Below	Max.
0.6(1)	2.5	0	–8	10	8	6	6	10	0	–40	—	—	12
2.5	10	0	–8	10	8	6	6	10	0	–120	0	–250	15
10	18	0	–8	10	8	6	6	10	0	–120	0	–250	20
18	30	0	–10	13	10	8	8	13	0	–120	0	–250	20
30	50	0	–12	15	12	9	9	15	0	–120	0	–250	20
50	80	0	–15	19	19	11	11	20	0	–150	0	–380	25
80	120	0	–20	25	25	15	15	25	0	–200	0	–380	25
120	180	0	–25	31	31	19	19	30	0	–250	0	–500	30
180	250	0	–30	38	38	23	23	40	0	–300	0	–500	30
250	315	0	–35	44	44	26	26	50	0	–350	0	–500	35
315	400	0	–40	50	50	30	30	60	0	–400	0	–630	40
400	500	0	–45	56	56	34	34	65	0	–450	—	—	50
500	630	0	–50	63	63	38	38	70	0	–500	—	—	60
630	800	0	–75	—	—	—	—	80	0	–750	—	—	70
800	1000	0	–100	—	—	—	—	90	0	–1000	—	—	80
1000	1250	0	–125	—	—	—	—	100	0	–1250	—	—	100
1250	1600	0	–160	—	—	—	—	120	0	–1600	—	—	120
1600	2000	0	–200	—	—	—	—	140	0	–2000	—	—	140

(1) 0.6mm is included in this class. (2) Applies to each orbit ring made for bearing combination.

(2) Outer Ring

D(mm) Nominal Outer Diameter of Bearing		$\triangle_{Dmp}$		Open Bearing Diameter Series 9 $V_{DP}f$	Open Bearing Diameter Series 0,1 $V_{DP}f$	Open Bearing Diameter Series 2,3,4 $V_{DP}f$	Sealed Bearing, Shielded Bearing Diameter Series 2,3,4 $V_{DP}f$	(4) V_{Dmp}	K_{ea}	$\triangle_{Cs}$		V_{cs}
More	or Less	Above	Below	Max.				Max.	Max.	Above	Below	Max.
2.5(3)	6	0	–8	10	8	6	10	6	15	Depends on $\triangle_{Bs}$ tolerance against d of the same bearing.		Depends on $\triangle_{Bs}$ tolerance against d of the same bearing.
6	18	0	–8	10	8	6	10	6	15			
18	30	0	–9	12	9	7	12	7	15			
30	50	0	–11	14	11	8	16	8	20			
50	80	0	–13	16	13	10	20	10	25			
80	120	0	–15	19	19	11	26	11	35			
120	150	0	–18	23	23	14	30	14	40			
150	180	0	–25	31	31	19	38	19	45			
180	250	0	–30	38	38	23	—	23	50			
250	315	0	–35	44	44	26	—	26	60			
315	400	0	–40	50	50	30	—	30	70			
400	500	0	–45	56	56	34	—	34	80			
500	630	0	–50	63	63	38	—	38	100			
630	800	0	–75	94	94	55	—	55	120			
800	1000	0	–100	125	125	75	—	75	140			
1000	1250	0	–125	—	—	—	—	—	160			
1250	1600	0	–160	—	—	—	—	—	190			
1600	2000	0	–200	—	—	—	—	—	220			
2000	2500	0	–250	—	—	—	—	—	250			

(3) 2.5mm is included in this class. (4) Applies when a retaining ring is not installed.

Dimension Tolerance

- $\triangle_{dmp}$: Tolerance of Mean Inner Diameter within the Plane
- $\triangle_{Dmp}$: Tolerance of Mean Outer Diameter within the Plane
- $\triangle_{Bs}$: Measured Inner Ring Tolerance or Height Tolerance of Center Orbiting Plate
- $\triangle_{Cs}$: Measured Outer Ring Tolerance

Dimensional Inequality

- V_{dp} : Inner Diameter Inequality within the Plane
- V_{dmp} : Mean Inner Diameter Inequality within the Plane
- V_{Dp} : Outer Diameter Inequality within the Plane
- V_{DMp}: Mean Outer Diameter Inequality within the Plane
- V_{Bs} : Inequality of Inner Ring Widths
- V_{Cs} : Inequality of Outer Ring Widths

Rotation Precision

- K_{ia} : Radial Deviation of Inner Rings
- K_{ea} : Radial Deviation of Outer Rings

About IP Codes for Sensor Switches

- IP codes in this catalog are based on "Protection Statement for Equipments" of IEC 529:1989. Sealing ability may be affected by the conditions or environment in which it is used, such as cutting oil, chemicals, or existence of dust.

IP 6 7

(International Protecion)
First Characteristic Numeral (0~6):Ingress of Solid Foreign Objects
Second Characteristic Numeral(0~8):Ingress of Water with Harmful Effects

Characteristic Numeral	Ingress of Solid Foreign Objects	Ingress of Water with Harmful Effects
0	Non-Protected	Non-Protected
1	Protected against solid foreign objects 50mm in diameter or greater.	Protected against vertically falling water drops.
2	Protected against solid foreign objects 12.5mm in diameter or greater.	Protected against vertically falling water drops angled within 15 degree.
3	Protected against solid foreign objects 2.5mm in diameter or greater.	Protected against spraying water.
4	Protected against solid foreign objects 1.0mm in diameter or greater.	Protected against splashing water.
5	Dust-protected: Prevents the penetration of dust in amounts interfering with equipment operation.	Protected against water jetting from any direction.
6	Dust-tight:No ingress of dust.	Protected against powerful water jetting from any direction.
7	—	Protected against ingress of water in quantities causing harmful effects when the enclosure is temporarily immersed.
8	—	Protected against ingress of water in quantities causing harmful effects when the enclosure is continuously immersed in water under conditions more severe than No. 7, as determined by the parties concerned.

Technical Data

How to Use Coil Springs and Precautions

■ How to Use Coil Springs and Precautions

MISUMI is engaged in a constant effort to design coil springs (excluding Round Wire Springs) with optimum cross-sectional shape and maximum durability. When using the springs, pay due attention to the following precautions and undesirable usage that should be avoided for the sake of safety.

(1) Always Use A Spring Guide

When used without a spring guide, the coil spring may buckle or bend midway. This can cause it to break since the internal surface of the bending is subjected to concentrated high stress. Be sure to use a spring guide, such as a shaft and an outer diameter guide, with the coil spring.

*In most cases, the best results are obtained by inserting a shaft all the way through the coil spring, from top to bottom, as an inner diameter guide.

(2) Clearance between the Spring Inner Diameter and Shaft

When clearance between the spring and the shaft is insufficient, the coil spring's internal surface may come into contact with the shaft and be subject to abrasion at that point. This can lead to the spring eventually breaking at the point of wear. Excessive clearance with shaft, on the other hand, can lead to buckling of the coil spring. It is recommended that the shaft diameter be set approximately 1.0 mm smaller than the inner diameter of the coil spring.

When the coil spring has a long free length (i.e., free length/OD is 4 or larger), set up a step on the shaft as shown in Fig.-1 to prevent the coil spring's internal surface from touching the shaft when it bends.

(3) Clearance between The Spring OD and Counterbore Hole

The coil spring expands in the outward direction when it deflects. Insufficient clearance between the spring and the counterbore hole restrains expansion, and the resulting concentration of stress can cause the coil spring to break. It is recommended that the counterbore diameter be set approximately 1.5mm larger than the outer diameter of the coil spring. The counterbore configuration shown in Fig.-1 is ideal for a coil spring with a long free length.

(4) Avoid A Short Shaft Length and Shallow Counterbore Hole Depth

If the guide is too short, the coil spring may touch the guides tip when it is buckled. The resulting friction can cause the coil spring to break. It is recommended that the guide length be set longer than half of the initial height. Also make sure to chamfer the shaft to around C3 level.

(5) Do Not Use in Excess of The Maximum Deflection (300,000 times limit) or Near Its Solid Length

When the coil spring is used in excess of the 300,000 times limit, its Cross-section starts receiving stress that is higher than the theoretical value. This can cause the coil spring to break. Furthermore, when the coil spring is used at around its solid length, its active coils gradually adhere to each other, increasing the spring constant value and causing the load curve to rise, as shown in Fig.-2. Do not use the coil spring in excess of the 300,000 times limit.

(6) Set up An Initial Deflection

When there is a gap for the coil spring to move vertically, it receives an impact force that causes it to bend midway or to buckle.

Setting up an initial deflection stabilizes the top and bottom ends of the spring.

(7) Avoid Entrapment of Debris or Foreign Matter

Debris or foreign matter that becomes caught between the coils cause that part of the coil spring to stop functioning as active coils, forcing the other coils to deflect, as shown in Fig.-3. This effectively reduces the number of active coils, increasing the stress on the spring, and eventually causing it to break. Be careful not to allow debris or foreign matter to clog the coils.

(8) Keep Mounting Faces Parallel

The coil spring should be mounted properly, with its mounting faces top and bottom faces parallel to each other. Misalignment can cause the spring to bend midway, subjecting the bend to high stress. This can cause the spring to break at the point. The same applies to the dies in which the coil spring is used, if the parallel alignment between the dies is poor, as shown in Fig.-4, the coil spring can bend midway or exceed the 300,000 times limit prematurely. Keep the coil spring mounting faces as perfectly parallel as possible to prevent this from occurring.

(9) Do Not Use Coil Springs in Series

If you use two coil springs in series, they will tend to bend, as shown in Fig.-5. This can cause them to move out of the shaft, counterbore holes. If this happens, this coil spring will eventually break for the same reasons described in (1) above. Moreover, due to spring load differences, the weaker spring is overcome by, and deflects more than, the stronger spring, as shown in Fig.-6. This will make the weaker spring more prone to damage, or cause it to break.

(10) Do Not Use Two Coil Springs in Parallel

Use of two coil springs in parallel, as shown in Fig.-7, may result in the inner coils being sandwiched between the outer coils, or vice versa, when they contract. This can cause the coil springs to break for the same reason noted in (4).

(11) Do Not Use the Coil Spring Horizontally

When the coil spring is used horizontally, the internal surface of the spring will come into contact with the shaft, causing abrasion at those spots. The spring will eventually break at these weakened spots.

MISUMI Endurance Test Conditions

(1) Spring Guide Formula
Shaft Penetration
Shapt Dia.: -1.0mm less than d dimension

(2) Initial Deflection
1.0mm

(3) Amplitude
Deflection with 300,000 time limit value

(4) Velocity
180spm

*The maximum number of allowable operating times may vary depending on the service conditions.

Fig-1

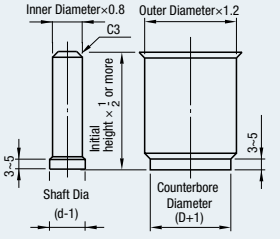


Fig-2

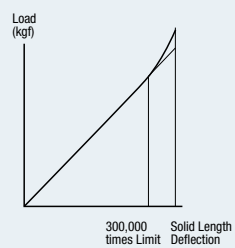


Fig-3

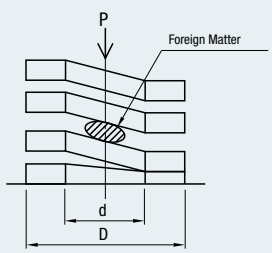


Fig-4

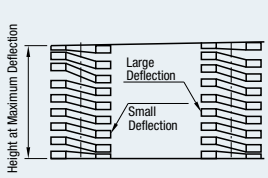


Fig-5

Fig-6

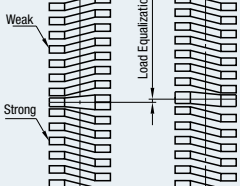


Fig-7

Technical Data

Excerpts from JIS B 2704(2000)

Spring Calculations

1. Calculation

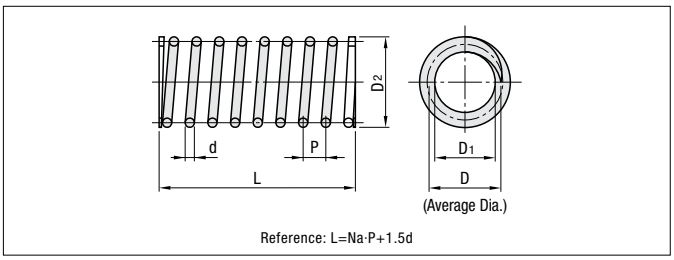
1.1 Symbols Used in Spring Design Formulae

Symbols used in spring design formulae are shown in Table 1.

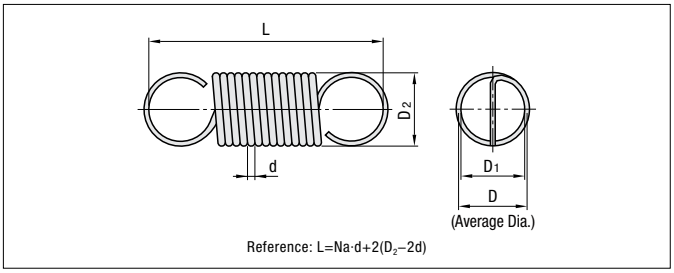
Table 1. Meaning of Symbols

Symbol	Meaning of Symbols	Unit
d	Diameter of Material	mm
D_1	Inner Diameter of a Coil	mm
D_2	Outer Diameter of a Coil	mm
D	Coil Mean Diameter= $\frac{D_1+D_2}{2}$	mm
N_t	Total Number of Winding	–
N_a	Number of Active Winding	–
L	Free Length(Length)	mm
H_S	Solid Length	mm
p	Pitch	mm
P_i	Initial Tension	N{kgf}
c	Spring Index $c=\frac{D}{d}$	–
G	Shear Modulus of Elasticity	N/mm^2{kgf/mm^2}
P	Load on Spring	N{kgf}
δ	Spring Deflection	mm
k	Spring Constant	N/mm{kgf/mm}
τ_0	Torsional Stress	N/mm^2{kgf/mm^2}
τ	Corrected Torsional Stress	N/mm^2{kgf/mm^2}
τ_i	Initial Stress	N/mm^2{kgf/mm^2}
χ	Stress Correction Factor	–
f	Frequency	Hz
U	Spring-Retained Energy	N·mm{kgf·mm}
ω	Per Unit Volume Material Weight	kg/mm^3
W	Mass of Moving Parts	kg
g	Gravitational Acceleration (1)	mm/s^2

Note (1) In spring calculations, a gravitational acceleration of 9806.65mm/s^2, is used.



Reference: L=Na·P+1.5d



Reference: L=Na·d+2(D$_2$−2d)

1.2 Basic Formulae Used in Designing of Springs

1.2.1 Compression Springs, and Tension Springs without Initial Tension

$$\delta=\frac{8N_aD^3P}{Gd^4} \quad (1) \qquad \tau=\chi\tau_0 \quad (5)$$

$$k=\frac{P}{\delta}=\frac{Gd^4}{8N_aD^3} \quad (2) \qquad d=\sqrt[3]{\frac{8DP}{\pi\tau_0}}=\sqrt[3]{\frac{8\chi DP}{\pi\tau}} \quad (6)$$

$$\tau_0=\frac{8DP}{\pi d^3} \quad (3) \qquad N_a=\frac{Gd^4\delta}{8D^3P}=\frac{Gd^4}{8D^3k} \quad (7)$$

$$\tau_0=\frac{Gd\delta}{\pi N_aD^2} \quad (4) \qquad U=\frac{P\delta}{2}=\frac{k\delta^2}{2} \quad (8)$$

1.2.2 Tension Springs with Initial Tension (Where:P>Pi)

$$\delta=\frac{8N_aD^3(P-P_i)}{Gd^4} \quad (1') \qquad \tau=\chi\tau_0 \quad (5')$$

$$k=\frac{P-Pi}{\delta}=\frac{Gd^4}{8N_aD^3} \quad (2') \qquad d=\sqrt[3]{\frac{8DP}{\pi\tau_0}}=\sqrt[3]{\frac{8\chi DP}{\pi\tau}} \quad (6')$$

$$\tau_0=\frac{8DP}{\pi d^3} \quad (3') \qquad N_a=\frac{Gd^4}{8D^3k}=\frac{Gd^4\delta}{8D^3(P-P_i)} \quad (7')$$

$$\tau_0=\frac{Gd\delta}{\pi N_aD^2}+\tau_i \quad (4') \qquad U=\frac{(P+P_i)\delta}{2} \quad (8')$$

1.3 Points to Note when Designing Springs

1.3.1 Shear Modulus of Elasticity

Shear modulus of elasticity(G) listed in Table 2 is recommended for the designing of springs.

Table 2. Shear Modulus of Elasticity(G)

Material		G Value N/mm^2 (kgf/mm^2)	Symbol
Spring Steel		78×10^3{8×10^3}	SUP6, 7, 9, 9A, 10, 11A, 12, 13
Hard Steel Wire		78×10^3{8×10^3}	SW-B, SW-C
Piano Wire		78×10^3{8×10^3}	SWP
Oil Tempered Steel Wire		78×10^3{8×10^3}	SWO, SWO-V, SWOC-V, SWOSC-V, SWOSM, SWOSC-B
Stainless Steel Wire	SUS 302	69×10^3{7×10^3}	SUS 302
	SUS 304		SUS 304
	SUS 304N1		SUS 304N1
	SUS 316		SUS 316
	SUS 631 J1	74×10^3{7.5×10^3}	SUS 631 J1

1.3.2 Number of Active Winding

The number of active winding can be determined as follows.

(1) Compression Springs

$N_a=N_t-(X_1+X_2)$

Where X1 and X2: are the number of turns at each end of the coil.

(a) When only the end of the coil is in contact with the next free coil
[Corresponding to (a) ~ (c) in Fig.2]

$X_1=X_2=1$

Therefore, $N_a=N_t-2$

(b) When the end of the coil is not in contact with the next coil, and the spring end has $\frac{3}{4}$ of a turn.
[Corresponding to (a) ~ (e) in Fig.2]

$X_1=X_2=0.75$

Therefore, $N_a=N_t-1.5$

(2) Tension Springs

The number of active winding can be determined as follows. But hooks are ignored.

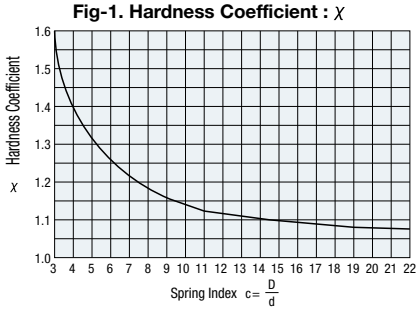
$N_a=N_t$

1.3.3 Stress Correction Factor

The stress correction factor relative to the spring index (C) can be determined by using the following formula or based on Fig.1.

$$\chi = \frac{4c-1}{4c-4} + \frac{0.615}{c} \quad \cdots\cdots (9)$$

Fig-1. Hardness Coefficient : χ



1.3.4 Solid Length

The solid length of a spring can normally be obtained by using the following simplified formula. Generally, the purchaser of a compression spring does not specify the solid length of the spring.

$$H_s=(N_t-1)d+(t_1+t_2) \quad \cdots\cdots (10)$$

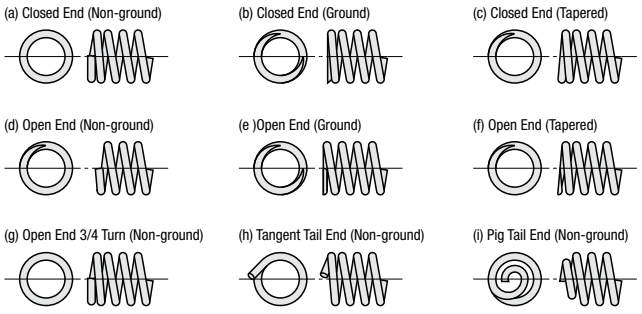
where, (t_1+t_2) : is the sum of the thicknesses of the coil ends.

As for those compression springs, both ends of which are shaped as shown in (b), (c), (e) or (f) of Figure 2 and for which the solid length needs to be specified, the following formula can be used to obtain the maximum solid length. However, the actual maximum solid length can be greater than the value thus calculated depending on the shape of the spring in question.

$$H_s=N_t\times d_{max} \quad \cdots\cdots (11)$$

where dmax : d is the material diameter with the maximum tolerance.

Fig-2. Coil End Shape



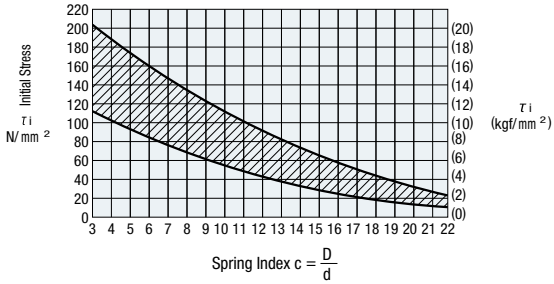
1.3.5 Initial Tension of Tension Springs

Cold-formed solid-coiled tension springs are subjected to initial tension (Pi).
The initial tension can be obtained using the following formula.

$$P_i=\frac{\pi d^3}{8D}\tau_i \quad \cdots\cdots (12)$$

On solid-coiled piano wire, hard steel wire, and other steel wires that are not low-temperature annealed, the initial stress occurs within the hatched range shown in Fig.3. However, if materials other than steel wire are used, or the wire in question is low-temperature annealed, the initial stress taken from within the hatched range in Fig.3 should be corrected as follows.

Fig-3 Initial Stress : τi (Spring formed from steel coil, not low-temperature annealed)



(1) When using stainless steel wire, decrease the initial stress value for steel wire by 15%.

(2) If the spring is low-temperature annealed after being formed, decrease the value by 20~35% for springs made of piano wire, hard steel wire, or other stainless steel wires, and by 15~25% for springs made of stainless steel wire.

Reference In place of Fig.3, the following empirical formula can be used to establish the initial stress for springs before low-temperature annealing.

$$\tau_i=\frac{G}{100c}$$

The following examples are for applications of this formula to obtain the initial tension.

(1) Piano Wire / Hard Steel Wire [$G=78\times10^3$N/mm^2 {8×10^3kgf/mm^2}]

Initial Stress $\tau_i=\frac{G}{100c}\times0.75$ (0.75 by 25, reduction by low-temperature annealing).

Initial Tension $P_i=\frac{\pi d^3}{8D}\ \tau_i=\frac{Gd^4}{255D^2}\times0.75=\frac{229d^4}{D^2}\left\{\frac{24d^4}{D^2}\right\}$

(2) When using stainless steel wire [$G=69\times10^3$N/mm^2{7×10^3kgf/mm^2}]

Initial Stress $\tau_i=\frac{G}{100c}\times0.8$(0.8 by 20, reduction by low-temperature annealing).

Initial Tension $P_i=\frac{\pi d^3}{8D}\ \tau_i=\frac{Gd^4}{255D^2}\times0.8=\frac{216d^4}{D^2}\left\{\frac{22d^4}{D^2}\right\}$

1.3.6 Surging

In order to prevent surging, the spring selected should be as that its natural frequency does not resonate with any of the natural frequencies that may act upon the spring.
The initial tension can be obtained using the following formula.

$$f=a\sqrt{\frac{kg}{W}}=a\frac{70d}{\pi N_aD^2}\sqrt{\frac{G}{\omega}} \quad \cdots\cdots (13)$$

Where, $a=\frac{i}{2}$:when both spring ends are either free or fixed

$a=\frac{2i-1}{4}$:When one spring end is fixed while the other end is free i=1,2,3

$G=78\times10^3$N/mm^2 {8×10^3kgf/mm^2},
$w=76.93\times10^{-6}$ N/mm^3 {7.85×10^{-6}kgf/mm^3} If both spring ends are either free or fixed, the natural primary frequency of a spring can be obtained as follows.

$$f_1=3.56\times10^5\frac{d}{NaD^2} \quad \cdots\cdots (13')$$

1.3.7 Other Points to Note

In spring design calculations, the following points should also be taken into account.

(1) Spring Index Excessive local stress can result from too small spring index. Machinability is compromised if the spring index is too great or small. The spring index should be selected from the range of 4~15 when hot forming, and from the range of 4~22 when cold forming.

(2) Slenderness Ratio In order to ensure the correct number of active winding, the slenderness ratio for a compression spring (Ratio of free height to coil mean diameter) should be 0.8 or greater. Furthermore, buckling considered, it is generally recommended that the slenderness ratio be selected from the range of 0.8~4 to prevent buckling.

(3) Number of Active Winding The number of active winding should be 3 or more in order to stabilize spring characteristics.

(4) Pitch Generally, when the pitch exceeds 0.5D, the spring deflection (load) increases to the extent that the coil diameter changes. This requires correction of the deflection and torsional stress values obtained by the basic formulae. Therefore, the pitch should be 0.5D or smaller. The pitch can generally be estimated using the following simplified formula.

$$p=\frac{L-H_s}{N_a}+d \quad \cdots\cdots (14)$$

Technical Data

Designing of Chain Drive Mechanism 1

Selection of Power Transmission Efficiency

The table of transmission performance in this catalog (**P. 235**) is based on the following conditions.

1) The chain drive mechanism is run in an atmosphere with a temperature of -10˚C~+60˚C and with no abrasive particles.
2) There is no adverse impact on the mechanism, such as corrosive gas or high humidity.
3) The two shafts between which power is transmitted are parallel with each other and correctly installed.
4) The recommended lubrication method and oil are used.
5) The power transmission is subjected to minimum load variation.

■ Power Transmission Coefficient for Multiple Chains

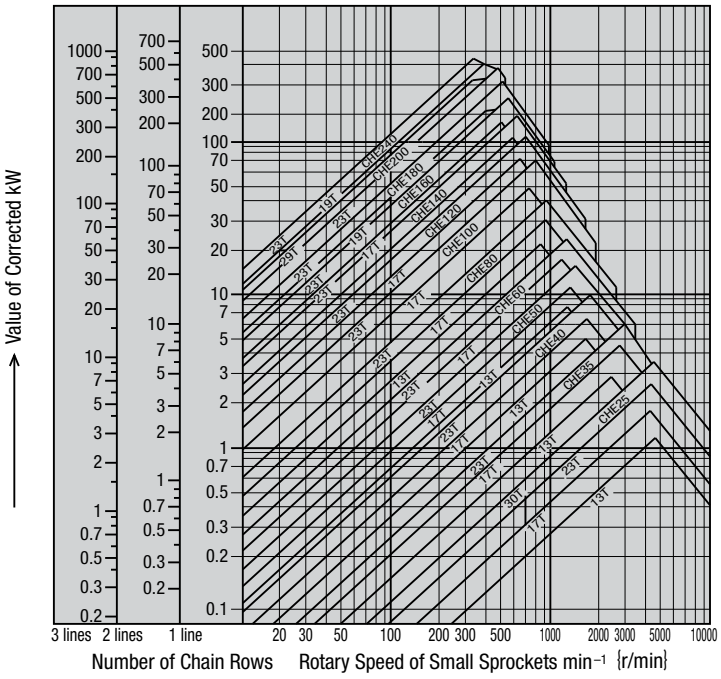
On multiple roller chains, the load is not shared evenly between each chain row. Therefore, the power transmission efficiency of multiple roller chains cannot be obtained by simply multiplying the power transmission efficiency of a single chain by the number of chain rows. The power transmission efficiency of multiple roller chains should be obtained by multiplying the power transmission efficiency of a single chain by the multiple chain power transmission coefficient.

Table 2. Power Transmission Coefficient for Multiple Chains

Number of Roller Chain Rows	Multiple Row Coefficient
2 lines	x1.7
3 lines	x2.5
4 lines	x3.3
5 lines	x3.9
6 lines	x4.6

■ Selection Guide Table

Table 3. Selection Guide Table



■ Application Coefficient Table

The power transmission efficiency table (**P. 235**) is based on minimum load variation. The transmitted kW shown in the table should be corrected as follows depending on the actual magnitude of load variation.

Table 1. Application Coefficient Table

Impact Type	Prime Motor Type Typical	Turbine Motor	Internal Combustion Engine	
			With Fluidic Mechanism	Without Fluidic Mechanism
Smooth Transmission	Belt conveyor with small load variation, Chain conveyor, Centrifugal pump, Centrifugal blower, General textile machinery, General machinery with small load variation.	x1.0	x1.0	x1.2
Transmission with Moderate Impact	Centrifugal compressor, Marine propeller, Conveyor with moderate load variation, Automatic furnace, Drier, Pulverizer, General machine tools, Compressor, General earth-moving machinery, General paper manufacturing machinery	x1.3	x1.2	x1.4
Transmission with Large Impact	Press, Crusher, Construction and mining machinery, Vibrator, Oil well digger, Rubber mixer, Roll, Rollgang, General machinery with reverse or impact load	x1.5	x1.4	x1.7

How to Read The Table

Ex. Corrected kW=5kW
Rotary Speed of Small Sprockets=300r/min
When single chain

The intersection point of the vertical axis (corrected kW) and the horizontal axis (rotary speed 300r/min) is below CHE 60 23T (23 toothed) and above 17T (17 toothed) A closer look at the location of the intersection point indicates that it most probably corresponds to 19T.

■ Specification Selection for Operation Under Normal Conditions

1.Operating Conditions

When selecting roller chains, the following 7 parameters should be taken into account.

1. Machine to be used
2. Impact Type
3. Prime Motor Type
4. Power Transmission(kW)
5. Diameter and Rotary Speed of High-Speed Shaft
6. Diameter and Rotary Speed of Low-Speed Shaft
7. Inter-Shaft Distance

2. Application Coefficient

Select the application coefficient from the application table (Table 1) that is appropriate for the machine to be driven and the prime motor type.

3. Corrected Power Transmission(kW)

Correct the power transmission(kW)using the application coefficient.

- Single Chain…Corrected Power Transmission(kW)=Power Transmission(kW)×Application Coefficient
- Multiple Chains…Select the appropriate coefficient from the table multiple-chain power transmission coefficients (Table 2).

$$\text{Corrected Power Transmission(kW)} = \frac{\text{Power Transmission(kW)} \times \text{Application Coefficient}}{\text{Multiple Row Coefficient}}$$

4. Chain and Number of Sprocket Teeth

Using the selection guide table(Table 3)or the power transmission efficiency tables, select the chain and the number of small sprocket teeth that satisfy the rotary speed of the high-speed shaft and the corrected power transmission(kW). The chain pitch should be as small as possible, as long as the required power transmission efficiency is achieved. This should minimize noise and ensure smooth transmission of power. (If a single chain does not provide the required power transmission efficiency, use multiple chains instead. If the installation space requires that the inter-shaft distance as well as the outer diameter of sprocket be minimized, use small-pitch multiple chains.) There should be a minimum wrap angle of 120° between the small sprocket and the chain.

5. Number of Large Sprocket Teeth

Number of Large Sprocket Teeth = Number of Small Sprocket Teeth × Speed Ratio Once the number of small sprocket teeth is determined, multiplying this by the speed ratio provides the number of large sprocket teeth. Generally, the appropriate number of small sprocket teeth is 17 or greater, or 21 or greater for high-speed operation, or 12 or greater for low speed operation. The number of large sprocket teeth should be 120 or less.Select the sprocket with as great a number of teeth as possible for a speed ratio of 1:1 or 2:1. The speed ratio should normally be 1:7 or less, and ideally 1:5.

6. Shaft Diameter

Ensure that the small sprocket selected as above is compatible with the diameter of the existing shaft on which it is to be installed. Refer to the specification table on this page. When the shaft diameter is too large for the bore in the sprocket, select another sprocket with a greater number of teeth or a larger chain.

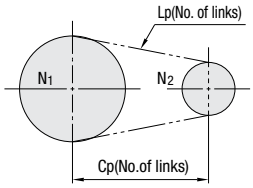
7. Inter-shaft Distance between Sprockets

The distance between the shafts can be reduced as long as the sprockets do not interfere with each other and the wrap angle between the small sprocket and the chain is 120° or more.

Generally, the inter-shaft distance should preferably be 30~50 times the pitch of the chain used. Under pulsating load conditions, decrease the distance to 20 times the chain pitch or less.

8. Chain Length and Distance between Shaft Centers

Once the chain, the number of teeth on both sprockets, and the inter-shaft distance are available, determine the number of chain links as follows.



Lp:Chain Length Expressed in Number of Links

N_1 : Number of Large Sprocket Teeth
N_2 : Number of Small Sprocket Teeth
Cp: Distance between Shaft Centers Expressed in Number of Links
π : ≈3.14

(1) Calculating the chain length (when the number of sprocket teeth N_1 and N_2 and the distance between shaft centers Cp are available)

$$Lp = \frac{N_1+N_2}{2} + 2Cp + \frac{\left(\frac{N_1-N_2}{2\pi}\right)^2}{Cp}$$

*Round up decimals of Lp to the next whole number.

Generally, when the chain length number of chain links obtained is an odd number, this should be raised to the next even number. When the inter-shaft distance demands the chain length to be an odd number, an offset link needs to be used. However, it should be avoided and an even number should be used as much as possible by adjusting the number of sprocket teeth or the inter-shaft distance.

(2) Calculating the distance between shaft centers (when the number of sprocket teeth N_1,and N_2 as the chain length Lp are available)

$$Cp = \frac{1}{8}\left\{ 2Lp - N_1 - N_2 + \sqrt{(2Lp - N_1 - N_2)^2 - \frac{8}{\pi^2}(N_1 - N_2)^2} \right\}$$

The pitch number obtained by the chain length formula is, in most cases, only approximate and not in exact agreement with a given inter-shaft distance. Therefore, it will be necessary to calculate the exact distance between the shaft centers based on the required overall length.

■ Example of Selection for Operation Under Normal Conditions

The following is an example of selection when a 3.7 kW 1,000r/min electric (motor) is used to drive a compressor.

[1] Operating Conditions

1) Machine to be used ····· Compressor, 10 hours operation
2) Impact Type ····· Smooth Transmission
3) Prime Motor Type ····· Electric Motor
4) Power Transmission ····· 3.7kW
5) Rotary Speed ····· 1000r/min

[2] Application Coefficient
From Table 1, an application coefficient of 1.2 is selected.

[3] Corrected Power Transmission(kW)
Corrected Power Transmission(kW)=Power Transmission(kW)×Application Coefficien
=3.7kW×1.2=4.44kW

[4] Chain and Number of Sprocket Teeth
Searching the selection guide table (Table 3) for a combination of 1,000 r/min and 4.44 kW provides a CHE40 chain and 17T sprocket.
On the power transmission efficiency table for the CHE40 chain, a combination of 13T and 1,000r/min provides a power transmission efficiency of 4.09 kW, which does not meet the required 4.44 kW. Therefore, 19T, which achieves 4.6 kW, should be selected to meet the requirement.
Results The CHE40 chain should be selected.
Number of Small Sprocket Teeth=19T

Technical Data

Designing of Chain Drive Mechanism 2

■ Specification Selection for Low-Speed Operation

In operations using a chain speed of 50 m/min. or less, chain elongation due to wear can almost be ignored. Under such low-speed conditions, the service life of the chain largely depends on its fatigue strength. Low-speed operation is more economical than operation under "normal conditions". Low speed is recommended for operations with fewer startups and stops that enable smooth power transmission. Selection of ambient atmosphere, layout, lubrication, etc. for low-speed operation is the same as that for operation under normal conditions. Selection should be made in accordance with the following formula.

Max. Allowable Tension of Chain	≥	Max. Tension N Working on Chain	x	Application Coefficient (Table 1) **P. 232**	x	Speed Coefficient (Table 4)

Table 4. Speed Coefficients

Roller Chain Speed	Speed Coefficient
0~15 m/min	1.0
15~30	1.2
30~50	1.4
50~70	1.6

[1] Operating Conditions
Same as for "Specifications Selection for Operation under Normal Conditions"

[2] Chain and Number of Small Sprocket Teeth
From the selection guide table 3 (**P. 232**), select a chain and a sprocket slightly undersized for the rotary speed (r/min) and the prime mover (kW) used.

[3] Calculating the Chain Speed
Based on the sprocket selected(chain pitch, number of teeth)and the number of revolutions (r/min), calculate the chain speed as follows.

$$V = \frac{P \cdot N \cdot n}{1000} \text{ (m/min)}$$

V : Chain Speed(m/min)
P: Chain Pitch(mm)
N: Number of Sprocket Teeth
n : Rotary of Sprocket Teeth(r/min)

[4] Calculating the Max. Working Load on Chain
Calculating the Maximum Working Load on the Chain

$$F = \frac{60 \cdot kW}{V} \text{ (kN)}$$

F : Load on Chain(kN)
V : Chain Speed(m/min)
kW: Power Transmission(kW)

[5] Application Coefficient
From the application coefficient table (Table 1), select the appropriate coefficient.

[6] Speed Coefficient
Based on the chain speed obtained in [3] above, calculate the appropriate speed coefficient.

[7] Maximum Allowable Tension of Chain
In the formula, substitute the values obtained in [4]~[6] above as well as the maximum allowable tension (obtained from actual products) for the chain selected in [2] above. Check whether these values satisfy the formula. If not, try again with another chain and sprocket set.

[8] Number of Large Sprocket Teeth, Shaft Diameter, and Chain Length same as for "Specification Selection for Operation under Normal Conditions".

■ Specification Selection for Low-Speed Operation with Impact Load

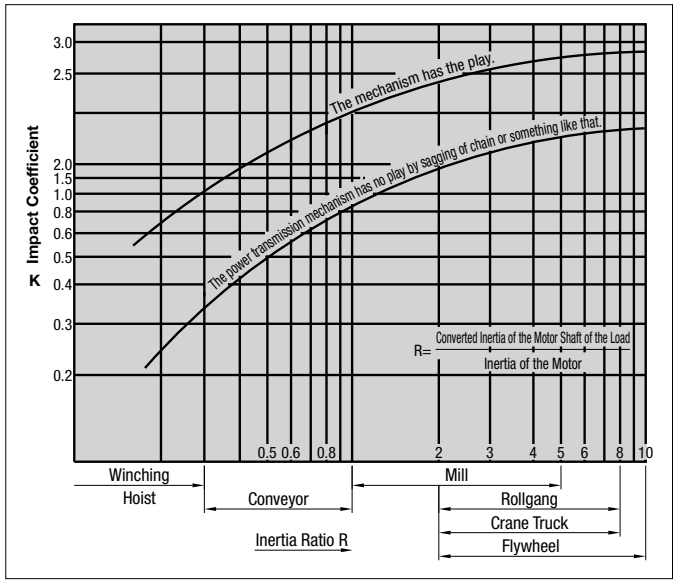
In operations with a great amount of impact loading due to frequent startups, stops, reversing, or braking, the inertia (GD^2) of the prime mover and the driven machine needs to be taken into account.
Under such conditions, exercise extreme caution, as the chain can be subjected to loads much greater than in operation under normal conditions.
Select the chain using the following formula.

Max. Allowable Load of Chain N	≥	Load Acting on Chain as Calculated from the Starting Torque of the Prime Mover	x	Impact	x	Speed

Impact Coefficient

This is a constant, shown in (Table 5), determined by the ratio of inertia (GD^2) of prime mover to driven machine as well as the magnitude of play in the power transmission mechanism used. When the power transmission mechanism has excessive play, it loads greater impact than those in the table can result.

Table 5. Impact Coefficient



■ Selection of Stainless Roller Chains (CHES)

Selection of stainless roller chains follows the specification selection for low-speed operation.

1). The maximum allowable tension for CHES (stainless type) is lower than that for CHE (steel type).

2). Avoid using offset links as much as possible.

■ Selection Based on Temperature

Selection of Roller Chains Based on Temperature

The following table shows selection criteria for roller chains by size based on temperature and the associated reduction in strength.

1) Problems associated with roller chain operation at high temperature
   (1) Reduced hardness and resultant increase in wear
   (2) Elongation due to softening
   (3) Poor lubrication and flexing and wear increase due to oil deterioration and carbonization
   (4) Wear increase and poor flexing due to scale
2) Problems associated with roller chain operation at low temperature
   (1) Low-temperature brittleness and resultant reduction in impact strength
   (2) Solidification of lubricating oil
   (3) Poor flexing due to attachment of frost and ice

Guide Table for Roller Chain Power Transmission Efficiency at High, Low Temperature

Temperature	CHE Roller Chain	
	CHE60 or Less	CHE80 or Above
-60˚C or below	—	—
-60˚C ~ -50˚C	—	—
-50˚C ~ -40˚C	—	Cannot Be Used
-40˚C ~ -30˚C	Cannot Be Used	Catalog Value×1/4
-30˚C ~ -20˚C	Catalog Value×1/4	Catalog Value×1/3
-20˚C ~ -10˚C	Catalog Value×1/3	Catalog Value×1/2
-10˚C ~ 60˚C	Catalog Value	Catalog Value
60˚C ~ -150˚C	Catalog Value	Catalog Value
150˚C ~ 200˚C	Catalog Value×3/4	Catalog Value×3/4
200˚C ~ 250˚C	Catalog Value×1/2	Catalog Value×1/2
Above 250˚C	Cannot Be Used	Cannot Be Used

Selection of Stainless Roller Chains for High-Temperature Operation

(1) Follow the specification selection for low-speed operation up to 400˚C.
(Do not use the specification selection method for operation under normal conditions.)
(2) Above 400˚C, use the temperature coefficient described below.
(3) Formula

Max. Working Load on Chain × Application Coefficient (Table 1) × Speed Coefficient (Table 4) × Temperature Coefficient (Kt) ≤ Max. Allowable Tension of Chain

Temperature Coefficient (Kt)

Temperature	Coefficient (Kt)
400˚C Less	1.0
400˚C ~ 500˚C	1.2
500˚C ~ 600˚C	1.5
600˚C ~ 700˚C	1.8
Above 700˚C	Cannot Be Used

Take account of corrosion resistance, which begins to decline above 400˚C.

■ Power and Torque

1kW=102kgf·m/sec 1PS=735.5W(Metric Power)
1kW=1000W 1HP=745.7W(Imperial Power) } ≈750W

*Torque :1kg·m=100kg·cm
1kg·m=9.8N·m (newton metre)
1N·m=0.120kg·m
1r/min =1rpm

Obtaining Power from Torque and Rotary Speed

$$\text{Output (kW)} = \frac{\text{Torque((N·m)} \times \text{ Rotary speed(r/min)}}{9.55 \times 1000}$$

CHE35 (Single Chain)

(kW)

Number of Small Sprocket Teeth	Rotary Speed of Small Sprockets min (r/min)																									
	50	100	300	500	700	900	1200	1500	1800	2100	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000	8500	9000	10000
9	0.06	0.11	0.29	0.46	0.63	0.79	1.02	1.25	1.48	1.69	1.98	1.62	1.29	1.05	0.88	0.75	0.66	0.57	0.51	0.46	0.41	0.37	0.34	0.31	0.27
10	0.07	0.12	0.33	0.52	0.71	0.89	1.15	1.40	1.65	1.89	2.22	1.90	1.51	1.23	1.04	0.88	0.77	0.67	0.60	0.53	0.48	0.43	0.40	0.37	0.31
11	0.07	0.13	0.37	0.57	0.78	0.98	1.27	1.55	1.83	2.10	2.46	2.19	1.74	1.42	1.19	1.02	0.88	0.78	0.69	0.61	0.55	0.50	0.46	0.43	0.36
12	0.08	0.15	0.40	0.63	0.86	1.07	1.40	1.71	2.01	2.31	2.70	2.50	1.98	1.62	1.36	1.16	1.01	0.88	0.78	0.70	0.63	0.57	0.52	0.48	0.41
13	0.09	0.16	0.44	0.69	0.94	1.17	1.52	1.86	2.19	2.52	2.95	2.81	2.24	1.83	1.53	1.31	1.13	0.99	0.88	0.79	0.71	0.65	0.59	0.54	0.46
14	0.10	0.18	0.47	0.75	1.01	1.28	1.65	2.01	2.37	2.73	3.19	3.15	2.50	2.04	1.72	1.46	1.27	1.11	0.98	0.88	0.80	0.72	0.66	0.60	0.51
15	0.10	0.19	0.51	0.81	1.10	1.37	1.78	2.17	2.56	2.94	3.44	3.49	2.77	2.27	1.90	1.62	1.40	1.23	1.10	0.98	0.88	0.80	0.73	0.67	0.57
16	0.11	0.20	0.54	0.87	1.17	1.47	1.90	2.33	2.75	3.15	3.69	3.84	3.05	2.50	2.10	1.79	1.55	1.36	1.21	1.08	0.97	0.88	0.81	0.74	0.63
17	0.12	0.22	0.58	0.93	1.25	1.57	2.04	2.48	2.93	3.36	3.94	4.21	3.34	2.74	2.29	1.95	1.69	1.49	1.32	1.18	1.07	0.97	0.88	0.81	0.69
18	0.13	0.23	0.62	0.98	1.33	1.67	2.16	2.64	3.12	3.58	4.19	4.59	3.64	2.98	2.50	2.13	1.85	1.62	1.44	1.29	1.16	1.05	0.96	0.88	0.75
19	0.13	0.25	0.66	1.04	1.41	1.77	2.29	2.80	3.30	3.80	4.44	4.98	3.95	3.23	2.71	2.31	2.01	1.76	1.56	1.40	1.26	1.14	1.04	0.95	0.82
20	0.14	0.26	0.69	1.10	1.49	1.87	2.42	2.96	3.49	4.01	4.69	5.37	4.27	3.49	2.94	2.50	2.16	1.90	1.69	1.51	1.36	1.23	1.13	1.04	0.88
21	0.15	0.28	0.73	1.16	1.57	1.97	2.55	3.13	3.68	4.23	4.95	5.78	4.59	3.75	3.15	2.69	2.33	2.04	1.81	1.62	1.46	1.33	1.21	1.11	0.95
22	0.16	0.28	0.77	1.22	1.66	2.07	2.69	3.28	3.87	4.47	5.20	6.12	4.92	4.03	3.37	2.88	2.50	2.19	1.95	1.74	1.57	1.42	1.30	1.19	1.02
23	0.16	0.30	0.81	1.28	1.74	2.18	2.82	3.45	4.06	4.66	5.45	6.43	5.26	4.30	3.60	3.08	2.67	2.34	2.08	1.86	1.68	1.52	1.39	1.28	1.09
24	0.17	0.31	0.85	1.34	1.82	2.28	2.95	3.61	4.25	4.89	5.71	6.73	5.60	4.59	3.84	3.28	2.84	2.50	2.22	1.98	1.79	1.62	1.48	1.36	1.16
25	0.18	0.33	0.89	1.40	1.90	2.38	3.08	3.77	4.44	5.10	5.97	7.03	5.96	4.88	4.09	3.49	3.02	2.66	2.36	2.10	1.90	1.72	1.57	1.45	1.23
26	0.19	0.34	0.93	1.46	1.98	2.48	3.22	3.93	4.63	5.33	6.23	7.34	6.32	5.17	4.33	3.70	3.21	2.81	2.50	2.24	2.01	1.83	1.67	1.53	1.31
28	0.20	0.37	1.00	1.58	2.15	2.69	3.48	4.26	5.02	5.77	6.75	7.98	7.06	5.78	4.84	4.14	3.59	3.15	2.79	2.50	2.25	2.04	1.87	1.72	1.46
30	0.22	0.40	1.08	1.71	2.31	2.90	3.75	4.59	5.41	6.21	7.27	8.58	7.83	6.41	5.37	4.59	3.98	3.49	3.10	2.77	2.50	2.27	2.07	1.90	1.62
32	0.23	0.43	1.16	1.83	2.48	3.11	4.02	4.92	5.80	6.60	7.76	9.18	8.65	7.06	5.92	5.05	4.38	3.84	3.41	3.05	2.75	2.50	2.28	2.10	0
35	0.25	0.48	1.28	2.01	2.73	3.42	4.44	5.42	6.39	7.34	8.58	10.1	9.85	8.06	6.77	5.78	5.01	4.40	3.90	3.49	3.15	2.86	2.61	2.40	0
40	0.29	0.54	1.47	2.33	3.16	3.95	5.13	6.27	7.38	8.50	9.92	11.7	12.1	9.85	8.28	7.06	6.12	5.37	4.77	4.27	3.84	3.49	0		
45	0.34	0.62	1.67	2.65	3.58	4.49	5.82	7.11	8.36	9.62	11.3	13.3	14.4	11.8	9.85	8.43	7.30	6.41	5.68	5.09	0				
Lubrication Method	A		B							C															

Lubrication Method A: Drop Lubrication, B: Oil Bath Lubrication C: Forced Circulation Lubrication by Pump Not applicable to selection of CHES-type chains.

Technical Data

Designing of Chain Drive Mechanism 3

CHE40 (Single Chain)

(kW)

Number of Small Sprocket Teeth	Rotary Speed of Small Sprockets min (r/min)																								
	10	25	50	100	200	300	400	500	700	900	1000	1200	1400	1600	1800	2100	2400	2700	3000	3500	4000	5000	6500	7000	8000
9	0.03	0.07	0.14	0.26	0.48	0.69	0.90	1.10	1.49	1.87	2.05	2.42	2.78	3.07	2.57	2.04	1.67	1.40	1.19	0.95	0.78	0.56	0.43	0.34	0.28
10	0.04	0.08	0.16	0.29	0.54	0.78	1.01	1.23	1.67	2.10	2.31	2.72	3.12	3.51	3.01	2.39	1.96	1.64	1.40	1.11	0.91	0.65	0.49	0.40	0.32
11	0.04	0.09	0.17	0.32	0.60	0.87	1.12	1.37	1.85	2.32	2.55	3.01	3.45	3.89	3.48	2.76	2.26	1.89	1.62	1.28	1.05	0.75	0.57	0.46	0.37
12	0.04	0.10	0.19	0.35	0.66	0.95	1.23	1.50	2.04	2.55	2.80	3.30	3.80	4.28	3.96	3.15	2.57	2.16	1.84	1.46	1.19	0.86	0.65	0.51	0.43
13	0.04	0.11	0.21	0.39	0.72	1.04	1.34	1.64	2.22	2.78	3.06	3.60	4.14	4.67	4.47	3.55	2.90	2.43	2.08	1.65	1.35	0.96	0.73	0.58	0.48
14	0.05	0.12	0.22	0.42	0.78	1.12	1.45	1.78	2.40	3.01	3.31	3.90	4.48	5.06	5.00	3.96	3.25	2.72	2.32	1.87	1.51	1.09	0.82	0.65	0.53
15	0.05	0.13	0.24	0.45	0.84	1.21	1.57	1.91	2.59	3.25	3.57	4.21	4.83	5.45	5.54	4.39	3.60	3.01	2.57	2.04	1.67	1.19	0.91	0.72	0.59
16	0.06	0.14	0.26	0.48	0.90	1.30	1.68	2.05	2.78	3.48	3.83	4.51	5.18	5.84	6.10	4.84	3.96	3.32	2.83	2.25	1.87	1.32	1.00	0.80	0.65
17	0.06	0.15	0.28	0.51	0.96	1.38	1.79	2.19	2.96	3.72	4.09	4.81	5.53	6.24	6.68	5.30	4.34	3.64	3.11	2.47	2.02	1.45	1.10	0.87	0.72
18	0.07	0.16	0.29	0.54	1.02	1.47	1.90	2.33	3.15	3.95	4.34	5.12	5.88	6.63	7.28	5.78	4.73	3.96	3.39	2.69	2.20	1.57	1.19	0.95	0
19	0.07	0.16	0.31	0.58	1.09	1.66	2.02	2.47	3.34	4.19	4.60	5.42	6.24	7.03	7.83	6.27	5.13	4.30	3.67	2.92	2.39	1.71	1.30	1.03	0
20	0.07	0.18	0.33	0.61	1.14	1.65	2.13	2.61	3.53	4.43	4.87	5.74	6.59	7.43	8.28	6.77	5.54	4.64	3.96	3.15	2.57	1.87	1.40	1.11	0
21	0.08	0.19	0.34	0.65	1.21	1.74	2.25	2.75	3.72	4.67	5.13	6.05	6.95	7.83	8.73	7.28	5.96	5.00	4.27	3.39	2.77	1.98	1.51	1.19	0
22	0.08	0.19	0.37	0.68	1.27	1.83	2.36	2.89	3.92	4.91	5.39	6.36	7.30	8.21	9.18	7.83	5.39	5.36	4.57	3.63	2.97	2.13	1.62	1.28	0
23	0.09	0.20	0.38	0.72	1.33	1.92	2.48	3.04	4.11	5.15	5.66	6.67	7.68	8.65	9.62	8.36	6.83	5.73	4.89	3.88	3.18	2.28	1.73	1.37	0
24	0.10	0.22	0.40	0.75	1.40	2.01	2.60	3.18	4.30	5.39	5.93	6.98	8.06	9.03	10.1	8.88	7.28	6.10	5.21	4.13	3.39	2.42	1.84	1.46	0
25	0.10	0.22	0.42	0.78	1.45	2.10	2.72	3.32	4.49	5.63	6.19	7.30	8.36	9.47	10.5	9.47	7.76	6.49	5.54	4.39	3.60	2.57	1.96	0	
26	0.10	0.23	0.43	0.81	1.52	2.19	2.83	3.46	4.68	5.88	6.46	7.61	8.73	9.85	11.0	10.1	8.21	6.89	5.88	4.66	3.82	2.73	2.08	0	
28	0.11	0.25	0.47	0.88	1.64	2.37	3.07	3.75	5.08	6.37	7.01	8.28	9.47	10.7	11.9	11.2	9.18	7.68	6.56	5.21	4.27	3.05	2.32	0	
30	0.12	0.28	0.51	0.95	1.78	2.55	3.30	4.04	5.47	6.66	7.53	8.88	10.2	11.5	12.8	12.5	10.1	8.50	7.28	5.78	4.73	3.39	2.57	0	
32	0.13	0.29	0.54	1.01	1.90	2.74	3.54	4.33	5.86	7.36	8.06	9.55	11.0	12.3	13.7	13.7	11.2	9.40	8.06	6.37	5.21	3.73	0		
35	0.14	0.32	0.60	1.12	2.10	3.01	3.91	4.77	6.46	8.13	8.88	10.5	12.1	13.6	15.1	15.7	12.8	10.7	9.18	7.28	5.96	4.27	0		
40	0.16	0.37	0.69	1.30	2.42	3.48	4.51	5.51	7.46	9.33	10.3	12.2	14.0	15.7	17.5	19.2	15.7	13.1	11.2	8.88	7.28	5.21	0		
45	0.19	0.43	0.79	1.47	2.75	3.95	5.13	6.27	8.50	10.6	11.7	13.8	15.8	17.8	19.8	22.8	18.7	15.7	13.4	10.6	8.73	0			
Lubrication Method	A				B					C															

Lubrication Method A: Drop Lubrication B: Oil Bath Lubrication C: Forced Circulation Lubrication by Pump Not applicable to selection of CHES-type chains. See P. 41 for CHEM Type.

CHE50 (Single Chain)

(kW)

Number of Small Sprocket Teeth	Rotary Speed of Small Sprockets min (r/min)																								
	10	25	50	100	200	300	400	500	700	900	1000	1200	1400	1600	1800	2100	2400	2700	3000	3500	4000	4500	5000	5500	6000
9	0.07	0.14	0.27	0.50	0.94	1.35	1.75	2.14	2.90	3.64	4.00	4.71	4.49	3.67	3.08	2.44	2.00	1.68	1.43	1.13	0.93	0.78	0.66	0.57	0.51
10	0.07	0.16	0.31	0.57	1.05	1.51	1.69	2.40	3.25	4.07	4.48	5.28	5.26	4.30	3.60	2.86	2.34	1.96	1.68	1.33	1.09	0.91	0.78	0.67	0.59
11	0.08	0.18	0.34	0.63	1.16	1.68	2.18	2.66	3.60	4.52	4.97	5.86	6.06	4.96	4.16	3.30	2.70	2.27	1.93	1.54	1.25	1.05	0.90	0.78	0.69
12	0.09	0.19	0.37	0.69	1.28	1.84	2.39	2.92	3.96	4.96	5.45	6.43	6.91	5.65	4.74	3.76	3.08	2.58	2.20	1.75	1.43	1.20	1.02	0.89	0.78
13	0.10	0.22	0.40	0.75	1.40	2.01	2.61	3.19	4.31	5.41	5.95	7.01	7.76	6.38	5.34	4.24	3.47	2.91	2.48	1.97	1.61	1.35	1.16	1.00	0
14	0.10	0.23	0.43	0.81	1.51	2.18	2.83	3.45	4.68	5.86	6.45	7.61	8.73	7.12	5.98	4.74	3.88	3.25	2.76	2.20	1.81	1.51	1.29	1.12	0
15	0.11	0.25	0.47	0.87	1.63	2.35	3.04	3.72	5.04	6.32	6.95	8.21	9.40	7.91	6.62	5.26	4.30	3.60	3.08	2.44	2.00	1.68	1.43	1.24	0
16	0.12	0.27	0.50	0.94	1.75	2.52	3.26	3.99	5.40	6.77	7.45	8.80	10.1	8.73	7.30	5.79	4.74	3.97	3.39	2.69	2.20	1.84	1.57	1.37	0
17	0.13	0.29	0.54	1.00	1.87	2.69	3.48	4.26	5.77	7.23	7.98	9.40	10.7	9.55	7.98	6.34	5.19	4.35	3.72	2.95	2.41	2.02	1.72	1.50	0
18	0.13	0.31	0.57	1.07	1.98	2.86	3.71	4.53	6.13	7.68	8.43	10.0	11.4	10.4	8.73	6.91	5.65	4.74	4.04	3.21	2.63	2.20	1.88	0	
19	0.14	0.32	0.60	1.13	2.10	3.04	3.93	4.80	6.51	8.13	8.95	10.6	12.2	11.3	9.47	7.46	6.13	5.14	4.39	3.48	2.85	2.39	2.04	0	
20	0.15	0.34	0.64	1.19	2.22	3.21	4.16	5.07	6.87	8.58	9.47	11.2	12.8	12.2	10.2	8.06	6.62	5.55	4.74	3.76	3.08	2.58	2.20	0	
21	0.16	0.36	0.67	1.26	2.34	3.38	4.38	5.35	7.24	9.10	10.0	11.8	13.5	13.1	11.0	8.73	7.12	5.98	5.10	4.04	3.31	2.78	2.37	0	
22	0.16	0.38	0.71	1.37	2.47	3.55	4.60	5.62	7.61	9.55	10.5	12.4	14.2	14.0	11.8	9.33	7.61	6.41	5.47	4.34	3.55	2.98	2.54	0	
23	0.17	0.40	0.75	1.39	2.59	3.73	4.83	5.90	7.98	10.0	11.0	13.0	14.9	15.0	12.6	10.0	8.21	6.85	5.85	4.64	3.80	3.19	0		
24	0.19	0.42	0.78	1.45	2.71	3.90	5.06	6.18	8.36	10.5	11.6	13.6	15.6	16.0	13.4	10.7	8.73	7.30	6.23	4.95	4.04	3.39	0		
25	0.19	0.43	0.81	1.51	2.83	4.08	5.28	6.46	8.73	11.0	12.1	14.2	16.3	17.0	14.2	11.3	9.25	7.76	6.62	5.26	4.30	3.60	0		
26	0.20	0.46	0.85	1.58	2.95	4.25	5.51	6.74	9.10	11.4	12.6	14.8	17.0	18.1	15.1	12.0	9.85	8.21	7.03	5.57	4.57	3.83	0		
28	0.22	0.49	0.92	1.72	3.20	4.61	5.98	7.30	9.85	12.4	13.7	16.0	18.4	20.1	16.9	13.4	11.0	9.18	7.83	6.23	5.10	4.27	0		
30	0.23	0.53	0.99	1.85	3.45	4.97	6.44	7.83	10.70	13.5	14.7	17.3	19.8	22.4	18.7	14.8	12.2	10.2	8.73	6.91	5.65	0			
32	0.25	0.57	1.06	1.98	3.70	5.33	6.90	8.43	11.4	14.3	15.7	18.6	21.3	24.0	20.7	16.4	13.4	11.3	9.62	7.61	6.23	0			
35	0.28	0.63	1.17	2.19	4.07	5.86	7.61	9.33	12.6	15.7	17.3	20.4	23.5	26.5	23.6	18.7	15.4	12.8	11.0	8.73	7.12	0			
40	0.32	0.72	1.35	2.52	4.71	6.77	8.80	10.70	14.5	18.2	20.0	23.6	27.1	30.6	28.9	22.9	18.7	15.7	13.4	10.7	0				
45	0.36	0.82	1.54	2.86	5.34	7.68	10.0	12.2	16.5	20.7	22.8	26.8	30.8	34.6	34.4	27.3	22.4	18.7	16.0	0					
Lubrication Method	A				B					C															

Lubrication Method A: Drop Lubrication B: Oil Bath Lubrication C: Forced Circulation Lubrication by Pump Not applicable to selection of CHES-type chains. See P. 41 for CHEM Type.

CHE60 (Single Chain) (kW)

Number of Small Sprocket Teeth	Rotary Speed of Small Sprockets min (r/min)																								
	10	25	50	100	150	200	300	400	500	600	700	800	900	1000	1100	1200	1400	1600	1800	2000	2500	3000	3500	4000	4500
9	0.11	0.25	0.46	0.87	1.25	1.61	2.33	3.01	3.69	4.34	4.98	5.62	6.25	6.87	7.45	6.54	5.19	4.25	3.56	3.04	2.18	1.66	1.31	1.07	0.90
10	0.12	0.28	0.52	0.97	1.40	1.81	1.86	3.38	4.13	4.86	5.59	6.30	7.00	7.68	8.36	7.68	6.08	4.98	4.17	3.56	2.55	1.94	1.54	1.26	1.05
11	0.13	0.31	0.57	1.07	1.54	2.01	2.89	3.74	4.57	5.39	6.19	6.98	7.76	8.50	9.33	8.88	7.02	5.74	4.81	4.11	2.94	2.24	1.78	1.45	1.22
12	0.15	0.34	0.63	1.18	1.70	2.20	3.17	4.11	5.03	5.92	6.80	7.68	8.50	9.40	10.2	10.1	7.98	6.54	5.48	4.68	3.35	2.55	2.02	1.66	1.39
13	0.16	0.37	0.69	1.29	1.86	2.40	3.46	4.48	5.48	6.45	7.42	8.36	9.33	10.2	11.1	11.3	9.03	7.38	6.18	5.28	3.77	2.87	2.28	1.87	0
14	0.18	0.40	0.75	1.40	2.01	2.60	3.74	4.86	5.94	6.99	8.06	9.03	10.1	11.0	12.1	12.7	10.1	8.28	6.91	5.90	4.22	3.22	2.55	2.09	0
15	0.19	0.43	0.81	1.50	2.16	2.80	4.04	5.28	6.39	7.53	8.65	9.77	10.8	11.9	13.0	14.0	11.2	9.18	7.68	6.54	4.68	3.56	2.83	2.31	0
16	0.20	0.46	0.87	1.61	2.32	3.01	4.33	5.61	6.86	8.06	9.25	10.4	11.6	12.8	14.0	15.1	12.3	10.1	8.43	7.21	5.15	3.92	3.11	2.55	0
17	0.22	0.49	0.93	1.72	2.48	3.21	4.63	5.99	7.32	8.65	9.92	11.2	12.5	13.7	14.8	16.1	13.5	11.0	9.25	7.91	5.65	4.30	3.41	2.79	0
18	0.23	0.52	0.98	1.83	2.63	3.42	4.92	6.37	7.76	9.18	10.5	11.9	13.2	14.5	15.8	17.1	14.7	12.0	10.1	8.58	6.15	4.68	3.72	3.04	0
19	0.25	0.56	1.04	1.94	2.79	3.62	5.21	6.75	8.28	9.70	11.2	12.6	14.0	15.4	16.8	18.1	16.0	13.1	10.9	9.33	6.68	5.08	4.03	3.30	0
20	0.26	0.59	1.10	2.05	2.95	3.83	5.51	7.14	8.73	10.3	11.8	13.4	14.8	16.3	17.8	19.2	17.2	14.1	11.8	10.1	7.21	5.48	4.35	0	
21	0.27	0.62	1.16	2.16	3.11	4.03	5.80	7.53	9.18	10.8	12.5	14.0	15.6	17.2	18.7	20.2	18.5	15.1	12.7	10.8	7.76	5.90	4.68	0	
22	0.28	0.65	1.22	2.28	3.27	4.24	6.11	7.91	9.70	11.4	13.1	14.8	16.4	18.1	19.7	21.3	19.8	16.3	13.6	11.6	8.28	6.33	5.02	0	
23	0.30	0.69	1.28	2.38	3.43	4.45	6.41	8.28	10.1	11.9	13.7	15.5	17.2	18.9	20.7	22.3	21.2	17.4	14.5	12.5	8.88	6.77	5.36	0	
24	0.31	0.72	1.34	2.50	3.60	4.66	6.71	8.65	10.6	12.5	14.4	16.2	18.1	19.8	21.6	23.3	22.6	18.5	15.5	13.3	9.47	7.21	5.72	0	
25	0.33	0.75	1.40	2.61	3.76	4.86	7.01	9.10	11.1	13.1	15.0	16.9	18.9	20.7	22.6	24.4	24.0	19.7	16.5	14.1	10.1	7.68	6.08	0	
26	0.34	0.78	1.45	2.72	3.92	5.08	7.31	9.47	11.6	13.7	15.7	17.7	19.7	21.6	23.6	25.4	25.5	20.9	17.5	14.9	10.7	8.13	6.45	0	
28	0.37	0.84	1.58	2.95	4.24	5.50	7.91	10.3	12.5	14.8	17.0	19.2	21.3	23.4	25.5	27.6	28.5	23.3	19.5	16.7	11.9	9.10	0		
30	0.40	0.91	1.70	3.18	4.57	5.92	8.50	11.0	13.5	16.0	18.3	20.7	23.0	25.2	27.5	29.7	31.6	25.9	21.7	18.5	13.3	10.1	0		
32	0.43	0.98	1.83	3.40	4.90	6.36	9.18	11.9	14.5	17.1	19.6	22.2	24.6	27.1	29.5	31.9	34.8	28.5	23.9	20.4	14.6	11.1	0		
35	0.47	1.07	2.01	3.75	5.40	7.00	10.1	13.1	16.0	18.8	21.6	24.4	27.1	29.8	32.5	35.1	39.8	32.6	27.3	23.3	16.7	12.7	0		
40	0.54	1.25	2.32	4.33	6.24	8.06	11.6	15.1	18.4	21.7	25.0	28.1	31.3	34.4	37.5	40.6	46.6	39.8	33.3	28.5	20.4	0			
45	0.62	1.41	2.63	4.92	7.09	9.18	13.2	17.2	21.0	24.7	28.3	32.0	35.6	39.1	42.6	46.0	52.9	47.5	39.8	34.0	24.3	0			
Lubrication Method	A			B							C														

Lubrication Method A: Drop Lubrication B: Oil Bath Lubrication C: Forced Circulation Lubrication by Pump Not applicable to selection of CHES-type chains. See P. 41 for CHEM Type.

CHE80 (Single Chain) (kW)

Number of Small Sprocket Teeth	Rotary Speed of Small Sprockets min (r/min)																								
	10	25	50	100	150	200	300	400	500	600	700	800	900	1000	1100	1200	1400	1600	1800	2000	2200	2400	2700	3000	3400
9	0.25	0.58	1.08	2.02	2.91	3.77	5.43	7.03	8.58	10.1	11.6	13.1	12.7	10.8	9.40	8.21	6.53	5.35	4.48	3.83	3.32	2.91	2.44	2.08	1.73
10	0.28	0.65	1.22	2.26	3.26	4.22	6.09	7.91	9.62	11.3	13.1	14.7	14.8	12.7	11.0	9.62	7.68	6.27	5.25	4.48	3.89	3.41	2.86	2.44	2.02
11	0.31	0.72	1.34	2.51	3.61	4.68	6.74	8.73	10.7	12.6	14.5	16.3	17.2	14.6	12.7	11.1	8.80	7.23	6.06	5.17	4.48	3.93	3.30	2.81	1.27
12	0.35	0.79	1.48	2.75	3.97	5.14	7.41	9.62	11.7	13.8	15.9	17.9	19.5	16.6	14.5	12.7	10.1	8.21	6.90	5.89	5.11	4.48	3.76	3.21	0
13	0.38	0.87	1.61	3.01	4.33	5.61	8.06	10.4	12.8	15.1	17.3	19.5	21.7	18.8	16.3	14.3	11.3	9.33	7.76	6.65	5.76	5.06	4.24	3.62	0
14	0.41	0.93	1.75	3.25	4.69	6.07	8.73	11.3	13.9	16.3	18.7	21.2	23.5	21.0	18.2	16.0	12.7	10.4	8.73	7.43	6.44	5.65	4.74	4.04	0
15	0.44	1.01	1.88	3.51	5.05	6.54	9.40	12.2	14.9	17.6	20.2	22.8	25.4	23.3	20.2	17.8	14.1	11.5	9.62	8.21	7.14	6.27	5.25	4.48	0
16	0.47	1.08	2.01	3.76	5.42	7.02	10.1	13.1	16.0	18.9	21.6	24.5	27.2	25.7	22.2	19.5	15.5	12.7	10.6	9.10	7.83	6.90	5.79	4.94	0
17	0.51	1.16	2.15	4.01	5.78	7.46	10.8	14.0	17.1	20.1	23.1	26.1	29.0	28.1	24.4	21.4	16.9	13.9	11.6	9.92	8.58	7.53	6.33	5.41	0
18	0.54	1.22	2.29	4.27	6.15	7.98	11.5	14.8	18.2	21.4	24.6	27.8	30.9	30.7	26.6	23.3	18.5	15.1	12.7	10.8	9.40	8.21	6.90	5.89	0
19	0.57	1.30	2.42	4.53	6.52	8.43	12.2	15.7	19.2	22.7	26.1	29.4	32.7	33.2	28.8	25.3	20.1	16.4	13.7	11.7	10.1	8.95	7.46	6.39	0
20	0.60	1.37	2.57	4.78	6.89	8.95	12.8	16.6	20.4	24.0	27.6	31.1	34.5	35.9	31.1	27.3	21.6	17.8	14.8	12.7	11.0	9.62	8.06	0	
21	0.63	1.45	2.70	5.04	7.27	9.40	13.6	17.5	21.5	25.3	29.1	32.7	36.5	38.6	33.4	29.4	23.3	19.1	16.0	13.7	11.9	10.4	8.73	0	
22	0.67	1.52	2.84	5.30	7.61	9.92	14.2	18.5	22.6	26.6	30.6	34.5	38.3	41.4	35.9	31.5	25.0	20.4	17.2	14.6	12.7	11.1	9.33	0	
23	0.70	1.60	2.98	5.57	7.98	10.4	15.0	19.4	23.7	27.9	32.1	36.2	40.2	44.2	38.3	33.6	26.7	21.9	18.4	15.7	13.6	11.9	10.0	0	
24	0.73	1.67	3.13	5.83	8.43	10.9	15.7	20.3	24.8	29.2	33.6	37.9	42.1	46.3	40.9	35.9	28.5	23.3	19.5	16.6	14.5	12.7	10.6	0	
25	0.77	1.75	3.26	6.09	8.80	11.3	16.3	21.2	25.9	30.9	35.1	39.5	44.0	48.4	43.4	38.1	30.3	24.6	20.7	17.8	15.4	13.5	11.3	0	
26	0.80	1.83	3.40	6.36	9.18	11.9	17.1	22.2	27.0	31.9	36.6	41.3	45.9	50.4	46.1	40.4	32.1	26.3	22.0	18.8	16.3	14.3	12.0	0	
28	0.87	1.98	3.69	6.89	9.92	12.8	18.5	23.9	29.3	34.5	39.7	44.7	49.8	54.7	51.5	45.2	35.9	29.4	24.6	21.0	18.2	16.0	0		
30	0.93	2.13	3.98	7.42	10.7	13.8	19.9	25.8	31.6	37.2	42.7	48.2	53.6	58.9	57.1	50.1	39.8	32.5	27.3	23.3	20.2	17.8	0		
32	1.00	2.28	4.26	7.98	11.4	14.8	21.3	27.7	33.9	39.9	45.8	51.6	57.4	63.1	62.9	55.2	43.8	35.9	30.1	25.7	22.2	19.5	0		
35	1.10	2.51	4.69	8.73	12.6	16.3	23.6	30.5	37.3	43.9	50.4	56.9	63.3	69.6	72.0	63.2	50.1	41.0	34.4	29.4	25.4	0			
40	1.28	2.90	5.42	10.1	14.5	18.9	27.2	35.2	43.0	50.7	58.3	65.7	73.9	80.6	87.3	76.8	61.3	50.1	42.0	35.9	14.9	0			
45	1.45	3.30	6.15	11.5	16.6	21.4	30.9	40.0	48.9	57.6	66.2	74.6	82.8	91.0	99.2	91.8	73.1	59.8	50.1	40.3	0				
Lubrication Method	A			B							C														

Lubrication Method A: Drop Lubrication B: Oil Bath Lubrication C: Forced Circulation Lubrication by Pump Not applicable to selection of CHES-type chains. See P. 41 for CHEM Type.

Technical Data

Designing of Chain Drive Mechanism 4

■ The table of transmission performance CHEM40 (1 line Chain)

(kW)

Number of Small Sprocket Teeth	Rotary Speed of Small Sprockets (r/min)											
	10	25	50	100	200	300	400	500	700	900	1000	1200
9	0.05	0.11	0.21	0.39	0.71	1.04	1.34	1.68	2.22	2.77	3.08	3.59
10	0.05	0.13	0.24	0.44	0.79	1.15	1.49	1.87	2.47	3.08	3.42	
11	0.06	0.15	0.26	0.48	0.87	1.27	1.64	2.05	2.72	3.39	3.80	
12	0.06	0.16	0.29	0.52	0.95	1.38	1.79	2.24	2.96	3.73		
13	0.07	0.18	0.31	0.57	1.03	1.50	1.94	2.43	3.27	4.05		
14	0.08	0.19	0.33	0.61	1.13	1.64	2.13	2.64	3.53			
15	0.08	0.20	0.36	0.65	1.21	1.76	2.29	2.83	3.78			
16	0.09	0.22	0.38	0.70	1.29	1.88	2.44	3.02	4.03			
17	0.09	0.23	0.41	0.74	1.37	2.00	2.59	3.21				
18	0.10	0.24	0.43	0.80	1.45	2.11	2.74	3.40				
19	0.10	0.26	0.45	0.86	1.57	2.28	2.95	3.65				
20	0.11	0.27	0.48	0.91	1.66	2.40	3.11	3.85				
21	0.11	0.28	0.50	0.95	1.74	2.52	3.26	4.04				
22	0.12	0.30	0.53	1.00	1.82	2.66	3.45	4.23				
23	0.12	0.31	0.55	1.04	1.92	2.81	3.61	4.42				
24	0.13	0.32	0.60	1.11	2.03	2.96	3.84					
25	0.13	0.34	0.63	1.15	2.11	3.08	4.00					
26	0.14	0.35	0.65	1.20	2.19	3.20	4.16					
27	0.15	0.36	0.68	1.25	2.28	3.33	4.32					
28	0.15	0.38	0.70	1.29	2.36	3.45	4.48					
30	0.16	0.40	0.75	1.40	2.53	3.70						
32	0.17	0.43	0.80	1.51	2.80	4.05						
35	0.19	0.47	0.88	1.65	3.06	4.43						
40	0.22	0.54	1.00	1.88	3.50							
45	0.24	0.61	1.13	2.12	3.94							

■ The table of transmission performance CHEM50 (1 line Chain)

(kW)

Number of Small Sprocket Teeth	Rotary Speed of Small Sprockets (r/min)											
	10	25	50	100	200	300	400	500	600	700	800	900
9	0.11	0.24	0.44	0.82	1.49	2.17	2.80	3.39	3.99	4.61	5.19	5.72
10	0.12	0.27	0.49	0.91	1.66	2.41	3.11	3.76	4.44	5.12	5.80	
11	0.14	0.29	0.54	1.00	1.83	2.65	3.42	4.14	4.88	5.63		
12	0.15	0.32	0.59	1.09	1.99	2.89	3.74	4.51	5.35	6.18		
13	0.16	0.35	0.64	1.18	2.16	3.14	4.07	4.91	5.80			
14	0.17	0.37	0.69	1.27	2.32	3.38	4.45	5.29	6.24			
15	0.19	0.40	0.74	1.36	2.49	3.62	4.76	5.67				
16	0.20	0.43	0.79	1.45	2.66	3.86	5.08	6.05				
17	0.21	0.45	0.84	1.54	2.82	4.10	5.40	6.43				
18	0.22	0.48	0.89	1.63	2.99	4.34	5.72					
19	0.24	0.51	0.97	1.79	3.31	4.81	6.21					
20	0.25	0.53	1.03	1.89	3.49	5.07	6.54					
21	0.26	0.56	1.08	1.98	3.66	5.32	6.86					
22	0.27	0.58	1.13	2.08	3.83	5.57						
23	0.29	0.61	1.18	2.17	4.01	5.83						
24	0.30	0.66	1.23	2.29	4.26	6.14						
25	0.31	0.68	1.28	2.38	4.44	6.39						
26	0.32	0.71	1.33	2.48	4.62	6.65						
27	0.34	0.74	1.38	2.57	4.80	6.90						
28	0.35	0.77	1.44	2.67	4.97	7.16						
30	0.37	0.82	1.54	2.86	5.33							
32	0.40	0.88	1.66	3.05	5.68							
35	0.44	0.97	1.81	3.34	6.22							
40	0.50	1.11	2.07	3.81	7.11							
45	0.56	1.24	2.33	4.29								

■ The table of transmission performance CHEM60 (1 line Chain)

(kW)

Number of Small Sprocket Teeth	Rotary Speed of Small Sprockets (r/min)											
	10	25	50	100	150	200	250	300	400	500	600	700
9	0.18	0.41	0.76	1.41	2.02	2.63	3.22	3.78	4.91	6.00	7.06	8.14
10	0.21	0.46	0.85	1.57	2.24	2.93	3.58	4.20	5.45	6.66	7.92	
11	0.23	0.51	0.93	1.73	2.47	3.22	3.94	4.62	6.00	7.33		
12	0.25	0.55	1.02	1.89	2.69	3.51	4.34	5.04	6.54	8.07		
13	0.27	0.60	1.10	2.04	2.97	3.88	4.75	5.46	7.23			
14	0.29	0.64	1.21	2.24	3.23	4.22	5.16	6.12	7.86			
15	0.31	0.69	1.30	2.41	3.46	4.52	5.53	6.56	8.43			
16	0.33	0.73	1.38	2.57	3.69	4.82	5.90	6.99				
17	0.35	0.78	1.47	2.73	3.92	5.12	6.27	7.43				
18	0.37	0.83	1.56	2.89	4.16	5.42	6.64	7.87				
19	0.39	0.89	1.69	3.17	4.51	5.89	7.21	8.46				
20	0.41	0.94	1.78	3.33	4.75	6.20	7.59	8.91				
21	0.43	0.98	1.87	3.50	4.99	6.51	7.97					
22	0.45	1.03	1.96	3.67	5.23	6.82	8.35					
23	0.47	1.08	2.05	3.83	5.46	7.13	8.73					
24	0.49	1.16	2.14	4.04	5.81	7.58	9.11					
25	0.51	1.21	2.23	4.20	6.05	7.90	9.67					
26	0.53	1.25	2.32	4.37	6.29	8.22						
28	0.58	1.35	2.49	4.71	6.78	8.85						
30	0.62	1.45	2.67	5.05	7.26	9.48						
32	0.66	1.56	2.93	5.53	7.96							
35	0.72	1.70	3.21	6.05	8.71							
40	0.82	1.95	3.66	6.92	9.95							
45	0.92	2.19	4.12	7.78								

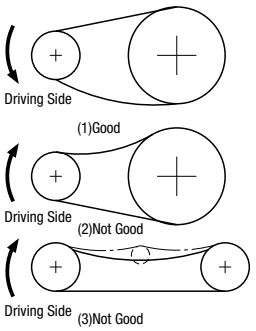
Installation Way

(A) Arrangement of Shafts

Horizontal Arrangement

Even when the shafts are arranged horizontally, the following points should be taken into account in terms of the rotary direction of the shafts. In (2) and (3) shown, elongation of the chain may prevent the chain links from leaving the sprocket teeth smoothly, resulting in biting. In (3) shown, the load bottom and slack top sides of the chain may come into contact with each other; to prevent this, use an idler or something equivalent.

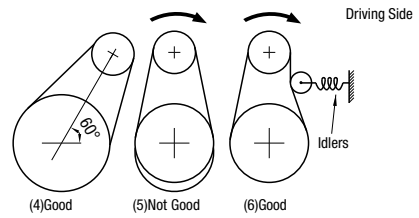
Horizontal Arrangement



Vertical Arrangement

In (5) shown, an elongated chain may sag below the bottom sprockets. In this case, when a small sprocket is arranged below a large sprocket, the elongated chain may drop away from the small sprocket. To prevent this, the shafts should be arranged as in (4) , maintaining the angle at a maximum of 60°. When the mechanism in question or the installation space requires a vertical arrangement, place the small sprocket above the large sprocket and use an idler, etc. on the outside or inside as shown in (6) .

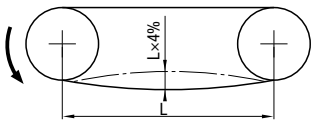
Vertical Arrangement



(B) Deflection

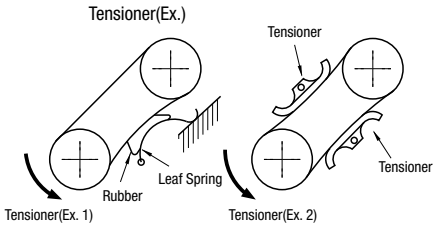
The deflection should normally be maintained at approximately 4% of the distance between the shafts, and approximately 2% in the following instances.

A. The shafts are arranged almost vertical transmission.
B. The distance between the shafts is 1 m or more.
C. The chain needs to be started and stopped frequently under heavy load.
D. The chain needs to be run in the reverse direction.



(C) Load Fluctuation

When the load varies during operation, install an initial tension either on the load or loose side of the chain. This can remove vibration and reduce the noise of the chain.



Lubrication

The service life of roller chains depends heavily on lubrication. Therefore, correct lubrication is extremely important. Today, as chains are increasingly run at higher speeds, they need to be lubricated more efficiently.

Benefits of Lubrication Oil

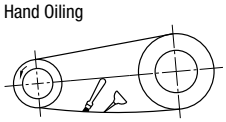
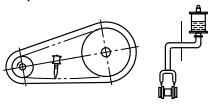
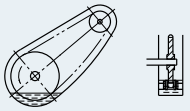
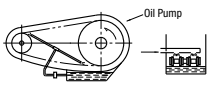
Oil applied into the space between pins, bushings and rollers forms oil film. Which then helps reduce wear of parts as well as absorb impact. Oil also cools down heat generated in the chain. Use good quality mineral oil to lubricate roller chains.

Recommended Lubricating Oil

Lubrication Method	A , B				C			
Temperature (℃) / Chain No.	-10 ~ 0	0 ~ 40	40 ~ 50	50 ~ 60	-10 ~ 0	0 ~ 40	40 ~ 50	50 ~ 60
CHE25~50	SAE10	SAE20	SAE30	SAE40	SAE10	SAE20	SAE30	SAE40
CHE60~80	SAE20	SAE30	SAE40	SAE50				

The lubrication methods

(mentioned in the power transmission efficiency tables are based on the followings.)

Lubrication	Method	Service Interval and Oiling Quantity	Notes
A	Hand Oiling 	Apply oil by hand using a hand oiler or a brush, normally at least once everyday.	While slowly turning the chain, apply oil evenly 3~4 times onto the entire length of the chain. Be careful not to allow hands or clothing to be caught between the chain and the sprocket. When the mechanism is run for the first time after oiling, be careful to excess oil splashing over.
	Drop Lubrication 	Oil the chain in a manner such that approximately 5~20 drops of oil are applied onto the chain per minute.	It is recommended that a simple casing be installed over the chain to prevent oil from splashing over.
B	Oil Bath Lubrication 	Dip the bottom of the chain approximately 10 mm below the oiled surface.	Use a leak-free oil container. Before installing the oil container, wash it carefully to remove dust, dirt and other foreign particles. Maintain the correct oil level. Do not overfill the container.
	Rotating Plate Lubrication 	The chain is oiled by a rotating plate. Dip the plate approximately 20mm below the oil level. The wind velocity of the plate should be 200 m/min or faster.	
C	Forced Circulation Lubrication by Pump 	It is necessary to adjust the oil quantity appropriately to prevent overheating.	Use a leak-free oil container. Before installing the oil container, wash it carefully to remove dust, dirt and other foreign particles.

Technical Data

Free Flow Chain / Table Top Chain Selection

■ Selection Procedure for Free Flow Conveyor Chains

[Step 1] Confirm Usage Condition

Confirm that the following conditions are true.

Temp.: -10°C ~ +80°c

Chain Velocity: 5~15m/min

Conveyor Length: 15m or less

Environment: No abrasive dusts, corrosive gasses, or high humidity

[Step 2] Finalize Chain Selection

Calculate Transferred Item Mass per 1m, and select a chain satisfying the Allowable Load Mass from the table below.

$WA(kg/m)=(W_1+W_2)/P_L$ WA: Transferred Item Mass per 1m (kgf)

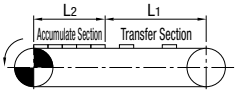
W_1: Workpiece Mass (kgf) W_2: Pallet Mass (kgf)

P_L: Pallet Move Distance (m)

Table 1. Allowable Load Mass

Chain	Allowable Load Mass (kgf/m)
WCHE3	30
WCHE4	55
WCHE5	55

[Step 3] Confirm Allowable Tension



$T=G/1000\times(Hw+Cw)L_1 \cdot fc+Aw \cdot L_2 \cdot fa+(Aw+Cw)L_2 \cdot fr+1.1Cw(L_1+L_2) \cdot fc$

T: Max. Tension Applied on Chain (kN)

L_1: Transfer Section Length (m)

L_2: Accumulation Section Length (m)

Hw: Transfer Section Transferred Mass including pallets (kg/m)

Aw: Accumulation Section Transferred Mass including pallets (kg/m)

Cw: Chain Weight (kg/m)

fa: Friction Coefficient of Transferred Item and Chain During Accumulation

fc: Friction Coefficient of Chain and Rail

fr: Friction Coefficient of Chain and Rail During Accumulation

G: Gravitational Acceleration=9.80665 (m/s^2)

Table 2. Friction Coefficient of Free Flow Conveyor Chains

Chain	Friction Coefficient
fa	0.10
fc	0.08
fr	0.20

(T) Max. Tension Applied on Chain is multiplied with (Table 3. K_1) Velocity Factor and (Table 4. K_2) Transferred Item Load Factor.

Tension per single chain is calculated (Two chains typically used for free-flow conveyors).

Allowable Chain Tension $\geq (T\times K_1\times K_2)/2$

If the calculated result exceeds the allowable tension of selected chain, re-select a chain one size larger or re-calculate with conveyor length divided into shorter sections.

Table 3. Velocity Factor Table

Chain Velocity m/min.	Factor K_1
1~4 or less	1.0
Over 4, 8 or less	1.1
Over 8, 10 or less	1.2
Over 10, 14 or less	1.5
Over 14, 18 or less	1.6

Table 4. Transferred Item Load Factor

Average Transferred Item Weight Wa (kg/m)	Factor K_2
30 or Less	1.00
31~40	1.10
41~50	1.15
51~70	1.20
71~90	1.25
91~120	1.35

Table 5. Max. Allowable Tension for Free Flow Conveyor Chains

Chain Velocity m/min.	Allowable Tension (kN)
WCHE3	0.55
WCHE4	0.88
WCHE5	1.37

■ Selection Procedure for Table Top Conveyor Chains

[Step 1] Calculate Effective Tension (Fe)

$Fe=g \cdot (m \cdot Lc \cdot \mu R + (m + M) \cdot (Lc-A) \cdot \mu R + MA \cdot A \cdot (\mu c + \mu R)+m \cdot A \cdot \mu R)$

Fe: Effective Tension (N)

Lc: Conveyor Length (m)

A: Accumulation Span Length (m)

* A=0 when there is no Accumulation.

M: Mass of Transferred Item

MA: Mass of Transferred Item for Accumulation Section

m: Chain Mass (kg/m)

μc: Dynamic Friction Coefficient of Chain and Transferred Item

μR: Dynamic Friction Coefficient of Chain and Rail

g: Gravitational Acceleration=9.80665 (m/sec^2)

Table 1. Friction Coefficient

Lubrication Method	Material of Transferred Item				
	Steel	Aluminum	Glass	Paper	Plastic
Dry	0.25	0.2	0.15	0.3	0.2
Soap Water	0.15	0.12	0.1	—	0.15

Lubrication Method	Gide Rail Material			
	Steel	Stainless	UHMW	Nylon
Dry	0.2	0.2	0.15	0.2
Soap Water	0.12	0.12	0.1	0.14

*The Friction Coefficients above are estimated values with safety ratio added, for use as tension calculation components.

[Step 2] Calculate Post-adjusted Tension based on conditions

$Fs=Fe \cdot Cs$

Fs: Post-adjusted Tension (N)

Cs: Load Correction Factor

For frequent starts and stops	=1.2
For wear intensive applications	=1.2
For multiple row use	=1.25
For other than above	=1.0

[Step 3] Calculate Chain Allowable Tension

$Fadm=FN \cdot Va \cdot Ta$ Fadm: Allowable Tension (N)

FN: Max. Allowable Tension (N) Va: Velocity Factor

Ta: Temperature Factor

Table 2. Maximum Allowable Tension

Type	Nomial	Max. Allowable Tension (N)
TPCH	826 1143	1650

Table 3. Velocity Factor

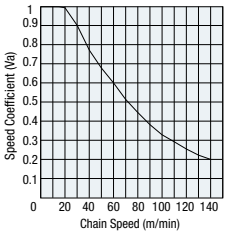
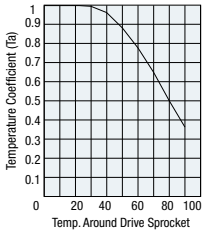


Table 4. Temperature Factor



[Step 4] Compare Allowable Tension and Post-adjusted Tension

If Fs≤Fadm, the selection is applicable.

[Step 5] Calculating Required Power

$P=Fs \cdot V/(60 \cdot \eta)$ P: Required Power (W)

V: Chain Velocity (m/min) η: Transmission Efficiency

Technical Data

Selection of Flat Belts

Allowable Stress for Tension Member

Check the belt that is selected for allowable stress, using the following procedures.

1. Calculating the Effective Tension

Formula 1 $F=f(W_G+W_1+W_2)L+f(W_1+W_3)L\pm W_G \cdot H$

(Carrier Side) (Return Side) (Vertical Side)

F: Effective Tension

f: Rolling friction coefficient of rollers, or friction coefficient between belt and supports (Select from Table 1.)

$_{\omega}$G: Weight of Carried Materials per Meter of Belt kg/m

$_{\omega}$1: Weight of belt per Meter kg/m

$_{\omega}$2: Carrier Roller Weight per 1m kg/m (Select from Table 2.)

$_{\omega}$3: Return Roller Weight per 1m kg/m (Select from Table 2.)

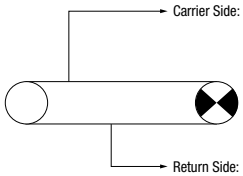
L: Conveyor Horizontal Length m

H: Vertical Height (+Up angle, -Down angle) m

Table 1. Table of f Values

Belt Surface in Contact with Supports	Smooth	Cloth Surfaced
Roller Support	0.05	0.05
Roller+Steel Plate Support	0.2	0.3
Steel Supported (SUS·SS)	0.4	0.5
Plywood Support	0.5	0.6

(When knife edges are used, add 0.2 to the above values in Table 1.)



Carrier Side: As the back of the belt has a cloth surface, avoid using iron plate or plywood as support as much as possible.

Return Side: When the front side of the belt has a cloth surface, or is coated with silicon or fluorocarbon resin, avoid using iron plate or plywood as support as much as possible. (Some types of belts identified by specific product names are compatible with the roller, table.)

Table 2. Table of Roller Weight

Roller Dia. (mm)	Single Roller (kg/roller)	Allowable Load (kg/roller)
28.6	0.2	50

Table 2. shows the weight of the revolving parts of a roller that meets (JISB8805-1965). For accurate calculation, check the actual weight of the roller being used.

2. Power Requirement

Formula 2 $P=\frac{F \cdot V}{60000}$

P: Power Requirement kW
F: Effective Tension N
V: Belt Speed m/min
60000: 60×102 (Constant)

3. Motor Power

Formula 3 $Pm=\frac{P}{\eta}$

Pm: Motor Power kW
P: Power Requirement kW
η: Mechanical Efficiency
(Standard Mechanical Efficiency Range: 0.5~0.65)

For efficient operation, it is recommended to check the motor property if the motor for use has a power rating less than 0.1kW.

4. Using the Tension on the Loose Side to Calculate Maximum Tension

Formula 4 $F_{M1}=F \cdot K$

F_{M1}: Maximum Tension N
F: Effective Tension N
K: Coefficient

Using Value μ selected from Table-3 and the wrap angle (θ), select value K from Table 4. (When the wrap angle (θ) is not listed in Table 4, Calculate from)

$K=\frac{e^{\mu\theta_1}}{e^{\mu\theta_1}-1}$

μ: Friction coefficient between driving pulley and belt (Select from Table 3.)
e: Base of Natural Logarithm (2.718)
θ': Radian ($\theta'=\theta\times\frac{2\pi}{360}$)

Table 3. List of μ values

Pulley Surface \ Surface Shape in Contact with Pulley		Smooth	Cloth Surfaced
Bare Steel Pulley	Dry	0.2	0.3
	Wet	0.15	0.2
Rubber Ranking Pulley	Dry	0.3	0.35
	Wet	0.2	0.25

Table 4. Table of Value K Based on Wrap Angle (θ)

θ° \ μ	0.1	0.15	0.2	0.25	0.3	0.35	0.5
180	3.8	2.7	2.2	1.9	1.7	1.5	1.3
190	3.6	2.6	2.1	1.8	1.6	1.5	1.3
200	3.4	2.5	2.0	1.8	1.6	1.5	1.3
210	3.3	2.4	2.0	1.7	1.5	1.4	1.2
220	3.2	2.3	1.9	1.7	1.5	1.4	1.2
230	3.1	2.3	1.9	1.6	1.4	1.4	1.2

5. Using Pretension to Calculate Maximum Tension

Formula 5 $F_{M2}=F+B \cdot T_C$

FM2: Maximum Tension N
B: Belt Width cm
TC: Initial Tension N/cm
(Select from Table 5.)

Table 5. Table of Tc Values

No. of Tension Members (No. of Plys)	1 Pc.
Initial Tension (N/cm)	1.5

Compare F_{M1} (Formula 4) and F_{M2} (Formula 5), and Make the larger as the Max. Tension FM.

6. Allowable Stress

Formula 6 $C\geq\frac{F_M}{B}$

C: Allowable Stress for Belt N/cm
FM: Effective Tension kg
B: Belt Width cm

When the allowable stress for the belt being used is equal to or higher than the maximum tension per 1cm width of the belt as expressed by Formula 6 above, the belt is suitable for use.

Technical Data

Selection of Timing Belts 1

[Step 1] Setting the Required Design Conditions

(1) Machine Type (2) Power Transmission (3) Load Variances (4) Operation Duration per Day (5) Small Pulley Rotational Speed
(6) Rotation Ratio (Lg. Pulley # of Teeth / Small Pulley # of Teeth) (7) Shaft Center Distance (Interim) (8) Pulley Diameter Limitation (9) Other Usage Conditions

[Step 2a] Calculating Design Power……MXL/XL/L/H/S_M/MTS_M/T Series

- Design Power (Pd) =Transmission Power (Pt) x Overload Factor (Ks)
- Calculate Transmission Power at Motor Rated Power Output. (Ideally should be calculated with the load applied to the belt)
- Overload Factor (Ks)=Ko+Kr+Ki Overload Factor (Ks)=Lo+Kr+Ki Ko: Overload Correction Factor (Table 1.) Kr: Rotation Ratio Correction Factor (Table 2.) Ki: Idler Correction Factor (Table 3.)

Table 1. Load Correction Factor (Ko)

Typical Machines Using a Belt	Motor					
	Max. Output not Exceeding 300% of Rated Value			Max. Output Exceeding 300% of Rated Value		
	AC Motor (Standard Motor, Synchronous Motor) DC Motor (Shunt), Engine with 2 or More Cylinders			Special Motor (High torque), Single-Cylinder Engine DC Motor (Series), Operation with Lye Shaft or Clutch		
	Operation Hours			Operation Hours		
	Intermittent use 1 Day 3 to 5 hrs	Regular Use 1 Day 8 to 12 hrs	Continuous Use 1 Day 8 to 12 hrs	Intermittent use 1 Day 3 to 5 hrs	Regular Use 1 Day 8 to 12 hrs	Continuous Use 1 Day 8 to 12 hrs
Exhibit Instrument, Projector, Measuring Instrument, Medical Machine	1.0	1.2	1.4	1.2	1.4	1.6
Cleaner, Sewing Machine, Office Machine, Carpentry Lathe, Belt Sawing Machine	1.2	1.4	1.6	1.4	1.6	1.8
Light Load Belt Conveyor, Packer, Sifter	1.3	1.5	1.7	1.5	1.7	1.9
Liquid Mixer, Drill Press, Lathe, Screw Machine, (Circular Sawing) Machine, Planer, Washing Machine, Paper Manufacturing Machine (Excluding Pulp Manufacturing Machine), Printing Machine	1.4	1.6	1.8	1.6	1.8	2.0
Mixer (Cement and Viscous Matter), Belt Conveyor (Ore, Coal and Sand), Grinder, Shaping Machine, Boring Machine, Milling Machine, Compressor (Centrifugal), Vibration Sifter, Textile Machine (Warper and Winder), Rotary Compressor, Compressor (Reciprocal)	1.5	1.7	1.9	1.7	1.9	2.1
Conveyor (Apron, Pan, Bucket and Elevator), Extraction, Fan, Blower (Centrifugal, Suction and Discharge), Power Generator, Exciter, Hoist, Elevator, Rubber Processor (Calender, Roll and Extruder), Textile Machine (Weaving Machine, Fine Spinning Machine, Twisting Machine and Weft Winding Machine)	1.6	1.8	2.0	1.8	2.0	2.2
Centrifugal Separator, Conveyor (Flight and Screw), Hammer Mill, Paper Manufacturing Machine (Pulpapitor)	1.7	1.9	2.1	1.9	2.1	2.3

- Typical machines using a belt are listed above. For other machines using a belt, a load correction coefficient should be fixed by reference to this table.
- In the case of starts and stops over 100 times per day or rapid acceleration and deceleration, check the above values multiplied by 1.3. (MTS_M only)

Table 2. Speed Ration Correction Coefficient (Kr)

Speed Ratio	Coefficient (Kr)
1.00 to 1.25	0
1.25 to 1.75	0.1
1.75 to 2.50	0.2
2.50 to 3.50	0.3
3.50 or more	0.4

Table 3. Idlers Correction Coefficient (Ki)

Position of Idler	Coefficient (Ki)
Inside the loose side of the belt	0
Outside the loose side of the belt	0.1
Inside the loose side of the belt	0.1
Outside the loose side of the belt	0.2

[Step 2b] Calculating Design Power ……For P_M/UP_M Series

- Design Power (Pd) =Transmission Power (Pt) x Overload Factor (Ks)
- Calculate Transmission Power at Motor Rated Power Output. (Ideally should be calculated with the load applied to the belt)
- Normal Motor Load Factor (Ks)=Ko+Ki+Kr+Kh
  Ko: Application Coefficient (Table 4.) Ki: Idler Correction Factor (Table 5.) Kr: Speed Multiplication Correction Factor (Table 6.) Kh: Operation Time Correction Factor (Table 7.)

Table 4. Application Coefficient (Ko)

Type of Passive Unit			Type of Motor / Peak Output/ Basic Output	Ⅰ 200% or Less	Ⅱ 200 to 300	Ⅲ 300% or More
A	Extremely Smooth Transmission			1.0	1.2	1.4
B	Fairly Smooth Transmission			1.3	1.5	1.7
C	Transmission with Moderate Impact			1.6	1.8	2.0
D	Transmission with Considerable Impact			1.8	2.0	2.2
E	Transmission with Large Impact			2.0	2.2	2.5
Motor	AC Motor	Single-Phase		—	—	All Types
		Squirrel-Cage Induction	2 Poles	100kW or More	90~3.7kW	2.2kW or Less
			4 Poles	55kW or More	45kW or Less	—
			6 Poles	37kW or More	30kW or Less	—
			8 Poles	15kW or More	11kW or Less	—
		Wire-Wound	4 Poles	—	15kW or Less	11kW or Less
			6 Poles	—	11kW or Less	7.5kW or Less
			8 Poles	—	5.5kW or Less	3.7kW or Less
		Synchronous Motor		—	Average Torque	High Torque
	DC Motor			Shunt	Compound	Series
	Internal Combustion Engine			8 or More Cylinders	7~5 Cylinders	4~2 Cylinders
	Hydraulic Motor			—	—	All Types

Note: When the transmission involves regular, reverse revolutions, large momentum or extreme impact, a basic-use coefficient of 2.5 or more can be used.

Type	Typical Passive Machines
A	Measuring Instrument, Camera Device, Radar, Medical Machine, Projector
B	Belt Conveyor (For Light Load), Chain Conveyor (For Light Load), Driller Press, Lathe, Screw Machine, Electric Typewriter, Calculator, Duplicator, Printing Press, Cutter, Paper Folder, Printer, Mixer, Calender-Dryer, Lathe, Belt Sawing Machine, Plane, Circular Sawing Machine, Planer, Mixer (Liquid), Bread Baking Machine, Flour Kneading Machine, Sifter (Drum and Cone), Sawing Machine
C	Belt Conveyor (Ore, Coal, Sand), Elevator, Boring Mill, Grinder, Milling Machine, Shaper, Metal Sawing Machine, Wind Hoist, Dryer, Washing Machine (Including a Wringer), Excavator, Mixer, Granulating Machine, Pump (Centrifugal, Gear and Rotary), Compressor (High-Speed Center), Stirrer, Mixer (Viscous Matter), Centrifugal Forced Blower, General Rubber Handling Machine, Power Generator, Sifter (Electric)
D	Conveyor (Apron, Bucket, Flight, Screw), Hoist, Cutting Press, Shattering Machine, Pulp Manufacturing Machine, Weaving Machine, Spinning Machine, Twisting Machine, Blender, Centrifugal Separator, Blower (Axial Flow, for Mining and Roots), General Construction Equipment, Hammer Mill, Rollgang
E	Crank Press, Pump (Reciprocal), Compressor (Reciprocating), Civil Engineering, Mining Equipment Including Crushing Machine (Ball, Rod, Gravel), Rubber Mixer

Table 5. Correction Coefficient when Idler is Used (Ki)

Location of Idler in Use	Inside	Outside
Loose Side of the Belt	0	+0.1
Tense Side of the Belt	+0.1	+0.2

Should be added for each idler.

Table 6. Speed Increase Correction Coefficient (Kr)

Speed Increase Ratio	Correction Coefficient
1 to 1.25	0
1.25 to 1.75	+0.1
1.75 to 2.5	+0.2
2.5 to 3.5	+0.3
3.5 or more	+0.4

Table 7. Operating Correction Coefficient (Kh)

Operation Hours	Correction Coefficient
Operated 10 or More Hours a Day	+0.1
Operated 20 or More Hours a Day	+0.2
Operated 500 Hours or Less (For Seasonal Operation)	–0.2

Selection is easy with Timing Pulleys and Belts automatic calculation tool available at: http://fawos.misumi.jp/FA_WEB/pulley_us/

[Step 2c] Calculating the Design Power……2GT/3GT Series

- Design Power (Pd) =Transmission Power (Pt) ×Overload Coefficient (Ks)
- Calculate the Transmission Power (Pt) in terms of the rated power of the prime motor. (Originally, it is ideal to calculate from the actual load applied to the belt)

A: Normal Motor Load Factor (Ks)=Ko+Ki+Kr+Kh

Ko: Load Correction Factor (Table 8) Ki: Idler Correction Factor (Table 9) Kr: Speed Multiplication Correction Factor (Table 10) Kh: Operation Time Correction Factor (Table 11)

B: Servo Motor Kp, other table*

Table 8. Load Correction Factor (Ko)

Type of Motor			Ⅰ	Ⅱ	Ⅲ
Peak Output/Basic Output			150% or Less	Over 150%~200% or Less	Over 250%
AC Motor	Single-Phase		—	—	All Types
	Squirrel Cage Type	2 Phase	—	—	All Types
		4 Phase	—	37Kw or More	30Kw or Less
		6 Phase · 8 Phase	—	—	All Types
	Wound Field Type	4 Phase	—	—	15Kw or Less
		6 Phase	—	—	11Kw or Less
		8 Phase	—	—	5.5Kw or Less
Synchronous Motor			—	Standard Torque Type	High Torque Type
DC Motor			Shunt	Wound Field	Series
Hydraulic Motor			—	—	All Types
Office Machinery	Printer · Fax Machine · Copy Machine		—	1.2	1.4
Home Appliance	Juicer		—	1.4	1.6
	Vacuum Cleaner		1.0	1.2	1.4
Finance Equipment	Money Exchanger · Ticket Machine · Ticket Gates · Bank Teller Machine		1.3	1.4	1.5
Food · Medicine · Medical Equipment	Bakery Equipment		1.2	1.4	1.6
	Mixer · Granulator		1.4	1.6	1.8
	Centrifuge		1.5	1.7	1.9
	Medical Machinery · Measurement Equipment		1.0	1.2	1.4
Machine Tool	Drill Press · Lathe		1.2	1.4	1.6
	Milling Machine		1.3	1.5	1.7
	Wood Lather		1.2	1.4	1.6
Printing Book Making	Printer · Book Making Machine · Cutter		1.2	1.4	1.6
Textile Machine	Textile · Knitting Machinery		1.3	1.5	1.7
Sawing Machine	Sawing Machine – Home Use		—	1.2	1.4
	Sawing Machine – Industrial		—	1.6	1.8
Belt Conveyor · Packaging Machine	Belt Conveyor – Light Objects		1.1	1.3	1.5
	Packaging Machine		1.2	1.4	1.6
Film · Wire Making Machine	Calender · Extruder		1.4	1.6	1.8
	Wire Making Machinery		1.4	1.6	1.8

Table 9. Idler Correction Factor (Ki)

Idler Position	Inside	Outside
Loose Side of the Belt	0	+0.1
Tense Side of the Belt	+0.1	+0.2

Table 10. Speed Multiplication Correction Factor (Kr)

Speed Increase Ratio	Correction Factor
1 or More Less than 1.25	0
1.25 or More Less than 1.75	+0.1
1.75 or More Less than 2.5	+0.2
2.5 or More Less than 3.5	+0.3
3.5 or More	+0.4

Table 11. Operation Time Correction Factor (Kh)

Operation Time	Correction Factor
Less than 10 hours (Everyday)	0
10~16 Hours Continuous (Everyday)	+0.2
16~24 Hours Continuous (Everyday)	+0.4
300 Hours/Year or Less (Seasonal operations etc.)	–0.2

Table 12. Special Motor Correction Factor (Kp)

Motor Type	Load Correction Factor
Servo Motor	Design as Kp=2.5 for Rated Output, and Kp=0.5 for Peak Output (Rational speed as applied speed)
Spindle Motor	Design as Kp=2.2 for Rated Output and Base Rotational Speed

[Step 2-d] Calculating Designed Power …… For EV5GT/EV8YU Series

- Design Power (Pd) =Transmission Power (Pt) x Overload Factor (Ks)
- Calculate Transmission Power at Motor Rated Power Output. (Ideally should be calculated with the load applied to the belt)
- Overload Factor (Ks)=Ko+Ki+Kr+Kh+Km

Ko: Load Correction Factor (Table 13) Ki: Idler Correction Factor (Table 14) Kr: Speed Multiplication Correction Factor (Table 15) Kh: Operation Time Correction Factor (Table 16) Km: Start/Stop Correction Factor (Table 17)

Table 13. Load Correction Factor (Ko)

Prime Motor Type		Induction Motor	Spindle Motor	Servo Motor (Peak Output/Rated Output)		
				200% or Less	201~299%	300% or More
Robot	Scara Type	2.0	2.0	1.6	1.7	1.8
Injection Mold Machine	Mold Fastening · Ball Screw Drive	1.8	1.8	1.3	1.4	1.5
Machine Tool	Lathe · Drill Press	1.6	1.3	1.2	1.3	1.4
Machine Tool	Milling Machine	1.7	1.3	1.2	1.3	1.4
Conveyor		1.8	1.8	1.4	1.5	1.6
Medical Machinery · Measurement Equipment		1.5	1.5	1.1	0.1	0.2
Packaging Machine		1.6	1.5	1.1	0.1	0.2
Agitator · Mixer	Liquid	1.6	1.6	1.2	1.3	1.4
	Viscous Material	1.7	1.7	1.3	1.4	1.5
Drilling Machine · Granulator		1.8	1.8	1.4	1.5	1.6
Centrifuge		1.9	1.9	1.5	1.6	1.7
Mills	Ball · Rods	2.2	2.2	1.7	1.8	1.9
Printing Machine · Book Making Machine		2.0	2.0	1.6	1.7	1.8
Paper Making Machine	Calender · Dryer	2.0	2.0	1.6	1.7	1.8
Textile Machine		2.0	2.0	1.6	1.7	1.8
Wire Related	Wire Drawing & Twisting Machine	2.1	2.0	1.6	0.1	0.2
Woodworking Machine		1.7	1.7	1.2	1.3	1.4
Pump		2.0	2.0	1.6	1.7	1.8
Compressor	Reciprocating · Rotating	2.0	2.0	1.6	1.7	1.8
Fan · Blower	Axial Flow · Roots	2.0	1.8	1.3	1.4	1.5
Generator · Exciter		1.8	1.8	1.4	1.5	1.6
Rubber Industry Machinery · Lumber Mill Machinery		2.0	2.0	1.6	1.7	1.8

Table 14. Idler Correction Factor (Ki)

No Idler	0
Inside Idler	0.1×(Qty-1)
Outside Idler	0.1×(Qty-1)

Table 15. Speed Multiplication Correction Factor (Kr)

Operation Duration (Hours/Day)	Correction Factor
1 or More Less than 1.25	0
1.25 or More Less than 1.75	0.1
1.75 or More Less than 2.5	0.2
2.5 or More Less than 3.5	0.3
3.5 or More	0.4

Table 16. Operation Time Correction Factor (Kh)

Operation Duration (Hours/Day)	Correction Factor
≦8	0.1
8<16	0.2
16≦	0.3

Table 17. Start/Stop Correction Factor (Km)

Start/Stop Frequency (Times/Day)	Correction Factor
≦10	0.1
11<100	0.2
101<500	0.3
501<	0.4

Technical Data

Selection of Timing Belts 2

[Step 3] Temporarily Selecting the Type of Belt from Selection Guide Table

Table 18. Selection Guide Table 1 (MXL,XL,L,H,T5,T10)

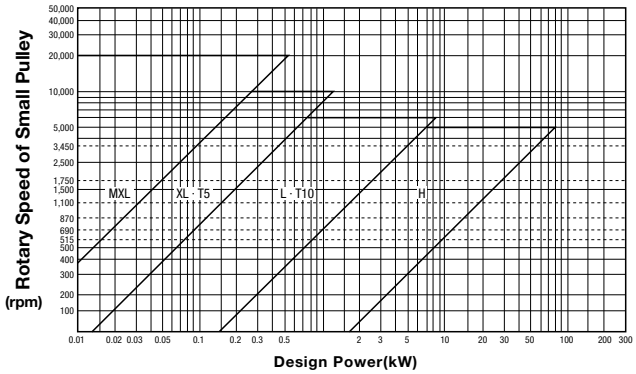


Table 19. Selection Guide Table 2 (S_M series)

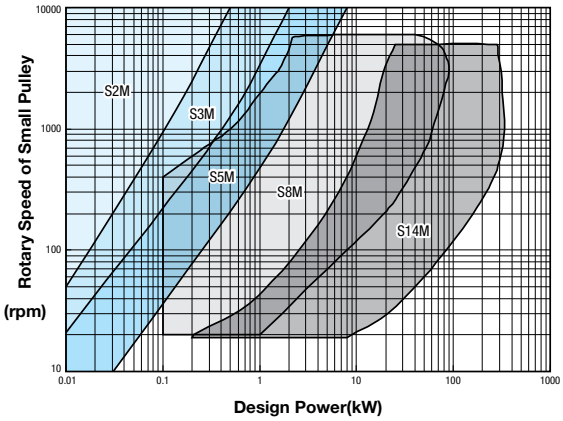


Table 20. Selection Guide Table 3 (P_M series)

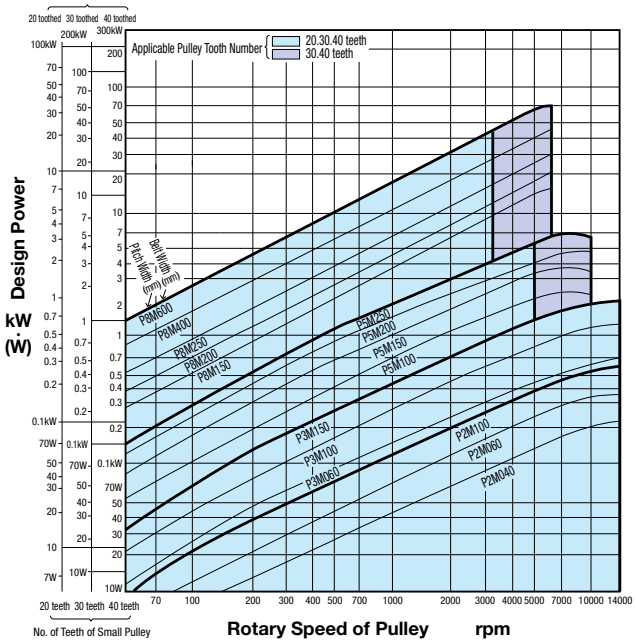


Table 21. Selection Guide Table 4 (MTS8M)

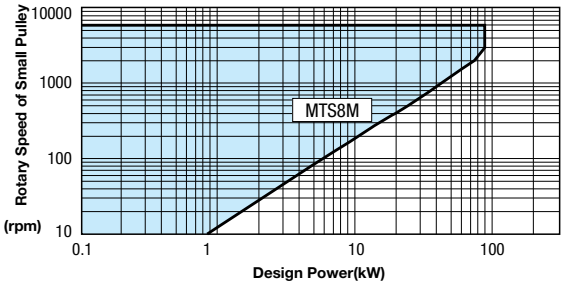


Table 22. Selection Guide Table 5 (UP_M series)

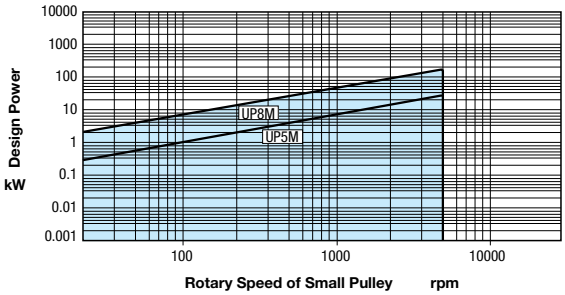


Table 23. Selection Guide Table (2GT·3GT series)

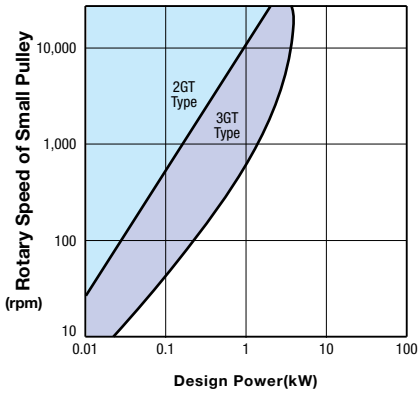
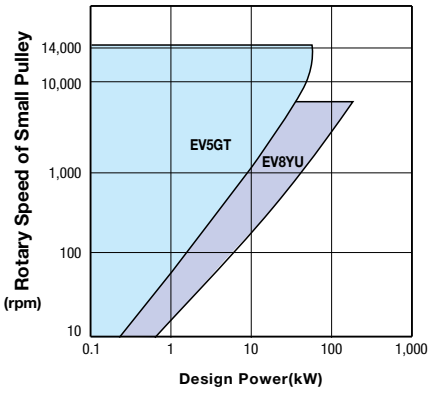


Table 24. Selection Guide Table (EV5GT·EV8YU series)



Selection is easy with Timing Pulleys and Belts automatic calculation tool available at: http://fawos.misumi.jp/FA_WEB/pulley_us/

[Step 4] Determining Number of Teeth of Large and Small Pulley, Belt Length, Inter-Shaft Distance

(1) Select the number of teeth of large and small pulley from **P. 248–258**, which can satisfy the predeterminated speed ratio.
(However, note that the number of teeth for small pulley should be larger than the min. number of teeth shown in Table 25.)

$$\text{Speed Ratio} = \frac{\text{Number of Teeth of Large Pulley}}{\text{Number of Teeth of Small Pulley}}$$

Table 25. Min. Number of Teeth of Pulley

Rotary Speed of Small Pulley (rpm)	Type of Belt, Minimum Number of Teeth											
	MXL	XL	L	H	S2M	S3M	S5M	S8M	S14M	MTS8M	T5	T10
900 or Less	12	10	12	14	14	14	14	22	—	24	12	14
Over 900 1200 or Less	12	10	12	16	14	14	16	24	34	24	12	16
Over 1200 1800 or Less	14	11	14	18	16	16	20	26	38	24	14	18
Over 1800 3600 or Less	16	12	16	20	18	18	24	28	40	24	16	20
Over 3600 4800 or Less	—	16	20	24	20	20	26	30	48	24	20	22
Over 4800 10000 or Less	—	—	—	—	20	20	26	—	—	—	—	—

(2) Determine approx. belt circum. length (Lp') in terms of temporary inter-shaft distance (C'), diameter of large pulley (Dp) and diameter of small pulley (dp).

$$Lp' = 2C' + \frac{\pi(Dp+dp)}{2} + \frac{(Dp-dp)^2}{4C'}$$

C' : Temporary Inter-shaft Distance
dp : Pitch Diameter of Small Pulley (mm)
Dp : Pitch Diameter of Large Pulley (mm)
Lp' : Approx. Belt Circum. Length (mm)

(3) Determine a belt circum. length (Lp') that is the nearest value to approx. belt circum. length referring to (select from actual product on the web), and then calculate the correct inter-shaft distance using the following formula.

$$C = \frac{b + \sqrt{b^2 - 8(Dp-dp)^2}}{8}$$

$$b = 2Lp - \pi(Dp+dp)$$

Dp : Pitch Diameter of Large Pulley (mm)
dp : Pitch Diameter of Small Pulley (mm)
C : Inter-shaft Distance
Lp : Belt Circum. Length (mm)

[Step 5] Determining Belt Width

(1) Calculate an approx. belt width using the following formula, and then select a belt width (Bw':mm) that is the nearest value to the approximated value.

$$Bw' = \frac{Pd}{Ps \cdot Km} \times Wp$$

Pd: Design Power
Ps: Reference Transmission Capacity .....Use the Reference Transmission Capacity Table on **P. 248–258**.
Km: Engagement Correction Coefficient (Table 26)
Wp: Reference Belt Width (Table 27.)

Table 26. Engagement Correction Coefficient (Km)

No. of Teeth Engaged Zm	More than 6	5	4	3	2
Km	1.0	0.8	0.6	0.4	0.2

$$\text{No. of Teeth Engaged (Zm)} = \frac{Zd \cdot \theta}{360°}$$

$$\theta = 180° - \frac{57.3(Dp-dp)}{C}$$

Zd: No.of Teeth of Small Pulley
θ : Contact Angle(°)
Dp: Pitch Diameter of Large Pulley(mm)
dp: Pitch Diameter of Small Pulley(mm)
C:Inter-shaft Distance(mm)

Table 27. Reference Belt Width (Wp)

Type of Belt	MXL	XL	L	H	S2M	S3M	S5M	S8M	S14M	MTS8M
Reference Belt Width	6.4	25.4	25.4	25.4	4	6	10	60	120	60

Type of Belt	P2M	P3M	P5M	P8M	T5	T10
Reference Belt Width	4	6	10	15	10	10

(2) Check if Design Power (Pd) satisfies the following formula. (If not, select the belt width of one size larger again.)

· Pd<Ps · Km · Kb
*2GT · 3GT · EV5GT · EV8YU
· Pd<Ps · Km · Kb · KL

Pd : Design Power
Ps : Reference Transmission Capacity
Km : Engagement Correction Coefficient
Kb : Width Correction Coefficient (Table 28)
KL : Length Correction Coefficient (Table 29)

Table 28. Width Correction Coefficient(Kb)

Type of Belt	Belt Width		Width Correction Coefficient
	Nominal	mm	Kb
MXL	019	4.8	0.72
	025	6.4	1.00
	037	9.5	1.57
	050	12.7	2.18
XL	025	6.4	0.15
	031	7.9	0.21
	037	9.5	0.28
	050	12.7	0.42
L	050	12.7	0.42
	075	19.1	0.71
	100	25.4	1.00
	150	38.1	1.56
H	075	19.1	0.71
	100	25.4	1.00
	150	38.1	1.56
	200	50.8	2.14

Type of Belt	Belt Width		Width Correction Coefficient
	Nominal	mm	Kb
S2M	040	4	1.00
	060	6	1.59
	100	10	2.84
S3M	060	6	1.00
	100	10	1.79
	150	15	2.84
S5M	100	10	1.00
	150	15	1.59
	250	25	2.84
S8M MTS8M	150	15	0.21
	250	25	0.37
	300	30	0.45
	400	40	0.63
S14M	400	40	0.29
	600	60	0.45

Type of Belt	Belt Width		Width Correction Coefficient
	Nominal	mm	Kb
P2M	40	4	1.00
	60	6	1.59
P3M	100	10	1.78
	150	15	2.84
P5M	100	10	1.00
	150	15	1.59
P8M	150	15	1.00
	250	25	1.79
T5	100	10	1.00
	150	15	1.60
	200	20	2.30
	250	25	2.90
T10	150	15	1.60
	200	20	2.30
	250	25	2.90
	300	30	3.50
	400	40	4.60
	500	50	5.80

Type of Belt	Belt Width		Width Correction Coefficient
	Nominal	mm	Kb
2GT	4	4	1.00
	6	6	1.67
	9	9	2.67
3GT	6	6	1.00
	9	9	1.66
	15	15	2.97
EV5GT	9	9	0.53
	12	12	0.76
	15	15	1.00
EV8YU	15	15	0.71
	20	20	1.00
	25	25	1.29

Table 29. Length Correction Coefficient (KL)

Length Correction Coefficient (KL)	0.80	0.90	1.00	1.10	1.20
2GT Belt Length (mm)	130 or less	131~182	183~280	281~419	420 or less
3GT Belt Length (mm)	190 or less	191~260	261~400	401~599	600 or less
EV5GT Belt Length (mm)	440 or less	441~550	551~800	801~1100	1001 or less
EV8YU Belt Length(mm)	600 or less	601~900	901~1250	1251~1799	1800 or less

Technical Data

Selection of Timing Belts 3 – Transmission Capacity Table –

[Step 6] Check if Inter-Shaft Distance Adjustment Range is Larger than that in Table 16

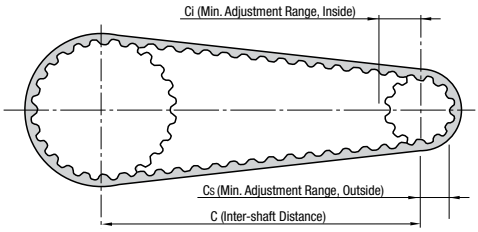


Table 16. Minimum Inter-Axial Distance Adjustment Range

Belt Length	Length Tolerance	Inter-Shaft Distance Tolerance	MXL		XL		L		H		S2M S3M S5M		S8M S14M		MTS8M		P2M P3M P5M		P8M		T5		T10	
			Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs
150 or Less	±0.35	±0.18	3	3	5	3	10	3	15	3	10	2	15	3	15	—	10	3	15	3	5	3	10	3
150 to 250	±0.41	±0.21		3		3		3		3		2		3		3		3		3		3		3
250 to 380	±0.46	±0.23		5		5		5		5		2		3		3		3		3		5		5
380 to 500	±0.51	±0.26		10		10		10		10		2		3		3		3		3		10		10
500 to 750	±0.60	±0.30		10		10		10		10		3		5		3		5		5		10		10
750 to 1000	±0.66	±0.33		15		15		15		15		3		5		5		5		5		15		15
1000 to 1250	±0.76	±0.38		15		15		15		15		5		10		5		10		10		15		15
1250 to 1500	±0.82	±0.41		25		25		25		25		5		10		10		10		10		25		25
1500 to 1750	±0.86	±0.43		25		25		25		25		5		10		10		10		10		25		25
1750 to 2000	±0.92	±0.46		30		30		30		30		5		10		10		10		10		30		30

Length	Length Tolerance	Inter-Shaft Distance Tolerance	2GT		3GT		EV5GT		EV8YU	
			Ci	Cs	Ci	Cs	Ci	Cs	Ci	Cs
150 or Less	± 0.40	± 0.20	4	3	5	3	10	3	20	3
Over 150 250 or Less	± 0.40	± 0.20		3		3		3		3
Over 250 380 or Less	± 0.46	± 0.23		3		3		3		3
Over 380 500 or Less	± 0.50	± 0.25		3		3		3		3
Over 500 750 or Less	± 0.60	± 0.30		5		5		5		5
Over 750 1000 or Less	± 0.66	± 0.33		5		5		5		5
Over 1000 1250 or Less	± 0.76	± 0.38		10		10		10		10
Over 1250 1500 or Less	± 0.82	± 0.41		10		10		10		10
Over 1500 1750 or Less	± 0.86	± 0.43		10		10		10		10
Over 1750 2000 or Less	± 0.92	± 0.46		10		10		10		10

■ Notes on Operation

1. Be careful to avoid the ingress of foreign particles.
When solid foreign particles enter during operation, it can scratch the belt and adversely affect the engagement of the belt and the pulley.
In some cases, the pulley may disengage, land on the teeth of the pulley, and be cut.

2. Avoid Adhesion of oil.
Oil on the rubber timing belt may wet and expand it, drastically shortening its service life.
(a) Take special care when using solvent type oil.
(b) A small amount of lubricant or grease, however, rarely causes a trouble.

3. Do not use the belt in a humid atmosphere.

4. Please use a well-ventilated safety cover.

5. The service life of the belt, when used at a high temperature (80˚C or more), can be drastically shortened.

<Reference> Belt Width Tolerance (Unit: mm)

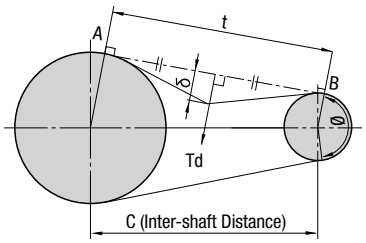
Belt Width	Belt Length			
	351 or Less	351 to 840	840 to 1680	1680 or More
10 or Less	+0.3 −0.6	+0.3 −0.6	+0.3 −0.6	+0.6 −0.6
10 to 40	+0.6 −0.6	+0.6 −0.6	+0.6 −0.6	+0.6 −0.6
40 to 50	+0.6 −0.6	+0.6 −0.6	+1.0 −1.0	+1.0 −1.3

Selection is easy with Timing Pulleys and Belts automatic calculation tool available at: http://fawos.misumi.jp/FA_WEB/pulley_us/

Cautions on Use of Belt

■ How to Extend Belt

When the belt is too taut, its service life can be shortened, while when it is not taut enough, the belt may (jump off) the groove of the pulley due to an activating torque or shock load. Keep the belt stationary and optimize its tautness. The warp load necessary to provide the optimum tautness can be calculated from values representing the belt, its width and the span in equation A below.



$$Td = \frac{Ti + \frac{t \times Y}{Lp}}{16} \quad \text{Equation A}$$

Td: Load N Needed for Deflection d at the Center of Span t

Ti : Initial Tension N — From Table 31

Y : Correction Coefficient — From Table 31

δ : Deflection (mm) — $\delta = 0.016t$

t : Span Length (mm) — $t = \sqrt{C^2 - \frac{(Dp-dp)^2}{4}}$

Lp : Length of the Belt (mm)

C : Inter-shaft Distance (mm)

dp : Diameter of the Pitch Circle of the Small Pulley (mm)

Dp : Diameter of the Pitch Circle of the Large Pulley (mm)

Table 31. Initial Tension (Ti) and Correction Coefficient (Y)

Type	Ti·Y		Belt Nominal Width	019	025	031	037	050	075	100	150	200
			Belt Width mm	4.8	6.4	7.9	9.5	12.7	19.1	25.4	38.1	50.8
MXL	Ti	Max. Value		9.8	13.7	—	21.6	29.9	—	—	—	—
	N	Recommended Value		5.8	8.2		12.9	18.0				
		Coefficient Y		—	—	—	—	—	—	—	—	—
XL	Ti	Max. Value		—	29	37	44	67	—	—	—	—
	N	Recommended Value			18	25	32	51				
		Coefficient Y		—	3.8	5.4	7.6	11.8	—	—	—	—
L	Ti	Max. Value		—	—	—	—	76	125	175	273	—
	N	Recommended Value						52	87	123	191	
		Coefficient Y		—	—	—	—	44.1	75.5	107	165	—
H	TiBelt	Max. Value		—	—	—	—	—	293	421	646	889
	N	Recommended Value							222	312	486	668
		Coefficient Y		—	—	—	—	—	142	205	317	423

Type	Ti·Y		Belt Nominal Width	60	100	150	250
			Belt Width mm	6	10	15	25
P2M	Ti	Max. Value		13	—	—	—
	N	Recommended Value		9.8			
		Coefficient Y		0.9	—	—	—
P3M	Ti	Max. Value		—	46	74	—
	N	Recommended Value			34	55	
		Coefficient Y		—	1.9	3.0	—
P5M	Ti	Max. Value		—	147	225.4	—
	N	Recommended Value			107.8	166.6	
		Coefficient Y		—	56.9	82.4	—
P8M	Ti	Max. Value		—	—	294	509.6
	N	Recommended Value				225.4	382.2
		Coefficient Y		—	—	135	239

Type	Ti·Y		Belt Nominal Width	40	60	100	150	250	300	400	600
			Belt Width mm	4	6	10	15	25	30	40	60
S2M	Ti	Max. Value		7.8	12.7	22.6	—	—	—	—	—
	N	Recommended Value		5.9	9.8	16.7					
		Coefficient Y		9.8	15.7	27.4	—	—	—	—	—
S3M	Ti	Max. Value		—	26	46	73	—	—	—	—
	N	Recommended Value			20	34	54				
		Coefficient Y		—	26.5	46.1	75.5	—	—	—	—
S5M	Ti	Max. Value		—	—	77	124	221	—	—	—
	N	Recommended Value				58	93	166			
		Coefficient Y		—	—	52.8	85.5	151.0	—	—	
S8M MTS8M	Ti	Max. Value		—	—	—	294	510	628	873	
	N	Recommended Value					226	382	470	657	
		Coefficient Y		—	—	—	98	196	235	333	
S14M	Ti	Max. Value		—	—	—	—	—	—	1226	1912
	N	Recommended Value								1108	1726
		Coefficient Y		—	—	—	—	—	—	686	1059

Type	Ti·Y		Belt Nominal Width	100	150	200	250	300	400	500
			Belt Width mm	10	15	20	25	30	40	50
T5	Ti	Max. Value		37.3	59	85	106	—	—	—
	N	Recommended Value		24.5	39	59	74			
		Coefficient Y		16.7	26.5	38.2	47.5	—	—	—
T10	Ti	Max. Value		—	162	235	294	363	500	628
	N	Recommended Value			108	157	196	245	333	422
		Coefficient Y		—	71.6	104.9	130.4	163.8	222.6	281.5

Type	Ti·Y		Belt Nominal Width	4	6	9	12	15	20	25
			Belt Width mm	4	6	9	12	15	20	25
2GT	Ti	Max. Value		12.2	20.5	32.8	—	—	—	—
	N	Recommended Value		9.4	15.8	25.2				
		Coefficient Y		—	—	—	—	—	—	—
3GT	Ti	Max. Value		—	38	57	—	96	—	—
	N	Recommended Value			29	44		74		
		Coefficient Y		—	—	—	—	—	—	—
EV5GT	Ti	Max. Value		—	—	92	127	163	—	—
	N	Recommended Value				71	98	125		
		Coefficient Y		—	—	—	—	—	—	—
EV8YU	Ti	Max. Value		—	—	—	—	273	364	455
	N	Recommended Value						210	280	350
		Coefficient Y		—	—	—	—	—	—	—

Technical Data

Selection of Timing Belts 4 – Transmission Capacity Table –

Table 32. Reference Transmission Capacity of MXL Ps – Nominal Width of Belts 025 (6.4 mm) – (W)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	12	14	15	16	18	20	22	24	25	26	28	30	32	36	40
Diameter of the Pitch Circle (mm)	7.76	9.06	9.70	10.35	11.64	12.94	14.23	15.52	16.17	16.82	18.11	19.40	20.70	23.29	25.97
950	9.0	10.5	11.3	12.0	13.5	15.0	16.5	18.0	18.8	19.6	21.1	22.6	24.1	27.1	30.1
1160	11.0	12.8	13.8	14.7	16.5	18.4	20.2	22.0	23.0	23.9	25.7	27.6	29.4	33.1	36.7
1425		15.8	16.9	18.0	20.3	22.6	24.8	27.1	28.2	29.3	31.6	33.9	36.1	40.6	45.1
1750		19.4	20.8	22.2	24.9	27.7	30.5	33.3	34.7	36.0	38.8	41.6	44.3	49.9	55.4
2850			33.9	36.1	40.6	45.1	49.6	54.1	56.4	58.6	63.1	67.6	72.1	81.0	90.0
3450			41.0	43.7	49.2	54.6	60.1	65.5	68.2	70.9	76.3	81.7	87.1	97.9	108.6
100	0.9	1.1	1.1	1.2	1.4	1.5	1.7	1.9	1.9	2.0	2.2	2.3	2.5	2.8	3.1
200	1.9	2.2	2.3	2.5	2.8	3.1	3.4	3.8	3.9	4.1	4.4	4.7	5.0	5.7	6.3
300	2.8	3.3	3.5	3.8	4.2	4.7	5.2	5.7	5.9	6.1	6.6	7.1	7.6	8.5	9.5
400	3.8	4.4	4.7	5.0	5.7	6.3	6.9	7.6	7.9	8.2	8.8	9.5	10.1	11.4	12.6
500	4.7	5.5	5.9	6.3	7.1	7.9	8.7	9.5	9.9	10.3	11.1	11.9	12.6	14.2	15.8
600	5.7	6.6	7.1	7.6	8.5	9.5	10.4	11.4	11.9	12.3	13.3	14.2	15.2	17.1	19.0
700	6.6	7.7	8.3	8.8	10.0	11.1	12.2	13.3	13.8	14.4	15.5	16.6	17.7	19.9	22.2
800	7.6	8.8	9.5	10.1	11.4	12.6	13.9	15.2	15.8	16.5	17.7	19.0	20.3	22.8	25.3
900	8.5	10.0	10.7	11.4	12.8	14.2	15.7	17.1	17.8	18.5	19.9	21.4	22.8	25.7	28.5
1000	9.5	11.1	11.9	12.6	14.2	15.8	17.4	19.0	19.8	20.6	22.2	23.8	25.3	28.5	31.7
1100	10.4	12.2	13.0	13.9	15.7	17.4	19.2	20.9	21.8	22.6	24.4	26.1	27.9	31.4	34.8
1200	11.4	13.3	14.2	15.2	17.1	19.0	20.9	22.8	23.8	24.7	26.6	28.5	30.4	34.2	38.0
1300		14.4	15.4	16.5	18.5	20.6	22.6	24.7	25.7	26.8	28.8	30.9	32.9	37.1	41.2
1400		15.5	16.6	17.7	19.9	22.2	24.4	26.6	27.7	28.8	31.0	33.3	35.5	39.9	44.3
1500		16.6	17.8	19.0	21.4	23.8	26.1	28.5	29.7	30.9	33.3	35.6	38.0	42.8	47.5
1600		17.7	19.0	20.3	22.8	25.3	27.9	30.4	31.7	32.9	35.5	38.0	40.5	45.6	50.7
1700		18.8	20.2	21.5	24.2	26.9	29.6	32.3	33.7	35.0	37.7	40.4	43.1	48.5	53.8
1800		19.9	21.4	22.8	25.7	28.5	31.4	34.2	35.6	37.1	39.9	42.8	45.6	51.3	57.0
2000			23.8	25.3	28.5	31.7	34.8	38.0	39.6	41.2	44.3	47.5	50.7	57.0	63.3
2200			26.1	27.9	31.4	34.8	38.3	41.8	43.6	45.3	48.8	52.2	55.7	62.7	69.6
2400			28.5	30.4	34.2	38.0	41.8	45.6	47.5	49.4	53.2	57.0	60.8	68.3	75.9
2600			30.9	32.9	37.1	41.2	45.3	49.4	51.5	53.5	57.6	61.7	65.8	74.0	82.1
2800				35.5	39.9	44.3	48.8	53.2	55.4	57.6	62.0	66.4	70.8	79.6	88.4
3000				38.0	42.8	47.5	52.2	57.0	59.3	61.7	66.4	71.2	75.9	85.3	94.6
3200				40.5	45.6	50.7	55.7	60.8	63.3	65.8	70.8	75.9	80.9	90.9	100.9
3400				43.1	48.5	53.8	59.2	64.5	67.2	69.9	75.2	80.6	85.9	96.5	107.1
3600				45.6	51.3	57.0	62.7	68.3	71.2	74.0	79.6	85.3	90.9	102.1	113.3
3800					54.1	60.1	66.1	72.1	75.1	78.1	84.0	90.0	95.9	107.7	119.5
4000					57.0	63.3	69.6	75.9	79.0	82.1	88.4	94.6	100.9	113.3	125.6
4200					59.8	66.4	73.0	79.6	82.9	86.2	92.8	99.3	105.8	118.8	131.8
4400					62.7	69.6	76.5	83.4	86.8	90.3	97.1	104.0	110.8	124.4	137.9
4600					65.5	72.7	79.9	87.1	90.7	94.3	101.5	108.6	115.8	129.9	144.0
4800					68.3	75.9	83.4	90.9	94.6	98.4	105.8	113.3	120.7	135.4	150.0

*Values in the table above are for nominal belt width 025 (6.4 mm). For other belt widths, those values should be multiplied by the width correction coefficient, Kb, shown in Table 28.

Table 33. Reference Transmission Capacity of XL Ps – Nominal Width of Belts 100 (25.4 mm) – (kW)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	10	11	12	14	15	16	18	19	20	21	22	24	25	26	28	30
Diameter of the Pitch Circle (mm)	16.17	17.79	19.40	22.64	24.26	25.87	29.11	30.72	32.34	33.96	35.57	38.81	40.43	42.04	45.28	48.51
950	0.14	0.16	0.17	0.20	0.21	0.23	0.26	0.27	0.29	0.30	0.32	0.35	0.36	0.38	0.41	0.43
1160	0.17	0.19	0.21	0.25	0.26	0.28	0.32	0.33	0.35	0.37	0.39	0.42	0.44	0.46	0.50	0.53
1425			0.26	0.30	0.32	0.35	0.39	0.41	0.43	0.46	0.48	0.52	0.54	0.57	0.61	0.65
1750			0.32	0.37	0.40	0.43	0.48	0.51	0.53	0.56	0.59	0.64	0.67	0.69	0.75	0.80
2850			0.52	0.61	0.65	0.07	0.78	0.82	0.87	0.91	0.95	1.04	1.08	1.12	1.21	1.29
3450			0.63	0.74	0.79	0.84	0.94	1.00	1.05	1.10	1.15	1.25	1.30	1.35	1.45	1.55
100	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04
200	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.09
300	0.04	0.05	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.10	0.11	0.11	0.12	0.12	0.13
400	0.06	0.06	0.07	0.08	0.09	0.09	0.11	0.11	0.12	0.12	0.13	0.14	0.15	0.16	0.17	0.18
500	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.16	0.18	0.19	0.20	0.21	0.23
600	0.09	0.10	0.11	0.12	0.13	0.14	0.16	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.25	0.27
700	0.10	0.11	0.12	0.15	0.16	0.17	0.19	0.20	0.21	0.22	0.23	0.25	0.27	0.28	0.30	0.32
800	0.12	0.13	0.14	0.17	0.18	0.19	0.22	0.23	0.24	0.25	0.27	0.29	0.30	0.32	0.34	0.37
900	0.13	0.15	0.16	0.19	0.20	0.22	0.25	0.26	0.27	0.29	0.30	0.33	0.34	0.36	0.38	0.41
1000	0.15	0.16	0.18	0.21	0.23	0.24	0.27	0.29	0.30	0.32	0.33	0.37	0.38	0.40	0.43	0.46
1100	0.16	0.18	0.20	0.23	0.25	0.27	0.30	0.32	0.33	0.35	0.37	0.40	0.42	0.44	0.47	0.50
1200	0.18	0.20	0.22	0.25	0.27	0.29	0.33	0.35	0.37	0.38	0.40	0.44	0.46	0.48	0.51	0.55
1300			0.24	0.28	0.30	0.32	0.36	0.38	0.40	0.42	0.44	0.48	0.50	0.52	0.56	0.59
1400			0.25	0.30	0.32	0.34	0.38	0.41	0.43	0.45	0.47	0.51	0.53	0.56	0.60	0.64
1500			0.27	0.32	0.34	0.37	0.41	0.43	0.46	0.48	0.50	0.55	0.57	0.59	0.64	0.69
1600			0.29	0.34	0.37	0.39	0.44	0.46	0.49	0.51	0.54	0.59	0.61	0.63	0.68	0.73
1700			0.31	0.36	0.39	0.41	0.47	0.49	0.52	0.54	0.57	0.62	0.65	0.67	0.73	0.78
1800			0.33	0.38	0.41	0.44	0.49	0.52	0.55	0.58	0.60	0.66	0.69	0.71	0.77	0.82
2000			0.37	0.43	0.46	0.49	0.55	0.58	0.61	0.64	0.67	0.73	0.76	0.79	0.85	0.91
2200			0.40	0.47	0.50	0.54	0.60	0.64	0.67	0.70	0.74	0.80	0.84	0.87	0.94	1.00
2400			0.44	0.51	0.55	0.59	0.66	0.70	0.73	0.77	0.80	0.88	0.91	0.95	1.02	1.09
2600			0.48	0.56	0.59	0.63	0.71	0.75	0.79	0.83	0.87	0.95	0.99	1.03	1.10	1.18
2800			0.51	0.60	0.64	0.68	0.77	0.81	0.85	0.89	0.94	1.02	1.06	1.10	1.19	1.27
3000			0.55	0.64	0.69	0.73	0.82	0.87	0.91	0.96	1.00	1.09	1.14	1.18	1.27	1.35
3200			0.59	0.68	0.73	0.78	0.88	0.92	0.97	1.02	1.07	1.16	1.21	1.26	1.35	1.44
3400			0.62	0.73	0.78	0.83	0.93	0.98	1.03	1.08	1.13	1.23	1.28	1.33	1.43	1.53
3600			0.66	0.77	0.82	0.88	0.98	1.04	1.09	1.14	1.20	1.30	1.35	1.41	1.51	1.61
3800					0.87	0.92	1.04	1.09	1.15	1.21	1.26	1.37	1.43	1.48	1.59	1.69
4000					0.91	0.97	1.09	1.15	1.21	1.27	1.33	1.44	1.50	1.55	1.67	1.78
4200					0.96	1.02	1.14	1.21	1.27	1.33	1.39	1.51	1.57	1.63	1.74	1.86
4400					1.00	1.07	1.20	1.26	1.33	1.39	1.45	1.58	1.64	1.70	1.82	1.94
4600					1.05	1.12	1.25	1.32	1.38	1.45	1.52	1.64	1.71	1.77	1.90	2.02
4800					1.09	1.16	1.30	1.37	1.44	1.51	1.58	1.71	1.78	1.84	1.97	2.10

*Values in the table above are for nominal belt width 100 (25.4 mm). For other belt widths, those values should be multiplied by the width correction coefficient, Kb, shown in Table 28.

Selection is easy with Timing Pulleys and Belts automatic calculation tool available at: http://fawos.misumi.jp/FA_WEB/pulley_us/

Table 34. Reference Transmission Capacity of L Ps – Nominal Width of Belts 100 (25.4 mm) – (kW)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	12	14	15	16	18	19	20	21	22	24	25	26	28	30	32	36	40	48
Diameter of the Pitch Circle (mm)	36.38	42.45	45.48	48.51	54.57	57.61	60.64	63.67	66.70	72.77	75.80	78.83	84.89	90.96	97.02	109.15	121.28	145.53
725	0.33	0.39	0.42	0.44	0.50	0.53	0.56	0.58	0.61	0.67	0.70	0.72	0.78	0.83	0.89	1.00	1.11	1.33
870	0.40	0.47	0.50	0.53	0.60	0.63	0.67	0.70	0.73	0.80	0.83	0.87	0.93	1.00	1.07	1.20	1.33	1.59
950	0.44	0.51	0.55	0.58	0.66	0.69	0.73	0.77	0.80	0.87	0.91	0.95	1.02	1.09	1.16	1.31	1.45	1.73
1160	0.53	0.62	0.67	0.71	0.80	0.85	0.89	0.93	0.98	1.07	1.11	1.15	1.24	1.33	1.41	1.59	1.76	2.09
1425		0.77	0.82	0.87	0.98	1.04	1.09	1.14	1.20	1.31	1.36	1.41	1.52	1.62	1.73	1.93	2.13	2.52
1750		0.94	1.01	1.07	1.20	1.27	1.34	1.40	1.47	1.59	1.66	1.72	1.85	1.97	2.10	2.34	2.58	3.02
2850				1.73	1.93	2.03	2.13	2.23	2.33	2.52	2.62	2.71	2.89	3.07	3.24	3.56	3.84	4.31
3450				2.07	2.31	2.43	2.54	2.66	2.77	2.99	3.09	3.19	3.39	3.58	3.76	4.07	4.33	4.67
100	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.12	0.13	0.15	0.18
200	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.23	0.24	0.27	0.30	0.37
300	0.13	0.16	0.17	0.18	0.20	0.22	0.23	0.24	0.25	0.27	0.29	0.30	0.32	0.34	0.37	0.41	0.46	0.55
400	0.18	0.21	0.23	0.24	0.27	0.29	0.30	0.32	0.34	0.37	0.38	0.40	0.43	0.46	0.49	0.55	0.61	0.74
500	0.23	0.27	0.29	0.30	0.34	0.36	0.38	0.40	0.42	0.46	0.48	0.50	0.54	0.58	0.61	0.69	0.77	0.92
600	0.27	0.32	0.34	0.37	0.41	0.44	0.46	0.48	0.51	0.55	0.58	0.60	0.64	0.69	0.74	0.83	0.92	1.10
700	0.32	0.37	0.40	0.43	0.48	0.51	0.54	0.56	0.59	0.64	0.67	0.70	0.75	0.81	0.86	0.97	1.07	1.28
800	0.37	0.43	0.46	0.49	0.55	0.58	0.61	0.64	0.68	0.74	0.77	0.80	0.86	0.92	0.98	1.10	1.22	1.46
900	0.41	0.48	0.52	0.55	0.62	0.66	0.69	0.73	0.76	0.83	0.86	0.90	0.97	1.03	1.10	1.24	1.37	1.64
1000	0.46	0.54	0.58	0.61	0.69	0.73	0.77	0.81	0.84	0.92	0.96	1.00	1.07	1.15	1.22	1.37	1.52	1.81
1100	0.51	0.59	0.63	0.68	0.76	0.80	0.84	0.89	0.93	1.01	1.05	1.09	1.18	1.26	1.34	1.51	1.67	1.99
1200	0.55	0.64	0.69	0.74	0.83	0.87	0.92	0.97	1.01	1.10	1.15	1.19	1.28	1.37	1.46	1.64	1.81	2.15
1300		0.70	0.75	0.80	0.90	0.95	1.00	1.05	1.09	1.19	1.24	1.29	1.39	1.48	1.58	1.77	1.96	2.32
1400		0.75	0.81	0.86	0.97	1.02	1.07	1.12	1.18	1.28	1.34	1.39	1.49	1.59	1.70	1.90	2.10	2.48
1500		0.81	0.86	0.92	1.03	1.09	1.15	1.20	1.26	1.37	1.43	1.48	1.59	1.70	1.81	2.03	2.24	2.64
1600		0.86	0.92	0.98	1.10	1.16	1.22	1.28	1.34	1.46	1.52	1.58	1.70	1.81	1.93	2.15	2.38	2.80
1700		0.91	0.98	1.04	1.17	1.23	1.30	1.36	1.42	1.55	1.61	1.68	1.80	1.92	2.04	2.28	2.51	2.95
1800		0.97	1.03	1.10	1.24	1.31	1.37	1.44	1.51	1.64	1.70	1.77	1.90	2.03	2.15	2.40	2.64	3.10
1900				1.16	1.31	1.38	1.45	1.52	1.59	1.73	1.80	1.86	2.00	2.13	2.27	2.52	2.77	3.24
2000				1.22	1.37	1.45	1.52	1.59	1.67	1.81	1.89	1.96	2.10	2.24	2.38	2.64	2.90	3.38
2200				1.34	1.51	1.59	1.67	1.75	1.83	1.99	2.06	2.14	2.29	2.44	2.59	2.87	3.14	3.64
2400				1.46	1.64	1.73	1.81	1.90	1.99	2.15	2.24	2.32	2.48	2.64	2.80	3.10	3.38	3.87
2500				1.52	1.70	1.80	1.89	1.97	2.06	2.24	2.32	2.41	2.58	2.74	2.90	3.20	3.49	3.98
2600				1.58	1.77	1.86	1.96	2.05	2.14	2.32	2.41	2.50	2.67	2.84	3.00	3.31	3.59	4.09
2800				1.70	1.90	2.00	2.10	2.20	2.29	2.48	2.58	2.67	2.85	3.02	3.19	3.51	3.80	4.27
3000				1.81	2.03	2.13	2.24	2.34	2.44	2.64	2.74	2.84	3.02	3.20	3.38	3.70	3.98	4.43
3200				1.93	2.15	2.27	2.38	2.48	2.59	2.80	2.90	3.00	3.19	3.38	3.55	3.87	4.15	4.56
3400				2.04	2.28	2.40	2.51	2.62	2.73	2.95	3.05	3.16	3.35	3.54	3.72	4.04	4.30	4.65
3600				2.15	2.40	2.52	2.64	2.76	2.87	3.10	3.20	3.31	3.51	3.70	3.87	4.18	4.43	4.71
3800					2.52	2.65	2.77	2.89	3.01	3.24	3.35	3.45	3.66	3.84	4.02	4.31	4.54	4.73
4000					2.64	2.77	2.90	3.02	3.14	3.38	3.49	3.59	3.80	3.98	4.15	4.43	4.62	4.72
4200					2.76	2.89	3.02	3.15	3.27	3.51	3.62	3.73	3.93	4.11	4.27	4.53	4.69	4.66
4400					2.87	3.01	3.14	3.27	3.40	3.64	3.75	3.85	4.05	4.23	4.38	4.61	4.72	4.56
4600					2.99	3.13	3.26	3.39	3.52	3.76	3.87	3.97	4.17	4.33	4.48	4.67	4.73	4.42
4800					3.10	3.24	3.38	3.51	3.64	3.87	3.98	4.09	4.27	4.43	4.56	4.71	4.72	4.23

*[ ] The circumferential speed of pulley is 33(m/s)or more; a dynamic balance for the pulley is essential.

*Values in the table above are for nominal belt width 100 (25.4 mm). For other belt widths, those values should be multiplied by the width correction coefficient, Kb, shown in Table 28.

Table 35. Reference Transmission Capacity of H Ps – Nominal Width of Belts 100 (25.4 mm) – (kW)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	14	15	16	18	19	20	21	22	24	25	26	28	30	32	36	40	48
Diameter of the Pitch Circle (mm)	56.60	60.64	64.68	72.77	76.81	80.85	84.89	88.94	97.02	101.06	105.1	113.19	121.28	129.36	145.53	161.70	194.04
725	1.33	1.43	1.52	1.71	1.81	1.90	2.00	2.09	2.28	2.38	2.47	2.66	2.85	3.04	3.41	3.79	4.53
870	1.60	1.71	1.83	2.05	2.17	2.28	2.40	2.51	2.74	2.85	2.96	3.19	3.41	3.64	4.08	4.53	5.41
950			1.99	2.24	2.37	2.49	2.61	2.74	2.99	3.11	3.23	3.48	3.72	3.97	4.45	4.93	5.89
1160			2.43	2.74	2.89	3.04	3.19	3.34	3.64	3.79	3.94	4.23	4.53	4.82	5.41	5.99	7.12
1425				3.35	3.54	3.72	3.91	4.09	4.45	4.63	4.81	5.17	5.53	5.89	6.59	7.27	8.61
1750				4.11	4.33	4.55	4.78	5.00	5.44	5.66	5.87	6.31	6.73	7.16	7.98	8.79	10.32
2850						7.27	7.61	7.95	8.61	8.93	9.25	9.87	10.48	11.06	12.16	13.15	14.80
3450						8.68	9.07	9.45	10.19	10.55	10.91	11.59	12.24	12.85	13.95	14.87	16.09
100	0.18	0.19	0.21	0.23	0.25	0.26	0.27	0.28	0.31	0.32	0.34	0.36	0.39	0.42	0.47	0.52	0.63
200	0.36	0.39	0.42	0.47	0.50	0.52	0.55	0.57	0.63	0.65	0.68	0.73	0.79	0.84	0.94	1.05	1.26
300	0.55	0.59	0.63	0.71	0.75	0.79	0.83	0.86	0.94	0.98	1.02	1.10	1.18	1.26	1.42	1.57	1.89
400	0.73	0.79	0.84	0.94	1.00	1.05	1.10	1.15	1.26	1.31	1.36	1.47	1.57	1.68	1.89	2.10	2.52
500	0.92	0.98	1.05	1.18	1.25	1.31	1.38	1.44	1.57	1.64	1.71	1.84	1.97	2.10	2.36	2.62	3.14
600	1.10	1.18	1.26	1.42	1.50	1.57	1.65	1.73	1.89	1.97	2.05	2.20	2.36	2.52	2.83	3.14	3.76
700	1.29	1.38	1.47	1.65	1.75	1.84	1.93	2.02	2.20	2.30	2.39	2.57	2.75	2.93	3.30	3.66	4.38
800	1.47	1.57	1.68	1.89	1.99	2.10	2.20	2.31	2.52	2.62	2.73	2.93	3.14	3.35	3.76	4.17	4.99
900	1.65	1.77	1.89	2.13	2.24	2.36	2.48	2.60	2.83	2.95	3.06	3.30	3.53	3.76	4.22	4.68	5.59
1000			2.10	2.36	2.49	2.62	2.75	2.88	3.14	3.27	3.40	3.66	3.92	4.17	4.68	5.19	6.18
1100			2.31	2.60	2.74	2.88	3.02	3.17	3.45	3.59	3.74	4.02	4.30	4.58	5.14	5.69	6.77
1200			2.52	2.83	2.99	3.14	3.30	3.45	3.76	3.92	4.07	4.38	4.68	4.99	5.59	6.18	7.35
1300				3.06	3.23	3.40	3.57	3.74	4.07	4.24	4.40	4.73	5.06	5.39	6.03	6.67	7.91
1400				3.30	3.48	3.66	3.84	4.02	4.38	4.55	4.73	5.09	5.44	5.79	6.48	7.16	8.47
1500				3.53	3.72	3.92	4.11	4.30	4.68	4.87	5.06	5.44	5.81	6.18	6.91	7.63	9.01
1600				3.76	3.97	4.17	4.38	4.58	4.99	5.19	5.39	5.79	6.18	6.57	7.35	8.10	9.55
1700				3.99	4.21	4.43	4.64	4.86	5.29	5.50	5.71	6.13	6.55	6.96	7.77	8.56	10.07
1800				4.22	4.45	4.68	4.91	5.14	5.59	5.81	6.03	6.48	6.91	7.35	8.19	9.01	10.57
1900						4.93	5.17	5.41	5.89	6.12	6.35	6.82	7.27	7.73	8.61	9.46	11.06
2000						5.19	5.44	5.69	6.18	6.43	6.67	7.16	7.63	8.10	9.01	9.89	11.53
2100						5.44	5.70	5.96	6.48	6.73	6.99	7.49	7.98	8.47	9.41	10.32	11.99
2200						5.69	5.96	6.23	6.77	7.03	7.30	7.82	8.33	8.83	9.81	10.73	12.43
2300						5.94	6.22	6.50	7.06	7.33	7.61	8.15	8.68	9.19	10.19	11.14	12.85
2400						6.18	6.48	6.77	7.35	7.63	7.91	8.47	9.01	9.55	10.57	11.53	13.25
2500						6.43	6.73	7.03	7.63	7.93	8.22	8.79	9.35	9.89	10.94	11.91	13.63
2600						6.67	6.99	7.30	7.91	8.22	8.52	9.10	9.68	10.24	11.30	12.28	13.99
2800						7.16	7.49	7.82	8.47	8.79	9.10	9.72	10.32	10.90	11.99	12.99	14.65
3000						7.63	7.98	8.33	9.01	9.35	9.68	10.32	10.94	11.53	12.64	13.63	15.21
3200						8.10	8.47	8.83	9.55	9.89	10.24	10.90	11.53	12.14	13.25	14.22	15.67
3400						8.56	8.95	9.33	10.07	10.42	10.78	11.45	12.10	12.71	13.81	14.75	16.02
3600						9.01	9.41	9.81	10.57	10.94	11.30	11.99	12.64	13.25	14.33	15.21	16.26
3800								10.28	11.06	11.44	11.80	12.50	13.15	13.75	14.80	15.60	16.38
4000								10.73	11.53	11.91	12.28	12.99	13.63	14.22	15.21	15.92	16.37
4200								11.18	11.99	12.37	12.75	13.44	14.08	14.65	15.56	16.16	16.23
4400								11.61	12.43	12.81	13.19	13.87	14.49	15.03	15.86	16.31	15.94
4600								12.03	12.85	13.23	13.60	14.28	14.87	15.37	16.09	16.39	15.51
4800								12.43	13.25	13.63	13.99	14.65	15.21	15.67	16.26	16.37	14.93

*[ ] The circumferential speed of pulley is 33(m/s)or more; a dynamic balance for the pulley is essential.

*Values in the table above are for nominal belt width 100 (25.4 mm). For other belt widths, those values should be multiplied by the width correction coefficient, Kb, shown in Table 28.

Technical Data

Selection of Timing Belts 5 – Transmission Capacity Table –

Table 36. Reference Transmission Capacity of S2M Ps -Belt Width 4mm- (W)

Rotary Speed of Small Pulley(rpm) \ No. of Teeth of Small Pulley	14	15	16	18	20	22	24	25	26	28	30	32	36	40	44	48	50	60
Diameter of the Pitch Circle(mm)	8.91	9.55	10.19	11.46	12.73	14.01	15.28	15.92	16.55	17.83	19.10	20.37	22.92	25.46	28.01	30.56	31.83	38.20
870	11	12	14	16	19	21	23	25	26	28	30	33	37	41	46	50	52	62
1160	13	15	17	20	23	26	29	31	32	35	38	41	46	52	57	62	65	77
1750	17	20	22	27	31	35	39	41	43	47	51	55	63	70	78	85	88	105
3500	26	30	34	41	49	56	63	67	70	77	83	90	102	115	126	138	143	170
50	1	1	1	2	2	2	2	2	2	3	3	3	3	4	4	5	5	6
100	2	2	2	3	3	4	4	4	4	5	5	6	6	7	8	8	9	11
150	3	3	3	4	5	5	6	6	6	7	7	8	9	10	11	12	12	15
200	4	4	4	5	6	7	7	8	8	9	9	10	11	13	14	15	16	19
250	4	5	5	6	7	8	9	9	10	10	11	12	14	15	17	18	19	23
300	5	5	6	7	8	9	10	11	11	12	13	14	16	18	19	21	22	26
350	6	6	7	8	9	10	11	12	13	14	15	16	18	20	22	24	25	30
400	6	7	8	9	10	11	13	13	14	15	16	18	20	22	25	27	28	33
450	7	8	8	10	11	13	14	15	15	17	18	19	22	25	27	30	31	37
500	7	8	9	11	12	14	15	16	17	18	20	21	24	27	29	32	33	40
550	8	9	10	11	13	15	16	17	18	20	21	23	26	29	32	35	36	43
600	8	9	10	12	14	16	18	18	19	21	23	24	28	31	34	37	39	46
650	9	10	11	13	15	17	19	20	21	22	24	26	30	33	36	40	41	49
700	9	10	12	14	16	18	20	21	22	24	26	28	31	35	39	42	44	52
750	10	11	12	14	17	19	21	22	23	25	27	29	33	37	41	44	46	55
800	10	12	13	15	17	20	22	23	24	26	28	31	35	39	43	47	49	58
850	11	12	13	16	18	21	23	24	25	28	30	32	36	41	45	49	51	61
900	11	13	14	16	19	22	24	25	26	29	31	34	38	43	47	51	53	63
950	12	13	14	17	20	22	25	26	28	30	33	35	40	44	49	53	56	66
1000	12	14	15	18	21	23	26	27	29	31	34	36	41	46	51	55	58	69
1100	13	14	16	19	22	25	28	29	31	34	36	39	44	50	55	60	62	74
1200	14	15	17	20	24	27	30	31	33	36	39	42	47	53	58	64	66	79
1300	14	16	18	22	25	28	32	33	35	38	41	44	50	56	62	68	71	84
1400	15	17	19	23	26	30	33	35	37	40	44	47	53	60	66	72	75	89
1500	16	18	20	24	28	31	35	37	39	42	46	49	56	63	69	75	79	94
1600	17	19	21	25	29	33	37	39	41	44	48	52	59	66	73	79	82	98
1700	17	19	22	26	30	34	39	41	43	46	50	54	62	69	76	83	86	103
1800	18	20	23	27	31	36	40	42	44	48	52	56	64	72	79	86	90	107
1900	18	21	23	28	33	37	42	44	46	50	55	59	67	75	82	90	94	111
2000	19	22	24	29	34	39	43	46	48	52	57	61	69	78	85	93	97	115
2200	20	23	26	31	36	41	46	49	51	56	61	65	74	83	92	100	104	124
2400	21	24	27	33	38	44	49	52	54	59	64	69	79	88	97	106	111	131
2600	22	25	28	35	40	46	52	55	57	63	68	73	84	93	103	112	117	139
2800	23	26	30	36	42	49	55	57	60	66	72	77	88	98	109	118	123	146
3000	24	28	31	38	44	51	57	60	63	69	75	81	92	103	114	124	129	153
3200	25	29	32	39	46	53	60	63	66	72	79	85	96	108	119	130	135	160
3400	26	30	33	41	48	55	62	65	69	75	82	88	100	112	124	135	140	167
3600	26	30	34	42	50	57	64	68	71	78	85	92	104	117	129	140	146	173
3800	27	31	35	44	51	59	67	70	74	81	88	95	108	121	133	145	151	179
4000	28	32	36	45	53	61	69	73	76	84	91	98	112	125	138	150	156	185
4500	29	34	39	48	57	66	74	78	82	90	98	106	121	135	149	162	168	199
5000	30	36	41	51	60	70	79	83	88	96	105	113	129	144	159	173	179	211
5500	32	37	43	53	63	74	83	88	93	102	111	119	136	152	168	183	190	223
6000	33	38	44	56	66	77	87	92	97	107	117	126	143	160	176	192	199	233
6500	33	40	46	58	69	80	91	97	102	112	122	132	150	168	184	200	208	243
7000	34	41	47	60	72	83	95	100	106	117	127	137	156	174	192	208	216	251
7500	34	41	48	61	74	86	98	104	110	121	132	142	162	181	198	215	223	259
8000	35	42	49	63	76	89	101	107	113	125	136	147	167	187	205	222	229	265
8500	35	43	50	64	78	91	104	110	116	128	140	151	172	192	210	227	235	270
9000	35	43	51	65	80	94	107	113	119	132	144	155	177	197	215	232	240	275

*Values in the table above are for 4mm belt width. For other belt widths, those values should be multiplied by the width correction coefficient, Kb, shown in Table 28.

Table 37. Reference Transmission Capacity of S3M Ps -Belt Width 6mm- (W)

Rotary Speed of Small Pulley(rpm) \ No. of Teeth of Small Pulley	14	15	16	18	20	22	24	25	26	28	30	32	36	40	44	48	50	60
Diameter of the Pitch Circle(mm)	13.37	14.32	15.28	17.19	19.10	21.01	22.92	23.87	24.83	26.74	28.65	30.56	34.38	38.20	42.02	45.84	47.75	57.30
870	53	58	62	73	79	87	95	99	103	110	118	125	140	155	169	182	188	222
1160	67	72	78	92	99	110	119	124	129	139	148	158	176	194	212	229	238	279
1750	92	100	107	128	137	151	165	171	178	192	205	218	243	268	291	315	326	381
3500	154	167	180	215	230	255	277	289	300	322	344	365	407	446	484	521	539	624
50	5	5	6	7	7	8	8	9	9	10	11	11	13	14	15	17	17	20
100	9	9	10	12	13	14	15	16	17	18	19	21	23	25	28	30	31	37
150	12	13	14	17	18	20	22	23	24	26	27	29	33	36	39	43	44	52
200	16	17	18	22	23	26	28	29	30	33	35	37	42	46	50	54	56	67
250	19	21	22	26	28	31	34	35	37	39	42	45	50	55	61	66	68	80
300	22	24	26	31	33	36	39	41	43	46	49	52	58	65	71	76	79	94
350	25	27	29	35	37	41	45	47	49	52	56	59	66	73	80	87	90	106
400	28	31	33	39	42	46	50	52	54	58	62	66	74	82	90	97	101	119
450	31	34	36	43	46	51	55	58	60	64	69	73	82	90	99	107	111	131
500	34	37	39	47	50	55	60	63	65	70	75	80	89	99	108	117	121	143
550	37	40	43	51	54	60	65	68	71	76	81	86	97	107	116	126	131	154
600	39	43	46	54	58	64	70	73	76	82	87	93	104	114	125	135	140	165
650	42	46	49	58	62	69	75	78	81	87	93	99	111	122	133	144	150	176
700	45	48	52	62	66	73	79	83	86	92	99	105	118	130	142	153	159	187
750	47	51	55	65	70	77	84	87	91	98	105	111	124	137	150	162	168	198
800	50	54	58	69	73	81	89	92	96	103	110	117	131	145	158	171	177	208
850	52	57	61	72	77	86	93	97	101	108	116	123	138	152	166	179	186	218
900	55	59	64	76	81	90	97	101	105	113	121	129	144	159	173	187	194	228
950	57	62	66	79	84	94	102	106	110	118	127	135	150	166	181	196	203	238
1000	60	64	69	82	88	97	106	110	115	123	132	140	157	173	188	204	211	248
1100	64	69	75	89	95	105	114	119	124	133	142	151	169	186	203	220	228	267
1200	69	74	80	95	102	113	122	128	133	143	152	162	181	200	218	235	244	286
1300	73	79	85	101	108	120	130	136	141	152	162	173	193	213	232	250	260	304
1400	78	84	90	107	115	127	138	144	150	161	172	183	204	225	245	265	275	322
1500	82	89	95	113	121	134	146	152	158	170	182	193	216	238	259	280	290	340
1600	86	93	100	119	127	141	154	160	166	179	191	203	227	250	272	294	305	357
1700	90	98	105	125	134	148	161	168	174	187	200	213	238	262	285	308	319	373
1800	94	102	110	130	140	155	168	175	182	196	209	222	248	273	298	322	333	390
1900	98	106	114	136	146	161	175	183	190	204	218	232	259	285	310	335	347	406
2000	102	110	119	141	151	168	182	190	198	212	227	241	269	296	322	348	361	421
2200	110	119	128	152	163	180	196	204	212	228	244	259	289	318	346	374	387	452
2400	117	127	136	162	174	193	210	218	227	244	261	277	309	340	369	398	413	481
2600	124	135	145	173	185	205	223	232	241	259	277	294	328	360	392	422	437	509
2800	131	142	153	182	195	216	235	245	255	274	292	311	346	380	413	446	461	536
3000	138	150	161	192	205	228	248	258	268	288	308	327	364	400	435	468	484	562
3200	145	157	169	201	216	239	260	270	281	302	322	342	381	419	455	490	507	588
3400	151	164	177	210	225	250	272	283	294	316	337	358	398	437	475	511	528	612
3600	157	171	184	219	235	260	283	295	306	329	351	373	415	455	494	531	549	635
3800	164	177	191	228	244	271	294	306	318	342	365	387	431	473	513	551	570	658
4000	170	184	198	237	253	281	305	318	330	355	378	402	447	490	531	570	590	679
4500	184	200	216	257	275	305	332	345	359	385	411	436	484	530	574	616	636	729
5000	198	215	232	277	297	329	357	372	386	414	442	468	520	568	614	658	679	774
5500	211	230	248	296	317	351	381	396	412	442	471	499	553	603	651	696	717	813
6000	224	243	263	313	336	372	404	420	436	468	498	528	584	636	685	731	753	848
6500	236	256	277	331	354	392	426	443	460	492	524	555	613	667	717	763	784	876
7000	247	269	291	347	371	411	446	464	482	516	549	580	640	695	745	791	812	900
7500	259	281	304	363	388	430	466	485	503	538	572	604	665	721	771	816	836	917
8000	269	293	316	378	404	447	485	504	523	559	594	627	688	744	793	837	856	929
8500	279	304	328	392	419	464	503	522	542	579	614	648	710	765	813	855	873	935
9000	289	315	340	406	434	480	520	540	559	597	633	667	729	784	830	869	885	935

*Values in the table above are for 6mm belt width. For other belt widths, those values should be multiplied by the width correction coefficient, Kb, shown in Table 28.

Selection is easy with Timing Pulleys and Belts automatic calculation tool available at:
http://fawos.misumi.jp/FA_WEB/pulley_us/

Table 38. Reference Transmission Capacity of S5M Ps -Belt Width 10mm- (W)

Rotary Speed of Small Pulley(rpm) \ No. of Teeth of Small Pulley	14	15	16	18	20	22	24	25	26	28	30	32	36	40	44	48	60
Diameter of the Pitch Circle(mm)	22.28	23.87	25.46	28.65	31.83	35.01	38.20	39.79	41.38	44.56	47.75	50.93	57.30	63.66	70.03	76.39	95.49
870	173	192	210	246	282	317	352	369	386	420	453	486	551	614	677	738	916
1160	216	239	263	309	355	399	443	465	487	529	572	613	695	775	854	931	1154
1750	293	326	359	425	488	551	613	643	673	733	792	849	963	1073	1181	1286	1587
3500	475	534	592	705	816	923	1029	1080	1131	1231	1330	1425	1611	1787	1955	2115	2544
50	16	18	19	22	25	28	31	33	34	37	40	43	48	54	59	64	80
100	30	32	35	41	46	52	57	60	62	68	73	78	88	98	108	118	147
150	42	46	50	58	66	73	81	85	89	96	104	111	125	140	154	168	209
200	53	58	63	74	84	94	104	108	113	123	132	142	161	179	197	215	268
250	64	70	76	89	101	113	125	131	137	149	160	172	194	217	239	260	324
300	74	81	89	103	118	132	146	153	160	173	187	200	227	253	279	304	378
350	84	92	101	118	134	150	166	174	182	198	213	228	259	288	318	346	431
400	93	103	112	131	150	168	186	195	203	221	238	255	289	323	355	388	482
450	103	113	124	145	165	185	205	215	224	244	263	282	319	356	392	428	532
500	112	123	135	158	180	202	224	234	245	266	287	308	349	389	428	467	581
550	121	133	146	170	195	218	242	254	265	288	311	333	378	421	464	506	629
600	129	143	156	183	209	235	260	272	285	310	334	358	406	453	499	544	676
650	138	152	167	195	223	250	278	291	304	331	357	383	434	484	533	581	722
700	146	161	177	207	237	266	295	309	323	351	379	407	461	514	566	618	767
750	154	171	187	219	250	281	312	327	342	372	401	431	488	544	599	654	812
800	162	179	197	231	264	296	329	345	361	392	423	454	514	574	632	689	856
850	170	188	206	242	277	311	345	362	379	412	445	477	541	603	664	724	899
900	178	197	216	253	290	326	362	379	397	432	466	500	566	632	696	759	941
950	185	205	225	264	303	341	378	396	415	451	487	522	592	660	727	793	983
1000	193	214	234	275	315	355	394	413	432	470	507	544	617	688	758	826	1025
1100	207	230	252	297	340	383	425	446	466	507	548	588	666	743	818	892	1106
1200	221	246	270	318	364	410	456	478	500	544	588	630	715	797	877	956	1185
1300	235	261	287	338	388	437	485	509	533	580	626	672	762	849	935	1019	1262
1400	248	276	304	358	411	463	515	540	565	615	664	713	808	901	992	1081	1338
1500	262	291	320	378	434	489	543	570	597	649	701	753	853	951	1047	1141	1411
1600	274	305	336	397	456	514	571	600	628	683	738	792	898	1001	1102	1200	1483
1700	287	319	352	415	478	539	599	629	658	716	774	830	941	1049	1155	1258	1553
1800	299	333	367	434	499	563	626	657	688	749	809	868	984	1097	1207	1314	1621
1900	311	347	382	452	520	587	653	685	717	781	844	905	1026	1144	1258	1370	1688
2000	323	360	397	470	541	611	679	713	746	813	878	942	1068	1189	1308	1424	1753
2200	346	386	426	504	581	656	730	767	803	874	944	1013	1148	1279	1406	1529	1879
2400	367	411	454	538	620	701	780	819	858	934	1009	1082	1226	1365	1500	1630	1998
2600	389	435	480	570	658	744	828	870	911	991	1071	1149	1301	1448	1590	1727	2111
2800	409	458	507	602	695	786	875	919	962	1048	1132	1214	1374	1528	1677	1820	2218
3000	429	481	532	633	731	826	920	967	1012	1102	1190	1277	1445	1606	1761	1910	2319
3200	448	502	556	662	765	866	965	1013	1061	1155	1247	1338	1513	1680	1841	1995	2414
3400	466	524	580	691	799	904	1008	1058	1108	1206	1303	1397	1579	1752	1918	2076	2502
3600	484	544	603	719	832	942	1049	1102	1154	1256	1356	1454	1642	1821	1992	2153	2584
3800	501	564	626	747	864	978	1090	1145	1199	1305	1408	1509	1704	1888	2062	2227	2659
4000	518	583	647	773	895	1014	1130	1186	1242	1352	1459	1563	1763	1951	2129	2296	2728
4500	558	629	699	837	970	1098	1224	1285	1345	1463	1578	1689	1901	2098	2282	2452	2870
5000	595	672	748	896	1039	1177	1312	1377	1441	1566	1688	1804	2025	2228	2414	2581	2966
5500	629	712	793	951	1104	1251	1393	1462	1530	1661	1788	1909	2135	2340	2523	2683	3014
6000	661	749	835	1003	1164	1319	1468	1540	1611	1747	1878	2002	2231	2434	2609	2756	3011
6500	690	783	874	1051	1220	1382	1537	1612	1685	1825	1958	2084	2312	2508	2672	2800	2955
7000	716	814	910	1096	1272	1440	1600	1677	1752	1895	2029	2154	2378	2563	2709	2812	2841
7500	741	843	943	1137	1320	1493	1657	1735	1811	1955	2090	2213	2428	2598	2720	2791	2666
8000	763	870	974	1174	1363	1540	1708	1787	1863	2007	2140	2260	2462	2611	2703	2735	2427
8500	783	894	1001	1208	1402	1583	1752	1831	1908	2050	2179	2294	2479	2602	2658	2643	2122
9000	801	915	1026	1239	1436	1620	1790	1869	1944	2084	2208	2315	2479	2570	2583	2513	1745

* ☐ The circumferential speed of pulley is 33(m/s)or more; a dynamic balance for the pulley is essential. *Values in the table above are for 10mm belt width. For other belt widths, those values should be multiplied by the width correction coefficient, Kb, shown in Table 28.

Table 39. Reference Transmission Capacity of S8M Ps -Belt Width 60mm- (kW)

Rotary Speed of Small Pulley(rpm) \ No. of Teeth of Small Pulley	20	21	22	24	25	26	28	30	32	34	36	38	40	44	48	50	60	72	84
Diameter of the Pitch Circle(mm)	50.93	53.48	56.02	61.12	63.66	66.21	71.30	76.39	81.49	86.58	91.67	96.77	101.86	112.05	122.23	127.32	152.79	183.35	213.90
870	6.38	6.70	7.02	7.66	7.98	8.29	8.93	9.56	10.20	10.83	11.47	12.10	12.73	14.00	15.25	15.88	19.01	22.73	26.41
1160	8.51	8.93	9.35	10.20	10.62	11.05	11.89	12.73	13.58	14.42	15.25	16.09	16.93	18.60	20.26	21.08	25.19	30.03	34.77
1750	12.81	13.44	14.07	15.34	15.97	16.61	17.86	19.12	20.37	21.62	22.86	24.10	25.33	27.78	30.20	31.40	37.29	44.09	50.52
3500	25.33	26.56	27.78	30.20	31.40	32.59	34.96	37.29	39.60	41.86	44.09	46.28	48.42	52.57	56.62	58.42	67.02	75.09	80.26
50	0.37	0.39	0.40	0.44	0.46	0.48	0.51	0.55	0.59	0.62	0.66	0.70	0.73	0.81	0.88	0.92	1.10	1.32	1.54
100	0.73	0.77	0.81	0.88	0.92	0.95	1.03	1.10	1.18	1.25	1.32	1.40	1.47	1.62	1.76	1.84	2.20	2.64	3.08
200	1.47	1.54	1.62	1.76	1.84	1.91	2.06	2.20	2.35	2.50	2.64	2.79	2.94	3.23	3.52	3.67	4.40	5.28	6.16
300	2.20	2.31	2.42	2.64	2.75	2.86	3.08	3.30	3.52	3.74	3.96	4.18	4.40	4.84	5.28	5.50	6.60	7.92	9.24
400	2.94	3.08	3.23	3.52	3.67	3.82	4.11	4.40	4.70	4.99	5.28	5.58	5.87	6.46	7.04	7.34	8.80	10.55	12.30
500	3.67	3.85	4.04	4.40	4.59	4.77	5.14	5.50	5.87	6.24	6.60	6.97	7.34	8.07	8.80	9.16	10.99	13.17	15.34
600	4.40	4.62	4.84	5.28	5.50	5.72	6.16	6.60	7.04	7.48	7.92	8.36	8.80	9.67	10.55	10.99	13.17	15.78	18.37
700	5.14	5.39	5.65	6.16	6.42	6.68	7.19	7.70	8.21	8.72	9.24	9.75	10.26	11.28	12.30	12.80	15.34	18.37	21.37
800	5.87	6.16	6.46	7.04	7.34	7.63	8.21	8.80	9.38	9.97	10.55	11.13	11.71	12.88	14.04	14.62	17.51	20.94	24.34
900	6.60	6.93	7.26	7.92	8.25	8.58	9.24	9.89	10.55	11.21	11.86	12.52	13.17	14.47	15.78	16.42	19.66	23.50	27.29
1000	7.34	7.70	8.07	8.80	9.16	9.53	10.26	10.99	11.72	12.44	13.17	13.89	14.62	16.06	17.51	18.22	21.80	26.03	30.20
1100	8.07	8.47	8.87	9.67	10.08	10.48	11.28	12.08	12.88	13.68	14.47	15.27	16.08	17.65	19.23	20.01	23.92	28.54	33.07
1200	8.80	9.24	9.67	10.55	10.99	11.42	12.30	13.17	14.04	14.91	15.77	16.64	17.51	19.23	20.94	21.80	26.03	31.02	35.90
1300	9.53	10.00	10.48	11.42	11.90	12.37	13.31	14.26	15.20	16.14	17.07	18.01	18.94	20.80	22.65	23.57	28.12	33.48	38.68
1400	10.26	10.77	11.28	12.30	12.80	13.31	14.33	15.34	16.35	17.36	18.37	19.37	20.37	22.37	24.35	25.33	30.20	35.90	41.41
1500	10.99	11.53	12.08	13.17	13.71	14.26	15.34	16.42	17.51	18.58	19.66	20.73	21.80	23.92	26.03	27.08	32.25	38.29	44.09
1600	11.71	12.30	12.88	14.04	14.62	15.20	16.35	17.50	18.66	19.80	20.94	22.08	23.22	25.47	27.71	28.82	34.29	40.64	46.71
1700	12.44	13.06	13.68	14.91	15.52	16.14	17.36	18.58	19.80	21.01	22.22	23.43	24.63	27.01	29.37	30.54	36.30	42.95	49.26
1800	13.17	13.82	14.47	15.78	16.42	17.07	18.37	19.66	20.94	22.22	23.50	24.77	26.03	28.54	31.02	32.25	38.29	45.22	51.75
1900	13.89	14.58	15.27	16.64	17.32	18.01	19.37	20.73	22.08	23.43	24.77	26.10	27.43	30.06	32.66	33.95	40.25	47.44	54.17
2000	14.62	15.34	16.06	17.51	18.22	18.94	20.37	21.80	23.22	24.63	26.03	27.43	28.82	31.57	34.29	35.63	42.18	49.62	56.52
2100	15.34	16.10	16.86	18.37	19.12	19.87	21.37	22.86	24.35	25.82	27.29	28.75	30.20	33.07	35.90	37.29	44.09	51.75	58.79
2200	16.06	16.86	17.65	19.23	20.01	20.80	22.36	23.92	25.47	27.01	28.54	30.06	31.57	34.56	37.49	38.94	45.96	53.83	60.98
2300	16.79	17.61	18.44	20.09	20.91	21.73	23.36	24.98	26.59	28.19	29.78	31.37	32.93	36.03	39.07	40.57	47.81	55.86	63.08
2400	17.51	18.37	19.23	20.94	21.80	22.66	24.34	26.03	27.71	29.37	31.02	32.66	34.29	37.49	40.64	42.18	49.62	57.83	65.10
2500	18.22	19.12	20.01	21.80	22.68	23.57	25.33	27.08	28.82	30.54	32.25	33.95	35.63	38.94	42.18	43.77	51.40	59.74	67.02
2600	18.94	19.87	20.80	22.65	23.57	24.49	26.31	28.12	29.92	31.71	33.48	35.23	36.96	40.38	43.71	45.34	53.15	61.59	68.84
2700	19.66	20.62	21.58	23.50	24.45	25.40	27.29	29.16	31.02	32.87	34.69	36.50	38.29	41.80	45.22	46.89	54.85	63.38	70.57
2800	20.37	21.37	22.36	24.35	25.33	26.31	28.26	30.20	32.12	34.02	35.90	37.76	39.60	43.20	46.71	48.42	56.52	65.10	72.19
2900	21.09	22.12	23.14	25.19	26.21	27.22	29.23	31.23	33.21	35.16	37.09	39.01	40.89	44.59	48.17	49.92	58.15	66.75	73.70
3000	21.80	22.86	23.92	26.03	27.08	28.13	30.20	32.25	34.29	36.30	38.28	40.25	42.18	45.97	49.62	51.40	59.74	68.33	75.09
3100	22.51	23.61	24.70	26.87	27.95	29.03	31.16	33.27	35.36	37.43	39.46	41.48	43.46	47.32	51.05	52.86	61.29	69.84	76.38
3200	23.22	24.35	25.47	27.71	28.82	29.92	32.12	34.29	36.43	38.55	40.63	42.69	44.72	48.66	52.45	54.29	62.79	71.27	77.54
3300	23.92	25.09	26.24	28.54	29.68	30.82	33.07	35.29	37.49	39.66	41.79	43.90	45.96	49.98	53.83	55.69	64.25	72.63	78.57
3400	24.63	25.82	27.01	29.37	30.54	31.71	34.02	36.30	38.55	40.76	42.95	45.09	47.20	51.29	55.19	57.07	65.66	73.90	79.48
3600	26.03	27.29	28.54	31.03	32.25	33.48	35.90	38.28	40.64	42.95	45.22	47.44	49.62	53.84	57.83	59.74	68.33	76.20	80.90
3700	26.73	28.02	29.30	31.85	33.10	34.36	36.83	39.27	41.67	44.02	46.33	48.60	50.81	55.08	59.11	61.03	69.60	77.22	81.41
3800	27.43	28.75	30.06	32.66	33.95	35.23	37.76	40.24	42.69	45.09	47.44	49.74	51.99	56.30	60.36	62.29	70.81	78.15	81.77
3900	28.12	29.48	30.82	33.48	34.79	36.10	38.68	41.21	43.71	46.15	48.54	50.87	53.15	57.51	61.59	63.52	71.96	78.98	81.98
4000	28.82	30.20	31.57	34.29	35.63	36.96	39.59	42.18	44.72	47.20	49.62	51.99	54.29	58.69	62.79	64.72	73.06	79.72	82.04
4200	30.20	31.64	33.07	35.90	37.29	38.68	41.41	44.09	46.71	49.26	51.75	54.18	56.52	60.98	65.10	67.02	75.09	80.90	
4400	31.57	33.07	34.56	37.50	38.94	40.38	43.20	45.96	48.66	51.28	53.83	56.30	58.69	63.18	67.29	69.18	76.89	81.68	
4600	32.93	34.49	36.03	39.08	40.57	42.05	44.97	47.81	50.58	53.26	55.86	58.37	60.78	65.29	69.35	71.20	78.43	82.02	
4800	34.29	35.90	37.49	40.64	42.18	43.71	46.71	49.62	52.45	55.19	57.83	60.37	62.79	67.29	71.27	73.06	79.72	81.92	
5000	35.63	37.30	38.94	42.18	43.77	45.34	48.42	51.40	54.29	57.07	59.74	62.30	64.72	69.18	73.06	74.77	80.74	81.34	
5200	36.96	38.68	40.37	43.71	45.34	46.95	50.10	53.14	56.08	58.90	61.59	64.15	66.57	70.96	74.71	76.32	81.47		
5400	38.29	40.05	41.79	45.22	46.89	48.54	51.75	54.85	57.83	60.67	63.38	65.94	68.33	72.63	76.20	77.69	81.91		
5600	39.60	41.41	43.20	46.71	48.42	50.10	53.37	56.52	59.53	62.39	65.10	67.64	70.00	74.18	77.54	78.89	82.04		
5800	40.89	42.76	44.59	48.18	49.92	51.64	54.96	58.15	61.19	64.05	66.75	69.27	71.58	75.60	78.71	79.91			
6000	42.18	44.09	45.96	49.63	51.40	53.15	56.52	59.74	62.79	65.66	68.33	70.81	73.06	76.89	79.72	80.73			

*Because the durability in terms of hours decreases in the ⬚ marked range, this range should be avoided whenever possible. * ☐ The circumferential speed of pulley is 33(m/s)or more; a dynamic balance for the pulley is essential. *Values in the table above are for 60mm belt width. For other belt widths, those values should be multiplied by the width correction coefficient, Kb, shown in Table 28.

Technical Data

Selection of Timing Belts 6 – Transmission Capacity Table –

Table 40. Reference Transmission Capacity of S14M Ps – Belt Width 120mm – (kW)

Rotary Speed of Small Pulley(rpm) \ Number of Teeth of the Pulley(T) / Pitch Dia.(mm)	28 / 124.78	30 / 133.69	32 / 142.60	34 / 151.52	36 / 160.43	40 / 178.25	42 / 187.17	44 / 196.08	48 / 213.90	50 / 222.82	56 / 249.55	60 / 267.38	64 / 285.21	72 / 320.86	84 / 374.33
575	32.08	34.36	36.63	38.90	41.17	45.68	47.94	50.19	54.67	56.91	63.58	68.00	72.39	81.10	93.92
690	38.45	41.17	43.88	46.59	49.29	54.67	57.36	60.03	65.35	68.00	75.89	81.09	86.26	96.44	111.32
870	48.35	51.75	55.14	58.52	61.88	68.57	71.90	75.20	81.77	85.03	94.68	101.02	107.27	119.49	136.99
1160	64.12	68.57	73.00	77.40	81.77	90.41	94.69	98.92	107.27	111.39	123.46	131.27	138.87	153.39	173.25
1750	95.20	101.57	107.84	114.03	120.11	131.93	137.68	143.29	154.11	159.32	174.00	182.96	191.21	205.36	220.00
3450	172.13	181.10	189.39	196.95	203.72	214.76	218.93	222.13	225.47						
20	1.12	1.20	1.28	1.36	1.44	1.60	1.68	1.76	1.92	2.00	2.24	2.40	2.56	2.88	3.36
40	2.24	2.40	2.56	2.72	2.88	3.20	3.36	3.52	3.84	4.00	4.48	4.80	5.12	5.76	6.71
60	3.36	3.60	3.84	4.08	4.32	4.80	5.04	5.28	5.76	6.00	6.71	7.19	7.67	8.63	10.07
80	4.48	4.80	5.12	5.44	5.76	6.39	6.71	7.03	7.67	7.99	8.95	9.59	10.23	11.51	13.42
90	5.04	5.40	5.76	6.12	6.47	7.19	7.55	7.91	8.63	8.99	10.07	10.79	11.51	12.94	15.10
100	5.60	6.00	6.39	6.79	7.19	7.99	8.39	8.79	9.59	9.99	11.19	11.99	12.79	14.38	16.77
200	11.19	11.99	12.78	13.58	14.38	15.98	16.78	17.57	19.17	19.96	22.35	23.94	25.53	28.71	33.47
300	16.78	17.97	19.17	20.36	21.56	23.94	25.14	26.33	28.71	29.90	33.47	35.84	38.21	42.94	49.99
400	22.35	23.94	25.53	27.12	28.71	31.88	33.47	35.05	38.21	39.79	44.51	47.65	50.78	57.01	66.27
500	27.92	29.90	31.88	33.86	35.84	39.79	41.76	43.72	47.64	49.60	55.45	59.33	63.20	70.87	82.22
600	33.47	35.84	38.21	40.58	42.94	47.64	49.99	52.34	57.00	59.33	66.27	70.87	75.43	84.47	97.76
700	39.00	41.76	44.51	47.26	49.99	55.45	58.17	60.88	66.27	68.96	76.95	82.22	87.45	97.76	112.80
800	44.51	47.65	50.77	53.90	57.01	63.19	66.27	69.34	75.43	78.46	87.45	93.36	99.21	110.68	127.26
900	49.99	53.51	57.00	60.49	63.97	70.87	74.29	77.70	84.47	87.82	97.75	104.27	110.68	123.19	141.06
1000	55.45	59.33	63.19	67.04	70.87	78.46	82.22	85.96	93.36	97.03	107.84	114.90	121.82	135.23	154.11
1100	60.88	65.12	69.34	73.54	77.70	85.96	90.05	94.10	102.11	106.06	117.68	125.23	132.60	146.75	166.35
1200	66.27	70.87	75.43	79.97	84.47	93.36	97.76	102.11	110.68	114.90	127.26	135.23	142.97	157.70	177.67
1300	71.63	76.57	81.47	86.34	91.16	100.66	105.35	109.97	119.07	123.53	136.53	144.87	152.91	168.02	188.00
1400	76.95	82.22	87.45	92.63	97.76	107.84	112.80	117.69	127.26	131.94	145.49	154.12	162.37	177.67	197.26
1500	82.22	87.82	93.36	98.85	104.27	114.90	120.11	125.23	135.23	140.10	154.11	162.94	171.32	186.69	205.36
1600	87.45	93.36	99.21	104.99	110.68	121.82	127.26	132.60	142.97	148.00	162.36	171.31	179.72	194.73	212.22
1700	92.63	98.85	104.98	111.04	116.99	128.60	134.25	139.78	150.46	155.62	170.22	179.21	187.53	202.03	217.76
1800	97.76	104.27	110.68	116.99	123.19	135.23	141.06	146.75	157.70	162.94	177.67	186.59	194.73	208.45	221.89
1900	102.83	109.62	116.29	122.85	129.27	141.70	147.69	153.51	164.65	169.95	184.67	193.43	201.26	213.94	224.54
2000	107.85	114.90	121.82	128.61	135.23	147.99	154.12	160.05	171.31	176.63	191.21	199.69	207.11	218.44	225.62
2100	112.80	120.10	127.26	134.25	141.06	154.11	160.34	166.35	177.67	182.96	197.25	205.36	212.22	221.89	
2200	117.69	125.23	132.60	139.78	146.75	160.05	166.35	172.40	183.70	188.93	202.79	210.39	216.56	224.26	
2300	122.51	130.27	137.83	145.19	152.30	165.78	172.13	178.18	189.39	194.51	207.78	214.76	220.10	225.47	
2400	127.26	135.23	142.97	150.47	157.70	171.31	177.67	183.70	194.72	199.69	212.22	218.43	222.80	225.50	
2500	131.94	140.10	147.99	155.62	162.94	176.63	182.97	188.93	199.69	204.46	216.06	221.39	224.63		
2600	136.54	144.87	152.90	160.63	168.02	181.82	188.00	193.86	204.27	208.78	219.29	223.59	225.54		
2700	141.06	149.54	157.70	165.51	172.93	186.58	192.77	198.49	208.45	212.66	221.89	225.01	225.50		
2800	145.50	154.12	162.36	170.23	177.67	191.21	197.26	202.79	212.22	216.06	223.83	225.62			
2900	149.85	158.58	166.90	174.80	182.22	195.58	201.46	206.76	215.55	218.98	225.08				
3000	154.12	162.94	171.31	179.21	186.59	199.69	205.36	210.39	218.43	221.39	225.62				
3100	158.29	167.19	175.58	183.46	190.76	203.53	208.95	213.66	220.86	223.28					
3200	162.37	171.31	179.71	187.53	194.73	207.10	212.22	216.56	222.80	224.63					
3300	166.35	175.32	183.70	191.44	198.49	210.39	215.16	219.09	224.25	225.42					
3400	170.23	179.21	187.53	195.16	202.03	213.37	217.76	221.22	225.20	225.63					
3500	174.00	182.96	191.21	198.69	205.36	216.06	220.01	222.94	225.62						
3600	177.67	186.59	194.72	202.04	208.45	218.43	221.89	224.26							
3700	181.23	190.08	198.08	205.18	211.32	220.49	223.41	225.14							
3800	184.67	193.43	201.26	208.12	213.94	222.21	224.54	225.58							
3900	188.00	196.63	204.27	210.86	216.31	223.59	225.28	225.58							
4000	191.21	199.69	207.10	213.38	218.44	224.63	225.62								
4100	194.30	202.60	209.75	215.68	220.30	225.30									
4200	197.26	205.36	212.22	217.76	221.89	225.62									
4300	200.09	207.95	214.49	219.61	223.21										
4400	202.79	210.39	216.56	221.22	224.26										
4500	205.36	212.66	218.43	222.59	225.01										
4600	207.79	214.76	220.10	223.71	225.47										
4700	210.08	216.68	221.56	224.58	225.64										
4800	212.22	218.43	222.80	225.20											
4900	214.22	220.00	223.83	225.55											
5000	216.06	221.39	224.63	225.63											

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible.
*The circumferential speed of pulley is 33 (m/s) or more in the [ ] marked range; a dymanic balance for the pulley is essential.
*The [ ] marked range should be avoided whenever possible, as above two factors overlap here.*Values in the table above is for nominal belt width 120 (120mm). For other belt widths, these values should be multiplied by the width correction coefficient in Table 28.

Table 41. Reference Transmission Capacity of MTS8M Ps – Belt Width 60mm – (kW)

Rotary Speed of Small Pulley(rpm) \ Number of Teeth of the Pulley(T) / Pitch Dia.(mm)	24 / 61.12	26 / 66.21	28 / 71.30	30 / 76.39	32 / 81.49	34 / 86.58	36 / 91.67	38 / 96.77	40 / 101.86	42 / 106.95	44 / 112.05	46 / 117.14	48 / 122.23	50 / 127.32	60 / 152.79	72 / 183.35	84 / 213.90
50	1.35	1.47	1.58	1.70	1.82	1.93	2.05	2.17	2.27	2.37	2.46	2.56	2.66	2.75	3.21	3.75	4.27
100	2.71	2.94	3.17	3.40	3.63	3.87	4.11	4.35	4.54	4.74	4.93	5.12	5.31	5.50	6.42	7.50	8.54
200	4.91	5.32	5.73	6.15	6.57	6.99	7.42	7.85	8.20	8.54	8.89	9.22	9.56	9.89	11.52	13.41	15.23
300	6.91	7.48	8.06	8.64	9.23	9.83	10.43	11.04	11.52	12.00	12.47	12.94	13.41	13.87	16.12	18.71	21.20
400	8.77	9.50	10.23	10.98	11.73	12.48	13.25	14.02	14.63	15.23	15.82	16.41	16.99	17.57	20.38	23.62	26.72
500	10.53	11.40	12.29	13.18	14.08	14.99	15.92	16.85	17.57	18.28	18.99	19.69	20.38	21.07	24.40	28.22	31.88
600	12.20	13.22	14.24	15.28	16.33	17.39	18.46	19.55	20.38	21.20	22.02	22.82	23.62	24.40	28.22	32.59	36.76
700	13.80	14.95	16.11	17.29	18.48	19.69	20.91	22.15	23.09	24.01	24.92	25.82	26.72	27.60	31.88	36.76	41.39
800	15.32	16.61	17.91	19.23	20.56	21.91	23.28	24.66	25.70	26.72	27.72	28.72	29.70	30.68	35.39	40.74	45.81
900	16.79	18.21	19.64	21.09	22.56	24.05	25.56	27.10	28.22	29.34	30.44	31.52	32.59	33.65	38.77	44.57	50.04
1000	18.21	19.75	21.31	22.89	24.50	26.13	27.78	29.46	30.68	31.88	33.06	34.23	35.39	36.53	42.03	48.25	54.09
1100	19.57	21.24	22.92	24.64	26.38	28.14	29.94	31.76	33.06	34.35	35.62	36.87	38.10	39.32	45.19	51.80	57.98
1200	20.89	22.67	24.48	26.33	28.20	30.10	32.04	34.00	35.39	36.76	38.10	39.43	40.74	42.03	48.25	55.22	61.71
1300	22.16	24.06	26.00	27.97	29.97	23.01	34.08	36.19	37.66	39.10	40.52	41.93	43.31	44.67	51.21	58.52	65.29
1400	23.38	25.40	27.46	29.56	31.69	33.86	36.07	38.33	39.87	41.39	42.89	44.36	45.81	47.24	54.09	61.71	68.73
1500	24.57	26.71	28.88	31.10	33.37	35.67	38.02	40.41	42.03	43.62	45.19	46.73	48.25	49.74	56.88	64.79	72.03
1600	25.71	27.97	30.26	32.61	35.00	37.44	39.92	42.46	44.15	45.81	47.44	49.05	50.63	52.18	59.59	67.76	75.19
1700	26.82	29.19	31.60	34.07	36.59	39.16	41.78	44.46	46.22	47.95	49.64	51.31	52.95	54.56	62.23	70.63	78.22
1800	27.89	30.37	32.90	35.49	38.14	40.84	43.60	46.42	48.25	50.04	51.79	53.52	55.22	56.88	64.78	73.40	81.12
1900	28.92	31.51	34.16	36.87	39.65	42.48	45.38	48.35	50.23	52.08	53.90	55.68	57.43	59.15	67.27	76.07	83.89
2000	29.92	32.62	35.39	38.22	41.12	44.09	47.13	50.23	52.18	54.09	55.96	57.79	59.59	61.36	69.68	78.64	86.53
2100	30.89	33.70	36.57	39.53	42.55	45.65	48.83	52.08	54.09	56.05	57.97	59.86	61.71	63.51	72.03	81.12	89.05
2200	31.82	34.74	37.73	40.80	43.95	47.19	50.50	53.90	55.96	57.97	59.95	61.88	63.77	65.62	74.30	83.50	91.43
2300	32.72	35.74	38.85	42.04	45.32	48.68	52.14	55.68	57.79	59.86	61.88	63.85	65.79	67.68	76.51	85.79	
2400	33.59	36.72	39.93	43.25	46.65	50.15	53.74	57.43	59.59	67.71	63.77	65.79	67.76	69.68	78.64	87.98	
2500	34.42	37.66	40.99	44.42	47.95	51.58	55.31	59.15	61.36	63.51	65.62	67.68	69.68	71.64	80.72	90.08	
2600	35.23	38.57	42.01	45.56	49.21	52.98	56.85	60.83	63.09	56.29	67.43	69.52	71.56	73.55	82.72	92.09	
2700	36.00	39.44	43.00	46.67	50.45	54.34	58.36	62.48	64.78	67.02	69.21	71.33	73.40	75.41	84.66		
2800	36.75	40.29	43.96	47.74	51.65	55.68	59.83	64.11	66.45	68.73	70.94	73.09	75.19	77.23	86.53		
2900	37.46	41.11	44.89	48.79	52.82	56.99	61.28	65.70	68.08	70.39	72.64	74.82	76.94	78.99	88.34		
3000	38.15	41.90	45.78	49.80	53.96	58.26	62.70	67.27	69.68	72.03	74.30	76.50	78.64	80.71	90.08		
3200	39.44	43.39	47.49	51.75	56.16	60.72	65.44	70.31	72.79	75.19	77.51	79.76	81.93	84.02			
3400	40.61	44.76	49.08	53.57	58.23	63.07	68.07	73.25	75.78	78.22	80.58	82.85	85.04	87.14			
3600	41.67	46.02	50.55	55.28	60.19	65.30	70.59	76.07	78.64	81.12	83.50	85.79	87.98	90.08			
3800	42.63	47.17	51.92	56.88	62.04	67.42	73.00	78.78	81.39	83.89	86.29	88.58	90.76				
4000	43.47	48.21	53.17	58.36	63.78	69.42	75.30	81.39	84.02	86.53	88.93	91.21					
4200	44.21	49.14	54.31	59.73	65.41	71.32	77.49	83.89	86.53	89.04	91.43						
4400	44.85	49.96	55.35	61.00	66.92	73.11	79.57	86.29	88.93	91.43							
4600	45.38	50.68	56.27	62.16	68.33	74.80	81.55	88.57	91.21								
4800	45.81	51.29	57.09	63.21	69.64	76.37	83.42	90.76									
5000	46.14	51.80	57.81	64.15	70.83	77.84	85.18										
5200	46.36	52.20	58.41	64.99	71.92	79.20	86.84										
5400	46.48	52.51		65.72	72.90	80.46											
5600	46.51	52.70		66.34	73.78												
5800	46.43			66.86	74.54												
6000	46.25																

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible.
*Because the circumferential speed of pulley within the [ ] marked range is higher than 20m/sec, this range should be avoided whenever possible.
*Values in the table above is for nominal belt width 600(60mm). For other belt widths, these values should be multiplied by the width correction coefficient, Kb, shown in Table 28.

Selection is easy with Timing Pulleys and Belts automatic calculation tool available at: http://fawos.misumi.jp/FA_WEB/pulley_us/

Table 42. Reference Transmission Capacity of P2M Ps – Belt Width 4mm – (W)

Rotary Speed of Small Pulley(rpm) \ No. of Teeth of Small Pulley	14	15	16	18	20	22	24	25	26	28	30	32	34	36	40	42	44	48
Diameter of the Pitch Circle(mm)	8.91	9.55	10.19	11.46	12.73	14.01	15.28	15.92	16.55	17.83	19.10	20.37	21.65	22.92	25.46	26.74	28.01	30.56
100	2	2	2	2	3	3	3	3	3	4	4	5	5	6	7	7	8	9
200	3	3	4	5	5	6	7	7	7	8	9	10	11	11	13	14	15	17
400	6	6	7	8	9	10	11	12	13	14	15	16	17	19	22	24	25	28
600	8	9	10	11	12	14	16	17	18	19	20	22	23	25	29	31	33	37
800	10	11	12	13	16	18	19	20	21	23	25	27	29	31	36	38	41	46
1000	12	13	14	16	18	20	23	24	25	27	30	32	34	37	42	45	48	54
1200	14	15	16	19	21	23	26	26	28	31	34	37	40	42	48	51	54	61
1400	16	17	18	21	24	26	29	30	32	35	38	41	44	47	54	57	61	68
1450	16	18	19	21	24	27	30	31	33	36	39	42	45	48	55	59	62	70
1500	16	18	19	22	25	28	31	32	34	37	40	43	46	50	57	60	64	71
1600	17	18	20	23	26	29	32	33	35	39	43	46	49	53	60	64	67	75
1750	19	20	22	25	28	31	35	37	38	42	45	49	53	56	64	68	71	79
1800	19	21	23	25	29	32	35	37	38	42	46	50	54	57	65	69	73	81
2000	21	22	24	28	31	34	38	40	42	46	50	54	58	62	70	74	78	87
2400	24	26	28	32	36	40	44	46	48	52	56	61	65	70	80	85	89	99
3000		30	32	37	42	46	52	54	57	62	67	72	77	82	93	98	102	115
3600		35	38	43	48	53	59	62	64	70	76	82	88	94	106	112	118	131
4000		38	41	47	52	58	64	67	70	76	82	88	94	101	114	120	127	140
5000			48	55	61	68	75	78	82	89	96	104	111	118	132	139	147	162
6000			55	63	70	78	86	90	93	101	109	117	125	133	149	157	164	180
8000				76	86	95	105	109	114	123	132	141	150	158	176	184	192	209
10000				91	101	111	122	127	132	142	151	161	170	178	196	203	210	224
12000					114	125	136	141	146	157	166	175	183	190	206	211	217	228
14000					125	136	148	153	158	168	176	185	190	196	208	214	220	232

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible. For other belt widths, values above should be multiplied by the width correction coefficient shown in Table 28.

Table 43. Reference Transmission Capacity of P3M Ps – Belt Width 6mm – (W)

Rotary Speed of Small Pulley(rpm) \ No. of Teeth of Small Pulley	10	12	14	15	16	18	20	22	24	25	26	28	30	32	34	36	40	42
Diameter of the Pitch Circle(mm)	9.55	11.46	13.37	14.32	15.28	17.19	19.10	20.01	22.92	23.87	24.83	26.74	28.65	30.56	32.47	34.38	38.20	40.11
100	4	5	6	6	7	8	9	10	12	12	13	14	15	17	19	20	22	23
200	8	11	12	13	14	16	18	20	23	24	25	28	31	34	36	38	45	47
400	14	17	20	22	24	27	32	35	39	41	43	47	51	56	61	65	75	79
600	19	23	28	30	33	37	42	47	53	55	58	63	69	75	81	87	100	105
800	24	29	35	38	41	46	53	59	65	68	72	79	85	92	99	107	123	129
1000	28	35	41	44	48	55	62	69	77	81	84	92	100	109	118	126	144	151
1200	33	40	47	51	55	63	71	79	88	92	97	106	115	125	135	144	164	172
1400	37	45	54	58	62	71	80	89	99	104	109	119	129	140	151	162	184	193
1450	38	46	55	59	64	72	82	90	102	106	111	122	133	144	155	166	188	197
1500	39	47	56	60	65	75	84	93	104	109	114	125	135	147	158	170	193	202
1600	41	49	59	63	68	79	88	98	109	114	120	131	142	154	166	178	202	212
1750	44	54	63	68	74	84	95	106	118	124	129	141	153	165	177	190	215	226
1800		55	65	70	75	86	97	108	120	126	131	143	155	168	181	193	219	230
2000		59	70	75	81	93	105	117	129	135	142	155	168	182	196	209	237	249
2400		68	81	87	93	107	121	134	148	155	162	177	192	207	223	238	270	284
3000			95	103	112	125	142	158	175	183	191	208	226	243	261	279	316	332
3600			110	118	127	145	163	182	201	210	219	238	258	278	298	318	359	377
4000			119	128	138	158	176	196	216	226	236	257	278	299	321	342	386	405
5000			141	152	163	186	208	231	255	267	278	302	326	351	375	399	448	470
6000				174	187	212	238	264	291	304	317	343	370	397	424	451	505	530
8000					232	263	293	324	356	371	387	418	448	479	508	538	597	627
10000						308	342	377	413	430	446	480	512	545	574	604	663	696
12000						349	386	423	460	477	495	530	562	594	620	646	699	734
14000							424	462	500	517	534	568	597	626	645	665	704	739

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible. For other belt widths, values above should be multiplied by the width correction coefficient shown in Table 28.

Technical Data

Selection of Timing Belts 7 – Transmission Capacity Table –

Table 44. Reference Transmission Capacity of P5M Ps – Belt Width 10 mm – (W)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	12	14	16	18	20	22	24	25	26	28	30	32	34	36	40	42	44	48	56
Diameter of the Pitch Circle (mm)	19.10	22.28	25.46	28.65	31.83	35.05	38.20	39.79	41.38	44.56	47.75	50.93	54.11	57.30	63.66	66.85	70.03	76.39	89.15
100	23	26	31	35	41	46	52	55	58	64	70	76	81	86	103	110	118	133	158
200	46	53	63	72	81	92	104	109	115	126	138	151	164	177	205	220	235	267	316
400	77	90	106	122	138	155	173	182	192	211	231	251	272	294	337	361	385	434	514
600	105	123	144	165	188	211	235	247	259	284	310	337	365	394	452	482	513	577	684
800	131	153	179	205	234	262	291	306	322	353	385	417	451	485	556	592	629	706	837
1000	156	182	212	243	276	309	343	361	379	415	453	491	530	570	651	694	738	825	977
1200	179	209	244	280	316	355	394	414	435	476	518	561	605	650	742	790	838	937	1110
1400	201	235	274	319	355	399	443	465	487	532	580	628	677	726	828	880	933	1040	1230
1450		242	282	323	365	409	453	476	499	546	594	643	694	745	850	903	957	1070	1260
1500		248	288	333	374	420	466	489	512	560	609	659	711	762	869	925	981	1090	1290
1600		261	303	348	393	441	489	514	538	588	639	691	745	799	910	970	1030	1140	1350
1750		278	325	372	420	471	522	548	575	628	683	738	795	852	970	1040	1100	1220	1430
1800			332	380	430	481	532	559	586	640	696	753	810	868	989	1050	1110	1240	1460
2000			360	412	465	520	576	605	633	691	751	812	874	937	1060	1130	1200	1330	1570
2400			413	472	532	595	658	691	723	789	857	925	992	1060	1210	1280	1350	1500	2030
3000				557	628	701	775	812	850	926	1000	1080	1150	1240	1400	1485	1570	1730	2120
3600				638	719	801	883	925	966	1050	1140	1230	1310	1400	1580	1670	1760	1940	2250
4000					776	865	953	997	1040	1130	1220	1320	1450	1500	1690	1785	1880	2060	2380
5000					911	1010	1110	1160	1210	1320	1420	1520	1620	1720	1920	2010	2110	2300	2610
6000						1140	1260	1310	1370	1480	1580	1690	1790	1900	2100	2190	2290	2460	2720
8000							1490	1550	1600	1720	1830	1930	2020	2120	2270	2330	2400	2480	2480
10000								1710	1760	1860	1940	2020	2080	2130	2170	2160	2150	2040	
12000								1770	1810	1880	1910	1940	1920	1900					
14000									1750	1760	1710	1660							

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible.
For other belt widths, values above should be multiplied by the width correction coefficient shown in Table 28.

Selection is easy with Timing Pulleys and Belts automatic calculation tool available at: http://fawos.misumi.jp/FA_WEB/pulley_us/

Table 45. Reference Transmission Capacity of P8M Ps – Belt Width 15 mm – (kW)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	20	22	24	26	28	30	32	34	36	38	40	44	48	50	56	60	64	72
Diameter of the Pitch Circle (mm)	50.93	56.02	61.12	66.21	71.30	76.39	81.49	86.58	91.67	96.77	101.86	112.05	122.23	127.32	142.06	152.79	162.97	183.35
100	0.16	0.17	0.19	0.21	0.23	0.26	0.31	0.41	0.44	0.48	0.51	0.56	0.60	0.63	0.70	0.74	0.78	0.89
200	0.32	0.35	0.39	0.42	0.45	0.50	0.59	0.69	0.78	0.85	0.91	0.99	1.07	1.14	1.23	1.35	1.40	1.57
400	0.65	0.71	0.77	0.84	0.90	0.95	1.09	1.25	1.37	1.48	1.59	1.72	1.86	1.94	2.16	2.30	2.43	2.71
600	0.96	1.06	1.16	1.25	1.35	1.45	1.53	1.70	1.86	2.02	2.17	2.37	2.55	2.66	2.95	3.12	3.30	3.66
800	1.29	1.41	1.54	1.67	1.80	1.93	2.06	2.18	2.31	2.51	2.69	3.02	3.16	3.27	3.64	3.83	4.08	4.75
870	1.40	1.54	1.68	1.82	1.96	2.10	2.24	2.38	2.51	2.66	2.86	3.16	3.36	3.48	3.90	4.13	4.44	4.98
1000	1.61	1.77	1.93	2.09	2.25	2.41	2.57	2.73	2.89	2.99	3.16	3.64	3.84	4.00	4.47	4.78	5.09	5.71
1160	1.86	2.05	2.24	2.42	2.61	2.79	2.98	3.16	3.35	3.53	3.84	4.08	4.44	4.62	5.17	5.52	6.48	7.28
1200	1.93	2.12	2.31	2.51	2.70	2.89	3.07	3.27	3.46	3.60	3.82	4.22	4.59	4.78	5.34	5.71	6.08	7.52
1400	2.25	2.45	2.70	2.94	3.15	3.37	3.59	3.80	4.03	4.25	4.47	4.90	5.34	5.55	6.20	6.62	7.04	8.68
1450	2.33	2.55	2.79	3.04	3.26	3.65	3.72	3.94	4.17	4.40	4.63	5.07	5.53	5.75	6.41	6.85	7.28	8.96
1500	2.41	2.64	2.89	3.15	3.37	3.72	3.84	4.07	4.31	4.55	4.78	5.25	5.71	5.94	6.62	7.07	7.51	9.25
1600	2.57	2.83	3.07	3.35	3.59	3.84	4.09	4.34	4.59	4.84	5.09	5.59	6.08	6.32	7.04	7.52	7.98	9.81
1750	2.81	3.08	3.36	3.64	3.92	4.20	4.47	4.74	5.01	5.28	5.56	6.09	6.63	6.88	7.68	8.17	8.70	10.6
1800	2.89	3.18	3.72	3.75	4.03	4.31	4.59	4.87	5.15	5.43	5.71	6.26	6.80	7.07	7.86	8.38	8.90	10.9
2000	3.20	3.52	4.01	4.15	4.47	4.78	5.09	5.40	5.71	6.01	6.32	6.93	7.52	7.81	8.68	9.24	9.81	11.9
2400	3.84	4.22	4.59	4.97	5.34	5.71	6.08	6.44	6.80	7.16	7.52	8.22	9.05	9.24	9.86	10.9	11.5	13.8
3000	4.63	5.20	5.62	6.02	6.52	6.81	7.32	7.76	8.22	8.71	9.02	9.84	10.7	11.1	12.2	12.6	12.9	14.6
3600		5.82	6.34	6.75	7.27	7.67	8.17	8.65	9.14	9.72	10.0	10.8	11.7	12.2	13.1	13.9	13.9	15.3
4000			7.06	7.48	8.14	8.46	9.00	9.60	10.0	10.7	11.0	11.7	12.7	13.2	14.0	14.7	14.9	15.8
5000				8.81	9.60	10.2	10.7	11.3	11.7	12.4	12.8	13.6	14.5	14.8	15.7			
6000				10.2	11.2	11.9	12.3	13.0	13.2	14.1	14.5	14.9	15.8	16.0				

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible.
For other belt widths, values above should be multiplied by the width correction coefficient shown in Table 28.

* [ ] The circumferential speed of pulley is 33 (m/s)or more; a dynamic balance for the pulley is essential.

Technical Data

Selection of Timing Belts 8 – Transmission Capacity Table –

Table 46. Reference Transmission Capacity of UP5M Ps – Belt Width 10 mm – (W)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	12	14	16	18	20	22	24	26	28	30	32	36	40	44	48	50	60	72
Diameter of the Pitch Circle (mm)	19.10	22.28	25.46	28.65	31.83	35.01	38.20	41.38	44.56	47.75	50.93	57.30	63.66	70.03	76.39	79.58	95.49	114.59
20	10	12	15	17	19	21	24	26	29	31	34	39	45	51	58	61	78	101
40	19	23	28	32	36	40	45	49	54	59	64	74	85	96	108	114	147	187
60	27	32	39	45	50	56	63	69	76	83	90	104	119	135	152	161	206	267
100	41	50	60	69	78	88	97	107	118	128	139	162	185	210	236	249	321	420
200	76	92	111	128	145	162	180	198	215	237	257	298	342	388	436	460	592	774
400	141	170	206	236	267	299	332	366	401	437	474	550	631	715	804	849	1092	1430
500	172	207	251	287	325	364	405	446	488	532	577	670	769	871	979	1034	1330	1741
600	202	243	295	338	382	428	475	524	574	625	678	788	903	1024	1151	1216	1563	2045
800	260	314	380	436	492	552	613	675	740	806	875	1016	1164	1320	1483	1567	2016	2637
1000	316	382	463	531	600	672	747	822	901	982	1065	1238	1418	1609	1806	1909	2454	3210
1200	376	453	550	630	713	799	887	977	1070	1167	1265	1470	1685	1910	2146	2266	2913	3811
1400	436	526	637	730	826	924	1026	1132	1240	1351	1466	1702	1951	2212	2484	2625	3372	4409
1450		544	658	755	854	957	1061	1171	1283	1397	1516	1760	2017	2288	2569	2714	3488	4559
1500		561	681	780	883	988	1098	1209	1324	1444	1566	1819	2084	2364	2654	2803	3601	4707
1600		599	724	831	940	1052	1169	1287	1410	1537	1667	1935	2218	2514	2823	2984	3833	5007
1750		652	790	907	1025	1147	1275	1405	1539	1677	1817	2111	2420	2743	3080	3254	4178	5455
1800			813	931	1053	1179	1309	1443	1582	1724	1868	2171	2486	2820	3165	3344	4293	5605
2000			902	1032	1169	1309	1453	1601	1754	1912	2071	2407	2757	3124	3508	3707	4687	6201
2400			1068	1222	1386	1552	1720	1897	2077	2262	2453	2849	3261	3695	4146	4378	5485	7293
3000				1517	1714	1918	2130	2348	2570	2798	3034	3520	4027	4559	5108	5389	6614	8885
3600				1794	2029	2272	2519	2774	3039	3307	3584	4151	4743	5361	5996	6320	7629	10250
4000					2245	2513	2785	3067	3358	3655	3956	4577	5226	5895	6583	6932	8040	11069
5000					2747	3072	3404	3747	4090	4446	4807	5542	6301	7066	7843	8229	9048	
6000					3217	3585	3969	4359	4757	5154	5559	6376	7185	7995	8776	9159		
8000							5002	5455	5908	6361	6795	7624	8366	8993	9465	9619		
10000								6313	6747	7156	7518	8072	8349	8253				
12000								6824	7142	7359	7475	7316						
14000								6848	6882	6730								

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible.
For other belt widths, values above should be multiplied by the width correction coefficient shown in Table 28.

Selection is easy with Timing Pulleys and Belts automatic calculation tool available at:
http://fawos.misumi.jp/FA_WEB/pulley_us/

Table 47. Reference Transmission Capacity of UP8M Ps – Belt Width 15mm – (kW)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	20	22	24	26	28	30	32	34	36	38	40	44	48	50	56	60	64	72
Diameter of the Pitch Circle (mm)	50.93	56.02	61.12	66.21	71.30	76.39	81.49	86.58	91.67	96.77	101.86	112.05	122.23	127.32	142.60	152.79	162.97	183.35
20	0.11	0.12	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.21	0.23	0.25	0.28	0.29	0.33	0.36	0.40	0.46
40	0.19	0.21	0.24	0.26	0.28	0.30	0.33	0.36	0.38	0.40	0.42	0.47	0.52	0.55	0.62	0.67	0.73	0.84
60	0.27	0.31	0.34	0.37	0.40	0.44	0.47	0.50	0.53	0.56	0.60	0.67	0.74	0.77	0.89	0.96	1.04	1.20
100	0.43	0.48	0.52	0.57	0.62	0.67	0.71	0.77	0.82	0.88	0.93	1.03	1.14	1.20	1.38	1.50	1.62	1.87
200	0.76	0.84	0.93	1.01	1.10	1.19	1.28	1.37	1.46	1.57	1.69	1.85	2.06	2.16	2.48	2.70	2.93	3.40
300	1.06	1.17	1.29	1.41	1.54	1.66	1.78	1.92	2.05	2.18	2.29	2.59	2.88	3.03	3.48	3.79	4.11	4.79
400	1.32	1.47	1.62	1.78	1.93	2.09	2.25	2.41	2.59	2.75	2.92	3.28	3.65	3.84	4.41	4.81	5.22	6.08
500	1.57	1.75	1.93	2.12	2.30	2.50	2.69	2.89	3.09	3.30	3.50	3.93	4.37	4.60	5.30	5.78	6.29	7.32
600	1.81	2.01	2.22	2.44	2.65	2.88	3.10	3.33	3.57	3.80	4.05	4.54	5.06	5.32	6.14	6.71	7.29	8.51
700	2.04	2.26	2.50	2.75	2.99	3.24	3.50	3.75	4.02	4.29	4.57	5.13	5.72	6.02	6.95	7.59	8.26	9.65
800	2.25	2.51	2.77	3.04	3.31	3.59	3.87	4.17	4.46	4.76	5.07	5.70	6.35	6.69	7.73	8.45	9.20	10.75
900	2.46	2.74	3.03	3.32	3.61	3.92	4.24	4.55	4.88	5.21	5.55	6.25	6.97	7.34	8.48	9.29	10.11	11.83
1000	2.66	2.96	3.28	3.58	3.91	4.24	4.58	4.93	5.28	5.64	6.02	6.78	7.56	7.96	9.22	10.08	10.99	12.88
1100	2.86	3.19	3.52	3.87	4.23	4.59	4.95	5.33	5.71	6.10	6.51	7.32	8.18	8.62	9.99	10.93	11.91	13.97
1200	3.06	3.42	3.78	4.15	4.53	4.92	5.31	5.72	6.13	6.55	6.98	7.87	8.79	9.26	10.74	11.76	12.83	15.05
1300	3.26	3.64	4.02	4.42	4.82	5.24	5.67	6.10	6.54	6.99	7.45	8.40	9.40	9.90	11.49	12.59	13.73	16.11
1400	3.46	3.86	4.27	4.69	5.12	5.57	6.01	6.47	6.95	7.43	7.92	8.94	9.99	10.53	12.23	13.40	14.62	17.17
1450	3.55	3.96	4.39	4.82	5.26	5.72	6.18	6.66	7.15	7.64	8.15	9.20	10.28	10.84	12.59	13.80	15.06	17.69
1500	3.65	4.07	4.51	4.95	5.41	5.87	6.35	6.85	7.35	7.85	8.38	9.46	10.58	11.15	12.95	14.20	15.50	18.22
1600	3.83	4.27	4.73	5.21	5.69	6.18	6.69	7.21	7.74	8.28	8.84	9.98	11.16	11.77	13.68	15.00	16.37	19.26
1750	4.11	4.59	5.08	5.59	6.12	6.64	7.19	7.75	8.32	8.91	9.50	10.74	12.03	12.69	14.75	16.19	17.68	20.81
1800	4.19	4.69	5.20	5.71	6.25	6.79	7.35	7.92	8.52	9.11	9.72	11.00	12.31	12.99	15.10	16.58	18.11	21.32
2000	4.56	5.09	5.65	6.21	6.79	7.39	8.00	8.63	9.28	9.93	10.61	11.99	13.44	14.18	16.51	18.14	19.82	23.37
2400	5.25	5.87	6.51	7.17	7.85	8.54	9.27	10.00	10.75	11.52	12.31	13.95	15.65	16.53	19.27	21.20	23.18	27.38
2800	5.91	6.61	7.34	8.09	8.87	9.66	10.48	11.32	12.18	13.06	13.97	15.84	17.81	18.81	21.97	24.19	26.49	31.35
3000	6.22	6.97	7.75	8.54	9.37	10.21	11.09	11.97	12.89	13.82	14.79	16.78	18.87	19.94	23.31	25.68	28.13	33.30
3600	6.93	7.79	8.66	9.56	10.49	11.45	12.44	13.46	14.50	15.57	16.66	18.94	21.33	22.56	26.44	29.15	31.97	37.94
4000	7.36	8.29	9.20	10.18	11.18	12.20	13.27	14.36	15.48	16.63	17.81	20.27	22.85	24.18	28.37	31.30	34.36	40.81
5000	8.29	9.34	10.41	11.52	12.68	13.87	15.10	16.38	17.68	19.02	20.40	23.26	26.29	27.84	32.75	36.20		
6000	9.05	9.05	11.41	12.65	13.95	15.28	16.66	18.08	19.55	21.06	22.61	25.85	29.24	31.02	36.56	40.46		

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible.
For other belt widths, values above should be multiplied by the width correction coefficient shown in Table 28.

* [ ] The circumferential speed of pulley is 33(m/s)or more; a dynamic balance for the pulley is essential.

Technical Data

Selection of Timing Belts 9 – Transmission Capacity Table –

Table 48. Reference Transmission Capacity of T5 Ps -Belt Width 10mm- (W)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	12	14	16	18	20	22	24	28	30
Diameter of the Pitch Circle (mm)	19.10	22.28	25.46	28.65	31.83	35.01	38.20	44.56	47.75
1160	98.5	114.9	131.3	147.7	164.1	180.5	196.9	229.7	246.1
1750	134.3	156.7	179.1	201.5	223.9	246.3	268.7	313.5	335.9
3500	222.5	259.6	296.7	333.7	370.8	407.9	445.0	519.1	556.2
100	10.7	12.4	14.2	16.0	17.8	19.5	21.3	24.9	26.6
200	20.8	24.3	27.7	31.2	34.7	38.2	41.6	48.6	52.0
300	30.5	35.6	40.7	45.7	50.8	55.9	61.0	71.2	76.2
400	39.7	46.4	53.0	59.6	66.2	72.9	79.5	92.7	99.4
500	48.6	56.7	64.8	72.9	81.0	89.1	97.2	113.4	121.5
600	57.0	66.5	76.0	85.6	95.1	104.6	114.1	133.1	142.6
700	65.1	76.0	86.8	97.7	108.6	119.4	130.3	152.0	162.8
800	72.9	85.0	97.2	109.3	121.5	133.6	145.8	170.1	182.2
900	80.3	93.7	107.1	120.5	133.9	147.3	160.7	187.5	200.9
1000	87.5	102.1	116.7	131.3	145.9	160.5	175.0	204.2	218.8
1100	94.4	110.2	125.9	141.6	157.4	173.1	188.9	220.3	236.1
1200	101.1	117.9	134.8	151.6	168.5	185.3	202.2	235.9	252.7
1300	107.5	125.5	143.4	161.3	179.2	197.2	215.1	250.9	268.9
1400	113.8	132.8	151.7	170.7	189.7	208.6	227.6	265.5	284.5
1500	119.9	139.8	159.8	179.8	200.0	219.2	239.7	279.7	299.7
1600	125.8	146.7	167.7	188.6	209.6	230.6	251.5	293.4	314.4
1700	131.5	153.4	175.4	197.3	219.2	241.1	263.0	306.9	328.8
1800	137.1	160.0	182.9	205.7	228.6	251.4	274.3	320.0	342.8
1900	142.6	166.4	190.2	214.0	237.7	261.5	285.3	332.8	356.6
2000	148.0	172.7	197.4	222.1	246.7	271.4	296.1	345.4	370.1
2200	158.6	185.0	211.4	237.8	264.3	290.7	317.8	370.0	396.4
2400	168.8	196.9	225.1	253.2	281.4	309.5	337.6	393.9	422.0
2600	178.8	208.7	238.5	268.3	298.1	327.9	357.7	417.3	447.1
2800	188.7	220.2	251.6	283.1	314.5	346.0	377.4	440.4	471.8
3000	198.5	231.6	264.6	297.7	330.8	363.9	397.0	463.1	496.2
3200	208.2	242.8	277.5	312.2	346.9	381.6	416.3	485.7	520.4
3400	217.7	254.0	290.3	326.6	362.9	399.2	435.5	508.0	544.3
3600	227.2	265.1	303.0	340.8	378.7	416.6	454.4	530.2	568.1
3800	236.6	276.0	315.5	354.9	394.3	433.8	473.2	552.1	591.5
4000	245.8	286.8	327.7	368.7	409.7	450.7	491.6	573.6	614.5
4200	254.8	297.3	339.7	382.2	424.7	467.2	509.6	594.6	637.0
4400	263.5	307.4	351.4	395.3	439.2	483.1	527.1	614.9	658.8
4600	271.9	317.2	362.5	407.8	453.1	498.4	543.7	634.4	679.7
4800	279.7	326.4	373.0	419.6	466.2	512.8	559.5	652.7	699.3
5000	287.0	334.8	382.7	430.5	478.3	526.2	574.0	669.7	717.5
5500			402.2	452.4	502.7	553.0	603.2	703.8	754.1
6000			412.1	463.6	515.1	566.6	618.1	721.1	772.6
6500			408.2	459.2	510.2	561.2	612.2	714.3	765.3
7000			385.3	433.5	481.-7	529.8	578.0	674.3	722.5
7500			337.7	379.9	422.1	464.3	506.6	591.0	633.2
8000				290.8	323.1	355.5	387.8	452.4	484.7
8500				157.7	175.3	192.8	210.3	245.4	262.9

*Avoiding the [ ] marked ranges is recommended as endurance time is shorten

*The above table shows values for the nominal width 10 (10mm). Multiply a value in the table by correction coefficient Kb in the table 28 for other widths.

Selection is easy with Timing Pulleys and Belts automatic calculation tool available at: http://fawos.misumi.jp/FA_WEB/pulley_us/

Table 49. Reference Transmission Capacity of T10 Ps - Belt Width 10mm- (W)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	12	14	16	18	20	22	24	26	28	30	32	36	40	44	48
Diameter of the Pitch Circle (mm)	38.20	44.56	50.93	57.30	63.66	70.03	76.39	82.76	89.12	95.49	101.86	114.59	127.32	140.06	152.79
870	254.9	297.4	339.9	382.4	424.9	467.4	509.9	552.4	594.9	637.4	679.8	764.8	849.8	938.8	1019.8
1160	321.2	374.8	428.3	481.8	535.4	588.9	642.4	696.0	749.5	803.0	856.6	963.7	1070.7	1177.8	1284.9
1750	438.3	511.3	584.4	657.4	730.5	803.5	876.6	949.6	1022.7	1095.7	1168.8	1314.9	1461.0	1607.1	1753.2
3500	725.8	846.8	967.8	1088.7	1209.7	1330.6	1451.6	1572.6	1693.6	1814.6	1935.5	2177.5	2419.4	2661.4	2903.3
100	34.8	40.6	46.4	52.1	57.9	63.7	69.5	75.3	81.1	86.9	92.7	104.3	115.9	127.5	139.1
200	67.9	79.2	90.5	101.9	113.2	124.5	135.8	147.1	158.4	169.8	181.1	203.7	226.3	249.0	271.6
300	99.5	116.1	132.7	149.3	165.8	182.4	199.0	215.6	232.2	248.8	265.3	298.5	331.7	364.9	398.0
400	129.7	151.3	172.9	194.5	216.1	237.7	259.4	281.0	302.6	324.2	345.8	389.0	432.3	475.5	518.7
500	158.5	184.9	211.3	237.8	264.2	290.6	317.0	343.4	369.8	396.3	422.7	475.5	528.3	581.2	634.0
600	186.1	217.1	248.1	279.1	310.1	341.1	372.2	403.2	434.2	465.2	496.2	558.2	620.3	682.3	744.3
700	212.5	247.9	283.3	318.7	354.2	389.6	425.0	460.4	495.8	531.2	566.6	637.5	708.3	779.1	850.0
800	237.8	277.5	317.1	356.7	396.4	436.0	475.6	515.3	554.9	594.5	634.2	713.4	792.7	872.0	951.3
900	262.1	305.8	349.5	393.2	436.9	480.6	524.3	568.0	611.7	655.3	699.0	786.4	873.8	961.2	1048.6
1000	285.5	333.1	380.7	428.3	475.9	523.5	571.1	618.7	666.2	713.8	761.4	856.6	951.8	1047.0	1142.1
1100	308.1	359.4	410.8	462.1	513.5	564.8	616.2	667.5	718.8	770.2	821.5	924.2	1026.9	1129.6	1232.3
1200	329.8	384.8	439.8	494.7	549.7	604.7	659.7	714.6	769.6	824.6	879.6	989.5	1099.4	1209.4	1319.3
1300	350.9	409.4	467.8	526.3	584.8	644.3	701.4	760.2	818.7	877.2	935.7	1052.6	1169.6	1286.5	1403.5
1400	371.3	433.1	495.0	556.9	618.8	680.6	742.5	804.4	866.3	928.1	990.0	1113.8	1237.5	1361.3	1485.0
1500	391.0	456.2	521.4	586.6	651.7	716.9	782.1	847.3	912.4	977.6	1042.8	1173.1	1303.5	1433.8	1564.2
1600	410.3	478.7	547.1	615.4	683.8	752.2	820.6	889.0	957.4	1025.7	1094.1	1230.9	1367.7	1504.4	1641.2
1700	429.1	500.6	572.1	643.6	715.1	786.6	858.1	929.6	1001.2	1072.7	1144.2	1287.2	1430.2	1573.3	1716.3
1800	447.4	522.0	596.5	671.1	745.7	820.2	894.8	969.4	1043.9	1118.5	1193.1	1342.2	1411.3	1640.5	1781.6
1900	465.4	542.9	620.5	698.0	775.6	853.1	930.7	1008.3	1085.8	1163.4	1240.9	1396.1	1551.2	1706.3	1861.4
2000	483.0	563.5	643.9	724.4	804.9	885.4	965.9	1046.4	1126.9	1207.4	1287.9	1448.9	1609.9	1770.9	1931.8
2200	517.3	603.5	689.7	776.0	862.2	948.4	1034.6	1120.8	1207.1	1293.3	1379.5	1551.9	1724.4	1896.8	2069.2
2400	550.7	642.5	734.3	826.1	917.9	1009.7	1101.4	1193.8	1285.0	1376.8	1468.6	1652.2	1835.8	2019.3	2202.9
2600	583.5	680.7	777.9	875.2	972.4	1069.7	1166.9	1264.1	1361.4	1458.6	1555.9	1750.4	1944.9	2139.3	2333.8
2800	615.7	718.3	820.9	923.5	1026.1	1128.7	1231.3	1333.9	1436.6	1539.2	1641.8	1847.0	2052.3	2257.5	2462.7
3000		755.4	863.4	971.3	1079.2	1187.1	1295.0	1402.9	1510.9	1618.8	1726.7	1942.5	2158.4	2374.2	2590.1
3200		792.2	905.4	1018.6	1131.8	1244.9	1358.1	1471.2	1584.5	1697.6	1810.8	2037.2	2263.5	2489.9	2716.2
3400		828.7	947.1	1065.5	1183.8	1302.2	1420.6	1539.0	1657.4	1775.8	1894.2	2130.9	2367.7	2604.5	2841.2
3600		864.8	988.4	1111.9	1235.4	1358.9	1482.5	1606.0	1729.6	1853.2	1976.7	2223.8	2470.9	2718.0	2965.1
3800		900.5	1029.1	1157.7	1286.4	1415.0	1543.6	1672.2	1800.9	1929.6	2058.2	2315.5	2572.8	2830.0	3087.3
4000			1069.2	1202.8	1336.5	1470.0	1603.7	1737.3	1871.1	2004.7	2138.4	2405.7	2673.0	2940.3	3207.6
4200			1108.3	1246.9	1385.4	1523.9	1662.4	1800.9	1939.6	2078.1	2216.7	2493.7	2770.8	3047.9	3325.0
4400			1146.2	1289.5	1432.8	1576.0	1719.2	1862.5	2005.9	2149.2	2292.5	2579.0	2865.6	3152.1	3438.7
4600			1182.5	1330.3	1478.1	1625.8	1773.6	1921.4	2069.4	2217.2	2365.0	2660.6	2956.3	3251.9	3547.5
4800			1216.7	1368.8	1520.9	1672.8	1824.9	1976.9	2129.2	2281.3	2433.4	2737.6	3041.8	3345.9	3650.1
5000			1248.3	1404.3	1560.4	1716.2	1872.2	2028.3	2184.5	2340.6	2496.6	2808.7	3120.8	3432.8	3744.9
5200			1276.7	1436.3	1595.9	1755.2	1914.8	2074.4	2234.2	2393.8	2553.4	2872.6	3191.8	3510.9	3830.1
5400			1301.3	1463.9	1626.6	1789.0	1951.6	2114.2	2277.2	2439.9	2602.5	2927.8	3253.2	3578.5	3903.8
5600			1321.2	1486.4	1651.5	1816.4	1981.5	2146.7	2312.2	2477.3	2642.5	2972.8	3303.1	3633.4	3963.7
5800			1335.8	1502.8	1669.8	1836.4	2003.4	2170.3	2337.7	2504.7	2671.7	3005.6	3339.6	3673.5	4007.5
6000			1344.2	1512.2	1680.2	1847.8	2015.8	2184.3	2352.3	2520.3	2688.3	3024.4	3360.4	3696.5	4032.5

*Avoiding the [ ] marked ranges is recommended as endurance time is shorten

*Balance the traveling speed as wind velocity of pulley in the [ ] marked range reaches more than 33 (m/s)

*The above table shows values for the nominal width 10 (10mm). Multiply a value in the table by correction coefficient Kb in the table 28 for other widths.

Technical Data

Selection of Timing Belts 10 – Transmission Capacity Table –

Table 50. Reference Transmission Capacity of 2GT Ps – Belt Width 4mm – (W)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	12	14	16	18	20	22	24	26	28	30	32	36	40	44	48	50	60	72
Diameter of the Pitch Circle (mm)	7.64	8.91	10.19	11.46	12.73	14.01	15.28	16.55	17.83	19.10	20.37	22.92	25.46	28.01	30.56	31.83	38.20	45.84
20	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.7	1.9	2.2	2.5	2.6	3.4	4.0
40	0.8	1.0	1.1	1.3	1.5	1.7	1.8	2.0	2.2	2.4	2.7	3.1	3.6	4.1	4.6	4.9	6.3	7.6
60	1.1	1.4	1.6	1.8	2.1	2.3	2.6	2.9	3.2	3.5	3.8	4.4	5.1	5.8	6.6	7.0	9.1	10.9
100	1.7	2.1	2.4	2.8	3.2	3.6	4.0	4.5	4.9	5.4	5.9	6.9	8.0	9.1	10.3	11.0	14.3	17.2
200	3.0	3.6	4.3	5.0	5.7	6.4	7.2	8.0	8.8	9.7	10.6	12.5	14.5	16.6	18.9	20.1	26.4	31.7
300	4.2	5.0	5.9	6.9	7.9	8.9	10.0	11.1	12.3	13.6	14.9	17.6	20.4	23.5	26.8	28.5	37.7	45.3
400	5.2	6.3	7.4	8.6	9.9	11.2	12.6	14.1	15.6	17.2	18.8	22.3	26.0	30.0	34.3	36.5	48.5	58.2
500	6.1	7.4	8.8	10.2	11.8	13.4	15.1	16.8	18.7	20.6	22.6	26.8	31.4	36.2	41.4	44.1	58.8	70.6
600	7.0	8.5	10.1	11.8	13.5	15.4	17.4	19.4	21.6	23.8	26.2	31.2	36.5	42.2	48.3	51.5	68.9	82.6
700	7.8	9.5	11.3	13.2	15.2	17.4	19.6	21.9	24.4	27.0	29.6	35.3	41.4	48.0	55.0	58.7	78.6	94.4
800	8.6	10.5	12.5	14.6	16.8	19.2	21.7	24.3	27.1	30.0	33.0	39.4	46.2	53.6	61.5	65.6	88.2	105.8
870	9.1	11.1	13.3	15.5	17.9	20.5	23.2	26.0	28.9	32.0	35.2	42.1	49.5	57.5	66.0	70.4	94.7	113.7
900	9.3	11.4	13.6	15.9	18.4	21.0	23.8	26.7	29.7	32.9	36.2	43.3	50.9	59.1	67.9	72.4	97.5	117.0
1000	10.0	12.3	14.6	17.2	19.9	22.7	25.7	28.9	32.2	35.7	39.3	47.1	55.4	64.4	74.1	79.1	106.7	128.0
1160	11.1	13.6	16.3	19.1	22.1	25.4	28.8	32.3	36.1	40.0	44.2	53.0	62.5	72.7	83.7	89.5	121.0	145.2
1200	11.4	13.9	16.6	19.6	22.7	26.0	29.5	33.2	37.0	41.1	45.3	54.4	64.2	74.8	86.1	92.0	124.6	149.5
1400	12.6	15.4	18.5	21.8	25.3	29.1	33.0	37.2	41.6	46.2	51.1	61.4	72.6	84.7	97.7	104.5	141.9	170.3
1450	12.9	15.8	19.0	22.4	26.0	29.8	33.9	38.2	42.7	47.5	52.5	63.1	74.7	87.2	100.6	107.6	146.2	175.4
1600	13.7	16.8	20.3	23.9	27.8	32.0	36.4	41.1	46.0	51.2	56.6	68.2	80.8	94.4	109.0	116.6	158.8	190.6
1750	14.5	17.8	21.5	25.4	29.6	34.1	38.8	43.8	49.1	54.7	60.6	73.1	86.7	101.4	117.2	125.5	171.2	205.4
1800	14.7	18.2	21.9	25.9	30.2	34.8	39.6	44.7	50.2	55.9	61.9	74.7	88.6	103.7	119.9	128.4	175.3	210.3
2000	15.7	19.4	23.4	27.8	32.4	37.4	42.7	48.3	54.2	60.4	66.9	81.0	96.2	112.8	130.5	139.9	191.4	229.7
2400	17.4	21.7	26.3	31.2	36.6	42.3	48.4	54.9	61.8	69.0	76.6	93.0	110.9	130.2	151.1	162.1	222.8	267.3
2800	19.0	23.7	28.8	34.4	40.4	46.9	53.8	61.1	68.9	77.1	85.8	104.4	124.8	146.9	170.8	183.4	253.1	303.7
3200	20.3	25.5	31.1	37.3	43.9	51.1	58.8	66.9	75.6	84.7	94.4	115.2	138.1	162.9	189.8	204.0	282.4	338.9
3600	21.5	27.1	33.2	39.9	47.2	55.0	63.4	72.4	81.9	92.0	102.6	125.6	150.9	178.4	208.2	223.9	311.0	373.2
4000	22.6	28.6	35.1	42.4	50.2	58.7	67.8	77.5	87.9	98.9	110.5	135.6	163.2	193.3	225.9	243.2	338.9	406.7
5000	24.7	31.6	39.2	47.7	56.9	66.9	77.7	89.2	101.6	114.7	128.7	158.9	192.2	228.7	268.3	289.3	406.0	487.2
6000	26.2	33.8	42.4	52.0	62.5	73.9	86.3	99.6	113.8	129.0	145.1	180.2	219.1	261.7	308.1	332.7	469.8	563.8
7000	27.1	35.5	45.0	55.5	67.2	79.9	93.8	108.8	124.8	142.0	160.2	200.0	244.2	292.8	345.8	373.9	531.0	637.3
8000	27.6	36.6	46.9	58.4	71.1	85.2	100.4	117.0	134.7	153.8	174.1	218.4	267.8	322.2	381.6	413.2	590.0	708.0
10000	27.5	37.5	49.2	62.4	77.1	93.5	111.4	130.9	151.9	174.6	198.7	251.8	311.2	376.8	448.7	487.0	702.1	842.6
12000	26.0	36.9	49.8	64.4	81.0	99.5	119.8	142.0	166.1	192.1	220.0	281.4	350.3	426.8	510.7	555.6	807.9	969.5
14000	23.5	35.1	48.9	64.9	83.1	103.5	126.1	150.9	177.9	207.1	238.4	307.8	385.9	472.8	568.5	619.7	908.3	1090.0

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible.
For other belt widths, values above should be multiplied by the width correction coefficient shown in Table 28.

Selection is easy with Timing Pulleys and Belts automatic calculation tool available at: http://fawos.misumi.jp/FA_WEB/pulley_us/

Table 51. Reference Transmission Capacity of 3GT Ps – Belt Width 6 mm – (W)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	12	14	16	18	20	22	24	26	28	30	32	36	40	48	54	60	72	80
Diameter of the Pitch Circle (mm)	11.46	13.37	15.28	17.19	19.10	21.01	22.92	24.83	26.74	28.65	30.56	34.38	38.20	45.84	51.57	57.30	68.75	76.39
20	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	5.9	6.4	6.9	7.8	8.7	10.5	11.8	13.1	15.7	17.4
40	3.6	4.5	5.5	6.4	7.3	8.2	9.1	10.0	10.9	11.8	12.6	14.3	16.0	19.3	21.7	24.2	28.9	32.0
60	5.0	6.4	7.7	9.0	10.3	11.6	12.9	14.2	15.4	16.7	17.9	20.4	22.8	27.5	30.9	34.4	41.1	45.5
100	7.6	9.7	11.8	13.9	15.9	18.0	19.9	21.9	23.9	25.9	27.8	31.6	35.3	42.6	48.0	53.4	63.8	70.6
200	13.1	16.9	20.8	24.6	28.2	32.0	35.6	39.2	42.8	46.4	49.9	56.8	63.6	76.8	86.5	96.1	114.8	127.0
300	17.7	23.2	28.7	34.1	39.2	44.6	49.6	54.8	59.9	65.0	69.8	79.6	89.2	107.7	121.4	134.8	161.0	178.1
400	21.9	28.9	35.9	42.8	49.4	56.3	62.7	69.3	75.7	82.2	88.4	100.9	113.0	136.5	153.9	171.0	204.1	225.7
500	25.6	34.2	42.6	51.0	58.9	67.2	74.9	82.9	90.6	98.5	105.9	121.0	135.6	163.8	184.7	205.1	244.8	270.7
600	29.1	39.0	48.9	58.7	67.8	77.5	86.5	95.8	104.8	114.0	122.6	140.1	157.1	189.8	214.0	237.7	283.7	313.5
700	32.2	43.6	54.8	66.0	76.4	87.4	97.6	108.2	118.4	128.9	138.6	158.5	177.8	214.8	242.2	269.1	321.0	354.7
800	35.2	47.9	60.4	72.9	84.6	96.9	108.3	120.1	131.5	143.2	154.1	176.2	197.7	239.0	269.4	299.3	357.0	394.3
870	37.2	50.8	64.2	77.6	90.1	103.3	115.5	128.2	140.4	152.9	164.6	188.3	211.3	255.4	288.0	319.8	381.4	421.3
900	38.0	52.0	65.8	79.6	92.4	106.0	118.6	131.6	144.2	157.0	169.0	193.3	217.0	262.3	295.8	328.5	391.7	432.6
1000	40.6	55.9	71.0	86.0	100.0	114.9	128.5	142.7	156.4	170.4	183.4	210.0	235.7	285.0	321.3	356.8	425.4	469.8
1160	44.4	61.8	78.8	95.8	111.6	128.4	143.8	159.9	175.2	191.1	205.7	235.6	264.5	319.9	360.7	400.6	477.4	527.0
1200	45.4	63.2	80.7	98.2	114.4	131.7	147.5	164.0	179.8	196.1	211.1	241.9	271.6	328.4	370.3	411.2	490.0	540.9
1400	49.6	69.9	89.7	109.6	128.0	147.5	165.5	184.2	202.1	220.5	237.5	272.2	305.7	369.8	416.9	462.9	551.4	608.3
1450	50.6	71.5	91.9	112.3	131.2	151.4	169.8	189.0	207.4	226.4	243.9	279.5	314.0	379.8	428.3	475.5	566.2	624.6
1600	53.4	76.0	98.2	120.3	140.8	162.6	182.5	203.3	223.2	243.7	262.6	301.1	338.4	409.3	461.5	512.3	609.8	672.5
1750	56.0	80.4	104.2	128.0	149.9	173.4	194.8	217.2	238.5	260.5	280.8	322.1	362.0	437.9	493.7	548.0	652.0	718.7
1800	56.8	81.7	106.1	130.5	152.9	176.9	198.8	221.7	243.5	266.0	286.7	328.9	369.7	447.2	504.2	559.6	665.7	733.7
2000	59.9	87.1	113.6	140.1	164.5	190.6	214.4	239.3	263.0	287.4	309.8	355.7	399.8	483.7	545.3	605.1	719.3	792.3
2400	65.2	96.6	127.3	158.1	186.2	216.4	243.8	272.4	299.7	327.9	353.7	406.3	456.9	552.8	622.9	690.9	820.1	902.2
2800	72.9	105.0	139.7	174.4	206.1	240.2	271.0	303.3	334.0	365.8	394.6	453.7	510.4	617.2	695.3	770.7	913.1	1003.1
3200	80.8	112.3	150.9	189.4	224.5	262.4	296.4	332.2	366.2	401.3	433.1	498.2	560.6	677.7	763.0	845.1	999.1	1095.6
3600	88.4	118.7	161.0	203.2	241.6	283.1	320.3	359.3	396.4	434.7	469.3	540.2	607.8	734.5	826.3	914.4	1078.4	1180.2
4000	95.9	124.3	170.2	216.0	257.5	302.4	342.6	384.9	424.9	466.3	503.5	579.8	652.4	787.8	885.6	979.0	1151.3	1257.0
5000	113.8	135.2	189.6	243.9	292.7	345.8	392.9	442.6	489.4	537.9	581.1	669.6	753.3	907.4	1017.3	1120.7	1306.3	1415.8
6000	130.7	154.3	204.6	266.8	322.3	383.0	436.3	492.7	545.5	600.3	648.7	747.7	840.5	1008.6	1126.6	1235.3	1422.5	1526.3
7000	147.0	173.3	216.0	285.5	347.2	414.7	473.7	536.1	594.2	654.6	707.3	815.0	915.0	1092.4	1214.1	1323.1	1499.2	1586.5
8000	162.6	191.5	224.1	300.4	367.7	441.6	505.6	573.4	636.2	701.3	757.6	872.2	977.3	1159.1	1279.9	1383.5	1534.5	1593.4
10000	192.2	225.7	259.3	320.5	397.5	482.4	554.7	631.3	701.2	773.7	834.6	957.4	1066.1	1240.3	1343.8	1418.4	1471.0	1431.9
12000	219.7	257.3	294.6	331.6	413.4	507.3	585.4	668.1	742.3	818.9	880.9	1004.0	1106.6	1249.1	1312.0	1329.1	1209.3	1008.1
14000	245.5	286.4	326.7	366.1	416.7	517.2	598.6	684.8	760.0	837.2	896.5	1010.9	1096.9	1180.1	1175.5	1102.1		

*Because the durability in terms of hours decreases in the marked range, this range should be avoided whenever possible.
For other belt widths, values above should be multiplied by the width correction coefficient shown in Table 28.

Technical Data

Selection of Timing Belts 11 – Transmission Capacity Table –

Table52. Reference Transmission Capacity of EV5GT Ps – Belt Width 15 mm – (W)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	14	16	18	20	22	24	26	28	30	32	36	40	44	48	54	60	72	80
Diameter of the Pitch Circle (mm)	22.28	25.46	28.65	31.83	35.01	38.20	41.38	44.56	47.75	50.93	57.30	63.66	70.03	76.39	85.94	95.49	114.59	127.32
20	13	18	22	27	33	38	42	47	52	56	64	72	80	87	97	108	128	139
40	24	33	41	50	61	70	79	88	96	104	120	136	150	163	183	203	240	263
60	33	46	58	72	87	100	113	126	139	150	173	196	216	236	264	293	348	380
100	50	71	91	113	136	157	178	199	219	237	273	310	343	374	419	465	552	604
200	85	125	163	205	248	287	326	365	403	438	506	575	636	695	780	867	1031	1129
300	115	173	228	289	350	407	464	520	574	625	723	823	912	996	1119	1244	1482	1623
400	142	217	289	369	447	520	594	667	737	803	931	1060	1176	1285	1445	1607	1914	2096
500	166	258	347	445	539	629	718	808	894	974	1131	1289	1430	1564	1759	1957	2333	2555
600	188	297	402	518	627	733	839	944	1046	1141	1325	1511	1678	1836	2065	2298	2740	3002
700	208	333	454	589	712	834	956	1077	1193	1302	1514	1728	1919	2101	2364	2632	3139	3439
800	227	368	505	657	795	933	1069	1206	1337	1460	1699	1940	2156	2360	2657	2958	3529	3866
870	239	392	540	704	851	1000	1147	1294	1436	1569	1826	2086	2319	2539	2858	3183	3797	4161
900	244	402	554	724	875	1028	1180	1332	1478	1615	1880	2148	2388	2615	2944	3279	3912	4286
1000	260	434	602	789	954	1122	1289	1456	1616	1767	2058	2352	2616	2865	3227	3593	4288	4698
1160	284	483	675	890	1075	1268	1459	1649	1832	2004	2337	2672	2973	3257	3669	4087	4878	5343
1200	289	495	693	915	1105	1304	1500	1696	1885	2062	2405	2751	3061	3353	3778	4209	5023	5502
1400	315	551	780	1035	1251	1478	1704	1929	2145	2349	2742	3138	3493	3828	4314	4807	5736	6282
1450	321	565	801	1065	1286	1521	1754	1986	2209	2419	2825	3233	3599	3945	4446	4954	5912	6474
1600	338	605	863	1152	1391	1647	1901	2155	2397	2627	3070	3516	3914	4291	4837	5390	6430	7040
1750	354	643	923	1237	1494	1771	2046	2320	2583	2831	3311	3793	4224	4631	5221	5817	6939	7595
1800	358	655	943	1264	1527	1811	2093	2374	2644	2899	3390	3884	4326	4743	5347	5958	7106	7777
2000	376	703	1020	1374	1659	1971	2280	2589	2884	3164	3703	4244	4728	5185	5846	6513	7765	8494
2400	406	791	1165	1584	1911	2278	2641	3003	3349	3678	4309	4943	5509	6042	6812	7587	9034	9868
2800	440	872	1301	1783	2151	2571	2986	3400	3795	4171	4892	5615	6259	6865	7737	8613	10238	11165
3200	486	945	1429	1973	2380	2851	3318	3782	4225	4647	5455	6263	6982	7657	8625	9594	11379	12384
3600	529	1011	1550	2155	2598	3120	3636	4150	4640	5107	5998	6888	7679	8419	9477	10531	12456	13522
4000	571	1072	1665	2330	2808	3379	3944	4505	5041	5550	6522	7492	8350	9151	10291	11423	13466	14575
5000	667	1202	1925	2738	3296	3986	4667	5343	5985	6597	7758	8910	9920	10854	12167	13450	15686	16815
6000		1305	2153	3108	3737	4539	5330	6112	6853	7559	8889	10199	11335	12372	13803	15172	17429	18431
7000		1382	2352	3445	4136	5044	5936	6817	7648	8438	9915	11358	12590	13695	15183	16561	18641	19343
8000			2524	3749	4495	5501	6487	7459	8370	9235	10835	12383	13677	14812	16285	17586	19259	
9000			2671	4023	4815	5912	6984	8037	9018	9946	11645	13265	14586	15706	17086	18212		
10000				4266	5096	6277	7426	8550	9591	10570	12339	13998	15303	16361	17560			
12000				4660	5541	6865	8141	9375	10498	11541	13356	14976	16113	16883				
14000				4930	5825	7256	8617	9915	11067	12113	13831	15238						

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible.
For other belt widths, values above should be multiplied by the width correction coefficient shown in Table 28.

Table53. Reference Transmission Capacity of EV8YU Ps – Belt Width 20 mm – (W)

Rotary Speed of Small Pulley (rpm) \ No. of Teeth of Small Pulley	20	22	24	26	28	30	32	34	36	38	40	44	48	54	60	64	72	80
Diameter of the Pitch Circle (mm)	50.93	56.02	61.12	66.21	71.30	76.39	81.49	86.58	91.67	96.77	101.86	112.05	122.23	137.51	152.79	162.97	183.35	203.72
10	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.10	0.12	0.13	0.14	0.16	0.18
20	0.07	0.08	0.09	0.10	0.10	0.11	0.13	0.13	0.14	0.15	0.16	0.18	0.20	0.23	0.26	0.28	0.32	0.36
40	0.13	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.36	0.40	0.46	0.52	0.56	0.64	0.72
60	0.18	0.21	0.23	0.26	0.29	0.32	0.35	0.38	0.41	0.44	0.48	0.54	0.60	0.69	0.78	0.84	0.96	1.08
100	0.28	0.33	0.37	0.42	0.47	0.52	0.57	0.62	0.67	0.72	0.78	0.88	0.99	1.14	1.30	1.40	1.60	1.80
200	0.52	0.60	0.69	0.79	0.89	0.99	1.10	1.20	1.29	1.39	1.52	1.73	1.96	2.27	2.58	2.79	3.19	3.60
300	0.74	0.86	0.99	1.13	1.29	1.45	1.62	1.76	1.90	2.05	2.25	2.57	2.92	3.38	3.85	4.18	4.78	5.40
400	0.94	1.10	1.28	1.47	1.67	1.89	2.12	2.30	2.50	2.70	2.97	3.40	3.86	4.48	5.12	5.56	6.37	7.20
500	1.13	1.34	1.56	1.80	2.05	2.32	2.61	2.84	3.08	3.33	3.68	4.23	4.81	5.59	6.38	6.94	7.95	8.99
600	1.32	1.57	1.83	2.12	2.42	2.75	3.10	3.38	3.67	3.97	4.38	5.04	5.75	6.68	7.64	8.31	9.53	10.78
700	1.50	1.79	2.10	2.43	2.79	3.17	3.58	3.90	4.24	4.59	5.08	5.86	6.68	7.77	8.89	9.68	11.10	12.57
800	1.68	2.00	2.36	2.74	3.15	3.59	4.05	4.43	4.81	5.22	5.78	6.66	7.61	8.86	10.14	11.04	12.67	14.34
870	1.80	2.15	2.54	2.95	3.40	3.87	4.38	4.79	5.21	5.65	6.26	7.23	8.26	9.62	11.01	11.99	13.76	15.58
900	1.85	2.21	2.61	3.04	3.50	4.00	4.52	4.94	5.38	5.83	6.47	7.47	8.54	9.95	11.39	12.40	14.23	16.11
1000	2.02	2.42	2.86	3.34	3.85	4.40	4.99	5.46	5.94	6.45	7.15	8.27	9.46	11.03	12.63	13.75	15.78	17.88
1160	2.28	2.74	3.26	3.81	4.41	5.05	5.73	6.27	6.83	7.42	8.24	9.54	10.92	12.75	14.60	15.91	18.26	20.68
1200	2.34	2.82	3.35	3.92	4.54	5.20	5.91	6.47	7.06	7.66	8.51	9.86	11.29	13.17	15.09	16.45	18.87	21.37
1400	2.65	3.21	3.83	4.50	5.22	5.99	6.82	7.48	8.16	8.86	9.86	11.43	13.11	15.30	17.54	19.11	21.93	24.83
1450	2.73	3.31	3.94	4.64	5.39	6.19	7.05	7.72	8.43	9.16	10.20	11.82	13.56	15.83	18.15	19.78	22.69	25.68
1600	2.95	3.59	4.29	5.06	5.88	6.77	7.72	8.47	9.24	10.05	11.20	12.99	14.91	17.41	19.96	21.75	24.95	28.23
1750	3.17	3.87	4.63	5.47	6.37	7.34	8.39	9.20	10.05	10.93	12.19	14.15	16.25	18.98	21.75	23.71	27.18	30.75
1800	3.24	3.96	4.75	5.61	6.53	7.53	8.61	9.44	10.31	11.22	12.52	14.54	16.69	19.50	22.35	24.36	27.93	31.58
2000	3.52	4.32	5.19	6.14	7.17	8.29	9.48	10.41	11.37	12.38	13.82	16.06	18.46	21.56	24.71	26.94	30.85	34.86
2400	4.06	5.01	6.05	7.19	8.43	9.76	11.20	12.30	13.45	14.65	16.39	19.07	21.93	25.61	29.34	31.97	36.55	41.21
2800	4.57	5.66	6.88	8.20	9.64	11.20	12.87	14.15	15.48	16.87	18.90	22.00	25.31	29.55	33.82	36.82	41.99	47.22
3200	5.05	6.29	7.67	9.18	10.82	12.59	14.50	15.95	17.46	19.03	21.35	24.86	28.60	33.35	38.12	41.46	47.14	52.83
3600	5.50	6.89	8.43	10.12	11.96	13.95	16.08	17.69	19.38	21.12	23.72	27.62	31.78	37.01	42.22	45.86	51.95	57.98
4000	5.94	7.47	9.17	11.03	13.06	15.26	17.62	19.39	21.23	23.15	26.02	30.30	34.84	40.50	46.10	50.00	56.39	
5000	6.91	8.79	10.87	13.16	15.65	18.34	21.24	23.37	25.59	27.88	31.39	36.50	41.90	48.40	54.68			
6000	7.75	9.94	12.38	15.05	17.97	21.12	24.52	26.95	29.47	32.08	36.16	41.92	47.96	54.90				
7000	8.44	10.92	13.68	16.70	20.00	23.57	27.39	30.06	32.82	35.65	40.22	46.41	52.84					
8000	8.99	11.72	14.76	18.09	21.72	25.63	29.82	32.65	35.55	38.52	43.45							

*Because the durability in terms of hours decreases in the [ ] marked range, this range should be avoided whenever possible.
For other belt widths, values above should be multiplied by the width correction coefficient shown in Table 28.

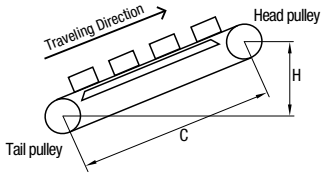
Technical Data

Selection of Conveyor Timing Belts

■ Conveyer belts selection procedure

The following steps for selection is based on the case that sizes of head pulley and tail pulley are same. (Follow the steps 1–3 even when sizes of head pulley and tail pulley are different.)
Use a head pulley as a driving pulley. For belt installation and tension control, make the structure of the driven side to be adjustable of alignment and center distance with set screws.
*Head Pulley: The front of the pulley against traveling direction
Tail Pulley: The rear end of the pulley against traveling direction

[Step 1] Calculate effective tension (Te)



$Te = 9.8(\mu \cdot G + G \cdot H/C)$

Te	(N)	Effective tension
G	(Kg)	Net weight of load placed on the belt surface
μ		Friction coefficient of belt vs. table (Table 1)
H	(mm)	Lift
C	(mm)	Tentative center dimension (conveyor length)

Table 1. Typical Friction Coefficient of Belt versus Table

Table Material	Steel	Stainless	Aluminium	UHMW	Teflon
Friction coefficient: μ	0.65	0.68	0.42	0.31	0.21

[Step 2] Calculate design tension (Td).

$Td = K \cdot Te$

Td	(N)	Design Tension
K		Overload Coefficient
Te	(N)	Effective Tension

$K = K1 + K2 + K3$

K1	Correction factors for daily operation hours
K2	Belt length correction coefficient
K3	Belt speed correction coefficient

Table 2. K1 Correction Factors for Daily Operation Hours Unit: hour

~5	5~8	8~12	12~16	16~24
1.0	1.1	1.2	1.3	1.4

Table 3. K2 Belt Length Correction Factors Unit: mm

~1500	1501~3000	3001~4500	4501~
0.3	0.2	0.1	0.0

Table 4. K3 Belt Speed Correction Factors Unit: m/minute

~60	61~90	91~120
0.0	0.1	0.2

[Step 3] Select belt type, belt width and pulley dimension

(1) Select from Table 5 a belt type and a width which have a greater allowable tension than the designed tension.

Table 5. Allowable Tension of Joint Belts Unit: N

Belt Type	Belt width (mm)						
	10	15	20	25	30	40	50
S5M	120	180	—	300	—	—	—
S8M	—	235	—	392	471	627	—
T5	58	87	116	145	—	—	—
T10	—	180	240	300	360	481	601
AT5	74	110	—	—	—	—	—
AT10	—	234	312	391	—	—	—

Unit: N

Belt Type	Belt Nominal Width				
	050	075	100	150	200
L	92	138	184	276	–
H	—	163	216	324	432

(2) Select a pulley with a larger number of teeth than the minimum allowable number in Table 6 for both of driving and driven pulley.

Table 6. Number of Minimum Allowable Number of Teeth for Pulleys

Belt Type	L	H	S5M	S8M	T5	T10	AT5	AT10
Pitch (mm)	9.525	12.7	5	8	5	10	5	10
Min. No. of Pully Teeth	14	14	14	24	12	14	20	14
Pully Diameter (mm)	42.45	56.60	22.28	61.12	19.10	44.56	31.83	44.56

[Step 4] Determine belt length (no. of teeth) and center distance.

(1) Obtain approximate belt length from tentative center dimension (C') and approximate pulley diameter (Dp').

$Lp' = 2 \cdot C' + \pi \cdot Dp'$

Lp'	(mm)	Approx. belt length
C'	(mm)	Tentative center dimension
Dp'	(mm)	Approx. pully diameter

(2) Determine the number of teeth required from the approximate belt length (Lp') and pitch (P). Round down the obtained number of teeth (N) to the nearest whole number.

$N = Lp' / P$

N		No. of belt teeth
p	(mm)	Pitch

*Check the minimum teeth of belt which is available.

(3) Obtain the proper belt length from the number of teeth (N) and pitch (P).

$Lp = P \cdot N$

Lp	(mm)	Belt length

(4) Determine proper center distance with the following formula:

$C = P \cdot (N - Dz)/2$

C	(mm)	Center Distance
Dz		No. of teeth of pulley

[Step 5] Confirm the ajustment margin for the center distance is larger than figures in Table7-a and 7-b.

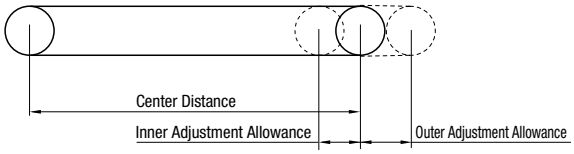


Table 7-a: Inner Adjustment Allowance (Attachment Allowance)

Belt Type	Inner Adjustment Allowance
L	More than 10mm
H	More than 15mm
S5M	More than 10mm
S8M	More than 15mm
T5	More than 5mm
T10	More than 10mm
AT5	More than 10mm
AT10	More than 15mm

Table 7-b: Outer Adjustment Allowance (Tension Allowance)

Distance between shafts (mm)	Outer Adjustment Allowance
0000~0500	More than 5mm
0501~1000	More than 10mm
1001~1500	More than 15mm
1501~2000	More than 20mm
2001~2500	More than 25mm
2501~0000	More than 1% of center distance

[Step 6] Install timing belt

Install the belt with the installation tension in Table 8.
Axis weight at this time is twice the installation tension.

$Fs = 2 \cdot Ti$

Fs	(N)	Shaft load
Ti	(N)	Fixing Tension (Table 8)

Table 8. Installation Tension for Joint Belts Unit: N

Belt Type	Belt width (mm)						
	10	15	20	25	30	40	50
S5M	60	90	—	150	—	—	—
S8M	—	117	—	196	235	313	—
T5	29	43	58	72	—	—	—
T10	—	90	120	150	180	240	300
AT5	37	55	—	—	—	—	—
AT10	117	156	195	—	—	—	—

Unit: N

Belt Type	Belt Nominal Width				
	050	075	100	150	200
L	46	69	92	138	—
H	—	81	108	162	216

Reference: Table on Open-end belts Allowable Tension Unit: N

Belt Type	Material	Belt width (mm)							
		6	10	15	20	25	30	40	50
S3M	Polyurethane	127	—	—	—	—	—	—	—
S5M	Rubber	—	310	490	—	—	—	—	—
	Polyurethane		215	323		539			
S8M	Rubber	—	—	—	—	950	—	—	—
	Polyurethane			647		1176	1412	1882	
T5	Polyurethane	—	112	166	225	284	—	—	—
T10	Polyurethane	—	—	299	397	529	627	862	1064
AT5	Polyurethane	—	147	221	—	—	—	—	—
AT10	Polyurethane	—	—	469	625	781	—	—	—

Unit: N

Belt Type	Material	Belt Nominal Width (mm)						
		025	037	050	075	100	150	200
XL	Rubber	—	45	70	—	—	—	—
	Polyurethane	66	102	142				
L	Rubber	—	—	95	165	—	—	—
	Polyurethane			259	387	519		
H	Rubber	—	—	—	—	600	—	—
	Polyurethane				397	529	799	1093

– When using belts for other purpose than conveyance (e.g. transmission), for polyurethane belt S3M; design with 1/2 of the allowable tension in the table; for XL, L, H, S5M, S8M, T5 and T10, design with approx. 2/3 of the allowable tension in the table.

Technical Data

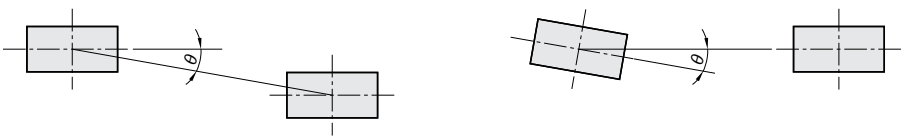
Synchronous Belt Reference Information

■ Early failures and countermeasures

Abnormal Phenomena	Cause	Measures
Abnormal Wear of Belt Side Faces	· Pulley misalignment · Pulley shafts misalignments · Bent pulley flanges	· Realign · Correct shaft misalignments · Correct bent pulley flanges
Tooth Contact Pressure Surface Abnormal Wear	· Overload · Belt tension too high, too low	· Redesign with a wide belt or use larger belt pitch · Adjust initial belt tension
Belt Abnormal Wear of Pulley Contacting Area	· Pulley tooth shape incorrect · Belt tension too high	· Adjust initial belt tension · Remake pulley taking note of tooth tip radius
Broken/Missing Tooth	· Pulley diameter too small · Small pulley meshing 6 teeth or less · Shock loading exists	· Redesign · Increase small pulley tooth mesh or redesign · Avoid shock loading on belt · Increase belt width
Severed Core Wire	· Overload · Core wire decreased elasticity or corrosion · Induction of foreign particels · Excessive temperature	· Redesign · Check belt storage and shipping history/condision · Avoid shocks · Provide a belt cover · Lower environment temperature
Cracks on Backing Rubber	· Usage in low temperature · Pulley diameter too small	· Raise environment temp. · Increase pulley diameter
Heat Degradation of Rubber	· Rubber degradation due to high enviroment temperature	· Lower environment temperature
Rubber Swelling	· Contact with oils · Contact with water	· Avoid oil from contacting · Avoid water from contacting
Abnormal Wear of Pulley Teeth	· Overload · Belt tension too high · Pulley material too soft	· Redesign · Adjust initial belt tension · Apply surface hardening treatment on pulley or change pulley material
Pulley Circumference Wear	· Pulley service life has been reached · Belt tension too high (core wire visible on belt back side)	· Replace with a new pulley · Replace with new pulley and belt, and use lower belt tension
Abnormal Sound	· Belt tension too high · Overload · Pulley diameter too small · Pulley tooth shape incorrect	· Realign · Adjust initial belt tension · Redesign · Correct pulley tooth geometry
Apparent Belt Stretch	· Shaft center distance too small · Loose machine base	· Adjust to correct shaft distance · Reinforce machine base

■ About Pulley Alignments

Misaligned pulleys may cause early belt failure and flange damages.
Align as show below



•MXL/XL/L/H/S_M/MTS_M/T Series

Belt Width (mm)	10	20	30≦
tanθ	5/1000	3/1000	2/1000

•P_M/UP_M

Belt Width (mm)	≦30
tanθ	5/1000

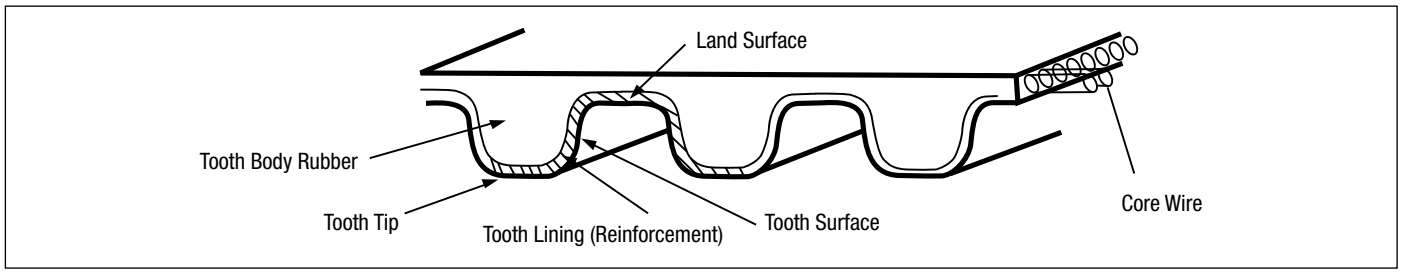
•_GT/EV5GT/EV8YU

Belt Width (mm)	≦20	20＜40
tanθ	6/1000	3/1000

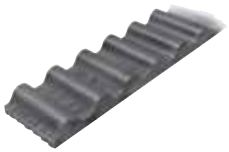
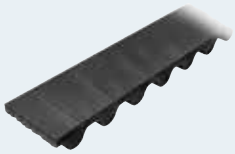
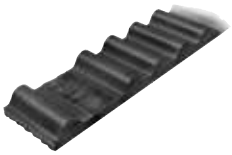
Technical Data

Synchronous Belt Replacement Indicators

■ Belt Structure



■ Examples of Belt Replacement Indicators

Examples	Condition
1. When belt tooth reinforcement fabric is worn and rubber/core wire are exposed. When tooth surface/grooves are worn and rubber/core wire are exposed	
2. When the backing rubber shows cracks due to hardening	
3. When cracks reaching the rubber are seen at tooth base	
4. Belt side faces are damaged due to wear	
5. When missing tooth can be seen	
6. When excessive wear can be seen on belt back side	
7. When belt or core wire are broken	

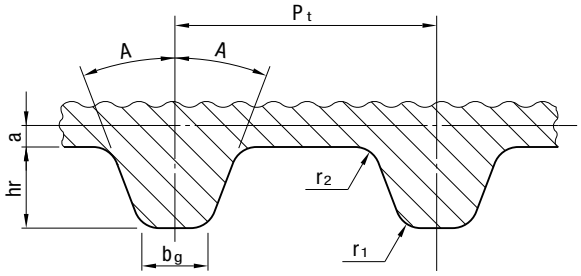
• These are timing belt replacement guides. Early or periodical replacements are recommended even the signs shown above are not yet visible.

Technical Data

Excerpts from JIS B 1856(1993)

Pulley/Tooth Tolerance

1. Dimensions of the Rack for the Cutter and the Tolerances



The pulley should have involute teeth, which are created and shaped by the cutter. The dimensions of the rack for the cutter and the tolerances as determined by analyzing the shape of the rack with a projector, shape measuring instrument or the like, should be agree with the relevant figures in the table below.

Unit: mm

Type	Number of Teeth of the Pulley Z	Pt	A ±0.12	hr +0.05 0	bg +0.05 0	r1 ±0.03	r2 ±0.03	2a(1) (Reference)
MXL	10 ≤ Z ≤ 23 24 ≤ Z	2.032 ± 0.008	28° 20°	0.64	0.61 0.67	0.30	0.23	0.508
XL	10 ≤ Z	5.080 ± 0.010	25°	1.40	1.27	0.61	0.61	0.508
L	10 ≤ Z	9.525 ± 0.012	20°	2.13	3.10	0.86	0.53	0.762
H	14 ≤ Z ≤ 19 20 ≤ Z	12.700 ± 0.016	20°	2.59	4.24	1.47	1.04 1.42	1.372

Note (1): a is a measurement indicating the position corresponding to the pitch line (Centerline of the Core Line of the Belt) of the belt corresponding to the shape of the rack for the cutter.

2. Tolerance of Adjacent Pitch Error and Cumulative Pitch Error

Unit: mm

Addendum Circle Diameter of Pulley d0	Allowable Value	
	Tolerance of Adjacent Pitch Error	Accumulated Pitch Error
5.96 ≤ do ≤ 25.40	0.03	0.05
25.40 < do ≤ 50.80	0.03	0.08
50.80 < do ≤ 101.60	0.03	0.10
101.60 < do ≤ 177.80	0.05	0.13
177.80 < do ≤ 304.80	0.05	0.15
304.80 < do ≤ 508.00	0.08	0.18
508.00 < do ≤ 762.00	0.08	0.20
762.00 < do ≤ 967.16	0.08	0.23

3. Tolerance of Side Deflection

Unit: mm

Addendum Circle Diameter of Pulley d0	Tolerance of Deflection (TIR)(2)
5.96 ≤ do ≤ 101.60	0.10
101.60 < do ≤ 254.00	Addendum Circle Dia. do×0.001
254.00 < do ≤ 967.16	0.25+[(Addendum Circle Dia. d0-254.00)×0.0005]

Note (2): TIR is an abbreviation for Total Indicator Reading and refers to the difference between the max. deflection reading and the min. deflection reading.

4. Tolerances of Addendum Circle Diameter

Unit: mm

Addendum Circle Diameter of Pulley d0	Tolerance
5.96 ≤ do ≤ 25.40	+0.05 0
25.40 < do ≤ 50.80	+0.08 0
50.80 < do ≤ 101.60	+0.10 0
101.60 < do ≤ 177.80	+0.13 0
177.80 < do ≤ 304.80	+0.15 0
304.80 < do ≤ 508.00	+0.18 0
508.00 < do ≤ 762.00	+0.20 0
762.00 < do ≤ 967.16	+0.23 0

5. Tolerance of Circumferential Deflection of Addendum Circle

Unit: mm

Addendum Circle Diameter of Pulley d0	Tolerance of Circumferential Deflection
5.96 ≤ do ≤ 203.20	0.13
203.20 < do ≤ 967.16	0.13 + [(Addendum Circle Dia. d0-203.20) × 0.0005]

6. Tolerance of Cylindricity and Parallelism

Unit: mm

Nominal Widths of Pulley	Cylindricity Tolerance	Parallelism Tolerance
025~050	0.01	0.03
075~150	0.02	
200 · 300	0.04	0.04
400 · 500	0.06	0.05

Technical Data

Excerpts from JIS B 0405, 0419(1991)

Regular Machining Dimension Tolerance

1. Regular Cut Dimension Tolerance B 0405-1991-

Tolerances in Respect of Length Excluding Chamfered Portion

Typically, unless otherwise specified, Misumi uses "medium" tolerance for all machined features. Please, verify the tolerance with Misumi technical team at engineering@misumiusa.com

Unit: mm

Tolerance Class		Classification of Reference Dimension							
Symbol	Description	0.5 (1) or More 3 or Less	More than 3 6 or Less	More than 6 30 or Less	More than 30 120 or Less	More than 120 400 or Less	More than 400 1000 or Less	More than 1000 2000 or Less	More than 2000 4000 or Less
		Tolerance							
f	Precision Grade	±0.05	±0.05	±0.1	±0.15	±0.2	±0.3	±0.5	—
m	Medium	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2
c	Coarse	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	±4
v	Extremely Coarse	—	±0.5	±1	±1.5	±2.5	±4	±6	±8

Note (1): A reference dimension less than 0.5 mm is followed by a tolerance.

2. Tolerances in Respect of the Length of the Chamfered Portion (Radius of rounding for edges and edge chamfering dimension)

Unit: mm

Tolerance Class		Classification of Reference Dimension		
Symbol	Description	0.5 (2) or More 3 or Less	More than 3 6 or Less	More than 6
		Tolerance		
f	Precision Grade	±0.2	±0.5	±1
m	Medium			
c	Coarse	±0.4	±1	±2
v	Extremely Coarse			

Note (2): A reference dimension less than 0.5 mm is followed by a tolerance.

3. Angle Tolerance

Tolerance Class		Length of Shorter Side (Unit: mm)				
Symbol	Description	10 or Less	More than 10 50 or Less	More than 50 120 or Less	More than 120 400 or Less	More than 400
		Tolerance				
f	Precision Grade	±1°	±30'	±20'	±10'	±5'
m	Medium					
c	Coarse	±1° 30'	±1°	±30'	±15'	±10'
v	Extremely Coarse	±3°	±2°	±1°	±30'	±20'

4. Regular Perpendicularity Tolerance B 0419-1991-

Unit: mm

Tolerance Class	Nominal Length of Shorter Side			
	100 or Less	More than 100 300 or Less	More than 300 1000 or Less	More than 1000 3000 or Less
	Perpendicularity Tolerance			
H	0.2	0.3	0.4	0.5
K	0.4	0.6	0.8	1
L	0.6	1	1.5	2

5. Regular Straightness and Flatness Tolerance

Unit: mm

Tolerance Class	Nominal Length					
	10 or Less	More than 10 30 or Less	More than 30 100 or Less	More than 100 300 or Less	More than 300 1000 or Less	More than 1000 3000 or Less
	Regular Straightness and Flatness Tolerance					
H	0.02	0.05	0.1	0.2	0.3	0.4
K	0.05	0.1	0.2	0.4	0.6	0.8
L	0.1	0.2	0.4	0.8	1.2	1.6

6.Regular Symmetry Tolerance

Unit: mm

Tolerance Class	Nominal Length			
	100 or Less	More than 100 300 or Less	More than 300 1000 or Less	More than 1000
	Symmetry Tolerance			
H	0.5			
K	0.6		0.8	1
L	0.6	1	1.5	2

Technical Data

Basis of Fitting Selection/Dimensional Tolerances and Fitting

		H6	H7	H8	H9	Applicable Part	Functional Classification		Application Example
Can be Moved Relatively	Clearance Fit – Loose Fit				c9	Part which accommodates a wide gap or moving part which needs a gap. Part which accommodates a wide gap to facilitate assembling. Part which needs an appropriate gap even at a high temperature.	Part whose structure needs a gap. Inflates. Large position error Fitting length is long. Cost needs to be reduced. Manufacturing Cost Maintenance Cost		Piston Ring and the Ring Groove Fitting by means of a loose set pin.
	Clearance Fit – Light Roll Fit			d9	d9	Part which accommodates or needs a gap.			Crank Web and Pin Bearing (Side) Exhaust Valve Box and the Sliding Part of a Spring Bearing Piston Ring and the Ring Groove
	Clearance Fit – Light Roll Fit		e7	e8	e9	Part which accommodates a wide gap or needs a gap. Fairly wide gap, well greased bearing. Bearing subjected to a high temperature, high speed and heavy load (high-degree forced lubrication).	Regular Rotary or Sliding Part (Must be well greased.)		Fitting of the Exhaust Valve Box Main Bearing for the Crank Shaft Regular Sliding Part
	Clearance Fit – Roll Fit	f6	f7	f7 f8		Fitting so as to provide an appropriate gap to permit movement (high-quality fitting). Regular normal temperature bearing lubricated with grease or oil.	Regular Fitting (Often comes apart.)		Part in which a cooled exhaust valve box is inserted. Regular Shaft and Bushing Link Device Lever and Bushing
	Clearance Fit – Fine Roll Fit	g5	g6			Continuously revolving part of a precision machine under a light load. Fitting with a narrow gap so as to permit movement (spigot and positioning). Precision sliding part.	Part required to make a precision motion with virtually no play.		Link Device Pin and Lever Key and its Groove Precision Control Valve Rod
Cannot be Moved Relatively	Transition Fit – Sliding Fit	h5	h6	h7 h8	h9	Fitting so as to permit movement by hand, with a lubricant applied. (high-quality positioning) Special High Precision Sliding Part Unimportant Stationary Part	Can be disassembled, reassembled without damaging component parts.	Force cannot be transmitted by the fitting force alone.	Fitting a rim and a boss together Fitting the gear of a precision gear device
	Transition Fit – Push Fit	h5 h6	js6			Fitting which accommodates a light gap. Precision fitting which locks both parts while the unit is used. Fitting which allows assembling and disassembling with a wooden or lead hammer.			Fitting Coupling Flanges Together Governor Path and Pin Fitting a Gear Rim and a Boss Together
	Transition Fit – Driving Fit	js5	k6			Fitting which requires an iron hammer or hand press for assembling, disassembling (a key or the like is necessary to prevent inter-part shaft rotation). Precision positioning.			Fixing the Shaft of a Gear Pump and a Casing Together Reamer Bolts
	Transition Fit – Driving Fit	k5	m6			Same as the above for assembling and disassembling. Precision positioning which allows no gap.			Reamer Bolts Fixing the piston of hydraulic equipment and a shaft together Fitting a Coupling Flange and a Shaft Together
	Transition Fit – Light Press Fit	m5	n6			Fitting which requires considerable force for assembling, disassembling. Precision stationary fitting (a key or the like is necessary for high torque transmission purposes)		Slight force can be transmitted by the fitting force alone.	Shaft of a Flexible Coupling and Gear (Passive Side) Precision Fitting Insertion of a Suction Valve and Valve Guide
	Interference Fit – Press Fit	n5 n6	p6			Fitting which requires much force for assembling, disassembling (a key or the like is necessary for high torque transmission). Light press fitting or the like is necessary for non-ferrous component parts. Standard press fitting is required for iron component parts and a bronze part and a copper part.	Hard to disassemble without damaging component parts.		Insertion of a Suction Valve and Valve Guide Fixing a Gear and a Shaft Together (Low Torque) Shaft of a Flexible Coupling and a Gear (Drive Side)
	Interference Fit – Press Fit	p5	r6			Same as the above for assembling and disassembling. Shrinkage press fitting, cold press fitting or forced press fitting is required for large component parts.			Coupling and Shaft
	Interference Fit – Strong Press Fit, Shrinkage Fit, Freeze Fit	r5	s6 t6 u6 x6			Firmly coupled together and requires shrinkage press fitting, cold press fitting or forced press fitting. Permanent assembly, which can not come apart. Press fitting or the like is required for light alloy members.		Considerable force can be transmitted by the fitting force alone.	Attaching and Fixing a Bearing Bushing Insertion of a Suction Valve and Valve Box Fixing a Coupling Flange and a Shaft Together (High Torque) Fixing the Rim of a Drive Gear and a Boss Together Attaching and Fixing a Bearing Bushing

1.1 Fitting, with Regularly Used Hole Adopted as Reference

Reference Shaft	Class of Tolerance Range for Shafts																		
	Clearance Fit							Transition Fit			Interference Fit								
H6						g5	h5	js5	k5	m5									
					f6	g6	h6	js6	k6	m6	n6*	p6*							
H7					f6	g6	h6	js6	k6	m6	n6	p6*	r6*	s6	t6	u6	x6		
				e7	f7		h7	js7											
H8					f7		h7												
				e8	f8		h8												
			d9	e9															
H9			d8	e8			h8												
		c9	d9	e9			h9												
H10	b9	c9	d9																

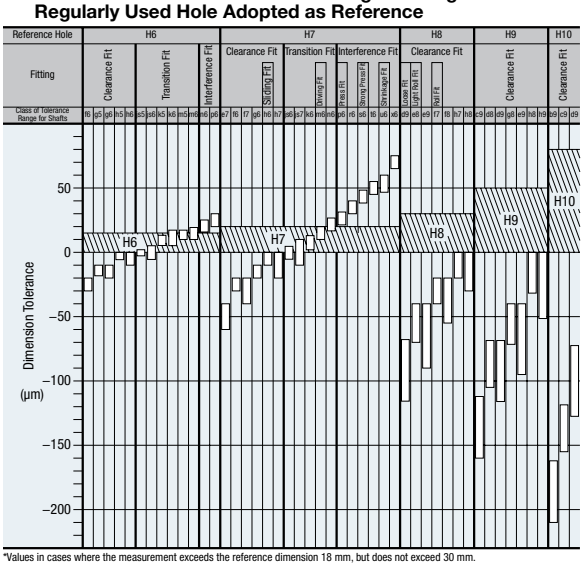
[Note]*An exception may arise according to the dimensional sectioning scheme.

2.1 Fitting, with Regularly Used Shaft Adopted as Reference

Reference Shaft	Class of Tolerance Range for Holes																		
	Clearance Fit							Transition Fit			Interference Fit								
h5							H6	JS6	K6	M6	N6*	P6							
h6					F6	G6	H6	JS6	K6	M6	N6	P6*							
					F7	G7	H7	JS7	K7	M7	N7	P7*	R7	S7	T7	U7	X7		
h7				E7	F7		H7												
					F8		H8												
h8			D8	E8	F8		H8												
			D9	E9			H9												
h9			D8	E8			H8												
		C9	D9	E9			H9												
	B10	C10	D10																

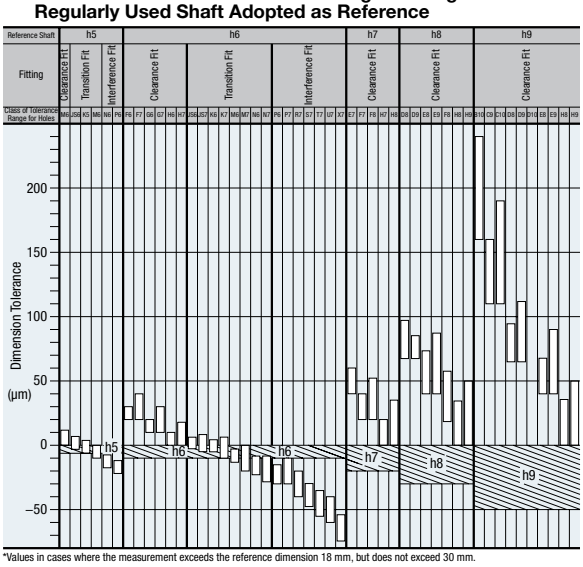
[Note]*An exception may arise according to the dimensional sectioning scheme.

1.2 Interrelation between Tolerance Ranges-Fitting with Regularly Used Hole Adopted as Reference



*Values in cases where the measurement exceeds the reference dimension 18 mm, but does not exceed 30 mm.

2.2 Interrelation between Tolerance Ranges-Fitting with Regularly Used Shaft Adopted as Reference



*Values in cases where the measurement exceeds the reference dimension 18 mm, but does not exceed 30 mm.

Technical Data

Excerpts from JIS B 0401 (1999)

Dimension Tolerance for Regularly Used Fitting

Dimension Tolerance of Shaft, Regularly Used Fitting

Reference Dimension (mm)		Class of Tolerance Range for Shafts																												Unit μm	
More than	or Less	b9	c9	d8	d9	e7	e8	e9	f6	f7	f8	g5	g6	h5	h6	h7	h8	h9	js5	js6	js7	k5	k6	m5	m6	n5*	n6	p6	r6	s6	t6	u6	x6
—	3	−140 −165	−60 −85	−20 −34	−20 −45	−14 −24	−14 −28	−14 −39	−6 −12	−6 −16	−6 −20	−2 −6	−2 −8	0 −4	0 −6	0 −10	0 −14	0 −25	±2	±3	±5	+4 0	+6 0	+6 +2	+8 +2	+8 +4	+10 +4	+12 +6	+16 +10	+20 +14	—	+24 +18	+26 +20
3	6	−140 −170	−70 −100	−30 −48	−30 −60	−20 −32	−20 −38	−20 −50	−10 −18	−10 −22	−10 −28	−4 −9	−4 −12	0 −5	0 −8	0 −12	0 −18	0 −30	±2.5	±4	±6	+6 +1	+9 +1	+9 +4	+12 +4	+13 +8	+16 +8	+20 +12	+23 +15	+27 +19	—	+31 +23	+36 +28
6	10	−150 −186	−80 −116	−40 −62	−40 −76	−25 −40	−25 −47	−25 −61	−13 −22	−13 −28	−13 −35	−5 −11	−5 −14	0 −6	0 −9	0 −15	0 −22	0 −36	±3	±4.5	±7.5	+7 +1	+10 +1	+12 +6	+15 +6	+16 +10	+19 +10	+24 +15	+28 +19	+32 +23	—	+37 +28	+43 +34
10	14	−150	−95	−50	−50	−32	−32	−32	−16	−16	−16	−6	−6	0	0	0	0	0	±4	±5.5	±9	+9	+12	+15	+18	+20	+23	+29	+34	+39	—	+44	+51 +40
14	18	−193	−138	−77	−93	−50	−59	−75	−27	−34	−43	−14	−17	−8	−11	−18	−27	−43				+1	+1	+7	+7	+12	+12	+18	+23	+28	—	+33	+56 +45
18	24	−160	−110	−65	−65	−40	−40	−40	−20	−20	−20	−7	−7	0	0	0	0	0	±4.5	±6.5	±10.5	+11	+15	+17	+21	+24	+28	+35	+41	+48	—	+54 +41	+67 +54
24	30	−212	−162	−98	−117	−61	−73	−92	−33	−41	−53	−16	−20	−9	−13	−21	−33	−52				+2	+2	+8	+8	+15	+15	+22	+28	+35	+54	+61 +41	+77 +64
30	40	−170	−120																												+64	+76	
40	50	−180 −242	−130 −192	−119	−142	−75	−89	−112	−41	−50	−64	−20	−25	−11	−16	−25	−39	−62	±5.5	±8	±12.5	+13 +2	+18 +2	+20 +9	+25 +9	+28 +17	+33 +17	+42 +26	+50 +34	+59 +43	+48 +70 +54	+60 +86 +70	—
50	65	−190 −264	−140 −214	−100	−100	−60	−60	−60	−30	−30	−30	−10	−10	0	0	0	0	0	±6.5	±9.5	±15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +41 +62	+72 +53 +78	+85 +66 +94	+106 +87 +121	—
65	80	−200 −274	−150 −224	−146	−174	−90	−106	−134	−49	−60	−76	−23	−29	−13	−19	−30	−46	−74											+43	+59	+75	+102	
80	100	−220 −307	−170 −257	−120	−120	−72	−72	−72	−36	−36	−36	−12	−12	0	0	0	0	0	±7.5	±11	±17.5	+18	+25	+28	+35	+38	+45	+59	+73 +51	+93 +71	+113 +91	+146 +124	—
100	120	−240 −327	−180 −267	−174	−207	−107	−126	−159	−58	−71	−90	−27	−34	−15	−22	−35	−54	−87				+3	+3	+13	+13	+23	+23	+37	+76 +54	+101 +79	+126 +104	+166 +144	
120	140	−260 −360	−200 −300																										+88 +63	+117 +92	+147 +122		
140	160	−280 −380	−210 −310	−145 −208	−145 −245	−85 −125	−85 −148	−85 −185	−43 −68	−43 −83	−43 −106	−14 −32	−14 −39	0 −18	0 −25	0 −40	0 −63	0 −100	±9	±12.5	±20	+21 +3	+28 +3	+33 +15	+40 +15	—	+52 +27	+68 +43	+90 +65	+125 +100	+159 +134	—	—
160	180	−310 −410	−230 −330																										+93 +68	+133 +108	+171 +146		
180	200	−340 −455	−240 −355																										+106 +77	+151 +122			
200	225	−380 −495	−260 −375	−170 −242	−170 −285	−100 −146	−100 −172	−100 −215	−50 −79	−50 −96	−50 −122	−15 −35	−15 −44	0 −20	0 −29	0 −46	0 −72	0 −115	±10	±14.5	±23	+24 +4	+33 +4	+37 +17	+46 +17	—	+60 +31	+79 +50	+109 +80	+159 +130	—	—	—
225	250	−420 −535	−280 −395																										+113 +84	+169 +140			
250	280	−480 −610	−300 −430	−190	−190	−110	−110	−110	−56	−56	−56	−17	−17	0	0	0	0	0	±11.5	±16	±26	+27 +4	+36 +4	+43 +20	+52 +20	—	+66 +34	+88 +56	+126 +94	—	—	—	—
280	315	−540 −670	−330 −460	−271	−320	−162	−191	−240	−88	−108	−137	−40	−49	−23	−32	−52	−81	−130											+130 +98				
315	355	−600 −740	−360 −500	−210	−210	−125	−125	−125	−62	−62	−62	−18	−18	0	0	0	0	0	±12.5	±18	±28.5	+29 +4	+40 +4	+46 +21	+57 +21	—	+73 +37	+98 +62	+144 +108	—	—	—	—
355	400	−680 −820	−400 −540	−299	−350	−182	−214	−265	−98	−119	−151	−43	−54	−25	−36	−57	−89	−140											+150 +114				
400	450	−760 −915	−440 −595	−230	−230	−135	−135	−135	−68	−68	−68	−20	−20	0	0	0	0	0	±13.5	±20	±31.5	+32 +5	+45 +5	+50 +23	+63 +23	—	+80 +40	+108 +68	+166 +126	—	—	—	—
450	500	−840 −995	−480 −635	−327	−385	−198	−232	−290	−108	−131	−165	−47	−60	−27	−40	−63	−97	−155											+172 +132				

Dimension Tolerance of Hole, Regularly Used Fitting

Reference Dimension (mm)		Class of Tolerance Range for Holes																												Unit μm	
More than	or Less	B10	C9	C10	D8	D9	D10	E7	E8	E9	F6	F7	F8	G6	G7	H6	H7	H8	H9	H10	JS6	JS7	K6	K7	M6	M7	N6	N7	P6	P7	R7	S7	T7	U7	X7
—	3	+180 +140	+85 +60	+100 +60	+34 +20	+45 +20	+60 +20	+24 +14	+28 +14	+39 +14	+12 +6	+16 +6	+20 +6	+8 +2	+12 +2	+6 0	+10 0	+14 0	+25 0	+40 0	±3	±5	0 −6	0 −10	−2 −8	−2 −12	−4 −10	−4 −14	−6 −12	−6 −16	−10 −20	−14 −24	—	−18 −28	−20 −30
3	6	+188 +140	+100 +70	+118 +70	+48 +30	+60 +30	+78 +30	+32 +20	+38 +20	+50 +20	+18 +10	+22 +10	+28 +10	+12 +4	+16 +4	+8 0	+12 0	+18 0	+30 0	+48 0	±4	±6	+2 −6	+3 −9	−1 −9	0 −12	−5 −13	−4 −16	−9 −17	−8 −20	−11 −23	−15 −27	—	−19 −31	−24 −36
6	10	+208 +150	+116 +80	+138 +80	+62 +40	+76 +40	+98 +40	+40 +25	+47 +25	+61 +25	+22 +13	+28 +13	+35 +13	+14 +5	+20 +5	+9 0	+15 0	+22 0	+36 0	+58 0	±4.5	±7.5	+2 −7	+5 −10	−3 −12	0 −15	−7 −16	−4 −19	−12 −21	−9 −24	−13 −28	−17 −32	—	−22 −37	−28 −43
10	14	+220	+138	+165	+77	+93	+120	+50	+59	+75	+27	+34	+43	+17	+24	+11	+18	+27	+43	+70	±5.5	±9	+2	+6	−4	0	−9	−5	−15	−11	−16	−21	—	−26	−33 −51
14	18	+150	+95	+95	+50	+50	+50	+32	+32	+32	+16	+16	+16	+6	+6	0	0	0	0	0			−9	−12	−15	−18	−20	−23	−26	−29	−34	−39		−44	−38 −56
18	24	+244	+162	+194	+98	+117	+149	+61	+73	+92	+33	+41	+53	+20	+28	+13	+21	+33	+52	+84	±6.5	±10.5	+2	+6	−4	0	−11	−7	−18	−14	−20	−27	—	−33	−46
24	30	+160	+110	+110	+65	+65	+65	+40	+40	+40	+20	+20	+20	+7	+7	0	0	0	0	0			−11	−15	−17	−21	−24	−28	−31	−35	−41	−48	−33 −54	−40 −61	−56 −77
30	40	+270	+182	+220																													−39	−51	
40	50	+170 +280 +180	+120 +192 +130	+120 +230 +130	+119 +80	+142 +80	+180 +80	+75 +50	+89 +50	+112 +50	+41 +25	+50 +25	+64 +25	+25 +9	+34 +9	+16 0	+25 0	+39 0	+62 0	+100 0	±8	±12.5	+3 −13	+7 −18	−4 −20	0 −25	−12 −28	−8 −33	−21 −37	−17 −42	−25 −50	−34 −59	−64 −45 −70	−76 −61 −86	—
50	65	+310	+214	+260																											−30	−42	−55	−76	
65	80	+190 +320 +200	+140 +224 +150	+140 +270 +150	+146 +100	+174 +100	+220 +100	+90 +60	+106 +60	+134 +60	+49 +30	+60 +30	+76 +30	+29 +10	+40 +10	+19 0	+30 0	+46 0	+74 0	+120 0	±9.5	±15	+4 −15	+9 −21	−5 −24	0 −30	−14 −33	−9 −39	−26 −45	−21 −51	−60 −32 −62	−72 −48 −78	−85 −64 −94	−106 −91 −121	—
80	100	+360	+257	+310																											−38	−58	−78	−111	
100	120	+220 +380 +240	+170 +267 +180	+170 +320 +180	+174 +120	+207 +120	+260 +120	+107 +72	+126 +72	+159 +72	+58 +36	+71 +36	+90 +36	+34 +12	+47 +12	+22 0	+35 0	+54 0	+87 0	+140 0	±11	±17.5	+4 −18	+10 −25	−6 −28	0 −35	−16 −38	−10 −45	−30 −52	−24 −59	−73 −41 −76	−93 −66 −101	−113 −91 −126	−146 −131 −166	—
120	140	+420	+300	+360																											−48	−77	−107		
140	160	+260 +440 +280	+200 +310 +210	+200 +370 +210	+208 +145	+245 +145	+305 +145	+125 +85	+148 +85	+185 +85	+68 +43	+83 +43	+106 +43	+39 +14	+54 +14	+25 0	+40 0	+63 0	+100 0	+160 0	±12.5	±20	+4 −21	+12 −28	−8 −33	0 −40	−20 −45	−12 −52	−36 −61	−28 −68	−88 −50 −90	−117 −85 −125	−147 −119 −159	—	—
160	180	+470 +310	+330 +230	+390 +230																											−53 −93	−93 −133	−131 −171		
180	200	+525 +340	+355 +240	+425 +240																											−60 −106	−105 −151			
200	225	+565 +380 +605	+375 +260 +395	+445 +260 +465	+242 +170	+285 +170	+355 +170	+146 +100	+172 +100	+215 +100	+79 +50	+96 +50	+122 +50	+44 +15	+61 +15	+29 0	+46 0	+72 0	+115 0	+185 0	±14.5	±23	+5 −24	+13 −33	−8 −37	0 −46	−22 −51	−14 −60	−41 −70	−33 −79	−63 −109 −67	−113 −159 −123	—	—	—
225	250	+420	+280	+280																											−113	−169			
250	280	+690 +480	+430 +300	+510 +300	+271	+320	+400	+162	+191	+240	+88	+108	+137	+49	+69	+32	+52	+81	+130	+210	±16	±26	+5	+16	−9	0	−25	−14	−47	−36	−74 −126		—	—	—
280	315	+750 +540	+460 +330	+540 +330	+190	+190	+190	+110	+110	+110	+56	+56	+56	+17	+17	0	0	0	0	0			−27	−36	−41	−52	−57	−66	−79	−88	−78 −130				
315	355	+830 +600	+500 +360	+590 +360	+299	+350	+440	+182	+214	+265	+98	+119	+151	+54	+75	+36	+57	+89	+140	+230	±18	±28.5	+7	+17	−10	0	−26	−16	−51	−41	−87 −144		—	—	—
355	400	+910 +680	+540 +400	+630 +400	+210	+210	+210	+125	+125	+125	+62	+62	+62	+18	+18	0	0	0	0	0			−29	−40	−46	−57	−62	−73	−87	−98	−93 −150				
400	450	+1010 +760	+595 +440	+690 +440	+327	+385	+480	+198	+232	+290	+108	+131	+165	+60	+83	+40	+63	+97	+155	+250	±20	±31.5	+8	+18	−10	0	−27	−17	−55	−45	−103 −166		—	—	—
450	500	+1090 +840	+635 +480	+730 +480	+230	+230	+230	+135	+135	+135	+68	+68	+68	+20	+20	0	0	0	0	0			−32	−45	−50	−63	−67	−80	−95	−108	−109 −172				

Reference: In each column, the upper value is the upper dimensional tolerance, and the lower figure is the lower one. [Note]*:n5 is the previous version of JIS. Presented here because many MISUMI products conform to this version.

Technical Data

Surface Roughness

JIS B 0601(1994)
Excerpts from JIS B 0031(1994)

1. Varieties of Surface Roughness Indicators

Definitions and presentations of arithmetic average roughness(Ra), maximum height(Ry), 10 spot average roughness(Rz), average concave to convex distance(Sm), average distance between local peaks S and load length rate tp are given as parameters indicating the surface roughness of an industrial product. Surface roughness is the arithmetical average of values at randomly extracted spots on the surface of an object.

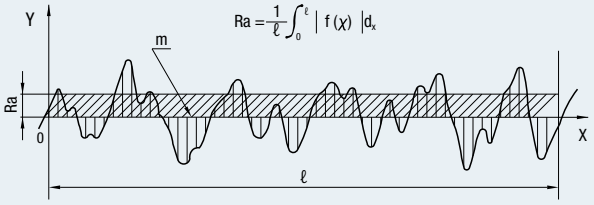
[Centerline average roughness(Ra75)is defined in the supplements to JIS B 0031 and JIS B 0601.]

Typical calculations of surface roughness

Arithmetic Average Roughness Ra

A portion stretching over a reference length in the direction in which the average line extends is cut out from the roughness curve. This portion is presented in a new graph with the X axis extending in the same direction as the average line and the Y axis representing the magnitude. Ra is represented by the equation shown at right, in microns(μm).

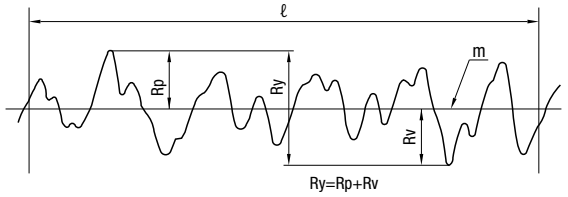
$$Ra = \frac{1}{\ell}\int_0^{\ell} |f(x)|\,dx$$



Maximum Height Ry

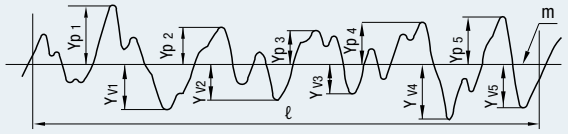
A portion stretching over a reference length in the direction in which the average line extends is cut out from the roughness curve. The gap between the peak line and the trough line is measured in the direction in which the magnitude axis extends, in microns(μm).

Reference A portion without an abnormally high peak or abnormally low trough, which may be regarded as a flaw, is cut out over the reference length.



Ten-spot Average Roughness Rz

A portion stretching over a reference length in the direction in which the average line extends is cut out from the roughness curve. The average of the levels(Yp)of the highest peak to the fifth highest peak as measured from the average line and the average of the levels(Yp)of the lowest trough to the fifth lowest trough similarly measured in the said portion are added together. Rz is this sum, in microns(μm).



$$Rz = \frac{|Yp_1 + Yp_2 + Yp_3 + Yp_4 + Yp_5| + |Yv_1 + Yv_2 + Yv_3 + Yv_4 + Yv_5|}{5}$$

$Yp_1, Yp_2, Yp_3, Yp_4, Yp_5$: Levels of the highest peak to the fifth highest peak in the said portion with the reference length ℓ.

$Yv_1, Yv_2, Yv_3, Yv_4, Yv_5$: Levels of the lowest trough to the fifth lowest trough in the said portion with the reference length ℓ.

Reference Relation between Arithmetic Average Roughness (Ra) and Conventional Parameters

Arithmetic Average Roughness Ra			Maximum Height Ry	Ten-spot Average Roughness Rz	Reference Length of Ry (Rz) ℓ (mm)	Conventional Finish Symbol
Standard Series	Cut-off Value c (mm)	Graphical Representation of Surface Texture	Standard Series			
0.012 a 0.025 a 0.05 a 0.1 a 0.2 a	0.08 0.25 0.8	0.012 ~ 0.2	0.05 s 0.1 s 0.2 s 0.4 s 0.8 s	0.05 z 0.1 z 0.2 z 0.4 z 0.8 z	0.08 0.25	
0.4 a 0.8 a 1.6 a		0.4 ~ 1.6	1.6 s 3.2 s 6.3 s	1.6 z 3.2 z 6.3 z	0.8	
3.2 a 6.3 a	2.5	3.2 ~ 6.3	12.5 s 25 s	12.5 z 25 z	2.5	
12.5 a 25 a	8	12.5 ~ 25	50 s 100 s	50 z 100 z	8	
50 a 100 a	—	50 ~ 100	200 s 400 s	200 z 400 z	—	~

*Interrelations among the three types shown here are not precise, and are presented for convenience only.
*Ra:The evaluation values of Ry and Rz are the cut-off value and the reference length each multiplied by five, respectively.

Technical Data

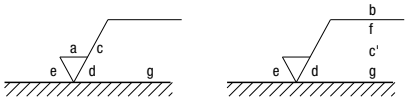
Excerpts from JISB0031(1994)

Drawing Indications of Surface Texture

1. Positions of Auxiliary Symbols for Surface Symbol

A surface roughness value, cut-off value or reference length, machining method, grain direction, surface undulation, etc. are indicated around the surface symbol as shown in Fig. 1 below.

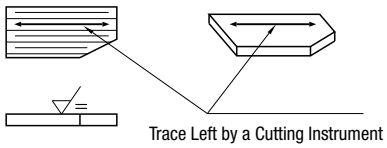
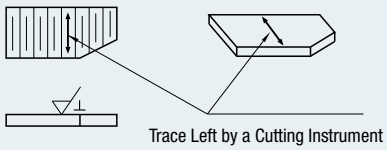
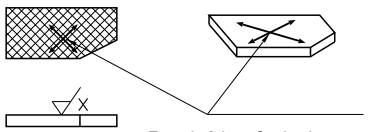
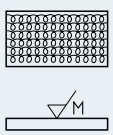
Fig. 1 Positions of Auxiliary Symbols



a : Ra Value
b : Machining Method
c : Cut-Off Value, Evaluation Length
c' : Reference Length, Evaluation Length
d : Grain Direction
f : Parameter other than Ra(tp:Parameter/Cut-Off Level)
g : Surface Undulation(JIS B 0610)

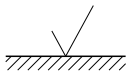
Reference These symbols except a and f are provided when they are needed.

Reference Under ISO 1302, a finish range should be indicated as e in Fig. 1.

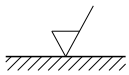
Code	Meaning	Illustration
=	The trace left by a cutting instrument is parallel to the projection plane in the drawing. Ex. Shaped Surface	 Trace Left by a Cutting Instrument
⊥	The trace left by a cutting instrument is perpendicular to the projection plane in the drawing. Ex. Shaped Surface(Side View) Circular Cut, Cylindrical Cut	 Trace Left by a Cutting Instrument
X	The pattern left by a cutting instrument diagonally crosses the projection plane in the drawing. Ex. Honed Surface	 Trace Left by a Cutting Instrument
M	The pattern left by a cutting instrument crosses in various directions or has no grain direction. Ex. Lapped Surface, Superfinished Surface and Surface Finished with a Front Mill or End Mill	
C	The pattern left by a cutting instrument is virtually concentric around the center of the plane in the drawing. Ex. Faced Surface	
R	The pattern left by a cutting instrument is virtually radial around the center of the plane in the drawing.	

■ Examples of Graphical Representation of Surface Texture

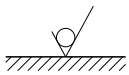
Surface Symbol



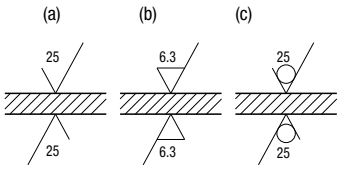
Removal of Material by Machining is required



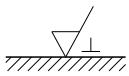
Removal of Material is Prohibited



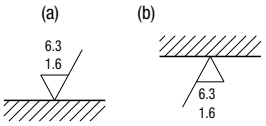
Upper Limit of Ra



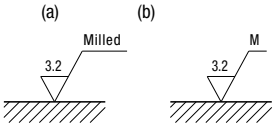
Grain Direction



Upper and Lower Limits of Ra



Machining Method



Technical Data

(SAEJ417) *Revised in 1983

Hardness Conversion Table

Approximate Conversion of Rockwell C Hardness Values for Steel[1]

(HRC) Rockwell C-Scale Hardness	(HV) Vickers Hardness	Brinell Hardness (HB) 10mm Ball, Load 3000kgf		Rockwell Hardness[3]			Rockwell Superficial Hardness Diamond Cone Indenter			(Hs)	Tensile Strength (Approximated Value) Mpa (kgf/mm²)[2]	Rockwell C-Scale Hardness[3]
		Standard Sphere	Tungsten Carbide Sphere	(HRA) A Scale, Load 60kgf, Diamond Cone Indenter	(HRB) B Scale, Load100kgf, Diameter 1.6mm (1/16in) Sphere	(HRD) D Scale, Load 100kgf, Diamond Cone Indenter	15-N Scale Load 15kgf	30-N Scale Load 30kgf	45-N Scale Load 45kgf	Shore Hardness		
68	940	—	—	85.6	—	76.9	93.2	84.4	75.4	97	—	68
67	900	—	—	85.0	—	76.1	92.9	83.6	74.2	95	—	67
66	865	—	—	84.5	—	75.4	92.5	82.8	73.3	92	—	66
65	832	—	(739)	83.9	—	74.5	92.2	81.9	72.0	91	—	65
64	800	—	(722)	83.4	—	73.8	91.8	81.1	71.0	88	—	64
63	772	—	(705)	82.8	—	73.0	91.4	80.1	69 9	87	—	63
62	746	—	(688)	82.3	—	72.2	91.1	79.3	68.8	85	—	62
61	720	—	(670)	81.8	—	71.5	90.7	78.4	67.7	83	—	61
60	697	—	(654)	81.2	—	70.7	90.2	77.5	66.6	81	—	60
59	674	—	(634)	80.7	—	69.9	89.8	76.6	65.5	80	—	59
58	653	—	615	80.1	—	69.2	89.3	75.7	64.3	78	—	58
57	633	—	595	79.6	—	68.5	88.9	74.8	63.2	76	—	57
56	613	—	577	79.0	—	67.7	88.3	73.9	62.0	75	—	56
55	595	—	560	78.5	—	66.9	87.9	73.0	60.9	74	2075 (212)	55
54	577	—	543	78.0	—	66.1	87.4	72.0	59.8	72	2015 (205)	54
53	560	—	525	77.4	—	65.4	86.9	71.2	58.5	71	1950 (199)	53
52	544	(500)	512	76.8	—	64.6	86.4	70.2	57.4	69	1880 (192)	52
51	528	(487)	496	76.3	—	63.8	85.9	69.4	56.1	68	1820 (186)	51
50	513	(475)	481	75.9	—	63.1	85.5	68.5	55.0	67	1760 (179)	50
49	498	(464)	469	75.2	—	62.1	85.0	67.6	53.8	66	1695 (173)	49
48	484	451	455	74.7	—	61.4	84.5	66.7	52.5	64	1635 (167)	48
47	471	442	443	74.1	—	60.8	83.9	65.8	51.4	63	1580 (161)	47
46	458	432	432	73.6	—	60.0	83.5	64.8	50.3	62	1530 (156)	46
45	446	421	421	73.1	—	59.2	83.0	64.0	49.0	60	1480 (151)	45
44	434	409	409	72.5	—	58.5	82.5	63.1	47.8	58	1435 (146)	44
43	423	400	400	72.0	—	57.7	82.0	62.2	46.7	57	1385 (141)	43
42	412	390	390	71.5	—	56.9	81.5	61.3	45.5	56	1340 (136)	42
41	402	381	381	70.9	—	56.2	80.9	60.4	44.3	55	1295 (132)	41
40	392	371	371	70.4	—	55.4	80.4	59.5	43.1	54	1250 (127)	40
39	382	362	362	69.9	—	54.6	79.9	58.6	41.9	52	1215 (124)	39
38	372	353	353	69.4	—	53.8	79.4	57.7	40.8	51	1180 (120)	38
37	363	344	344	68.9	—	53.1	78.8	56.8	39.6	50	1160 (118)	37
36	354	336	336	68.4	(109.0)	52.3	78.3	55.9	38.4	49	1115 (114)	36
35	345	327	327	67.9	(108.5)	51.5	77.7	55.0	37.2	48	1080 (110)	35
34	336	319	319	67.4	(108.0)	50.8	77.2	54.2	36.1	47	1055 (108)	34
33	327	311	311	66.8	(107.5)	50.0	76.6	53.3	34.9	46	1025 (105)	33
32	318	301	301	66.3	(107.0)	49.2	76.1	52.1	33.7	44	1000 (102)	32
31	310	294	294	65.8	(106.0)	48.4	75.6	51.3	32.7	43	980 (100)	31
30	302	286	286	65.3	(105.5)	47.7	75.0	50.4	31.3	42	950 (97)	30
29	294	279	279	64.7	(104.5)	47.0	74.5	49.5	30.1	41	930 (95)	29
28	286	271	271	64.3	(104.0)	46.1	73.9	48.6	28.9	41	910 (93)	28
27	279	264	264	63.8	(103.0)	45.2	73.3	47.7	27.8	40	880 (90)	27
26	272	258	258	63.3	(102.5)	44.6	72.8	46.8	26.7	38	860 (88)	26
25	266	253	253	62.8	(101.5)	43.8	72.2	45.9	25.5	38	840 (86)	25
24	260	247	247	62.4	(101.0)	43.1	71.6	45.0	24.3	37	825 (84)	24
23	254	243	243	62.0	100.0	42.1	71.0	44.0	23.1	36	805 (82)	23
22	248	237	237	61.5	99.0	41.6	70.5	43.2	22.0	35	785 (80)	22
21	243	231	231	61.0	98.5	40.9	69.9	42.3	20.7	35	770 (79)	21
20	238	226	226	60.5	97.8	40.1	69.4	41.5	19.6	34	760 (77)	20
(18)	230	219	219	—	96.7	—	—	—	—	33	730 (75)	(18)
(16)	222	212	212	—	95.5	—	—	—	—	32	705 (72)	(16)
(14)	213	203	203	—	93.9	—	—	—	—	31	675 (69)	(14)
(12)	204	194	194	—	92.3	—	—	—	—	29	650 (66)	(12)
(10)	196	187	187	—	90.7	—	—	—	—	28	620 (63)	(10)
(8)	188	179	179	—	89.5	—	—	—	—	27	600 (61)	(8)
(6)	180	171	171	—	87.1	—	—	—	—	26	580 (59)	(6)
(4)	173	165	165	—	85.5	—	—	—	—	25	550 (56)	(4)
(2)	166	158	158	—	83.5	—	—	—	—	24	530 (54)	(2)
(0)	160	152	152	—	81.7	—	—	—	—	24	515 (53)	(0)

Note(1): Blue figures: Based on ASTM E 140, Table 1 (Jointly coordinated by SAE, ASM and ASTM.)

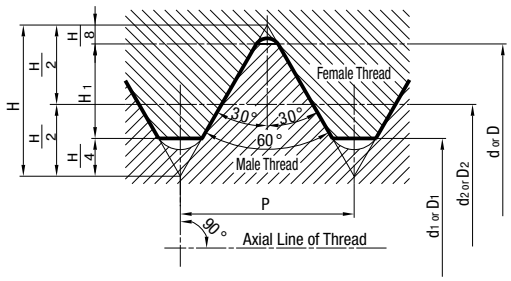
(2): The units and figures shown in brackets are the results of conversion from psi figures by reference to JIS Z 8413 and Z 8438 conversion tables. Moreover, 1MPa=1N/mm²

(3): The figures in brackets are in ranges not frequently used. They are given as referential data.

Technical Data

Excerpts from JIS B0205 (2001)

Metric Coarse Screw Threads



$H = 0.866025P$ $\quad D = d$

$H_1 = 0.541266P$ $\quad D_2 = d_2$

$D_1 = d_1$

$d_2 = d - 0.649519P$

$d_1 = d - 1.082532P$

Unit:mm

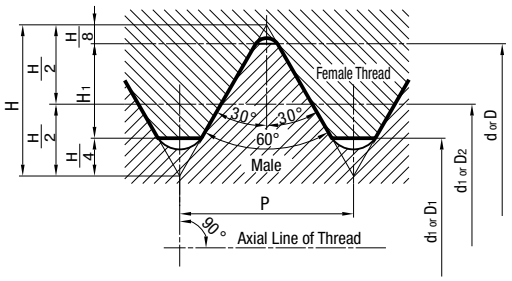
Nominal of Thread(1)*			Pitch P	Height of Engagement H_1	Female Thread		
					Minor Dia. D	Effective Dia. D_2	Inner Dia. D_1
					Male Thread		
Column 1	Column 2	Column 3			Outer Dia. d	Effective Dia. d_2	Inner Dia. d_1
M1			0.25	0.135	1.000	0.838	0.729
	M1.1		0.25	0.135	1.100	0.938	0.829
M1.2			0.25	0.135	1.200	1.038	0.929
	M1.4		0.3	0.162	1.400	1.205	1.075
M1.6			0.35	0.189	1.600	1.373	1.221
	M1.8		0.35	0.189	1.800	1.573	1.421
M2			0.4	0.217	2.000	1.740	1.567
	M2.2		0.45	0.244	2.200	1.908	1.713
M2.5			0.45	0.244	2.500	2.208	2.013
M3			0.5	0.271	3.000	2.675	2.459
	M3.5w		0.6	0.325	3.500	3.110	2.850
M4			0.7	0.379	4.000	3.545	3.242
	M4.5		0.75	0.406	4.500	4.013	3.688
M5			0.8	0.433	5.000	4.480	4.134
M6			1	0.541	6.000	5.350	4.917
		M7	1	0.541	7.000	6.350	5.917
M8			1.25	0.677	8.000	7.188	6.647
		M9	1.25	0.677	9.000	8.188	7.647
M10			1.5	0.812	10.000	9.026	8.376
		M11	1.5	0.812	11.000	10.026	9.376
M12			1.75	0.947	12.000	10.863	10.106
	M14		2	1.083	14.000	12.701	11.835
M16			2	1.083	16.000	14.701	13.835
	M18		2.5	1.353	18.000	16.376	15.294
M20			2.5	1.353	20.000	18.376	17.294
	M22		2.5	1.353	22.000	20.376	19.294
M24			3	1.624	24.000	22.051	20.752
	M27		3	1.624	27.000	25.051	23.752
M30			3.5	1.894	30.000	27.727	26.211
	M33		3.5	1.894	33.000	30.727	29.211
M36			4	2.165	36.000	33.402	31.670
	M39		4	2.165	39.000	36.402	34.670
M42			4.5	2.436	42.000	39.077	37.129
	M45		4.5	2.436	45.000	42.077	40.129
M48			5	2.706	48.000	44.752	42.587
	M52		5	2.706	52.000	48.752	46.587
M56			5.5	2.977	56.000	52.428	50.046
	M60		5.5	2.977	60.000	56.428	54.046
M64			6	3.248	64.000	60.103	57.505
	M68		6	3.248	68.000	64.103	61.505

*Priority should be given to Column 1. If required, select items in Column 2 and 3, in that order.

Technical Data

Metric Fine Screw Threads

Excerpts from JIS B 0207 (1999)



$H = 0.866025P$
$H_1 = 0.541266P$

$d_2 = d - 0.649519P$
$d_1 = d - 1.082532P$

$D = d$
$D_2 = d_2$
$D_1 = d_1$

Unit: mm

Nominal of Thread	Pitch P	Height of Engagement H_1	Female Thread		
			Minor Dia. D	Effective Dia. D_2	Inner Dia. D_1
			Male Thread		
			Outer Dia. d	Effective Dia. d_2	Inner Dia. d_1
M 1 ×0.2	0.2	0.108	1.000	0.870	0.783
M 1.1×0.2	0.2	0.108	1.100	0.970	0.883
M 1.2×0.2	0.2	0.108	1.200	1.070	0.983
M 1.4×0.2	0.2	0.108	1.400	1.270	1.183
M 1.6×0.2	0.2	0.108	1.600	1.470	1.383
M 1.8×0.2	0.2	0.108	1.800	1.670	1.583
M 2 ×0.25	0.25	0.135	2.000	1.838	1.729
M 2.2×0.25	0.25	0.135	2.200	2.038	1.929
M 2.5×0.35	0.35	0.189	2.500	2.273	2.121
M 3 ×0.35	0.35	0.189	3.000	2.773	2.621
M 3.5×0.35	0.35	0.189	3.500	3.273	3.121
M 4 ×0.5	0.5	0.271	4.000	3.675	3.459
M 4.5×0.5	0.5	0.271	4.500	4.175	3.959
M 5 ×0.5	0.5	0.271	5.000	4.675	4.459
M 5.5×0.5	0.5	0.271	5.500	5.175	4.959
M 6 ×0.75	0.75	0.406	6.000	5.513	5.188
M 7 ×0.75	0.75	0.406	7.000	6.513	6.188
M 8 ×1	1	0.541	8.000	7.350	6.917
M 8 ×0.75	0.75	0.406	8.000	7.513	7.188
M 9 ×1	1	0.541	9.000	8.350	7.917
M 9 ×0.75	0.75	0.406	9.000	8.513	8.188
M 10 ×1.25	1.25	0.677	10.000	9.188	8.647
M 10 ×1	1	0.541	10.000	9.350	8.917
M 10 ×0.75	0.75	0.406	10.000	9.513	9.188
M 11 ×1	1	0.541	11.000	10.350	9.917
M 11 ×0.75	0.75	0.406	11.000	10.513	10.188
M 12 ×1.5	1.5	0.812	12.000	11.026	10.376
M 12 ×1.25	1.25	0.677	12.000	11.188	10.647
M 12 ×1	1	0.541	12.000	11.350	10.917
M 14 ×1.5	1.5	0.812	14.000	13.026	12.376
M 14 ×1.25	1.25	0.677	14.000	13.188	12.647
M 14 ×1	1	0.541	14.000	13.350	12.917
M 15 ×1.5	1.5	0.812	15.000	14.026	13.376
M 15 ×1	1	0.541	15.000	14.350	13.917
M 16 ×1.5	1.5	0.812	16.000	15.026	14.376
M 16 ×1	1	0.541	16.000	15.350	14.917
M 17 ×1.5	1.5	0.812	17.000	16.026	15.376
M 17 ×1	1	0.541	17.000	16.350	15.917
M 18 ×2	2	1.083	18.000	16.701	15.835
M 18 ×1.5	1.5	0.812	18.000	17.026	16.376
M 18 ×1	1	0.541	18.000	17.350	16.917
M 20 ×2	2	1.083	20.000	18.701	17.835
M 20 ×1.5	1.5	0.812	20.000	19.026	18.376
M 20 ×1	1	0.541	20.000	19.350	18.917
M 22 ×2	2	1.083	22.000	20.701	19.835
M 22 ×1.5	1.5	0.812	22.000	21.026	20.376
M 22 ×1	1	0.541	22.000	21.350	20.917
M 24 ×2	2	1.083	24.000	22.701	21.835
M 24 ×1.5	1.5	0.812	24.000	23.026	22.376
M 24 ×1	1	0.541	24.000	23.350	22.917

Nominal of Thread	Pitch P	Height of Engagement H_1	Female Thread		
			Minor Dia. D	Effective Dia. D_2	Inner Dia. D_1
			Male Thread		
			Outer Dia. d	Effective Dia. d_2	Inner Dia. d_1
M 25×2	2	1.083	25.000	23.701	22.835
M 25×1.5	1.5	0.812	25.000	24.026	23.376
M 25×1	1	0.541	25.000	24.350	23.917
M 26×1.5	1.5	0.812	26.000	25.026	24.376
M 27×2	2	1.083	27.000	25.701	24.835
M 27×1.5	1.5	0.812	27.000	26.026	25.376
M 27×1	1	0.541	27.000	26.350	25.917
M 28×2	2	1.083	28.000	26.701	25.835
M 28×1.5	1.5	0.812	28.000	27.026	26.376
M 28×1	1	0.541	28.000	27.350	26.917
M 30×3	3	1.624	30.000	28.051	26.752
M 30×2	2	1.083	30.000	28.701	27.835
M 30×1.5	1.5	0.812	30.000	29.026	28.376
M 30×1	1	0.541	30.000	29.350	28.917
M 32×2	2	1.082	32.000	30.701	29.835
M 32×1.5	1.5	0.812	32.000	31.026	30.376
M 33×3	3	1.624	33.000	31.051	29.752
M 33×2	2	1.083	33.000	31.701	30.835
M 33×1.5	1.5	0.812	33.000	32.026	31.376
M 35×1.5	1.5	0.812	35.000	34.026	33.376
M 36×3	3	1.624	36.000	34.051	32.752
M 36×2	2	1.083	36.000	34.701	33.835
M 36×1.5	1.5	0.812	36.000	35.026	34.376
M 38×1.5	1.5	0.812	38.000	37.026	36.376
M 39×3	3	1.624	39.000	37.051	35.752
M 39×2	2	1.083	39.000	37.701	36.835
M 39×1.5	1.5	0.812	39.000	38.026	37.376
M 40×3	3	1.624	40.000	38.051	36.752
M 40×2	2	1.083	40.000	38.701	37.835
M 40×1.5	1.5	0.812	40.000	39.026	38.376
M 42×4	4	2.165	42.000	39.402	37.670
M 42×3	3	1.624	42.000	40.051	38.752
M 42×2	2	1.083	42.000	40.701	39.835
M 42×1.5	1.5	0.812	42.000	41.026	40.376
M 45×4	4	2.165	45.000	42.402	40.670
M 45×3	3	1.624	45.000	43.051	41.752
M 45×2	2	1.083	45.000	43.701	42.835
M 45×1.5	1.5	0.812	45.000	44.026	43.376
M 48×4	4	2.165	48.000	45.402	43.670
M 48×3	3	1.624	48.000	46.051	44.752
M 48×2	2	1.083	48.000	46.701	45.835
M 48×1.5	1.5	0.812	48.000	47.026	46.376
M 50×3	3	1.624	50.000	48.051	46.752
M 50×2	2	1.083	50.000	48.701	47.835
M 50×1.5	1.5	0.812	50.000	49.026	48.376
M 52×4	4	2.165	52.000	49.402	47.670
M 52×3	3	1.624	52.000	50.051	48.752
M 52×2	2	1.083	52.000	50.701	49.835
M 52×1.5	1.5	0.812	52.000	51.026	50.376
M 55×4	4	2.165	55.000	52.402	50.670
M 55×3	3	1.624	55.000	53.051	51.752
M 55×2	2	1.083	55.000	53.701	52.835
M 55×1.5	1.5	0.812	55.000	54.026	53.376

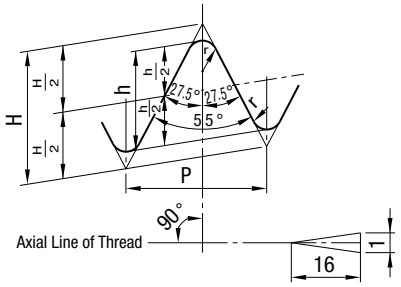
Technical Data

Taper Pipe Threads

Excerpts from JIS B 0203 (1999)

Reference Thread Shape and Reference Dimension

Reference Thread Shape and Basic Dimension for a Tapered Male/Female Thread



Thick Solid Lines: Reference Thread Shape

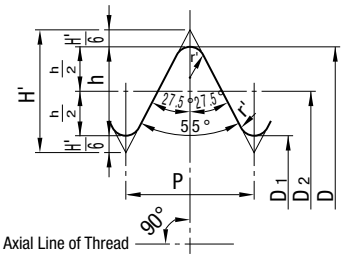
$P=\frac{25.4}{n}$

H=0.960237P

h=0.640327P

r =0.137278P

Reference Thread Shape for a Parallel Female Thread



Thick Solid Lines: Reference Thread Shape

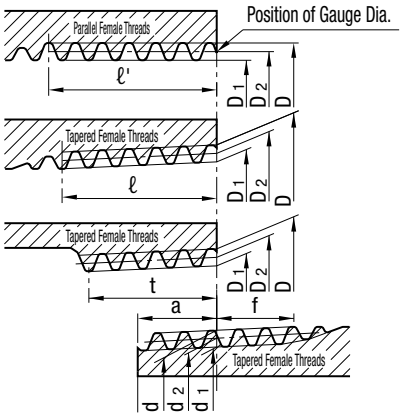
$P=\frac{25.4}{n}$

H'=0.960491P

h =0.640327P

r' =0.137329P

Fitting together a tapered female thread or parallel female thread and a tapered male thread.



Unit: mm

Nominal of Thread[1]	Thread: Number of Threads n	Thread: Pitch P (Reference)	Thread: Thread Height h	Thread: Roundness r or r'	Gauge Dia.: Male Thread: Outer Dia. d	Gauge Dia.: Male Thread: Effective Dia. d_2	Gauge Dia.: Male Thread: Minor Dia. d_1	Gauge Dia.: Female Thread: Minor Dia. D	Gauge Dia.: Female Thread: Effective Dia. D_2	Gauge Dia.: Female Thread: Inner Dia. D_1	Position of Gauge Dia.: Male Thread: From Pipe End: Reference Length a	Position of Gauge Dia.: Male Thread: From Pipe End: Axial Tolerance b	Position of Gauge Dia.: Female Thread: Pipe End: Axial Tolerance c	D, D_2 and D_1 Tolerances of Parallel Female Threads	Length of Effective Thread (Min.): Male Thread: From Position of Gauge Dia. Spot to Major Dia. Spot f	Length of Effective Thread (Min.): Female Thread: With Incomplete Threaded Portion: Tapered Female Threads: From Position of Gauge Dia. Spot to Minor Dia. Spot ℓ	Length of Effective Thread (Min.): Female Thread: With Incomplete Threaded Portion: Parallel Female Threads: From pipe end or pipe fitting end ℓ' (Reference)	Length of Effective Thread (Min.): Female Thread: Without Incomplete Threaded Portion: Tapered Female Threads, Parallel Female Threads: t[2]	Carbon Steel for Piping Size of Steel Pipe (Reference): Outer Diameter	Carbon Steel for Piping Size of Steel Pipe (Reference): Thickness
R1/16	28	0.9071	0.581	0.12	7.723	7.142	6.561				3.97	±0.91	±1.13	±0.071	2.5	6.2	7.4	4.4	—	—
R1/8	28	0.9071	0.581	0.12	9.728	9.147	8.566				3.97	±0.91	±1.13	±0.071	2.5	6.2	7.4	4.4	10.5	2.0
R1/14	19	1.3368	0.856	0.18	13.157	12.301	11.445				6.01	±1.34	±1.67	±0.104	3.7	9.4	11.0	6.7	13.8	2.3
R3/8	19	1.3368	0.856	0.18	16.662	15.806	14.950				6.35	±1.34	±1.67	±0.104	3.7	9.7	11.4	7.0	17.3	2.3
R1/2	14	1.8143	1.162	0.25	20.955	19.793	18.631				8.16	±1.81	±2.27	±0.142	5.0	12.7	15.0	9.1	21.7	2.8
R3/4	14	1.8143	1.162	0.25	26.441	25.279	24.117				9.53	±1.81	±2.27	±0.142	5.0	14.1	16.3	10.2	27.2	2.8
R1	11	2.3091	1.479	0.32	33.249	31.770	30.291				10.39	±2.31	±2.89	±0.181	6.4	16.2	19.1	11.6	34	3.2
R1 1/4	11	2.3091	1.479	0.32	41.910	40.431	38.952				12.70	±2.31	±2.89	±0.181	6.4	18.5	21.4	13.4	42.7	3.5
R1 1/2	11	2.3091	1.479	0.32	47.803	46.324	44.845				12.70	±2.31	±2.89	±0.181	6.4	18.5	21.4	13.4	48.6	3.5
R2	11	2.3091	1.479	0.32	59.614	58.135	56.656				15.88	±2.31	±2.89	±0.181	7.5	22.8	25.7	16.9	60.5	3.8
R2 1/2	11	2.3091	1.479	0.32	75.184	73.705	72.226				17.46	±3.46	±3.46	±0.216	9.2	26.7	30.1	18.6	76.3	4.2
R3	11	2.3091	1.479	0.32	87.884	86.405	84.926				20.64	±3.46	±3.46	±0.216	9.2	29.8	33.3	21.1	89.1	4.2
R4	11	2.3091	1.479	0.32	113.030	111.551	110.072				25.40	±3.46	±3.46	±0.216	10.4	35.8	39.3	25.9	114.3	4.5
R5	11	2.3091	1.479	0.32	138.430	136.951	135.472				28.58	±3.46	±3.46	±0.216	11.5	40.1	43.5	29.3	139.8	4.5
R6	11	2.3091	1.479	0.32	163.830	162.351	160.872				28.58	±3.46	±3.46	±0.216	11.5	40.1	43.5	29.3	165.2	5.0

Note(1): The nominal of a tapered male thread is given here. For a taper female thread or parallel female thread, R should be replaced with Rc or Rp. (Refer to*)

(2): Tapered thread: length from position of gauge dia. spot to a minor dia. spot. /Parallel female thread: length from a pipe end or pipe fitting end.

Reference

1. The threads should be at right angles to the central axial line, and the pitch should be measured along the central axial line.
2. The length of the effective thread means the length over which threads are fully provided. A pipe or a pipe fitting may be left in place on the crests of the last few threads. A chamfered end, if any, of a pipe or a pipe fitting should be included in the length of the effective thread.
3. When the value of a, f and t does not meet the requirements, the criteria of other standard is provided.

(*) Tapered threads type for a pipe are specified as taper male thread for a pipe, taper female thread and parallel female thread for a pipe.

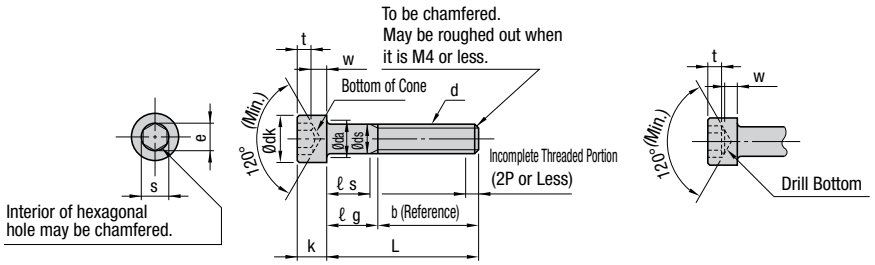
The parallel female thread for a pipe should be mated with a tapered male thread for a pipe, and differs in dimension tolerances from the parallel female thread specified by JIS B 0202.

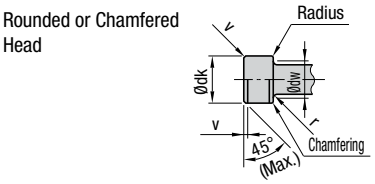
Technical Data

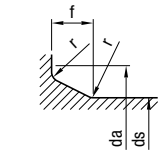
Excerpts from JIS B 1176 (1999, 2000)

Hexagon Socket Head Cap Screws

1. Dimensions of Sections







f (Max.) = 1.7r (Max.)

$$r\,(\text{Max.}) = \frac{da\,(\text{Max.}) - ds\,(\text{Max.})}{2}$$

r (Min.) = Value in the Attached Table

Unit: mm

Nominal of Thread (d)[2]		M2	M2.5	M3	M4	M5	M6	M8	M10	M12	(M14)	M16	(M18)	M20	(M22)	M24	(M27)	M30
Pitch of Thread (P)		0.4	0.45	0.5	0.7	0.8	1	1.25	1.5	1.75	2	2	2.5	2.5	2.5	3	3	3.5
b	Reference	16	17	18	20	22	24	28	32	36	40	44	48	52	56	60	66	72
dk	Max. (Basis)*	3.8	4.5	5.5	7	8.5	10	13	16	18	21	24	27	30	33	36	40	45
	Max.**	3.98	4.68	5.68	7.22	8.72	10.22	13.27	16.27	18.27	21.33	24.33	27.33	30.33	33.39	36.39	40.39	45.39
	Min.	3.62	4.32	5.32	6.78	8.28	9.78	12.73	15.73	17.73	20.67	23.67	26.67	29.67	32.61	35.61	39.61	44.61
da	Max.	2.6	3.1	3.6	4.7	5.7	6.8	9.2	11.2	13.7	15.7	17.7	20.2	22.4	24.4	26.4	30.4	33.4
ds	Max. (Basis)	2	2.5	3	4	5	6	8	10	12	14	16	18	20	22	24	27	30
	Min.	1.86	2.36	2.86	3.82	4.82	5.82	7.78	9.78	11.73	13.73	15.73	17.73	19.67	21.67	23.67	26.67	29.67
e	Min.	1.73	2.30	2.87	3.44	4.58	5.72	6.86	9.15	11.43	13.72	16.00	16.00	19.44	19.44	21.73	21.73	25.15
f	Max.	0.51	0.51	0.51	0.60	0.60	0.68	1.02	1.02	1.45	1.45	1.45	1.87	2.04	2.04	2.04	2.89	2.89
k	Max. (Basis)	2	2.5	3	4	5	6	8	10	12	14	16	18	20	22	24	27	30
	Min.	1.86	2.36	2.86	3.82	4.82	5.70	7.64	9.64	11.57	13.57	15.57	17.57	19.48	21.48	23.48	26.48	29.48
r	Min.	0.1	0.1	0.1	0.2	0.2	0.25	0.4	0.4	0.6	0.6	0.6	0.6	0.8	0.8	0.8	1	1
s	Nominal (Basis)	1.5	2	2.5	3	4	5	6	8	10	12	14	14	17	17	19	19	22
	Min.	1.52	2.02	2.52	3.02	4.02	5.02	6.02	8.025	10.025	12.032	14.032	14.032	17.05	17.050	19.065	19.065	22.065
	Max.[1] Column 1	1.560	2.060	2.580	3.080	4.095	5.140	6.140	8.175	10.175	12.212	14.212	14.212	17.230	17.230	19.275	19.275	22.275
	Max.[1] Column 2	1.545	2.045	2.560	3.080	4.095	5.095	6.095	8.115	10.115	12.142	14.142	14.142					
t	Min.	1	1.1	1.3	2	2.5	3	4	5	6	7	8	9	10	11	12	13.5	15.5
v	Max.	0.2	0.25	0.3	0.4	0.5	0.6	0.8	1	1.2	1.4	1.6	1.8	2	2.2	2.4	2.7	3
dw	Min.	3.40	4.18	5.07	6.53	8.03	9.38	12.33	15.33	17.23	20.17	23.17	25.87	28.87	31.81	34.81	38.61	43.61
w	Min.	0.55	0.85	1.15	1.4	1.9	2.3	3.3	4	4.8	5.8	6.8	7.7	8.6	9.5	10.4	12.1	13.1

Note [1]: Column 1 for s (max.) is applicable to strength class 8.8, 10.9, A 2-50 and A 2-70; Column 2 should be applied to strength class 12.9.
Column 1 may be applicable to strength class 12.9 in accordance with an agreement made between the delivering and receiving sides.
When the nominal of thread is M20 or larger, s (max.) should be applied to all strength classes.

Note [2]: Nominal of thread in brackets should not be used unless it is absolutely necessary.

Reference

1. A side of the head should be knurled into a straight line or crisscross pattern [refer to JIS B 0951 (knurling pattern)]. dk(max.) should be the value marked with**.
If no knurled pattern is needed, purchasers can indicate that. However, dk(max.) should be the value marked with*.

2. Recommended nominal lengths (L) for individual nominal of thread are shown within the bold lines.
If L is shorter than the dotted line, the thread should be fully threaded, and the incompletely threaded part length beneath the neck should be approximately 3P.

3. lg (max.) and lg (min.) for a screw, whose length (L) exceeds the dotted line, are obtained by the equations below:

lg(Max)=Nominal Length(L)-b

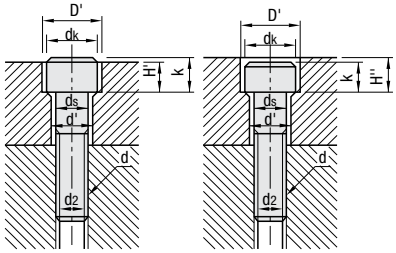
ls(Min)=lg(Max)-5P

2. L, s and g of Hexagon Socket Head Cap Screws

Unit: mm

Nominal of Thread (d)			M2		M2.5		M3		M4		M5		M6		M8		M10		M12		M14		M16		(M18)		M20		(M22)		M24		(M27)		M30	
L			ℓs min and ℓg max																																	
Nominal Length	min	max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max	ℓs min	ℓg max
5	4.76	5.24																																		
6	5.76	6.24																																		
8	7.71	8.29																																		
10	9.71	10.29																																		
12	11.65	12.35																																		
16	15.65	16.35																																		
20	19.58	20.42	2	4																																
25	24.58	25.42			5.75	8	4.5	7																												
30	29.58	30.42					9.5	12	6.5	10	4	8																								
35	34.5	35.5							11.5	15	9	13	6	11																						
40	39.5	40.5							16.5	20	14	18	11	16	5.75	12																				
45	44.5	45.5									19	23	16	21	10.75	17	5.5	13																		
50	49.5	50.5									24	28	21	26	15.75	22	10.5	18																		
55	54.4	55.6											26	31	20.75	27	15.5	23	10.25	19																
60	59.4	60.6											31	36	25.75	32	20.5	28	15.25	24	10	20														
65	64.4	65.6													30.75	37	25.5	33	20.25	29	15	25	11	21	4.5	17										
70	69.4	70.6													35.75	42	30.5	38	25.25	34	20	30	16	26	9.5	22										
80	79.4	80.6													45.75	52	40.5	48	35.25	44	30	40	26	36	19.5	32	15.5	28	11.5	24						
90	89.3	90.7															50.5	58	45.25	54	40	50	36	46	29.5	42	25.5	38	21.5	34	15	30	9	24		
100	99.3	100.7															60.5	68	55.25	64	50	60	46	56	39.5	52	35.5	48	31.5	44	25	40	19	34		
110	109.3	110.7																	66.25	74	60	70	56	66	49.5	62	45.5	58	41.5	54	35	50	29	44	20.5	38
120	119.3	120.7																	75.25	84	70	80	66	76	59.5	72	55.5	68	51.5	64	45	60	39	54	30.5	48
130	129.2	130.8																			80	90	76	86	69.5	82	65.5	78	61.5	74	55	70	49	64	40.5	58
140	139.2	140.8																			90	100	86	96	79.5	92	75.5	88	71.5	84	65	80	59	74	50.5	68
150	149.2	150.8																					96	106	89.5	102	85.5	98	81.5	94	75	90	69	84	60.5	78
160	159.2	160.8																					106	116	99.5	112	95.5	108	91.5	104	85	100	79	94	70.5	88
180	179.2	180.8																							119.5	132	115.5	128	111.5	124	105	120	99	114	90.5	108
200	199.05	200.95																									135.5	148	131.5	144	125	140	119	134	110.5	128
220	219.05	220.95																															139	154	130.5	148
240	239.05	240.95																															159	174	150.5	168
260	258.95	261.05																															179	194	170.5	188
280	278.95	281.05																															199	214	190.5	208
300	298.95	301.05																															219	234	210.5	228

Reference: Dimensions of Counterboring and Bolt Hole for the Hexagon Socket Head Cap Screws



Nominal of Thread (d)	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27	M30
ds	3	4	5	6	8	10	12	14	16	18	20	22	24	27	30
d'	3.4	4.5	5.5	6.6	9	11	14	16	18	20	22	24	26	30	33
dk	5.5	7	8.5	10	13	16	18	21	24	27	30	33	36	40	45
D'	6.5	8	9.5	11	14	17.5	20	23	26	29	32	35	39	43	48
k	3	4	5	6	8	10	12	14	16	18	20	22	24	27	30
H'	2.7	3.6	4.6	5.5	7.4	9.2	11	12.8	14.5	16.5	18.5	20.5	22.5	25	28
H''	3.3	4.4	5.4	6.5	8.6	10.8	13	15.2	17.5	19.5	21.5	23.5	25.5	29	32
d2	2.6	3.4	4.3	5.1	6.9	8.6	10.4	12.2	14.2	15.7	17.7	19.7	21.2	24.2	26.7

Technical Data

Proper Bolt Axial Tightening Force and Proper Tightening Torque

■ Axial Tightening Force for Bolt and Fatigue Limit

- The proper axial tightening force for a bolt should be calculated within an elasticity range up to 70% of the rated yield strength when the torque method is used.
- The fatigue strength of bolt under repeated load should not exceed the specified tolerance.
- Do not let the seat of a bolt or nut dent the contact area.
- Do not break the tightened piece by tightening.

A bolt is tightened by torque, torque inclination, rotating angle, stretch measurement and other methods. The torque method is widely used due to its simplicity and convenience.

■ Calculation of Axial Tightening Force and Tightening Torque

The relation between the axial tightening force and Ff is represented by Equation (1) below:

$Ff=0.7\times\sigma y\times As$……(1)

Tightening torque T_{fA} can be obtained by using the following formula(2).

$T_{fA}=0.35k(1+1/Q)\sigma y \cdot As \cdot d$……(2)

k : Torque Coefficient
d : Nominal Diameter of Bolt [cm]
Q : Tightening Coefficient
σy : Tensile strength (When the strength class is 12.9, it is 112kgf/mm^2)
As : Effective Sectional Area of the Bolt [mm^2]

■ Calculation Example

Proper torque and axial force for Mild steel pieces tightened together by means of a hexagon socket head cap screw, M6 (strength class 12.9), with the pieces lubricated with oil can be calculated.

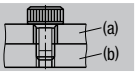
- Proper Torque, by using Equation (2)

$T_{fA}=0.35k\ (1+1/Q)\ \sigma y \cdot As \cdot d$
$=0.35 \cdot 0.17\ (1+1/1.4)\ 1098 \cdot 20.1 \cdot 0.6$
$=1351$[N · cm] {138[kgf · cm]}

- Axial Force Ff, by using Equation(1)

$Ff=0.7\times\sigma y\times As$
$=0.7\times1098\times20.1$
$=15449$[N] {1576[kgf]}

■ Surface Treatment for Bolt and Torque Coefficient Dependent on the Combination of Material for Area to be Fastened and Material of Female Thread

Bolt Surface Treatment Lubrication	Torque Coefficient k	Combination of material for area to be fastened and material for female thread (a) (b) 
Steel Bolt Black Oxided Film Oil Lubrication	0.145	SCM–FC FC–FC SUS–FC
	0.155	S10C–FC SCM–S10C SCM–SCM FC–S10C FC–SCM
	0.165	SCM–SUS FC–SUS AL–FC SUS–S10C SUS–SCM SUS–SUS
	0.175	S10C–S10C S10C–SCM S10C–SUS AL–S10C AL–SCM
	0.185	SCM–AL FC–AL AL–SUS
	0.195	S10C–AL SUS–AL
	0.215	AL–AL
Steel Bolt Black Oxided Film Unlubricated	0.25	S10C–FC SCM–FC FC–FC
	0.35	S10C–SCM SCM–SCM FC–S10C FC–SCM AL–FC
	0.45	S10C–S10C SCM–S10C AL–S10C AL–SCM
	0.55	SCM–AL FC–AL AL–AL

S10C: Mild steel not thermally refined
FC: Cast Iron(FC200)
SCM:Thermally Refined Steel(35HRC)
AL:Aluminum
SUS: Stainless Steel

■ Standard Value of Tightening Coefficient Q

Tightening Coefficient Q	Tightening Method	Surface Condition		Lubrication
		Bolts	Nuts	
1.25	Torque Wrench	Manganese Phosphate	Not treated or Treated with Phosphate.	Lubricated with oil or MoS^2 paste
1.4	Torque Wrench Limited-Torque Wrench	Not treated or Treated with Phosphate.		
1.6	Impact Wrench			
1.8	Torque Wrench Limited-Torque Wrench	Not treated or Treated with Phosphate.	No Treatment	Unlubricated

Strength Class
Ex. 12.9
Tensile Strength (Yield Stress): 90% of the minimum value of tensile strength
The minimum value of tensile strength is 1220N/mm^2 { 124kgf/mm^2 }
10.9
Tensile Strength (Yield Stress): 90% of the minimum value of tensile strength
The minimum value of tensile strength is 1040N/mm^2 { 106kgf/mm^2 }

■ Initial Tightening Force and Tightening Torque

Nominal of Thread	Effective Sectional Area As mm^2	Strength Class 12.9			10.9			8.8		
		Yield Load	Initial Tightening Force	Tightening Torque	Yield Load	Initial Tightening Force	Tightening Torque	Yield Load	Initial Tightening Force	Tightening Torque
		N {kgf}	N {kgf}	N · cm {kgf · cm}	N {kgf}	N {kgf}	N · cm {kgf · cm}	N {kgf}	N {kgf}	N · cm {kgf · cm}
M 3×0.5	5.03	5517 { 563 }	3861 { 394 }	167 { 17 }	4724 { 482 }	3312 { 338 }	147 { 15 }	3214 { 328 }	2254 { 230 }	98 { 10 }
M 4×0.7	8.78	9633 { 983 }	6742 { 688 }	392 { 40 }	8252 { 842 }	5772 { 589 }	333 { 34 }	5615 { 573 }	3930 { 401 }	225 { 23 }
M 5×0.8	14.2	15582 { 1590 }	10907 { 1113 }	794 { 81 }	13348 { 1362 }	9339 { 953 }	676 { 69 }	9085 { 927 }	6360 { 649 }	461 { 47 }
M 6×1	20.1	22060 { 2251 }	15445 { 1576 }	1352 { 138 }	18894 { 1928 }	13220 { 1349 }	1156 { 118 }	12867 { 1313 }	9006 { 919 }	784 { 80 }
M 8×1.25	36.6	40170 { 4099 }	28116 { 2869 }	3273 { 334 }	34398 { 3510 }	24079 { 2457 }	2803 { 286 }	23422 { 2390 }	16395 { 1673 }	1911 { 195 }
M10×1.5	58	63661 { 6496 }	44561 { 4547 }	6497 { 663 }	54508 { 5562 }	38161 { 3894 }	5557 { 567 }	37113 { 3787 }	25980 { 2651 }	3783 { 386 }
M12×1.75	84.3	92532 { 9442 }	64768 { 6609 }	11368 { 1160 }	79223 { 8084 }	55458 { 5659 }	9702 { 990 }	53949 { 5505 }	37759 { 3853 }	6605 { 674 }
M14×2	115	126224 { 12880 }	88357 { 9016 }	18032 { 1840 }	108084 { 11029 }	75656 { 7720 }	15484 { 1580 }	73598 { 7510 }	51519 { 5257 }	10486 { 1070 }
M16×2	157	172323 { 17584 }	117982 { 12039 }	28126 { 2870 }	147549 { 15056 }	103282 { 10539 }	24108 { 2460 }	100470 { 10252 }	70325 { 7176 }	16366 { 1670 }
M18×2.5	192	210739 { 21504 }	147519 { 15053 }	38710 { 3950 }	180447 { 18413 }	126312 { 12889 }	33124 { 3380 }	126636 { 12922 }	88641 { 9045 }	23226 { 2370 }
M20×2.5	245	268912 { 27440 }	188238 { 19208 }	54880 { 5600 }	230261 { 23496 }	161181 { 16447 }	46942 { 4790 }	161592 { 16489 }	113112 { 11542 }	32928 { 3360 }
M22×2.5	303	332573 { 33936 }	232799 { 23755 }	74676 { 7620 }	284768 { 29058 }	199332 { 20340 }	63896 { 6520 }	199842 { 20392 }	139885 { 14274 }	44884 { 4580 }
M24×3	353	387453 { 39536 }	271215 { 27675 }	94864 { 9680 }	331759 { 33853 }	232231 { 23697 }	81242 { 8290 }	232819 { 23757 }	162974 { 16630 }	57036 { 5820 }

(Note) • Tightening Conditions:Use of a torque wrench(Lubricated with Oil, Torque Coefficient k=0.17, Tightening Coefficient Q=1.4) • The torque coefficient varies with the conditions of use. Values in this table should be used as rough referential values. • The table is an excerpt from a catalog of Kyokuto Seisakusho Co., Ltd.

Technical Data

Strength of Bolts, Screw Plugs and Dowel Pins

■ Strength of Bolt

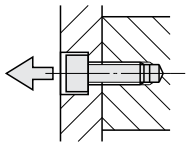
1) Tensile Load Bolt

P=σt×As.....(1)
=πd2σt/4.....(2)

Pt : Tensile Load in the Axial Direction [N]
σb : Yield Stress of the Bolt [N/mm^2]
σt : Allowable Stress of the Bolt [N/mm^2]
(σt=σb/Safety Factorα)
As : Effective Sectional Area of the Bolt [mm^2]
As=πd2/4
d : Effective Dia. of the Bolt (Core Dia.) [mm]

(Ex.) The proper size of a hexagon socket head cap screws, which is to bear a repeated tensile load (pulsating) at P=1960N {200 kgf} , should be determined. (The hexagon socket head cap screws are 4137 Alloy Steel, 38 to 43 HRC, strength class 12.9)

(1) Using Equation
As=Pt/σt
=1960/219.6
=8.9 [mm^2]



∴ By finding a value greater than the result of the equation in the Effective Sectional Area column in the table on the right, M5, 14.2[mm^2], should be selected.
M6, allowable load of 2087N {213 kgf}, should be selected from the column for strength class 12.9, with the fatigue strength taken into account.

2) If the bolt, like a stripper bolt, is to bear a tensile impact load, the right size should be selected from the fatigue strength column.(Under a load of 1960N {200kgf}, stripper bolt made of 4137 Alloy Steel, 33 to 38 HRC, strength class 10.9)

By finding a value greater than the allowable load of 1960N {200 kgf} in the Strength Class 10.9 column in the table on right, M8, 3116[N] {318[kgf]}, should be selected. Hence, MSB10 with the M8 threaded portion and an axial diameter of 10 mm should be selected.
If it is to bear a shearing load, a dowel pin should also be used.

■ Strength of Screw Plug

When screw plug MSW30 is to bear an impact load, allowable load P should be determined. (The materials of MSW30 are 1045 Carbon Steel, 34 to 43 HRC, tensile strength σt 637N/mm^2 {65kgf/mm^2.})

If M S W is shorn at a spot within the root diameter section and is broken, allowable load P can be calculated as shown below.

Allowable Load P=τt×A
=3.9×107.4
=40812[N] {4164[kgf]}

Find the allowable shearing force base on the core diameter of female thread if a tap is made of soft material.

Area A=Root Diameter d1×π×L
(Root Diameter d1≈M–P)
A=(M–P)πL=(30–1.5)π×12
= 1074 [mm^2]

Yield Stress≈0.9×Tensile Strength σb=0.9×637=573[N/mm^2]

Shearing Stress≈0.8×Yield Stress
= 459 [N/mm^2]

Allowable Shearing Stress
τt=Shearing Stress/Safety Factor12
= 459/12=38 [N/mm2] {3.9 [kgf/mm^2]}

■ Strength of Dowel Pins

The proper size of a dowel pin under repeated shearing load of 7840N {800 kgf} (Pulsating) should be determined.
(The material of Dowel Pins is 52100 Bearing Steel.
Hardness 58HRC~)

P=A×τ
=πD2τ/4
D=$\sqrt{(4P)/(\pi\tau)}$
=$\sqrt{(4\times7840)/(3.14\times188)}$
≈7.3

Yield Stress for 52100 Bearing Steel
σb=1176 [N/mm^2] {120 [kgf/mm^2]}

Allowable Shearing Strength
τ=σb×0.8/Safety Factor α
=1176×0.8/5
=188 [N/mm2] {19.2 [kgf/mm^2]}

∴ D8 or a larger size should be selected for MS.
If the dowel pins are of a roughly uniform size, the number of the necessary tools and extra pins can be reduced.

■ Safety Factorα of Unwin Based on Tensile Strength

Materials	Static Load	Repeated Load		Impact Load
		Pulsating	Reversed	
Steel	3	5	8	12
Cast Iron	4	6	10	15
Copper, Soft Metal	5	5	9	15

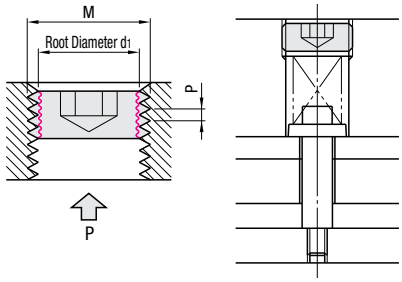
Allowable Stress = Reference Strength / Safety Factor$_\alpha$
Reference Strength:Yield Stress for Ductile Material
Fracture Stress for Fragile Material

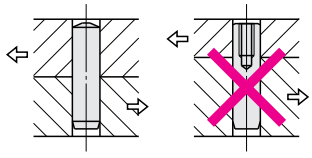
The yield stress, strength class 12.9, is σb=1098[N/mm^2] {112[kgf/mm^2]}.
Allowable Stress σ t= σ b/Safety Factor (from the above table Safety Factor 5)
=1098/5
=219.6[N/mm^2] {22.4[kgf/mm^2]}

■ Fatigue Strength of Bolt (Thread: Fatigue Strength is 2 million times)

Nominal of Thread	Effective Sectional Area as mm^2	Strength Class			
		12.9		10.9	
		Fatigue Strength†	Allowable Load	Fatigue Strength†	Allowable Load
		N/mm^2 [kgf/mm^2]	N {kgf}	N/mm^2 [kgf/mm^2]	N {kgf}
M 4	8.78	128 {13.1}	1117 {114}	89 {9.1}	774 {79}
M 5	14.2	111 {11.3}	1568 {160}	76 {7.8}	1088 {111}
M 6	20.1	104 {10.6}	2087 {213}	73 {7.4}	1460 {149}
M 8	36.6	87 {8.9}	3195 {326}	85 {8.7}	3116 {318}
M10	58	73 {7.4}	4204 {429}	72 {7.3}	4145 {423}
M12	84.3	66 {6.7}	5537 {565}	64 {6.5}	5370 {548}
M14	115	60 {6.1}	6880 {702}	59 {6}	6762 {690}
M16	157	57 {5.8}	8928 {911}	56 {5.7}	8771 {895}
M20	245	51 {5.2}	12485 {1274}	50 {5.1}	12250 {1250}
M24	353	46 {4.7}	16258 {1659}	46 {4.7}	16258 {1659}

Fatigue strength* is a revision of an excerpt from "Estimated Fatigue Limits of Small Screws, Bolts and Metric Screws for Nuts" (Yamamoto).





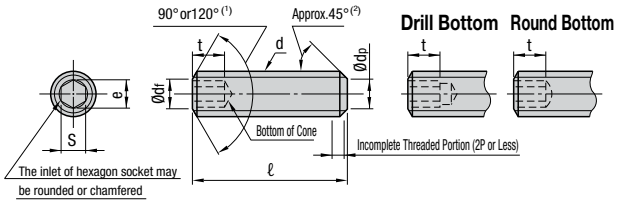
The dowel pin must not be loaded.

Typical strength calculations are presented here. In practice, further conditions including hole-to-hole pitch precision, hole perpendicularity, surface roughness, circularity, plate material, parallelism, quenching or non-quenching, precision of the press, product output, wear of tools should be considered. Hence the values in these examples are typical but not guaranteed values.

Technical Data

Hexagon Socket Set Screws (Flat Type)

1. Shape and Dimension of Hexagon Socket Set Screws and Its Flat End (JIS B 1177-1997).



Note (1): Should be chamfered to 120° if l falls short of the dotted line, which forms stairs, in the table.
(2): 45° Slanted portion below the trough diameter line of the male thread.

Nominal of Thread(d)			M2	M3	M4	M5	M6	M8	M10	M12	M16	M20	M24
Pitch (P)			0.4	0.5	0.7	0.8	1.0	1.25	1.5	1.75	2.0	2.5	3.0
d_p	Max. (Reference Dimension)		1.0	2.0	2.5	3.5	4.0	5.5	7.0	8.5	12.0	15.0	18.0
	Min.		0.75	1.75	2.25	3.2	3.7	5.2	6.64	8.14	11.57	14.57	17.57
d_f	Approx.		Thread Bottom Diameter of Male Thread										
e	Min.(3)		1.003	1.73	2.30	2.87	3.44	4.58	5.72	6.86	9.15	11.43	13.72
s	Nominal (Reference Dimension)		0.9	1.5	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0	12.0
	Max.		0.902	1.545	2.045	2.560	3.080	4.095	5.095	6.095	8.115	10.115	12.142
	Min.		0.889	1.520	2.020	2.520	3.020	4.020	5.020	6.020	8.025	10.025	12.032
t	Min.(4)	Column 1	0.8	1.2	1.5	2.0	2.0	3.0	4.0	4.8	6.4	8.0	10.0
		Column 2	1.7	2.0	2.5	3.0	3.5	5.0	6.0	8.0	10.0	12.0	15.0
ℓ(5)			Approx. Mass Per 1000 Units										
Nominal Length (Reference Dimension)	Min.	Max.	Unit:kg (Density:7.85kg/dm^3)										
2	1.8	2.2	0.029	0.059									
2.5	2.3	2.7	0.037	0.08	0.099								
3	2.8	3.2	0.044	0.1	0.14	0.2							
4	3.7	4.3	0.059	0.14	0.22	0.32	0.41						
5	4.7	5.3	0.074	0.18	0.3	0.44	0.585	0.945					
6	5.7	6.3	0.089	0.22	0.38	0.56	0.76	1.26	1.77				
8	7.7	8.3	0.119	0.3	0.54	0.8	1.11	1.89	2.78	4			
10	9.7	10.3	0.148	0.38	0.7	1.04	1.46	2.52	3.78	5.4	8.5		
12	11.6	12.4		0.46	0.86	1.28	1.81	3.15	4.78	6.8	11.1	15.8	
16	15.6	16.4		0.62	1.18	1.76	2.51	4.41	6.78	9.6	16.3	24.1	30
20	19.6	20.4			1.49	2.24	3.21	5.67	8.76	12.4	21.5	32.3	42
25	24.6	25.4				2.84	4.09	7.25	11.2	15.9	28	42.6	57
30	29.6	30.4					4.97	8.82	13.7	19.4	34.6	52.9	72
35	34.5	35.5						10.4	16.2	22.9	41.1	63.2	87
40	39.5	40.5						12	18.7	26.4	47.7	73.5	102
45	44.5	45.5							21.2	29.9	54.2	83.8	117
50	49.5	50.5							23.7	33.4	60.7	94.1	132
55	54.4	55.6								36.8	67.3	104	147
60	59.4	60.6								40.3	73.7	115	162

Note (3): when e min.=1.14×s(min.) Excluding nominal of thread M25 or less for screws.
(4): The values in Column 1 for t min. are applicable to the nominal lengths (l) falling short of the dotted border, and the values in Column 2 to the nominal lengths beyond the border.
(5): Min.rand max. are based on JIS B 1021. They are rounded to the first digit below zero.

Reference
1. Recommended nominal lengths (l) for individual nominal of thread are enclosed by thick lines.
If the required l-value is not given in the table, it should be specified by the ordering side.
2. The shape and dimensions of the flat end of the screw are based on JIS B 1003 (shape and dimensions of the end of the screw).
3. The shape of the hexagon socket bottom may be a conical, drill or round bottom.

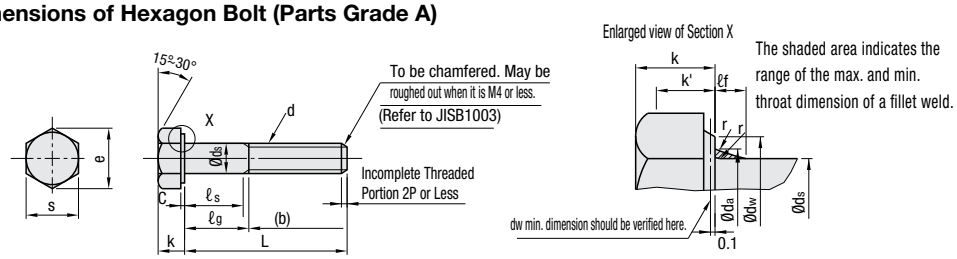
The shape and dimensions indicated in the reference table are based on ISO 4026-1977.

Technical Data

Excerpts from JIS B 1180 (1999)

Hexagon Bolts

1. Shape and Dimensions of Hexagon Bolt (Parts Grade A)



Unit: mm

Nominal of Thread d		M2	M3	M4	M5	M6	M8	M10	M12	—	M16	M20	M24
	Coarse Thread Column Ⅰ	M2	M3	M4	M5	M6	M8	M10	M12	—	M16	M20	M24
	Coarse Thread Column Ⅱ	—	—	—	—	—	—	—	—	M14	—	—	—
	Coarse Thread Pitch P	0.4	0.5	0.7	0.8	1	1.25	1.5	1.75	2	2	2.5	3
	Fine Thread Column Ⅰ	—	—	—	—	—	M8×1	M10×1	M12×1.5	—	M16×1.5	M20×1.5	M24×2
	Fine Thread Column Ⅱ	—	—	—	—	—	—	M10×1.25	M12×1.25	M14×1.5	—	M20×2	—
b (Reference)	L≤125mm	10	12	14	16	18	22	26	30	34	38	46	54
	125<L≤150mm	—	—	—	—	—	—	—	—	40	44	52	60
c	Min.	0.1	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.2	0.2	0.2
	Max.	0.25	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.8	0.8	0.8
da	Max.	2.6	3.6	4.7	5.7	6.8	9.2	11.2	13.7	15.7	17.7	22.4	26.4
ds	Reference Dimension=Max.	2	3	4	5	6	8	10	12	14	16	20	24
	Min.	1.86	2.86	3.82	4.82	5.82	7.78	9.78	11.73	13.73	15.73	19.67	23.67
dw	Min.	3.07	4.57	5.88	6.88	8.88	11.63	14.63	16.63	*19.64	22.49	28.19	33.61
e	Min.	4.32	6.01	7.66	8.79	11.05	14.38	17.77	20.03	23.36	26.75	33.53	39.98
ℓf	Max.	0.8	1	1.2	1.2	1.4	2	2	3	3	3	4	4
k	Reference Dimension=Nominal	1.4	2	2.8	3.5	4	5.3	6.4	7.5	8.8	10	12.5	15
	Min.	1.275	1.875	2.675	3.35	3.85	5.15	6.22	7.32	8.62	9.82	12.285	14.785
	Max.	1.525	2.125	2.925	3.65	4.15	5.45	6.58	7.68	8.98	10.18	12.715	15.215
k'	Min.	0.89	1.31	1.87	2.35	2.7	3.61	4.35	5.12	6.03	6.87	8.6	10.35
r	Min.	0.1	0.1	0.2	0.2	0.25	0.4	0.4	0.6	0.6	0.6	0.8	0.8
s	Reference Dimension=Max.	4	5.5	7	8	10	13	16	18	21	24	30	36
	Min.	3.82	5.32	6.78	7.78	9.78	12.73	15.73	17.73	20.67	23.67	29.67	35.38

Length of Bolt L			ℓs and ℓg																							
Nominal Length (Reference Dimension)	Min.	Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.	ℓs Min.	ℓg Max.
16	15.65	16.35	4	6																						
20	19.58	20.42	8	10	5.5	8																				
25	24.58	25.42			10.5	13	7.5	11	5	9																
30	29.58	30.42			15.5	18	12.5	16	10	14	7	12														
35	34.5	35.5					17.5	21	15	19	12	17														
40	39.5	40.5					22.5	26	20	24	17	22	11.75	18												
45	44.5	45.5							25	29	22	27	16.75	23	11.5	19										
50	49.5	50.5							30	34	27	32	21.75	28	16.5	24	11.25	20								
55	54.4	55.6									32	37	26.75	33	21.5	29	16.25	25								
60	59.4	60.6									37	42	31.75	38	26.5	34	21.25	30	16	26						
65	64.4	65.6											36.75	43	31.5	39	26.25	35	21	31	17	27				
70	69.4	70.6											41.75	48	36.5	44	31.25	40	26	36	22	32				
80	79.4	80.6											51.75	58	46.5	54	41.25	50	36	46	32	42	21.5	34		
90	89.3	90.7													56.5	64	51.25	60	46	56	42	52	31.5	44	21	36
100	99.3	100.7													66.5	74	61.25	70	56	66	52	62	41.5	54	31	46
110	109.3	110.7															71.25	80	66	76	62	72	51.5	64	41	56
120	119.3	120.7															81.25	90	76	86	72	82	61.5	74	51	66
130	129.2	130.8																	80	90	76	86	65.5	78	55	70
140	139.2	140.8																	90	100	86	96	75.5	88	65	80
150	149.2	150.8																			96	106	85.5	98	75	90

Reference

1. Priority should be given to the nominal of thread in Column Ⅰ. The screw size codes are based on JIS B 0123.
2. Recommended nominal lengths(L)for individual nominal of thread are enclosed by thick lines.
3. When the thread part length (b) of a bolt exceeds the max. nominal value given within the thick lines, the tolerance of the thread part length should be agreed upon by the delivering and receiving sides, corresponding to JIS B 1021.
4. Max. value lg and Min. value ls as follows: lg max Nominal Length(L)-b, ls min.=lg max-5P(P=Coarse Thread Pitch)
5. da and r in this table are based on JIS B 1005.
6. "Chamfered" and "Unpointed", the shape of the end screw should be decided according to JIS B 1003.
7. The asterisked figures in the table are values after correction with the relevant international standard.

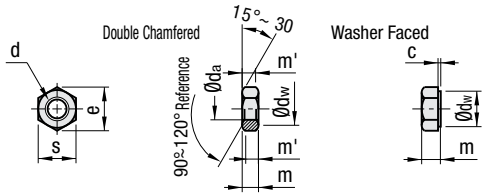
*With some of the hexagon bolts and hexagon nuts for M10 and M12 distributed at present, the opposite side S is based on JIS prior to the revision.

Technical Data

Hexagon Nuts / Cotter Pins

Excerpts from JIS B 1181 (1995)
Excerpts from JIS B 1351 (1987)

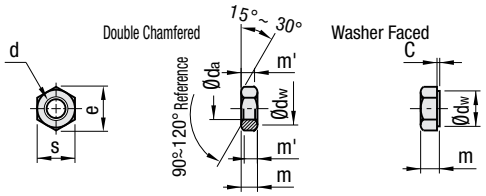
1. Shape and Dimensions of Hexagon Nuts Style Ⅰ (Parts Grade A)



Unit: mm

Nominal of Thread d		M2	M3	M4	M5	M6	M8	M10	M12	(M14)	M16
Pitch P		0.4	0.5	0.7	0.8	1	1.25	1.5	1.75	2	2
c	Max.	0.2	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.8
	Min.	0.1	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.2
d_a	Min.(Reference Dimension)	2	3	4	5	6	8	10	12	14	16
	Max.	2.3	3.45	4.6	5.75	6.75	8.75	10.8	13	15.1	17.3
d_w	Min.	3.07	4.6	5.9	6.9	8.9	11.6	14.6	16.6	19.6	22.5
e	Min.	4.32	6.01	7.66	8.79	11.05	14.38	17.77	20.03	23.35	26.75
m	Max.(Reference Dimension)	1.6	2.4	3.2	4.7	5.2	6.8	8.4	10.8	12.8	14.8
	Min.	1.35	2.15	2.9	4.4	4.9	6.44	8.04	10.37	12.1	14.1
m'	Min.	1.08	1.72	2.32	3.52	3.92	5.15	6.43	8.3	9.68	11.28
s	Max.(Reference Dimension)	4	5.5	7	8	10	13	16	18	21	24
	Min.	3.82	5.32	6.78	7.78	9.78	12.73	15.73	17.73	20.67	23.67

2. Shape and Dimensions of Hexagon Nuts Style Ⅱ (Parts Grade A)



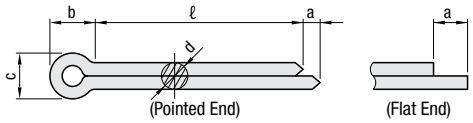
Unit: mm

Nominal of Thread d		M5	M6	M8	M10	M12	(M14)	M16
Pitch P		0.8	1	1.25	1.5	1.75	2	2
c	Max.	0.5	0.5	0.6	0.6	0.6	0.6	0.8
	Min.	0.15	0.15	0.15	0.15	0.15	0.15	0.2
d_a	Min.(Reference Dimension)	5	6	8	10	12	14	16
	Max.	5.75	6.75	8.75	10.8	13	15.1	17.3
d_w	Min.	6.9	8.9	11.6	14.6	16.6	19.6	22.5
e	Min.	8.79	11.05	14.38	17.77	20.03	23.35	26.75
m	Max.(Reference Dimension)	5.1	5.7	7.5	9.3	12	14.1	16.4
	Min.	4.8	5.4	7.14	8.94	11.57	13.4	15.7
m'	Min.	3.84	4.32	5.71	7.15	9.26	10.7	12.6
s	Max.(Reference Dimension)	8	10	13	16	18	21	24
	Min.	7.78	9.78	12.73	15.73	17.73	20.67	23.67

Reference 1. Nominal of thread in brackets should not be used unless it is absolutely necessary.
2. The shape of nuts, unless otherwise designated, shall be "double chamfered", and the "washer faced" shall be as designated by the purchaser.
Chamfering for the "washer faced" threads shall based on the chamfered dimensions for "double chamfered".

*With some of the hexagon bolts and hexagon nuts for M10 and M12 distributed at present, the opposite side S is based on JIS prior to the revision.

3. Shape and Dimensions of Cotter Pins



Unit: mm

Nominal Diameter		0.6	0.8	1	1.2	1.6	2	2.5	3.2	4	5	6.3	8	10	13	16	20
d	Reference Dimension	0.5	0.7	0.9	1	1.4	1.8	2.3	2.9	3.7	4.6	5.9	7.5	9.5	12.4	15.4	19.3
	Tolerance	0 −0.1									0 −0.2					0 −0.3	
c	Reference Dimension	1	1.4	1.8	2	2.8	3.6	4.6	5.8	7.4	9.2	11.8	15	19	24.8	30.8	38.6
	Tolerance	0 −0.1	0 −0.2		0 −0.3	0 −0.4		0 −0.6	0 −0.7	0 −0.9	0 −1.2	0 −1.5	0 −1.9	0 −2.4	0 −3.1	0 −3.8	0 −4.8
b	Approx.	2	2.4	3	3	3.2	4	5	6.4	8	10	12.6	16	20	26	32	40
a	Approx.	1.6	1.6	1.6	2.5	2.5	2.5	2.5	3.2	4	4	4	4	6.3	6.3	6.3	6.3
Diameter of Applicable Bolts and Pins: Bolts	Over than	–	2.5	3.5	4.5	5.5	7	9	11	14	20	27	39	56	80	120	170
Bolts	or Less	2.5	3.5	4.5	5.5	7	9	11	14	20	27	39	56	80	120	170	–
Clevis Pin	Over than	–	2	3	4	5	6	8	9	12	17	23	29	44	69	110	160
	or Less	2	3	4	5	6	8	9	12	17	23	29	44	69	110	160	–
Dia. of Pin Hole	(Reference)	0.6	0.8	1	1.2	1.6	2	2.5	3.2	4	5	6.3	8	10	13	16	20

ℓ	
4	
5	
6	±0.5
8	
10	±0.5
12	
14	±0.5
16	
18	±0.8
20	
22	±0.8
25	
28	±0.8
32	
36	±1.2
40	
45	±1.2
50	
56	
63	±1.2
71	
80	±2
90	
100	±2
112	
125	
140	±2
160	
180	±2
200	
224	±2
250	
280	

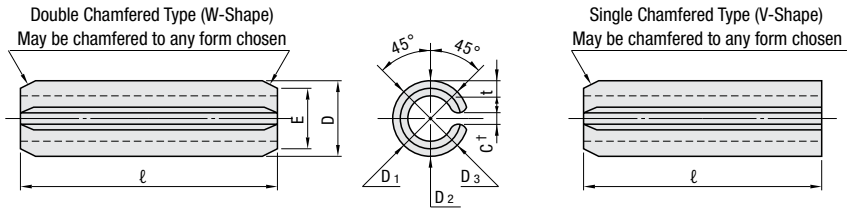
Reference 1. The nominal diameter is dependent on the diameter of the pin hole.
2. d is a value for a spot somewhere between the end and the l/2 spot.
3. The end may be pointed or flat. If a pointed end or a flat one is needed, it should be specified.
4. The length (l) should be one enclosed by thick lines. The value in an enclosed area is a tolerance. If the required r-value is not given in the table, it should be specified by the ordering side.
5. The head must not tilt excessively from the axial center.

Technical Data

Spring Pins / Retaining Rings (E Type)

Excerpts from JIS B 2808 (1995)
Excerpts from JIS B 2805 (1978)

Shape and Dimensions of Spring Pins



*The size of Gap C should be able to avoid the contact between the spring pin and the hole in which the pin is to be inserted.

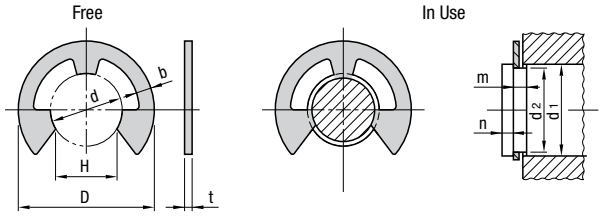
Unit: mm

Nominal Diameter			1	1.2	1.4	1.5	1.6	2	2.5	3	4	5	6	8	10	13
Spring Pins	D(1)	Max.	1.2	1.4	1.6	1.7	1.8	2.25	2.75	3.25	4.4	5.4	6.4	8.6	10.6	13.7
		Min.	1.1	1.3	1.5	1.6	1.7	2.15	2.65	3.15	4.2	5.2	6.2	8.3	10.3	13.4
	t (Reference)	For General Use	0.2	0.25	0.28	0.3	0.3	0.4	0.5	0.6	0.8	1	1.2	1.6	2	2.5
		Light Load	0.1	0.12	0.15	0.15	0.15	0.2	0.25	0.3	0.4	0.5	0.6	—	—	—
	E (Max.)		0.9	1.1	1.3	1.4	1.5	1.9	2.4	2.9	3.9	4.8	5.8	7.8	9.8	12.7
	Double Shearing Load kN{kgf} Minimum Value	For General Use	0.69 {70}	1.02 {104}	1.35 {138}	1.55 {158}	1.68 {171}	2.76 {281}	4.31 {440}	6.20 {633}	10.80 {1130}	17.25 {1760}	24.83 {2532}	44.13 {4500}	68.94 {7030}	112.78 {11500}
		Light Load	0.38 {39}	0.56 {57}	0.80 {82}	0.87 {89}	0.93 {95}	1.55 {158}	2.42 {247}	3.49 {356}	6.21 {633}	9.70 {989}	13.96 {1424}	—	—	—
Applicable Holes		Diameter	1	1.2	1.4	1.5	1.6	2	2.5	3	4	5	6	8	10	13
		Dimensional Tolerance	+0.08 0					+0.09 0			+0.12 0			+0.15 0		+0.2 0

ℓ	Dimensional Tolerance	Nominal Diameter 1	1.2	1.4	1.5	1.6	2	2.5	3	4	5	6	8	10	13
4	+0.5 0	0	0	0	0	0									
5		0	0	0	0	0	0	0							
6		0	0	0	0	0	0	0	0						
8		0	0	0	0	0	0	0	0	0					
10		0	0	0	0	0	0	0	0	0	0				
12	+1.0 0		0	0	0	0	0	0	0	0	0	0			
14				0	0	0	0	0	0	0	0	0			
16						0	0	0	0	0	0	0	0		
18							0	0	0	0	0	0	0	0	
20							0	0	0	0	0	0	0	0	
22								0	0	0	0	0	0	0	0
25								0	0	0	0	0	0	0	0
28									0	0	0	0	0	0	0
32									0	0	0	0	0	0	0
36										0	0	0	0	0	0
40										0	0	0	0	0	0
45											0	0	0	0	0
50											0	0	0	0	0
56	+1.5 0											0	0	0	0
63												0	0	0	0
70													0	0	0
80													0	0	0
90														0	0
100														0	0
110															0
125															0
140															0

Note(1): Maximum value for D is the maximum value on the pin's circumference, and the minimum value for D is the average of D1, D2 and D3.
Reference: t is in accordance with JSMA (Japan Spring Manufactures Association Standard) No.6.

Shape and Dimensions of Retaining Ring-E Type



Reference: Typical shape is shown.

Unit: mm

Nominal	Retaining Rings d(1) Reference Dimension	d(1) Tolerance	D Reference Dimension	D Tolerance	H Reference Dimension	H Tolerance	t Reference Dimension	t Tolerance	b Approx.	Applicable Shaft (Reference) Classification of d_1 More than	d_1 or Less	d_2 Reference Dimension	d_2 Tolerance	m Reference Dimension	m Tolerance	n Min.
0.8	0.8	0 −0.08	2	±0.1	0.7		0.2	±0.02	0.3	1	1.4	0.8	+0.05 0	0.3		0.4
1.2	1.2		3		1		0.3	±0.025	0.4	1.4	2	1.2		0.4	+0.05 0	0.6
1.5	1.5		4		1.3	0 −0.25	0.4	±0.03	0.6	2	2.5	1.5	+0.06 0	0.5		0.8
2	2	0 −0.09	5		1.7		0.4		0.7	2.5	3.2	2				1
2.5	2.5		6		2.1		0.4		0.8	3.2	4	2.5				
3	3		7		2.6		0.6		0.9	4	5	3		0.7		1.2
4	4		9		3.5		0.6		1.1	5	7	4	+0.075 0		+0.1 0	
5	5	0 −0.12	11	±0.2	4.3	0 −0.3	0.6		1.2	6	8	5				
6	6		12		5.2		0.8	±0.04	1.4	7	9	6		0.9		1.5
7	7		14		6.1		0.8		1.6	8	11	7	+0.09 0			1.8
8	8	0 −0.15	16		6.9	0 −0.35	0.8		1.8	9	12	8				2
9	9		18		7.8		0.8		2.0	10	14	9				
10	10		20		8.7		1.0	±0.05	2.2	11	15	10		1.15		2.5
12	12	0 −0.18	23		10.4		1.0		2.4	13	18	12	+0.11 0		+0.14 0	
15	15		29		13	0 −0.45	1.6[2]	±0.06	2.8	16	24	15		1.75[2]		3
19	19	0 −0.21	37	±0.3	16.5		1.6[2]		4.0	20	31	19	+0.13 0			3.5
24	24		44		20.8	0 −0.5	2.0	±0.07	5.0	25	38	24		2.2		4

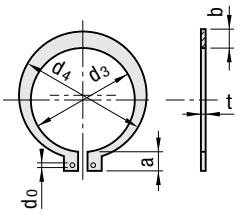
Note(1): d should be measured with a limit plug gauge. Note(2): thickness(t)=1.6mm, may be kept at 1.5mm for the time being. m should be 1.65mm.
Reference: The recommended dimensions of the applicable shaft are given here for reference.

Technical Data

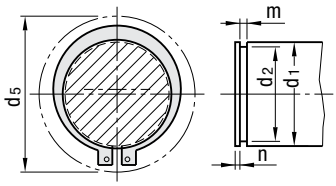
Retaining Rings (C Type)

Excerpts from JIS B 2804(2001)

1. Retaining Rings-C Type-External



The hole with diameter d_0 should be positioned to protrude out of the groove when the retaining ring is inserted in the shaft.



d_5 is the max. outer diameter when the retaining ring is fitted onto the shaft.

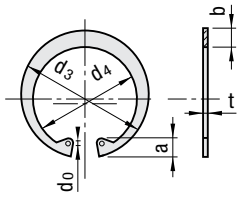
Retaining Rings-C Type-External

Unit: mm

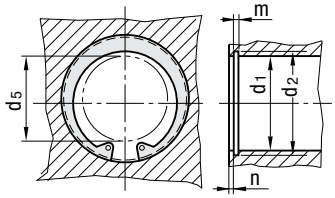
Nominal[1]	Retaining Rings							Applicable Shaft (Reference)						
	d3		t		b	a	d_0	d_5	d_1	d_2		m		n
	Reference Dimension	Tolerance	Reference Dimension	Tolerance	(Approx.)	(Approx.)	(Min.)			Reference Dimension	Tolerance	Reference Dimension	Tolerance	(Min.)
10	9.3	±0.15	1	±0.05	1.6	3	1.2	17	10	09.6	0 −0.09	1.15	+0.14 0	1.5
(11)	10.2				1.8	3.1		18	11	10.5	0 −0.11			
12	11.1	±0.18			1.8	3.2	1.5	19	12	11.5				
(13)	12.0				1.8	3.3		20	13	12.4				
14	12.9				2	3.4	1.7	22	14	13.4				
15	13.8				2.1	3.5		23	15	14.3				
16	14.7				2.2	3.6		24	16	15.2				
17	15.7				2.2	3.7		25	17	16.2				
18	16.5		1.2	±0.06	2.6	3.8	2	26	18	17		1.35		
(19)	17.5				2.7	3.8		27	19	18				
20	18.5	±0.2			2.7	3.9		28	20	19	0 −0.21			
(21)	19.5				2.7	4		30	21	20				
22	20.5				2.7	4.1		31	22	21				
(24)	22.2				3.1	4.2		33	24	22.9				
25	23.2				3.1	4.3		34	25	23.9				
(26)	24.2				3.1	4.4		35	26	24.9				
28	25.9		1.6[2]		3.1	4.6		38	28	26.6		1.75		
(29)	26.9				3.5	4.7		39	29	27.6				
30	27.9				3.5	4.8		40	30	28.6				
32	29.6				3.5	5	2.5	43	32	30.3	0 − 0.25			
(34)	31.5	±0.25			4	5.3		45	34	32.3				
35	32.2				4	5.4		46	35	33				
(36)	33.2		1.8	±0.07	4	5.4		47	36	34		1.95		2
(38)	35.2				4.5	5.6		50	38	36				
40	37.0	±0.4			4.5	5.8		53	40	38				
(42)	38.5				4.5	6.2		55	42	39.5				
45	41.5				4.8	6.3		58	45	42.5				
(48)	44.5				4.8	6.5		62	48	45.5				
50	45.8		2		5	6.7		64	50	47		2.2		
(52)	47.8				5	6.8		66	52	49				
55	50.8	±0.45			5	7		70	55	52	0 −0.3			
(56)	51.8				5	7		71	56	53				
(58)	53.8				5.5	7.1		73	58	55				
60	55.8				5.5	7.2		75	60	57				
(62)	57.8				5.5	7.2		77	62	59				
(63)	58.8				5.5	7.3		78	63	60				
65	60.8		2.5	±0.08	6.4	7.4		81	65	62		2.7		2.5
(68)	63.5				6.4	7.8		84	68	65				
70	65.5				6.4	7.8		86	70	67				
(72)	67.5				7	7.9		88	72	69				
75	70.5				7	7.9		92	75	72				
(78)	73.5				7.4	8.1		95	78	75				
80	74.5				7.4	8.2		97	80	76.5				

Note[1]: Priority should be given to values not in ( ). A value in ( ) may be used if necessary.
Note[2]: Thickness(t)=1.6mm, may be kept at 1.5mm for the time being. m should be 1.65mm.
Reference: 1. The minimum width of the ring of the retaining ring should be less than the plate thickness t.
2. The recommended dimensions of the applicable shaft are given here for reference.
3. d_4 (mm) should preferably be equal to d4=d3+(1.4~1.5)b.
Reference: The thickness t, conforms to the Japan Spring Manufactures Association Standard, JSMA No. 6-1976 (steel belt for a spring).

2. Retaining Rings-C Type-Internal



The hole with diameter d_0 should be positioned to protrude out of the groove when the retaining ring is inserted in the hole.



d_5 is the minimum diameter of the internal circumference when the retaining ring is fitted.

Unit: mm

Retaining Rings-C Type-Internal

Nominal[1]	Retaining Rings							Applicable Shaft (Reference)						
	d_3		t		b	a	d_0	d_5	d_1	d_2		m		n
	Reference Dimension	Tolerance	Reference Dimension	Tolerance	(Approx.)	(Approx.)	(Min.)			Reference Dimension	Tolerance	Reference Dimension	Tolerance	(Min.)
10	10.7	±0.18	1	±0.05	1.8	3.1	1.2	3	10	10.4	+0.11 0	1.15	+0.14 0	1.5
11	11.8				1.8	3.2		4	11	11.4				
12	13				1.8	3.3	1.5	5	12	12.5				
(13)	14.1				1.8	3.5		6	13	13.6				
14	15.1				2	3.6	1.7	7	14	14.6				
15	16.2				2	3.6		8	15	15.7				
16	17.3				2	3.7		8	16	16.8				
(17)	18.3	±0.2			2	3.8		9	17	17.8				
18	19.5				2.5	4		10	18	19	+0.21 0			
19	20.5				2.5	4	2	11	19	20				
20	21.5				2.5	4		12	20	21				
(21)	22.5				2.5	4.1		12	21	22				
22	23.5				2.5	4.1		13	22	23				
(24)	25.9		1.2	±0.06	2.5	4.3		15	24	25.2		1.35		
25	26.9				3	4.4		16	25	26.2				
(26)	27.9				3	4.6		16	26	27.2				
28	30.1	±0.25			3	4.6		18	28	29.4				
30	32.1				3	4.7		20	30	31.4	+0.25 0			
32	34.4				3.5	5.2		21	32	33.7				
(34)	36.5		1.6[2]		3.5	5.2		23	34	35.7		1.75		2
35	37.8				3.5	5.2		24	35	37				
(36)	38.8				3.5	5.2		25	36	38				
37	39.8				3.5	5.2		26	37	39				
(38)	40.8				4	5.3		27	38	40				
40	43.5	±0.4	1.8	±0.07	4	5.7	2.5	28	40	42.5		1.95		
42	45.5				4	5.8		30	42	44.5				
45	48.5				4.5	5.9		33	45	47.5				
47	50.5	±0.45			4.5	6.1		34	47	49.5				
(48)	51.5				4.5	6.2		35	48	50.5				
50	54.2		2		4.5	6.5		37	50	53	+0.3 0	2.2		
52	56.2				5.1	6.5		39	52	55				
55	59.2				5.1	6.5		41	55	58				
(56)	60.2				5.1	6.6		42	56	59				
(58)	62.2				5.1	6.8		44	58	61				
60	64.2				5.5	6.8		46	60	63				
62	66.2				5.5	6.9		48	62	65				
(63)	67.2				5.5	6.9		49	63	66				
(65)	69.2		2.5	±0.08	5.5	7		50	65	68		2.7		2.5
68	72.5				6	7.4		53	68	71				
(70)	74.5				6	7.4		55	70	73				
72	76.5				6.6	7.4		57	72	75				
75	79.5				6.6	7.8		60	75	78				
(78)	82.5	±0.55			6.6	8		62	78	81	+0.35 0			
80	85.5				7	8		64	80	83.5				

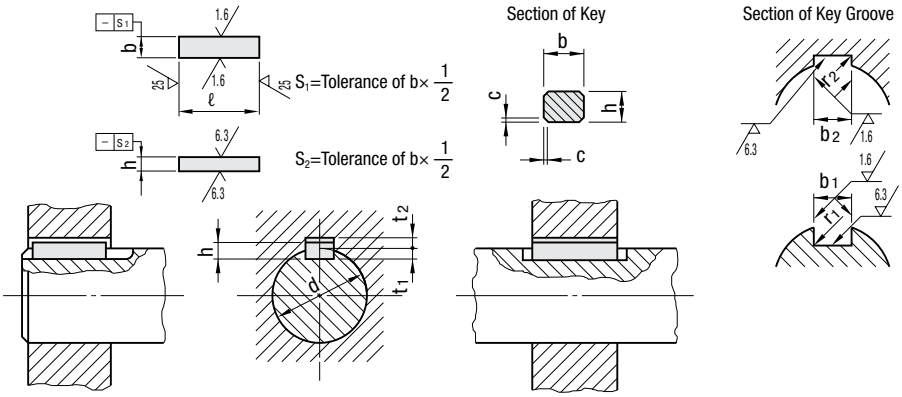
Note[1]: Priority should be given to values not in( ). A value in( )may be used if necessary.
Note[2]: Thickness(t)=1.6mm, may be kept at 1.5mm for the time being. m should be 1.65mm.
Reference: 1. The minimum width of the ring of the retaining ring should be less than the plate thickness t.
2. The recommended dimensions of the applicable shaft are given here for reference.
3. d_4(mm)should preferably be equal to d4=d3−(1.4~1.5)b.
Reference: The thickness t, conforms to the Japan Spring Manufactures Association Standard, JSMA No. 6-1976 (steel belt for a spring).

Technical Data

Excerpts from JIS B 1301 (1996)

Machine Keys and Key Grooves

1. Parallel Keys and Key Grooves



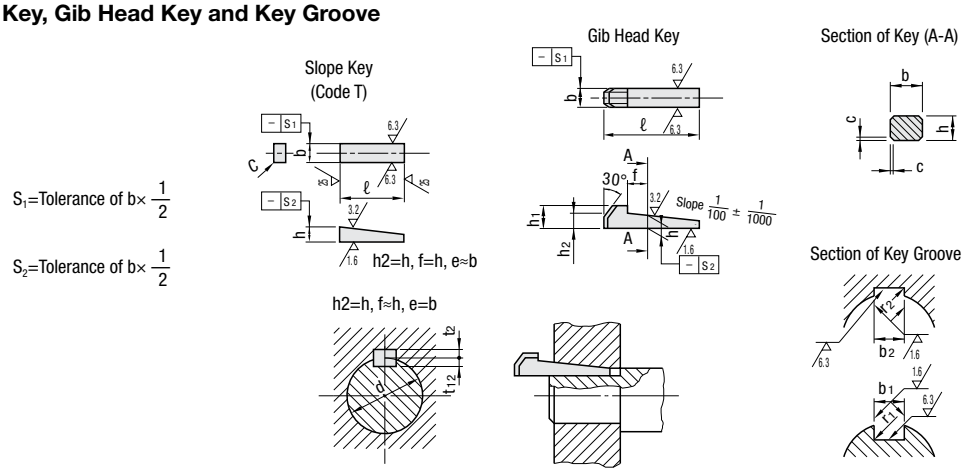
Unit: mm

Key Nominal Dimension b×h	Dimension of Key Groove										Reference
	Reference Dimension of b_1, b_2	(Sliding Type)		Standard		Precision Class	r_1 and r_2	Reference Dimension of t_1	Reference Dimension of t_2	Reference Dimension of t_2, t_1	Applicable Shaft Dia.(1) d
		b_1	b_2	b_1	b_2	b_1 and b_2					
		Tolerance (H9)	Tolerance (D10)	Tolerance (N9)	Tolerance (Js9)	Tolerance (P9)					
2×2	2	+0.025 0	+0.060 +0.020	−0.004 −0.029	±0.0125	−0.006 −0.031	0.08~0.16	1.2	1.0	+0.1 0	6~800
3×3	3							1.8	1.4		8~100
4×4	4	+0.030 0	+0.078 +0.030	0 −0.030	±0.0150	−0.012 −0.042		2.5	1.8		10~120
5×5	5						0.16~0.25	3.0	2.3		12~170
6×6	6							3.5	2.8		17~220
(7×7)	7	+0.036 0	+0.098 +0.040	0 −0.036	±0.0180	−0.015 −0.051		4.0	3.0	+0.2 0	20~250
8×7	8							4.0	3.3		22~300
10×8	10						0.25~0.40	5.0	3.3		30~380
12×8	12	+0.043 0	+0.120 +0.050	0 −0.043	±0.0215	−0.018 −0.061		5.0	3.3		38~440
14×9	14							5.5	3.8		44~500
(15×10)	15							5.0	5.0		50~550
16×10	16							6.0	4.3		50~580
18×11	18							7.0	4.4		58~650
20×12	20	+0.052 0	+0.149 +0.065	0 −0.052	±0.0260	−0.022 −0.074	0.40~0.60	7.5	4.9		65~750
22×14	22							9.0	5.4		75~850
(24×16)	24							8.0	8.0		80~900
25×14	25							9.0	5.4		85~950
28×16	28							10.0	6.4		95~110
32×18	32	+0.062 0	+0.180 +0.080	0 −0.062	±0.0310	−0.026 −0.088		11.0	7.4		110~130
(35×22)	35						0.70~1.00	11.0	11.0	+0.3 0	125~140
36×20	36							12.0	8.4		130~150
(38×24)	38							12.0	12.0		140~160
40×22	40							13.0	9.4		150~170
(42×26)	42							13.0	13.0		160~180
45×25	45							15.0	10.4		170~200
50×28	50							17.0	11.4		200~230
56×32	56	+0.074 0	+0.220 +0.100	0 −0.074	±0.0370	−0.032 −0.106	1.20~1.60	20.0	12.4		230~260
63×32	63							20.0	12.4		260~290
70×36	70							22.0	14.4		290~330
80×40	80						2.00~2.50	25.0	15.4		330~380
90×45	90	+0.087 0	+0.260 +0.120	0 −0.087	±0.0435	−0.037 −0.124		28.0	17.4		380~440
100×50	100							31.0	19.5		440~500

Note(1) The applicable shaft diameter is calculated from the torque corresponding to the strength of the key, for presentation as referential data for general-purpose use. When the key is of an appropriate size relative to the torque to be transmitted, a shaft thicker than the applicable shaft diameter may be used. In some cases, t_1 and t_2 should be adjusted so that a side of the key will come into uniform contact with the shaft and the hub. A shaft narrower than the applicable shaft diameter should not be used.

Reference The nominal sizes given in ( ) do not conform to the relevant international standard and must not be used in new design.

2. Slope Key, Gib Head Key and Key Groove



Unit: mm

Key Nominal Dimension b×h	Dimension of Key Groove									Dimension of Key Groove						Reference
	b		h			h1	c	ℓ(1)		b1 and b2		r1 and r2	Reference Dimension of t1	Reference Dimension of t2	Reference Dimension of t2, t1	Applicable Shaft Dia.(2) d
	Reference Dimension	Tolerance (h9)	Reference Dimension	Tolerance						Reference Dimension	Tolerance (D10)					
2×2	2	0 −0.025	2	0 −0.025	h9	—	0.16 ~0.25	6~30		2	+0.060 +0.020	0.08 ~0.16	1.2	0.5	+0.05 0	6~800
3×3	3		3			—		6~36		3			1.8	0.9		8~100
4×4	4	0 −0.030	4	0 −0.030		7		8~45		4	+0.078 +0.030		2.5	1.2	+0.1 0	10~120
5×5	5		5			8	0.25 ~0.40	10~56		5		0.16 ~0.25	3.0	1.7		12~170
6×6	6		6			10		14~70		6			3.5	2.2		17~220
(7×7)	7	0 −0.036	7.2	0 −0.036		10		16~80		7	+0.098 +0.040		4.0	3.0		20~250
8×7	8		7	0 −0.090	h11	11		18~90		8			4.0	2.4	+0.2 0	22~300
10×8	10		8			12	0.40 ~0.60	22~110		10		0.25 ~0.40	5.0	2.4		30~380
12×8	12	0 −0.043	8			12		28~140		12	+0.120 +0.050		5.0	2.4		38~440
14×9	14		9			14		36~160		14			5.5	2.9		44~500
(15×10)	15		10.2	0 −0.070	h10	15		40~180		15			5.0	5.0	+0.1 0	50~550
16×10	16		10	0 −0.090	h11	16		45~180		16			6.0	3.4	+0.2 0	50~580
18×11	18		11	0 −0.110		18		50~200		18			7.0	3.4		58~650
20×12	20	0 −0.052	12			20	0.60 ~0.80	56~220		20	+0.149 +0.065	0.40 ~0.60	7.5	3.9		65~750
22×14	22		14			22		63~250		22			9.0	4.4		75~850
(24×16)	24		16.2	0 −0.070	h10	24		70~280		24			8.0	8.0	+0.1 0	80~900
25×14	25		14	0 −0.110	h11	22		70~280		25			9.0	4.4	+0.2 0	85~950
28×16	28		16			25		80~320		28			10.0	5.4		95~110
32×18	32		18			28		90~360		32			11.0	6.4		110~130
(35×22)	35		22.3	0 −0.084	h10	32	1.00 ~1.20	100~400		35	+0.180 +0.080	0.70 ~1.00	11.0	11.0	+0.15 0	125~140
36×20	36		20	0 −0.130	h11			–		36			12.0	7.1	+0.3 0	130~150
(38×24)	38	0 −0.062	24.3	0 −0.084	h10	36		–		38			12.0	12.0	+0.15 0	140~160
40×22	40		22	0 −0.130	h11	36		–		40			13.0	8.1	+0.3 0	150~170
(42×26)	42		26.3	0 −0.084	h10	40		–		42			13.0	13.0	+0.15 0	160~180
45×25	45		25	0 −0.130	h11	40		–		45			15.0	9.1	+0.3 0	170~200
50×28	50		28			45		–		50			17.0	10.1		200~230
56×32	56	0 −0.074	32	0 −0.160		50	1.60 ~2.00	–		56	+0.220 +0.100	1.20 ~1.60	20.0	11.1		230~260
63×32	63		32			50		–		63			20.0	11.1		260~290
70×36	70		36			56		–		70			22.0	13.1		290~330
80×40	80		40			63	2.50 ~3.00	–		80		2.00 ~2.50	25.0	14.1		330~380
90×45	90	0 −0.087	45			70		–		90	+0.260 +0.120		28.0	16.1		380~440
100×50	100		50			80		–		100			31.0	18.1		440~500

Note(1): From the values for l given below, which are in the appropriate range in the table, one should be selected.
The tolerance for l should be h12 under JIS B0401 (dimension tolerance and fitting), in principle.
6,8,10,12,14,16,18,20,22,25,28,32,36,40,45,50,56,63,70,80,90,100,110,125,140,160,180,200,220,250,280,320,360,400

Note(2): The appropriate shaft diameter should be matched with the torque corresponding to the strength of the key.

Reference: The nominal sizes given in ( ) should not be used unless they are absolutely necessary.
The groove for the boss should be slanted to 1/100, in principle.

Materials

Varieties and Applications 1

1. General Steel Materials

Type	Material Code	Applications	Comment	JIS	Flat Bar	Square Bar	Hexagonal Bar	Round Bar	Steel Plate	Section Steel
Rolled Steel for General Structure	1018 Carbon Steel	General Machine Parts	Fine Workability and Weldability	JIS G 3101	0	0		0	0	0
Polished Steel Bar (Cold-Drawn)	JIS-SS400D	General Machine Parts	Excellent Precision and Surface Roughness. Ready for use directly after slight cutting.	–	0	0	0	0		
Carbon Steel for Machine Structural Use	1045 Carbon Steel	General Machine Parts	Fit for Hardening Tensile Strength 58kgf/mm^2	JIS G 4051	0	0	0	0	0	
	1049 Carbon Steel		Fit for Hardening Tensile Strength 66kgf/mm^2							
Carbon Tool Steel	W1-9 Tool Steel	Shafts, Pins, etc.	For Drill Rod (Round Bar) SK4 surface-finished after cold drawing. Class 7(–DG7)=h7 Class 8(–DG8)=h8 Class 9(–DG9)=h9.	JIS G 4401	0			0		
	W1-8 Tool Steel				0			0	0	
Alloy Tool Steel	JIS-SKS93	Hardening Parts	Deformation caused by Hardening is much less than that of SK material.	JIS G 4404	0	0		0		
	01 Tool Steel									
Chrome Molybdenum Steel	4137 Alloy Steel	General Machine Parts requiring strength Screws, etc.	Tensile Strength 70kgf/mm^2, Tensile Strength after Hardening & tempering: 95 kgf/mm^2 or more. Hardness: HB270 or more. Hardening: HRC50 or more.	JIS G 4105	0	0	0	0	0	
	SCM415 Alloy Steel									
	JIS-SCM420									
Sulfuric and Sulfur Compound Free Cutting Steel	1212 Carbon Steel	General Machine Parts (Free-Cutting steel)	Made of carbon steel plus sulfur to enhance machinability.	JIS G 4804		0	0	0		
	12L13 Carbon Steel		Free-Cutting Steel containing sulfur and lead.							
	12L14 Carbon Steel									
High Carbon Chrome Bearing Steel	52100 Bearing Steel	Roller Bearings, etc.	Bearing Steel	JIS G 4805				0		
Cold-Rolled Steel Plate	Low Carbon Steel	Covers, Cases, etc.	Rolled at an almost ambient temperature. High dimensional precision and fair texture. Fine machinability. Easy to bend, wring and cut. Fine Weldability.	JIS G 3141					0	
Hot-Rolled Steel Plate	Low Carbon Steel	General Machine Structural Parts	Plates for general use are 6 mm or less in thickness.	JIS G 3131					0	

2. Stainless Steel Materials

Type	Material Code	Applications	Comment	Magnetism	JIS	Flat Bar	Square Bar	Hexagonal Bar	Round Bar	Steel Plate	Section Steel
Austenite	303 Stainless Steel	Machine parts requiring antirusting	18-8 Free-Cutting Stainless Steel, Non-Magnetic. More Machinable than SUS304	None*	JIS G 4303~	Good			Good		
Austenite	304 Stainless Steel	Machine parts requiring antirusting	Most Versatile Antirusting and Heat-Resisting Steel for General Use	None*		Good	Good	Good	Good	Good	Good
Austenite	316 Stainless Steel	Machine parts requiring antirusting	More resisting to seawater and other media than SUS304.	None*		Good			Good	Good	
Martensite	440C Stainless Steel	Machine parts requiring antirusting (Less corrosion resistant than austenite.)	Fit for Hardening.	Available					Good		
Martensite	410 Stainless Steel	Machine parts requiring antirusting (Less corrosion resistant than austenite.)	Fit for Hardening. Fine Machinability.	Available					Good		

*Martensite exhibits magnetic properties. Machining of Austenite may cause magnetic properties.

<Reference: Corrosion Resistance of Stainless Steel>

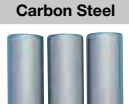
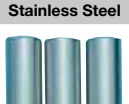
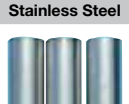
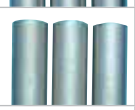
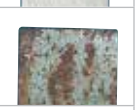
Testing Method

Conforms to the JIS H 8502 Cycle Test Method as a complex corrosion test

Test Conditions

(1) Salt water spray test (5%NaCl. 35˚C) 2 hr
(2) Drying (60˚C) 4 hr
(3) Wetting (95%RH. 35˚C) 2 hr
One cycle takes 8 hr

Appearance of test piece 48 hr, 168 hr before test.

	1018 Carbon Steel	440C Stainless Steel	304 Stainless Steel	316 Stainless Steel	*G–STAR
Before Test					
48 hr					
168 hr					

*G-STAR is martensite stainless steel (pre-hardened steel) manufactured by the Daido Special Steel Co., Ltd.

3. Aluminum Alloy Materials

Type	Material Code	Applications	Comment	JIS	Flat Bar	Square Bar	Hexagonal Bar	Round Bar	Section Steel
Al–Cu Alloy	A2011	General-Use Strength Materials	Free-Cutting Alloy. It excels in machinability but has worse corrosion resistance.	JIS H 4000			Good		
Al–Cu Alloy	A2017	General-Use Strength Materials	High Strength and Machinability Duralumin		Good		Good	Good	
Al–Mg Alloy	A5052	General Machine Parts Covers, cases, etc.	Most typical aluminum alloy with medium strength. With high fatigue strength in comparison with its strength and high corrosion resistance to seawater.		Good			Good	
Al–Mg Alloy	A5056	General Machine Parts	It has fine machined surface and high corrosion resistance to seawater. It has fine machined surface and high corrosion resistance to seawater.				Good		
Al–Mg–Si Alloy	A6061	General Machine Parts	Heat-treated corrosion resisting alloy. High durability owing to T6 treatment.		Good		Good		
Al–Mg–Si Alloy	A6063	General Machine Parts and Structural Material	Weaker than 6061, but more extrudable. Applicable to complex cross-sections shapes. Good corrosion resistance and surface treatment.		Good	Good			Good
Al–Zn–Mg Alloy	A7075	Jigs and Dies	It is one of the strongest aluminum alloys but has worse corrosion resistance. Extra Super Duralumin		Good				

JIS Acronyms for Non-Ferrous Metal

P	Plate, Strip, Disk
PC	Laminate
BE	Extruded Bar
BD	Drawn Bar
W	Drawn Wire

TE	Seamless Extruded Tube
TD	Seamless Drawn Tube
TW	Welded Tube
TWA	Arc-Welded Tube
S	Extruded Section

BR	Riveted Bar
FD	Die-Forged Part
FH	Free-Forged Part

Quality Codes for Aluminum and Aluminum Alloys

Code		Definition	Description
F		Plain Manufactured Material	Completed as a product, without any order for thermal refining. Extruded or forged material, not thermally refined.
H112		Wrought material, for which certain mechanical properties are guaranteed without the need of hardening.	
O		Brought into the softest state by annealing.	Completely re-crystallized by annealing. A thermally treated alloy should be cooled at a temperature below the annealing temperature to prevent the effect of annealing completely.
H	H1n	Hardened by cold working.	n is a numeral from 1 to 9, representing the degree of hardening. "8" represents hard material, and "4" represents the state halfway 1/2 between 0 and hard material. "2" represents the level halfway between 0 and 1/2 hardness, and "6" the state halfway between 1/2 hardness and hard material.
	H2n	Hardened and then properly softened by heat.	
	H3n	Stabilized after cold working.	
T	T1	Cooled after high-temperature working and then allowed to age naturally.	Quenched at the end of a cold working process and allowed to age and harden at ambient temperature. Extruded material is typical material processed in this way. Cold working such as correction may be conducted unless it affects the strength. Used for an alloy such as 6063, for which the effect of quenching can be realized by cooling after hot working (extrusion).
	T3	Allowed to age naturally after solution treatment and cold working.	Cold working is conducted for plates, rods, tubes, etc. to enhance the strength in some cases, and to improve the corrective dimension precision in other cases, with an obvious effect. T361 when cold working is performed to a higher degree than that for T3.
	T351	Allowed to age naturally after solution treatment and cold working.	Cold working is conducted to enhance the strength after solution treatment, and then it is tension processed to give 1.5% to 3% permanent distortion to remove residual tension, and allowed to age naturally.
	T4	Natural aging after solution treatment	Aging is usually completed after exposure to ambient temperature for approx. 4 days. In the case of 7N01, however, aging is a longer process. The tensile property upon the elapse of one month is adopted as referential data. The variety that is given T4 treatment by a user under specified conditions is called T42.
	T5	Hardened through artificial aging after high-temperature processing and quenching	Hardened through artificial aging to improve the mechanical properties and stabilize the dimensions. Used for an alloy or casting such as 6063, for which the effect of quenching can be realized by cooling after hot working (extrusion).
	T6	Hardened through artificial aging after solution treatment.	Excellent strength can be attained for a thermally treated alloy without cold working in the typical heat treatment process. An item that is given T6 treatment by a user under specified conditions is called T62.
	T61	Wrought Materials: Hardened through artificial aging after solution treatment by quenching with lukewarm water. Casting:Tempered after hardening	Quenched with lukewarm water to prevent distortion due to the main hardening. The conditions for hardening through artificial aging are adjusted to attain strength exceeding that accomplished by regular T6 treatment.
	T7	Stabilized after solution treatment	Overaging surpassing those needed for hardening through artificial aging is carried out to attain the maximum strength, because special properties are adjusted somewhat at the expense of strength.
	T73	Overaging after solution treatment.	Overaging after solution treatment to rectify the tendency to crack due to corrosion under stress. Specified in 7075, forgings, of JIS.
	T7352	Overaging after removal of residual stress after solution treatment.	Overaging after removal of residual stress by compression to retain 1% to 5% permanent deformation subsequent to solution treatment, in order to rectify the tendency to crack due to corrosion under stress. Included in free-forged part, 7075.
	T8	Hardened through artificial aging after cold working subsequent to solution treatment.	Cold working performed, with a noticeable effect, to improve the mechanical properties or to rectify drawbacks or improve dimension precision. Called T83 when the sectional area is reduced 3%through cold working. Called T86 when the reduction rate is 6%. These procedures are performed to enhance the strength.
	T9	Cold working after hardening through artificial aging subsequent to solution treatment.	Cold working is necessary to enhance the strength.

Materials

Hardening and Hardness Test Methods

■ Heat Treatment for Steel Materials

Name	Vickers Hardness (HV)	Hardening Depth (mm)	Strain	Applicable Materials	Typical Material	Reference
Through Hardening	750 or Less	Full Depth	Varies according to materials	High Carbon Steel C>0.45%	01 Tool Steel JIS-SKS21 52100 Bearing Steel M2 Tool Steel JIS-SKS93 W1-9 Tool Steel 1045 Carbon Steel	– Operation of heating copper to an appropriate temperature over transformation point and quickly cooling it in an appropriate medium in order to increase hardness or improve strength. – Not applicable to long or precision parts, such as spindles, etc.
Carburization	500 or Less	Standard 0.5 Up to 2	Moderate	Low Carbon Steel C<0.3%	SCM415 Alloy Steel JIS-SNCM220	– Applicable to partial hardening – Hardening depth should be specified on drawings – Applicable to precision parts
Induction Hardening	750 or Less	1~2	High	Medium Carbon Steel C 0.3~0.5%	1045 Carbon Steel	– A surface hardening method that uses high frequency induction current to quickly heat and cool the steel surface – Applicable to partial hardening – Expensive in small-volume lots – High fatigue resistance
Nitriding	900~1000	0.1~0.2	Low	Nitriding Steel	JIS-SCM645	– A surface hardening method that forms hardening layer of hard nitride compounds on the steel surface – Obtains highest degree of hardness among all hardening techniques – Fit for mass production – Applicable to spindles for sliding bearing
TUFFTRIDE is the trademark of Durferrit GmbH, Germany (salt bath process)	Carbon Steel 500 Stainless Steel 1000	0.01~0.02	Low	Steel Material	1045 Carbon Steel SCM415 Alloy Steel W1-10 Tool Steel Stainless Steel	– Tufftride is one of the nitriding methods called soft-nitriding (salt bath process) – High fatigue resistance and abrasion resistance – Same corrosion resistance as zinc plating – Not applicable to precision parts because of incapability of polishing after heat treatment –Applicable to oil free bearings.
Bluing	—	—	—	Wire Rod	JIS-SWP-B	– Low temperature annealing – Removes internal stress during forming to enhance elasticity

■ Hardness Test Methods and Applicable Parts

Testing Method	Principle	Applicable Heat-Treated Parts	Features	Reference
Brinell Hardness	– A (steel or super hard alloy) ball indenter is used to indent the test surface. Hardness is given as a quotient divided by the surface area of the dent, computed from the diameter.	– Annealing – Normalized parts – Anchored materials	– Applicable to uneven materials and forged products because indent is large – Not applicable to small or thin specimens	JIS Z2243
Rockwell Hardness	– This standard or test load is applied via a diamond or ball indenter. Hardness is read on a tester.	– Hardening tempered parts – Carburized surfaces – Nitrided parts – Thin sheets such as copper, brass, bronze, etc.	– Hardness value obtained quickly – Applicable to intermediate testing of actual products – Caution is required as there are 30 types	JIS Z2245
Shore Hardness	– The specimen is set on a table. A hammer is dropped from a uniform height. Hardness is based on how height the hammer bounces.	– Hardening tempered parts – Nitrided parts – Large carburized parts, etc.	– Extremely easy to operate and data can be obtained quickly – Applicable to large parts – Indent is kept shallow, therefore is applicable to actual products – Portable, as being compact and light weight	JIS Z2246
Vickers Hardness	– Uses a diamond 136°square pyramid indenter. Hardness value is obtained from the surface area of the dent, computed from the experimental load and the length of the diagonal lines of the dent. (Automatically calculated)	– This hardening layers by induction hardening, carburizing, nitriding, electrolytic plating, ceramic coating, etc. – Hardening layer depth in carburized and nitrided parts	– Applicable to small and thin specimens – Applicable to all materials because of diamond indenter	JIS Z2244

Materials

Standard Material Sizes 1

■ General Steel Materials

Type	Material Code	Shapes	Unit	Standard Dimensions
Rolled Steel for General Structure	1018 Carbon Steel	Flat Bar	t	6, 9, 12, 13, 14, 16, 19, 22, 25, 28, 30, 32, 35, 38, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105
		Square Bar	—	9, 13, 16, 19, 22, 25, 32, 38, 44, 50, 65, 75, 90, 100
Polished Steel Bar (Cold-Drawn)	JIS SS400D	Flat and Square Steel Bar	t	Width W
			2	6, 8, 10, 12, 16, 20
			3	6, 8, 9, 10, 12, 13, 16, 19, 22, 25, 32, 38, 50
			4	10, 13, 16, 19, 20, 22, 25, 32
			4.5	11, 13, 16, 19, 22, 25, 32, 38, 50
			5	8, 10, 13, 16, 19, 20, 22, 25, 30, 32, 38, 50
			6	9, 10, 13, 16, 19, 20, 22, 25, 32, 38, 44, 50, 60, 65, 75, 90, 100, 125
			8	10, 12, 13, 16, 19, 22, 25, 30, 32, 38
			9	12, 13, 16, 19, 22, 25, 32, 38, 44, 50, 60, 65, 75, 90, 100, 125
			10	13, 15, 16, 20, 22, 25, 30, 32, 38, 40, 50, 60, 65, 100
			12	16, 19, 22, 32, 38, 44, 45, 50, 60, 65, 75, 90, 100, 125
			16	19, 22, 25, 32, 38, 44, 50, 60, 65, 75, 90, 100, 125
			19	22, 25, 32, 38, 44, 50, 60, 65, 75, 90, 100, 125
			22	25, 32, 38, 44, 50, 60, 65, 75, 90, 100, 125
			25	32, 38, 44, 50, 60, 65, 75, 90, 100, 125
			30	50, 65, 75, 100, 125
			32	50, 65, 75, 100, 125
			38	50, 65, 75, 100, 125
		Square Bar	—	2.5, 3, 4, 4.5, 5, 5.5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 28, 30, 32, 34, 35, 36, 38, 40, 42, 44, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 100, 110, 120, 130
		Hexagonal Bar	Opposite Side H	3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 19, 21, 22, 23, 24, 26, 27, 29, 30, 32, 35, 36, 38, 41, 46, 50, 54, 55, 58, 60, 63, 65, 67, 70, 71, 75, 77, 80, 85, 90, 95, 100, 115
		Round Bar	D	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 42, 43, 44, 45, 46, 48, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 140, 150, 160, 170, 180, 190, 200
Cold-Rolled Steel Plate	Low Carbon Steel	Steel Plate	t	0.4, 0.5, 0.6, 0.7, 0.8, 1, 1.2, 1.6, 2, 2.3, 3.2
Hot-Rolled Steel Plate	Low Carbon Steel	Steel Plate	t	(1.2), 1.6, 2.3, 2.6, 3.2, 4.5
Carbon Steel for Machine Structural Use	1045 Carbon Steel (Polished)	Round Bar	D	2, 2.5, 3, 3.5, 4, 4.5, 6, 7, 8, 9, 9.5, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36, 38, 40, 42, 44, 45, 46, 48, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130
	1049 Carbon Steel	Flat Bar	t	6, 9.5, 12.7, 13, 16, 19, 22, 25, 27, 32, 38, 45, 50, 55, 65, 75, 85, 95, 105, 115, 125, 135, 145, 155, (165), (175), (185), (205)
		Square Bar	—	12.7, 13, 16, 19, 25, 28, 32, 38, 44, 50, 55, 65, 75, 90, 100, 110, 120, 130, 155
Carbon Tool Steel	JIS-SKS93	Flat Bar	t	2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 16, 19, 22, 25, 27, 32, 38, 43, 50, 53, 65, 75, 90, 105, 130, 155
	JIS-SKS93	Square Bar	—	10, 13, 16, 19, 22, 25, 28, 32, 38, 45, 50, 55, 65, 75, 90, 105, 130, (155), (210)
	W1-9 Tool Steel -DG8	Round Bar	D	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 28, 30, 32, 36, 38, 40, 42, 45, 48, 50, 55, 60, 65, 70, 75, 80
Alloy Tool Steel	01 Tool Steel	Flat Bar	t	2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 16, 19, 22, 25, 27, 32, 38, 43, 50, 53, 65, 75, 90, 105, 130, 155, (160)
		Square Bar	—	10, 13, 16, 19, 22, 25, 28, 32, 36, 38, 45, 50, 55, 65, 75, 90, 105, 130, (155), (210)
		Round Bar	D	13, 16, 19, 22, 25, 28, 32, 38, 42, 46, 50, 55, 60, 65, 70, 80, 85, 90, 100, 110, 120, 130, 150, 160, 180
Chrome Molybdenum Steel	4137 Alloy Steel	Hexagonal Bar	Opposite Side H	6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 19, 21, 22, 23, 24, 26, 27, 30, 32, 35, 36, 38, 41, 46, 50, 54, 55
		Round Bar	D	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 32, 34, 35, 36, 38, 40, 42, 45, 46, 48, 50
Sulfuric and Sulfur Compound Free Cutting Steel	12L14 Carbon Steel	Round Bar	D	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 22, 23, 24, 25, 26, 28, 30, 32, 34, 35, 36, 38, 40
High Carbon Chrome Bearing Steel	52100 Bearing Steel	Round Bar	D	13, 16, 19, 22, 25, 28, (30), 32, (34), 36, 38, 42, (44), 46, (48), 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120, 130, 140, 150, (160), (170), (180), (190), (200), (210), (220), (230), (240), (250)

Materials

Standard Material Sizes 2

■ Stainless Steel Materials

Type	Material Code	Shapes	Unit	Standard Dimensions
Austenite	303 Stainless Steel	Round Bar	D	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 28, 30
Austenite	304 Stainless Steel	Flat Bar	t	3, 4, 5, 6, 8, 9, 10, 12, 14, 15, 16, 19, 20, 22, 25, 28, 30, 35, 40, 45, 50, 55, 60, 70
		Square Bar	_	5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 19, 20, 22, 25, 28, 30, 32, 36, 38, 40, 45, 50, 60
		Hexagonal Bar	Opposite side H	8, 10, 14, 17, 19, 21, 22, 23, 24, 26, 29, 30, 32, 35, 36, 38, 41, 46
		Round Bar	D	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 30, 32, 34, 35, 36, 38, 40, 42, 45, 46, 48, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230
		Steel Plate	t	0.3, 0.4, 0.5, 0.6, 0.8, 1, 1.2, 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20

■ Copper Alloy Materials

Type	Material Code	Shapes	Unit	Standard Dimensions
Brass Plate	C28000 Brass	Steel Plate	t	0.1, 0.15, 0.2, 0.3, 0.4, 0.5, 0.8, 1, 1.2, 1.5, 1.6, 2, 2.3, 2.5, 3, 3.5, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30, 40, 50
Free-Cutting Brass (Extruded Bar)	C3604 BD Brass (JIS)	Square Bar	—	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 30, 32, 35, 36, 38, 40, 42, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100
		Hexagonal Bar	Opposite Side H	5, 5.5, 6, 7, 8, 9.5, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 34, 35, 36, 38, 40, 41, 42, 44, 45, 46, 50, 54, 55, 58, 60, 65, 70, 75, 80
		Round Bar	D	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36, 38, 40, 42, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 270, 280, 300, 320, 350

■ Aluminum Alloy Materials

Type	Material Code	Shapes	Unit	Standard Dimensions
Al-Cu Alloy	2017 Aluminum Alloy	Flat Bar	t	0.5, 0.6, 0.8, 1, 1.2, 1.5, 1.6, 2, 2.5, 3, 4, 5, 6, 8, 10, 12, 15, 20, 25, 30, 40, 45, 50, 60, 70, 80, 90, 100
		Round Bar	D	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 280, 300
Al-Mg Alloy	5052 Aluminum Alloy	Flat Bar	t	0.4, 0.5, 0.6, 0.7, 0.8, 1, 1.2, 1.5, 1.6, 2, 3, 3.2, 4, 5, 6, 7, 8, 10, 12, 15, 16, 18, 20, 22, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 120, 130, 150, 160, 170, 180, 200
Al-Mg Alloy	5056 Aluminum Alloy	Round Bar	D	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 420
Al-Mg-Si Alloy	6063 Aluminum Alloy	Square Bar	—	6, 8, 10, 12, 14, 15, 16, 18, 19, 20, 22, 25, 30, 32, 35, 40, 45, 50, 60, 70, 80, 100

■ Resin Type Materials

Type	Material Code	Shapes	Unit	Standard Dimensions
Laminated Sheet	Bakelite	Plate	t	(0.5), (0.6), 0.8, 1, 1.2, 1.5, 1.6, 2, 2.5, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 25, 30, 35, 40, 50 Sizes in ( ) for cloth base only.
Polyamide Resin	Nylon 6, 66	Plate	t	5, 10, 15, 20, 25, 30, 40, 50
		Bar	D	6, 8, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 90, 100, 120, 140, 160, 180, 200
(MC Nylon)	MC Nylon	Plate	t	5, 7, 10, 12, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 120
		Bar	D	20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 225, 250, 275, 300, 325, 350, 375, 400, 450, 500, 600
Acetal Resin	Polyacetal	Plate	t	5, 6, 8, 10, 12, 15, 20, 25, 30, 35, 40, 50, 60, 70, 80, 90, 100
		Bar	D	4, 5, 6, 7, 8, 9, 10, 12, 12.5, 13, 15, 16, 17.5, 20, 22.5, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 100, 110, 120, (130), (140), 150, (160), (180), 200
General Methacrylic Resin Plate	Acrylic	Plate	t	0.8, 1, 1.5, 2, 3, 4, 5, 6, 8, 10, 15, 20, 25, 30

Materials Data

Comparisons of Materials Between JIS and Foreign Standards 1

■ Carbon Steel for Machine Structural Use, Alloy Steel

Japan Industrial Standards		Steel Type Related to Foreign Standards					
Standard Number Name	Symbol	ISO 683/1,10,115)	AISI SAE	BS 970 Part1,3 BS EN 10083–1,2	DIN EN 10084 DIN EN 10083–1,2	NF A35–551 NF EN 10083–1,2	ГOCT 4543
JIS G 4051 Carbon Steel for Machine Structural Use	S10C	C10	1010	040A10 045A10 045M10	C10E C10R	XC10	—
	S12C	—	1012	040A12	—	XC12	—
	S15C	C15E4 C15M2	1015	055M15	C15E C15R	—	—
	S17C	—	1017	—	—	XC18	—
	S20C	—	1020	070M20 C22 C22E C22R	C22 C22E C22R	C22 C22E C22R	—
	S22C	—	1023	—	—	—	—
	S25C	C25 C25E4 C25M2	1025	C25 C25E C25R	C25 C25E C25R	C25 C25E C25R	—
	S28C	—	1029	—	—	—	25Г
	S30C	C30 C30E4 C30M2	1030	080A30 080M30 C30 C30E C30R	C30 C30E C30R	C30 C30E C30R	30Г
	S33C	—	—	—	—	—	30Г
	S35C	C35 C35E4 C35M2	1035	C35 C35E C35R	C35 C35E C35R	C35 C35E C35R	35Г
	S38C	—	1038	—	—	—	35Г
	S40C	C40 C40E4 C40M2	1039 1040	080M40 C40 C40E C40R	C40 C40E C40R	C40 C40E C40R	40Г
	S43C	—	1042 1043	080A42	—	—	40Г
	S45C	C45 C45E4 C45M2	1045 1046	C45 C45E C45R	C45 C45E C45R	C45 C45E C45R	45Г
	S48C	—	—	080A47	—	—	45Г
	S50C	C50 C50E4 C50M2	1049	080M50 C50 C50E C50R	C50 C50E C50R	C50 C50E C50R	50Г
	S53C	—	1050 1053	—	—	—	50Г
	S55C	C55 C55E4 C55M2	1055	070M55 C55 C55E C55R	C55 C55E C55R	C55 C55E C55R	—
	S58C	C60 C60E4 C60M2	1059 1060	C60 C60E C60R	C60 C60E C60R	C60 C60E C60R	60Г
	S09CK	—	—	045A10 045M10	C10E	XC10	—
	S15CK	—	—	—	C15E	XC12	—
	S20CK	—	—	—	—	XC18	—
JIS G 4106 Manganese Steel and Chrome-Manganese Steel for Machine Structural Use	SMn420	22Mn6	1522	150M19	—	—	—
	SMn433	—	1534	150M36	—	—	30Г 2 35Г 2
	SMn438	36Mn6	1541	150M36	—	—	35Г 2 40Г 2
	SMn443	42Mn6	1541	—	—	—	40Г 2 45Г 2
	SMnC420	—	—	—	—	—	—
	SMnC443	—	—	—	—	—	—
JIS G 4202 Aluminum Chrome Molybdenum Steel	SACM645	41CrAlMo74	—	—	—	—	—
JIS G 4052 Structural Steel with Guaranteed Hardenability (H Steel)	SMn420H	22Mn6	1522H	—	—	—	—
	SMn433H	—	—	—	—	—	—
	SMn438H	36Mn6	1541H	—	—	—	—
	SMn443H	42Mn6	1541H	—	—	—	—
	SMnC420H	—	—	—	—	—	—
	SMnC443H	—	—	—	—	—	—
	SCr415H	—	—	—	17Cr3 17CrS3	—	15X
	SCr420H	20Cr4 20CrS4	5120H	—	—	—	20X
	SCr430H	34Cr4 34CrS4	5130H 5132H	34Cr4 34CrS4	34Cr4 34CrS4	34Cr4 34CrS4	30X
	SCr435H	34Cr4 34CrS4 37Cr4 37CrS4	5135H	37Cr4 37CrS4	37Cr4 37CrS4	37Cr4 37CrS4	35X
	SCr440H	37Cr4 37CrS4 41Cr4 41CrS4	5140H	41Cr4 41CrS4	41Cr4 41CrS4	41Cr4 41CrS4	40X
	SCM415H	—	—	—	—	—	—
	SCM418H	18CrMo4 18CrMoS4	—	—	18CrMo4 18CrMoS4	—	—
	SCM420H	—	—	—	—	—	—
	SCM435H	34CrMo4 34CrMoS4	4135H 4137H	34CrMo4 34CrMoS4	34CrMo4 34CrMoS4	34CrMo4 34CrMoS4	—
	SCM440H	42CrMo4 42CrMoS4	4140H 4142H	42CrMo4 42CrMoS4	42CrMo4 42CrMoS4	42CrMo4 42CrMoS4	—
	SCM445H	—	4145H 4147H	—	—	—	—
	SCM822H	—	—	—	—	—	—
	SNC415H	—	—	—	—	—	—
	SNC631H	—	—	—	—	—	—
	SNC815H	15NiCr13	—	655H13	15NiCr13	—	—
	SNCM220H	20NiCrMo2 20NiCrMoS2	8617H 8620H 8622H	805H17 805H20 805H22	—	20NCD2	—
	SNCM420H	—	4320H	—	—	—	—

Japan Industrial Standards		Steel Type Related to Foreign Standards					
Standard Number Name	Symbol	ISO 683/1,10,115)	AISI SAE	BS 970 Part1,3 BS EN 10083–1,2	DIN EN 10084 DIN EN 10083–1,2	NF A35–551 NF EN 10083–1,2	ГOCT 4543
JIS G 4102 Nickel-Chromium Steel	SNC236	—	—	—	—	—	40XH
	SNC415	—	—	—	—	—	—
	SNC631	—	—	—	—	—	30XH3A
	SNC815	15NiCr13	—	655M13	15NiCr13	—	—
	SNC836	—	—	—	—	—	—
JIS G 4103 Nickel Chrome Molybdenum Steel	SNCM220	20NiCrMo2 20NiCrMoS2	8615 8617 8620 8622	805A20 805M20 805A22 805M22	20NiCrMo2 20NiCrMoS2	20NCD2	—
	SNCM240	41CrNiMo2 41CrNiMoS2	8637 8640	—	—	—	—
	SNCM415	—	—	—	—	—	—
	SNCM420	—	4320	—	—	—	20XH2M(20XHM)
	SNCM431	—	—	—	—	—	—
	SNCM439	—	4340	—	—	—	—
	SNCM447	—	—	—	—	—	—
	SNCM616	—	—	—	—	—	—
	SNCM625	—	—	—	—	—	—
	SNCM630	—	—	—	—	—	—
	SNCM815	—	—	—	—	—	—
JIS G 4104 Chrome Steel	SCr415	—	—	—	17Cr3 17CrS3	—	15X 15XA
	SCr420	20Cr4 20CrS4	5120	—	—	—	20X
	SCr430	34Cr4 34CrS4	5130 5132	34Cr4 34CrS4	34Cr4 34CrS4	34Cr4 34CrS4	30X
	SCr435	34Cr4 34CrS4 37Cr4 37CrS4	5132	37Cr4 37CrS4	37Cr4 37CrS4	37Cr4 37CrS4	35X
	SCr440	37Cr4 37CrS4 41Cr4 41CrS4	5140	530M40 41Cr4 41CrS4	41Cr4 41CrS4	41Cr4 41CrS4	40X
	SCr445	—	—	—	—	—	45X
JIS G 4105 Chrome Molybdenum Steel	SCM415	—	—	—	—	—	—
	SCM418	18CrMo4 18CrMoS4	—	—	18CrMo4 18CrMoS4	—	20XM
	SCM420	—	—	708M20	—	—	20XM
	SCM421	—	—	—	—	—	—
	SCM430	—	4131	—	—	—	30XM 30XMA
	SCM432	—	—	—	—	—	—
	SCM435	34CrMo4 34CrMoS4	4137	34CrMo4 34CrMoS4	34CrMo4 34CrMoS4	34CrMo4 34CrMoS4	35XM
	SCM440	42CrMo4 42CrMoS4	4140 4142	708M40 709M40 42CrMo4 42CrMoS4	42CrMo4 42CrMoS4	42CrMo4 42CrMoS4	—
	SCM445	—	4145 4147	—	—	—	—
	SCM822	—	—	—	—	—	—
JIS G 4107 High-Temperature Alloy Steel for Bolts	SNB5	—	501	—	—	—	—
	SNB7	42CrMo4 42CrMoS4	4140 4142 4145	708M40 709M40 42CrMo41)	42CrMo42)	42CrMo44)	—
	SMB16	—	—	40CrMoV4—61)	40CrMoV473)	40CrMoV4—64)	—
JIS G 4108 Steel Bar for Special-Purpose Alloy Bolts	SNB21—1~5	—	—	40CrMoV4—61)	40CrMoV473)	40CrMoV4—64)	—
	SNB22—1~5	42CrMo4 42CrMoS4	4142H	—	42CrMo42)	—	—
	SNB23—1~5	—	E4340H	—	—	—	—
	SNB24—1~5	—	4340	—	—	—	—

Cautions
1) BS EN 10259
2) DIN 1654 Part 4
3) DIN 17240
4) NF EN 10259
5) ISO683-1, 10 and 11 have been translated into JIS as JIS G 7501, G 7502 and G 7503.

ISO: International Organization for Standardization
SAE: Society of Automotive Engineers
DIN: Deutsches Institut für Nörmung
NF: Norme Francaise
AISI: American Iron and Steel Institute
BS: British Standards
EN: European Standards
ГOCT: National Standards of Former USSR

Names of Tool Steels

Rolled Steel for General Structure	SS400 . . . . . Steel, Structure, 400N/mm^2
Carbon Steel for Mechanical Structure	S45C . . . . . Steel, 0.45%C
Chrome Molybdenum Steel	SCM435. . . . . Steel, Cr, Mo 435
Nickel Chrome Molybdenum Steel	SNCM220 . . . . Steel, Ni, Cr, Mo 220
Carbon Tool Steel	SK105 . . . . . Steel, Tool (Kogu, in Japanese), Type105 (Old SK3)
Alloy Tool Steel	SKS3 . . . . . Steel, Tool (Kogu, in Japanese), Special, Type 3
Alloy Tool Steel	SKD11 . . . . . Steel, Tool (Kogu, in Japanese), Dies, Type 11
High-Speed Tool Steel	SKH51 . . . . . Steel, Tool (Kogu, in Japanese), High Speed, Type 51
High Carbon Chrome Bearing Steel	SUJ2 . . . . . Steel, Use, Bearing, Type 2
Stainless Steel	SUS304 . . . . . Steel, Use, Stainless, Type 304
Gray Cast Iron	FC250 . . . . . Ferrum (Iron), Cast, 250N/mm^2

Materials Data

Comparisons of Materials Between JIS and Foreign Standards 2

■ Stainless Steel, Heat-Resisting Steel

Japan Industrial Standards		International Standard	Foreign Standards						European Standard	
Standard Number, Name (Stainless Steel)	JIS	ISO TR 15510 L-No.	US		UK	Germany	France	Russia (Former USSR)	EN	
			UNS	AISI	BS	DIN	NF	Г ОСТ	Type	No.
JIS G 4303–4305	SUS 201	12	S20100	201			Z12CMN17-07Az		X12CrMnNiN17-7-5	1.4372
	SUS 202		S20200	202	284S16			12Х17 Г 9АН4	X12CrMnNiN18-9-5	1.4373
Bar Hot-Rolled Plate and Band Cold-Rolled Plate and Band	SUS 301	5	S30100	301	301S21	X12CrNi17 7	Z11CN17-08	07Х16Н6	X5CrNi17-7	1.4319
	SUS 301L	4				X2CrNiN18-7			X2CrNiN18-7	1.4318
	SUS 301J1					X12CrNi17 7				
JIS G 4308–4309	SUS 302		S30200	302	302S25		Z12CN18-09	12Х18Н9		
	SUS 302B		S30215	302B						
Wire Rod Wire	SUS 303	13	S30300	303	303S21	X10CrNiS18 9	Z8CNF18-09		X8CrNiS18-9	1.4305
	SUS 303Se		S30323	303Se	303S41			12Х18Н10Е		
	SUS 303Cu									
JIS G 4313–4315	SUS 304	6	S30400	304	304S31	X5CrNi18 10	Z7CN18-09	08Х18Н10	X4CrNi18-10	1.4301
	SUS 304L	1 2	S30403	304L	304S11	X2CrNi19 11	Z3CN19-11	03Х18Н11	X2CrNi19-11	1.4307 1.4307
Band for Spring Wire for Spring Wire for Cold Forging	SUS 304N1	10	S30451	304N			Z6CN19-09Az		X2CrNi18-9	1.4306
	SUS 304N2		S30452							
	SUS 304LN	3	S30453	304LN		X2CrNiN18 10	Z3CN18-10Az		X2CrNiN18-10	1.4311
JIS G 4317–4320	SUS 304J1									
	SUS 304J2									
Hot-Rolled Equal-Leg Angle Cold-Finished Bar Steel Piece for Forged Article Cold-Rolled Equal-Leg Angle	SUS 304J3		S30431	S30431						
	SUS 305	8	S30500	305	305S19	X5CrNi18 12	Z8CN18-12	06Х18Н11	X4CrNi18-12	1.4303
	SUS 305J1									
	SUS 309S	X6CrNi23-14	S30908	309S			Z10CN24-13			
	SUS 310S	X6CrNi25-21	S31008	310S	310S31		Z8CN25-20	10Х23Н18	X6CrNi25-20	
	SUS 315J1									
	SUS 315J2									
	SUS 316	26	S31600	316	316S31	X5CrNiMo17 12 2	Z7CND17-12-02		X4CrNiMo17-12-2	1.4401
	SUS 316F	27				X5CrNiMo17 13 3	Z6CND18-12-03		X4CrNiMo17-13-3	1.4436
	SUS 316L	19	S31603	316L	316S11	X2CrNiMo17 13 2	Z3CND17-12-02		X2CrNiMo17-12-2	1.4404
		20				X2CrNiMo17 14 3	Z3CND17-13-03	03Х17Н14М3	X2CrNiMo17-13-3	1.4432
									X2CrNiMo18-14-3	1.4435
	SUS 316N		S31651	316N						
	SUS 316LN	22	S31653	316LN		X2CrNiMoN17 12 2	Z3CND17-11Az		X2CrNiMoN17-11-2	1.4406
		23				X2CrNiMoN17 13 3	Z3CND17-12Az		X2CrNiMoN17-13-3	1.4429
	SUS 316Ti	28	S31635			X6CrNiMoTi17 12 2	Z6CNDT17-12	08Х17Н13М2Т	X6CrNiMoTi17-12-2	1.4571
	SUS 316J1									
	SUS 316J1L									
	SUS 317		S31700	317	317S16					
	SUS 317L	21	S31703	317L	317S12	X2CrNiMo18 16 4	Z3CND19-15-04		X2CrNiMo18-15-4	1.4438
	SUS 317LN	24	S31753				Z3CND19-14Az		X2CrNiMoN18-12-4	1.4434
	SUS 317J1								X2CrNiMoN17-13-5	1.4439
	SUS 317J2									
	SUS 317J3L									
	SUS 836L		N08367							
	SUS 890L	31	N08904	N08904	904S14		Z2NCDU25-20		X1CrNiMoCuN25-25-5	1.4539
	SUS 321	15	S32100	321	321S31	X6CrNiTi18 10	Z6CNT18-10	08Х18Н10Т	X6CrNiTi18 10	1.4541
	SUS 347	17	S34700	347	347S31	X6CrNiNb18 10	Z6CNNb18-10	08Х18Н12 Б	X6CrNiNb18 10	1.4550
	SUS 384	9	S38400	384			Z6CN18-16			
	SUS XM7	D26(1)	S30430	304Cu	394S17		Z2CNU18-10		X3CrNiCu18-9-4	1.4587
	SUS XM15J1		S38100				Z15CNS20-12		X1CrNiSi18-15-4	1.4381
	SUS 329J1		S32900	329						
	SUS 329J3L	33	S39240	S31803			Z3CNDU22-05Az	08Х21Н6М2Т	X2CrNiMoN22-5-3	1.4462
	SUS 329J4L	34	S39275	S31260			Z3CNDU25-07Az		X2CrNiMoCuN25-6-3	1.4507

Japan Industrial Standards		International Standard	Foreign Standards						European Standard	
Standard Number, Name (Stainless Steel)	JIS	ISO TR 15510 L-No.	US		UK	Germany	France	Russia (Former USSR)	EN	
			UNS	AISI	BS	DIN	NF	Г ОСТ	Type	No.
	SUS 405	40	S40500	405	405S17	X6CrAl13	Z8CA12		X6CrAl13	1.4002
	SUS 410L						Z3C14			
	SUS 429		S42900	429						
	SUS 430	41	S43000	430	430S17	X6Cr17	Z8C17	12Х17	X6Cr17	1.4016
	SUS 430F	42	S43020	430F		X7CrMoS18	Z8CF17		X6CrMoS17	1.4105
	SUS 430LX	44	S43035			X6CrTi17	Z4CT17		X3CrTi17	1.4510
						X6CrNb17			X2CrTi17	1.4520
	SUS 430J1L						Z4CNb17		X3CrNb17	1.4511
	SUS 434	43	S43400	434	434S17	X6CrMo17 1	Z8CD17-01		X6CrMo17-1	1.4113
	SUS 436L		S43600	436					X1CrMoTi16-1	1.4513
	SUS 436J1L									
	SUS 444	46	S44400	444			Z3CDT18-02		X2CrMoTi18-2	1.4521
	SUS 445J1									
	SUS 445J2									
	SUS 447J1		S44700							
	SUS XM27		S44627				Z1CD26-01			
	SUS 403		S40300	403						
	SUS 410	48	S41000	410	410S21	X10Cr13	Z13C13		X12Cr13	1.4006
	SUS 410S	39	S41008	410S	403S17	X6Cr13	Z8C12	08Х13	X6Cr13	1.4000
	SUS 410F2									
	SUS 410J1		S41025							
	SUS 416	49	S41600	416	416S21		Z11CF13		X12CrS13	1.4005
	SUS 420J1	50	S42000	420	420S29	X20Cr13	Z20C13	20Х13	X20Cr13	1.4021
	SUS 420J2	51	S42000	420	420S37	X30Cr13	Z33C13	30Х13	X30Cr13	1.4028
	SUS 420F		S42020	420F			Z30CF13		X29CrS13	1.4029
	SUS 420F2									
	SUS 429J1									
	SUS 431	57	S43100	431	431S29	X20CrNi17 2	Z15CN16-02	20Х17Н2	X19CrNi17 2	1.4057
	SUS 440A		S44002	440A			Z70C15		X70CrMo15	1.4109
	SUS 440B		S44003	440B						
	SUS 440C		S44004	440C			Z100CD17	95Х18	X105CrMo17	1.4125
	SUS 440F		S44020	S44020						
	SUS 630	58	S17400	S17400			Z6CNU17-04		X5CrNiCuNb16-4	1.4542
	SUS 631	59	S17700	S17700		X7CrNiAl17 7	Z9CNA17-07	09Х17Н7 І0	X7CrNiAl17-7	1.4568
	SUS 632J1									
JIS G 4311–4315 Heat Resisting Steel Bar Heat Resisting Steel Plate	SUH 31				331S42		Z35CNWS14-14	45Х14Н14В2М		
	SUH 35	X53CrMnNi21 4 (2)			349S52		Z52CMN21-09Az			
	SUH 36		S63008		349S54	X53CrMnNi21 9	Z55CMN21-09Az	55Х20 Г 9АН4		
	SUH 37		S63017		381S34					
	SUH 38									
	SUH 309		S30900	309	309S24		Z15CN24-13			
	SUH 310		S31000	310	310S24	CrNi2520	Z15CN25-20	20Х25Н20С2		
	SUH 330		N08330	N08330			Z12NCS35-16			
	SUH 660		S66286				Z6NCTV25-20			
	SUH 661		R30155							
	SUH 21					CrAl1205				
	SUH 409	37	S40900	409	409S19	X6CrTi12	Z6CT12			
	SUH 409L	36					Z3CT12		X2CrTi12	1.4512
	SUH 446	X15CrN26(2)	S44600	446			Z12C25	15Х28		
	SUH 1	X45CrSi9-3(2)	S65007		401S45	X45CrSi9 3	Z45CS9			
	SUH 3						Z40CSD10	40Х10С2М		
	SUH 4				443S65		Z80CSN20-02			
	SUH 11	X50CrSi18-2(2)						40Х9С2		
	SUH 600							20Х12ВНМ 5 ϕ r		
	SUH 616		S42200							

Reference
1. ISO:ISO TR 15510:1997. EN Symbols. (1) ISO 4954, (2) ISO 683, 15.
2. US:UNS registration numbers and the AISI Steel Manual
3. European Standard:EN 10088-1:1995
4. European countries:BS, DIN, NF, etc. These national standards are to be abolished in favor of EN.
5. Г ОСТ: 5632

■ Tool Steel

Japan Industrial Standards		Steel Type Related to Foreign Standards					
Standard Number Name	Code	ISO	AISI ASTM	BS	DIN VDEh	NF	Г ОСТ
JIS G 4401 Carbon Tool Steel	SK140(Old SK1)	TC140	—	—	—	C140E3U	Y13
	SK120(Old SK2)	TC120	W1-11 1/2	—	—	C120E3U	Y12
	SK105(Old SK3)	TC105	W1-10	—	C105W1	C105E2U	Y11
	SK95(Old SK4)	TC 90	W1-9	—	—	C90 E2U	Y10
	SK85(Old SK5)	TC 90 TC 80	W1-8	—	C 80W1	C90 E2U C80 E2U	Y8 Г Y9
	SK75(Old SK6)	TC 80 TC 70	—	—	C 80W1	C80 E2U C70 E2U	Y8
	SK65(Old SK7)	—	—	—	C 70W2	C70 E2U	Y7
JIS G 4403 High-Speed Tool Steel	SKH 2	HS18-0-1	T 1	BT 1	—	HS18-0-1	P18
	SKH 3	HS18-1-1-5	T 4	BT 4	S18-1-2-5	HS18-1-1-5	—
	SKH 4	HS18-0-1-10	T 5	BT5	—	HS18-0-2-9	—
	SKH10	HS12-1-5-5	T15	BT15	S12-1-4-5	HS12-1-5-5	—
	SKH51	HS 6-5-2	M2	BM2	S 6-5-2	HS 6-5-2	—
	SKH52	—	M3-1	—	—	—	—
	SKH53	HS 6-5-3	M3-2	—	S 6-5-3	HS 6-5-3	—
	SKH54	—	M4	BM4	—	HS 6-5-4	—
	SKH55	HS 6-5-2-5	—	BM35	S 6-5-2-5	HS 6-5-2-5HC	P6M5K5
	SKH56	—	M36	—	—	—	—
	SKH57	HS10-4-3-10	—	BT42	S10-4-3-10	HS10-4-3-10	—
	SKH58	HS 2-9-2	M7	—	—	HS 2-9-2	—
	SKH59	HS 2-9-1-8	M42	BM42	S 2-10-1-8	HS 2-9-1-8	—
JIS G 4404 Alloy Tool Steel	SKS11	—	F2	—	—	—	XB4
	SKS 2	105WCr1	—	—	105WCr6	105WCr5	XB Г
	SKS21	—	—	—	—	—	—
	SKS 5	—	—	—	—	—	—
	SKS51	—	L6	—	—	—	—
	SKS 7	—	—	—	—	—	—
	SKS 8	—	—	—	—	C140E3UCr4	13X
	SKS 4	—	—	—	—	—	—
	SKS41	—	—	—	—	—	—
	SKS43	TCV105	W2-9 1/2	BW2	—	100V2	—
	SKS44	—	W2-8	—	—	—	—
	SKS 3	—	—	—	—	—	9XB Г
	SKS31	105WCr1	—	—	105WCr6	105WCr5	XB Г
	SKS93	—	—	—	—	—	—
	SKS94	—	—	—	—	—	—
	SKS95	—	—	—	—	—	—
	SKD 1	210Cr12	D3	BD3	X210Cr12	X200Cr12	X12
	SKD11	—	D2	BD2	—	X160CrMoV12	—
	SKD12	100CrMoV5	A2	BA2	—	X100CrMoV5	—
	SKD 4	30WCrV5	—	—	—	X32WCrV3	—
	SKD 5	30WCrV9	H21	BH21	—	X30WCrV9	—
	SKD 6	—	H11	BH11	X38CrMoV51	X38CrMoV5	4Х5М0С
	SKD61	40CrMoV5	H13	BH13	X40CrMoV51	X40CrMoV5	4Х5М01С
	SKD62	—	H12	BH12	—	X35CrWMoV5	3Х3М3Ø
	SKD 7	30CrMoV3	H10	BH10	X32CrMoV33	32CrMoV12-18	—
	SKD 8	—	H19	BH19	—	—	—
	SKT 3	—	—	—	—	55CrNiMoV4	—
	SKT 4	55NiCrMoV2	—	BH224/5	55NiCrMoV6	55NiCrMoV7	5XHM

Special Purpose Steels

Japan Industrial Standards		Steel Type Related to Foreign Standards					
Standard Number Name	Code	ISO	AISI SAE	BS	DIN	NF	Г ОСТ
JIS G 4801 Spring Steel	SUP 3	—	1075 1078	—	—	—	75 80 85
	SUP 6	59Si7	—	—	—	60Si7	60C2
	SUP 7	59Si7	9260	—	—	60Si7	60C2 Г
	SUP 9	55Cr3	5155	—	55Cr3	55Cr3	—
	SUP 9A	—	5160	—	—	60Cr3	—
	SUP10	51CrV4	6150	735A51,735H51	50CrV4	51CrV4	ХØА50Х Г ØА
	SUP11A	60CrB3	51B60	—	—	—	50Х Г Р
	SUP12	55SiCr63	9254	685A57,685H57	54SiCr6	54SiCr6	—
	SUP13	60CrMo33	4161	705A60,705H60	—	60CrMo4	—
JIS G 4804 Sulfuric and Sulfur Compound Free Cutting Steel	SUM11	—	1110	—	—	—	—
	SUM12	—	1108	—	—	—	—
	SUM21	9 S20	1212	—	—	—	—
	SUM22	11SMn28	1213	(230M07)	9 SMn28	S250	—
	SUM22L	11SMnPb28	12L13	—	9 SMnPb28	S250Pb	—
	SUM23	—	1215	—	—	—	—
	SUM23L	—	—	—	—	—	—
	SUM24L	11SMnPb28	12L14	—	9 SMnPb28	S250Pb	—
	SUM25	12SMn35	—	—	9 SMn36	S300	—
	SUM31	—	1117	—	15S10	—	—
	SUM31L	—	—	—	—	—	—
	SUM32	—	—	210M15,210A15	—	(13MF4)	—
	SUM41	—	1137	—	—	(35MF6)	—
	SUM42	—	1141	—	—	(45MF6.1)	—
	SUM43	44SMn28	1144	(226M44)	—	(45MF6.3)	—
JIS G 4805 High Carbon Chrome Bearing Steel	SUJ 1	—	51100	—	—	—	—
	SUJ 2	B1 or 100Cr6	52100	—	100Cr6	100Cr6	ШХ15
	SUJ 3	B2 or 100CrMnSi4-4	ASTM A 485 Grade 1	—	—	—	—
	SUJ 4	—	—	—	—	—	—
	SUJ 5	—	—	—	—	—	—

Materials Data

Steel Brand Comparative Table / Hardness of Materials and Corresponding Tools

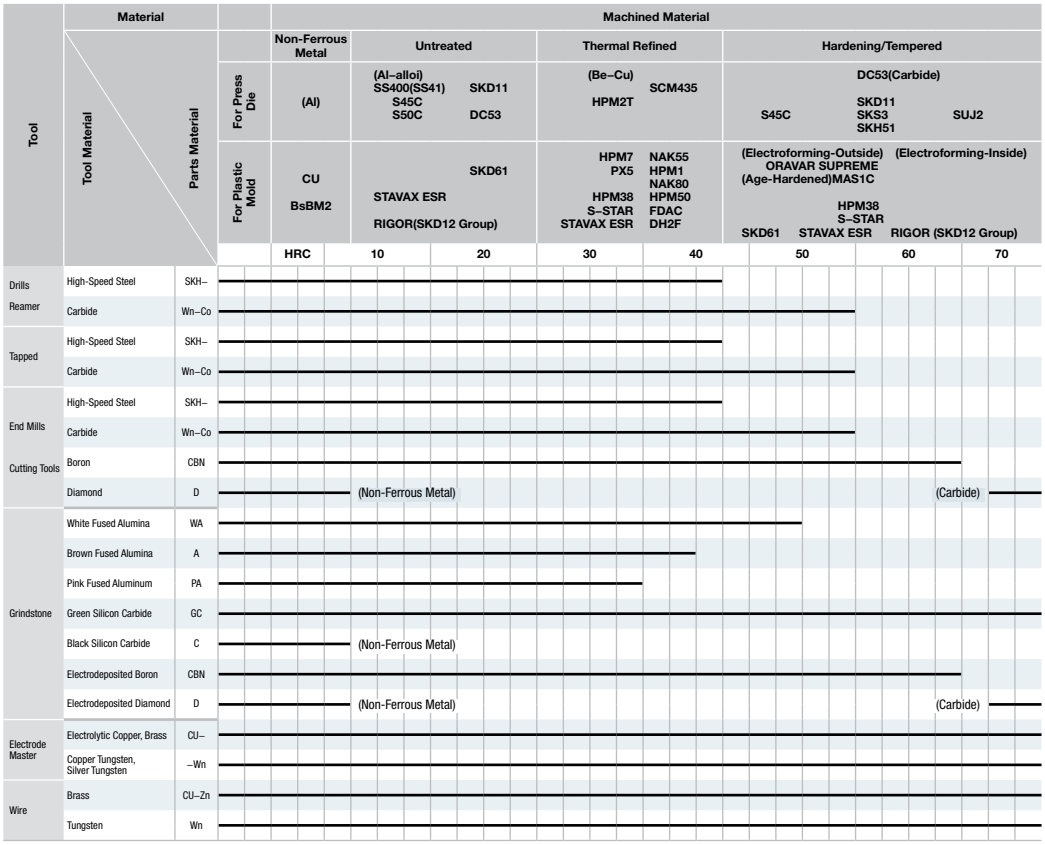
■ Steel Brand Comparative Table

Type	Steel Types Related to the Foreign Standards				Hitachi Metals, Ltd.	Aichi Steel Works, Ltd.	Kobe Steel Co., Ltd.	Sanyo Special Steel Co., Ltd.	Daido Steel Co., Ltd.	Nippon Koshuha Steel Co., Ltd.	Nachi-Fujikoshi	Riken Steel	Uddeholm (Sweden)	Bohler (Germany)
	JIS	AISI	DIN	ISO										
Carbon Tool Steel	SK105(Old SK3)	W1-10		TC105	YC3	SK3		OK3	YK3	K3				K990
Alloy Tool Steel	SKS93				YCS3	SK301		OKSM	YK30	K3M	SK3M			
	SKS3				SGT	SKS3		OKS3	GOA	KS3	SKS3	RS3	ARNE	K460
	SKD1	D3		X210Cr12	CRD	SKD1		QC1	DC1	KD1			SVERKER3	K100 K107
	SKD11	D2	X210Cr12	X210Cr12W12	SLD	SKD11		QC11	DC11	KD11	CDS11	RD11	SVERKER21	K105 K110
	SKD11(Modification)				SLD8 SLD10	AUD15		QCM8 QCM10	DC53	KD11S KD21	MDS9		SLEIPNER	K340
	Matrix Group CrSKD				ARK1	SXACE		QCM7	DCX					
	SKD12			X100CrMoV5	SCD	SKD12			DC12	KD12			RIGOR	K305
	Pre-Hardened 40HRC	A2			HPM2T				G040F	KAP65			IMPAX	
	Pre-Hardened 50HRC or more				PRE2				CX1	RC55				
	Flame-Hardened Steel				HMD5 HMD1	SX105V SX4		QF3	G05	FH5			FERNO	
	Low Temperature Air Cooled Steel				ACD37	AKS3			G04	KSM				
	Shock Resistance Steel				YSM	AKS4		QF1	GS5	KTV5	SRS6		PREGA COMPAX	K630
	Others				ACD8	AUD11 SX5 SX44					ICS22 MCR1		CALMAX VIKING ELMAX VANADIS4 VANADIS6 VANADIS10	K190
High-Speed Tool Steel	SKH51	M2	H6.5.2	HS6–5–2	YXM1			QH51	MH51	H51	SKH9	RHM1		S600
	SKH55 Group		S6.2.5	HS6–5–2–5	YXM4				MH55	HM35	HM35 HSS3M	RHM5		S705
	SKH57 Group		S10–4–3–10	HS10–4–3–10	XVC5				MH8	MV10	HS93R HS98M FM38V	RHM7		S700
	Matrix Group				YXR33 YXR3 YXR7			QHZ	MH85 MH88	KXM KMX2 KMX3	MDS1 MDS3 MDS7 MATRIX2 ATM3			
P/M High Speed Tool Steel	SKH40			HS6–5–3–8	HAP40		KHA30		DEX40		FAX38		ASP30	S590
	Matrix Group				HAP5R		KHA3VN		DEX–M1 DEX–M3					
					HAP10									S690
							KHA32	SPM23	DEX21		FAX31		ASP23	S790
					HAP50				DEX60					S390
									DEX61		FAX55			
	Others				HAP72		KHA60	SPM60	DEX80		FAXG1		ASP60	
							KHA77				FAX18			
											FAXG2			
							KHA30N							
							KHA33N							
							KHA3NH							
							KHA5NH							

Reference:"Special Steel", Nov. 2001

Matrix Group: This is a type of tool steels that has enhanced machinability and toughness by decreasing the large-size carbide responsible for expedited tool abrasion during a cutting process and flexibility reduction.

Machining Method		Equipment	Required Tool
Machining	Hole Machining on Side and Bottom	General Purpose Milling Cutter NC Milling Cutter Machining Center	Drills Reamer End Mills Cutting Tools
	Hole Machining	Drilling Machine Drill Press Boring Machine Jig Borer	Drills Tapped Reamer Cutting Tools
	Machining Cylinders	General Purpose Lathe NC Lathe Turning Center	Drills Reamer Tapped Cutting Tools
Grinding		Surface Grinder Cylindrical Grinder Jig Grinder Profile Grinder Forming Grinder	Grindstone
Electric Discharging		EDM	Electrode Master
		WEDM	Wire



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NOTE: The complete Terms and Conditions applicable to the products and purchases from this catalog are found at: http://us.misumi-ec.com/contents/terms/.

Express Limited Warranty (Annex-B)

MISUMI USA, Inc. (the "Company") has a Mechanical Components for Assembly Automation Catalog (the "Catalog") that lists products for sale (the "Products") which are subject to the Terms and Conditions of Catalog Use (the "Terms and Conditions"). The Company provides an Express Limited Warranty (the "Limited Warranty") for Products that is further set forth in this Annex A. Customer, through their purchase of Products, agrees to be bound by this Limited Warranty. A manufacturer guarantee certificate or warranty may also apply to certain Products, which shall supersede and void this Limited Warranty as to such Product(s).

A. Scope of Limited Warranty

1. Company warrants that the Products shall be free of defects in material and workmanship. During the Warranty Periond, the Company at its sole discretion may repair or replace a Product with a defect attributable to the Company ("Defect") free of charge on condition that the customer provides the Company with written notice describing the alleged defect, within the warranty period (defined in the Limited Warranty), and the Company deems the alleged defect covered under this Limited Warranty. Minor flaws such as scratches, marks, dents or discoloration that do not affect the function of the Product do not constitute a Defect, unless the Company, in its sole discretion, deems such flaw to be a Defect.

2. **EXCLUSIONS**

This Limited Warranty does not cover damages or defects to Products resulting from or in any way contributed to:

(1) Use in devices that transport humans such as automobiles, vehicles, or ships; medical equipment with the purpose of curing or diagnosing humans; or general household consumer goods such as electronic and electric equipment.

(2) Use in aerospace equipment, nuclear energy equipment, or military-related products such as weapons or arms.

(3) Customer's reckless, negligent or abusive handling or use of the Product.

(4) Natural disasters including, but not limited to, earthquakes, fires and floods.

(5) Failure to comply with Product specifications, intended uses, Terms and Conditions, drawings; or documentation shipped with the Product or accessory.

(6) Any repair, modification, processing or disassembly of the Product.

(7) Damage to equipment other than the Product itself.

(8) Use outside of the country where the Company originally shipped the Product at the time of purchase.

B. Warranty Period

This Limited Warranty is valid for a period of one (1) year from the date Company ships Product to original purchaser.

C. Inspection and Notification

Within one (1) week of receipt of Product, customer should confirm the name, quantity and specifications of the Product(s) and check for any Defect. The customer must provide written notice to the Company within one (1) week of receipt of Product, or the Company may deem that the Product(s) are free from Defect.

D. Uncovered Products

The customer will be charged for all replacements and repairs of Product not covered by this Limited Warrarny.

E. LIMITATION OF LIABILITY

IN NO EVENT SHALL COMPANY BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO, ANY CLAIMS OF PROPERTY DAMAGE, BASED UPON BREACH OF WARRANTY, BREACH OF CONTRACT, TORT, OR ANY OTHER LEGAL THEORY. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you.

F. LIMITATION OF WARRANTY

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G. ENTIRE AGREEMENT

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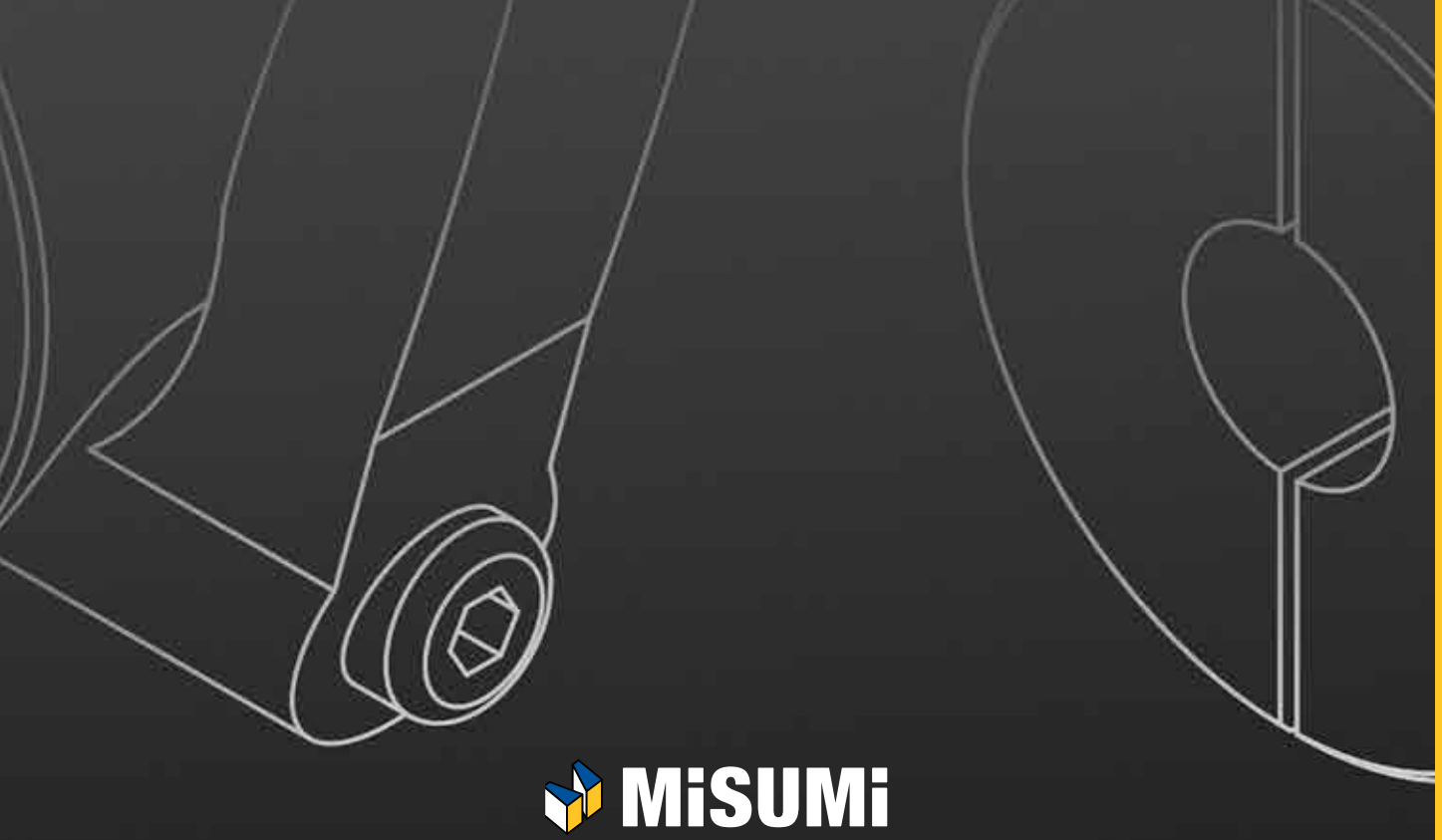

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