



CONFIGURABLE NAAMS

PLUS A FULL LINE OF AUTOMOTIVE FIXTURING COMPONENTS

1ST EDITION





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.



The MISUMI Approach to Standard & Configurable NAAMS

After extensive market research, MISUMI USA discovered that standard NAAMS components frequently required additional machining, or even a make detail for customization. MISUMI USA worked closely with several large customers to develop configurable NAAMS components that required no additional machining, not connected to each other, and at a lower cost than customized NAAMS components.

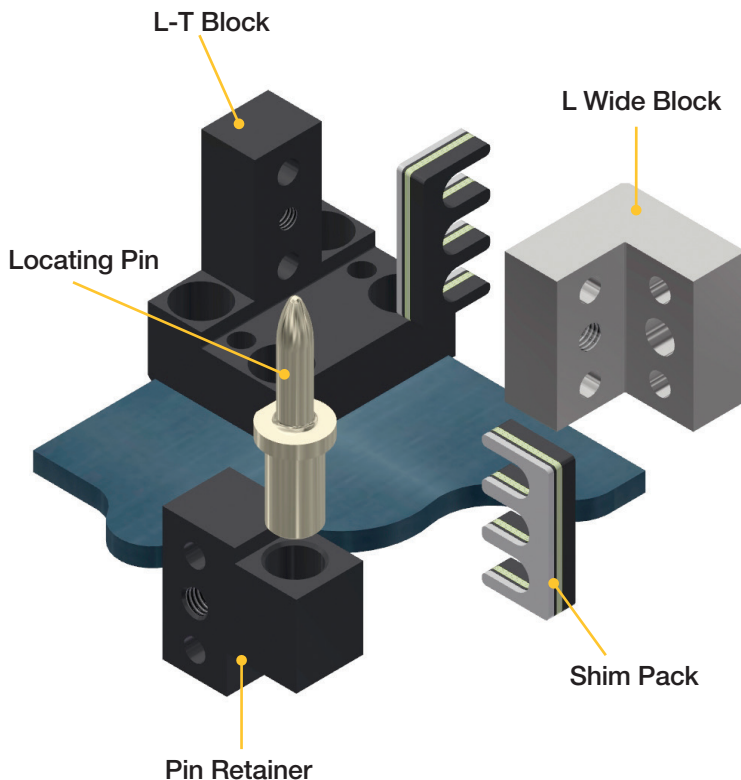
What is NAAMS?

The North American Automotive Metric Standard (NAAMS) was created by the Big 3 Auto Makers and Dayton Progress Corporation (now a MISUMI Group company). MISUMI USA pioneered the configurable NAAMS component product line to address the needs in the automotive Body-in-White market.

Please visit www.naamsstandards.org to review the most current specifications.

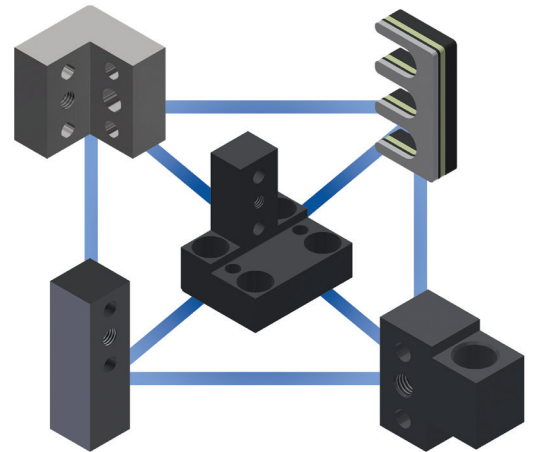
Typical NAAMS Assembly

A typical NAAMS pin stack uses multiple locating pins and pin retainers, in addition to several styles of L-Blocks and NC blocks. Shim Packs are used to adjust the assembly as needed.



NAAMS Bolting Pattern

The NAAMS bolting pattern is a unique benefit of the NAAMS standards. The bolting pattern is standardized with a 15 mm pitch, so components are easily interchangeable and assembly is quick and easy.





New Configurable NAAMS Components

Configurable Locating Pins

MISUMI's new configurable locating pins feature:

1. Configurable lead length to eliminate work piece damage for smaller envelopes
2. Configurable outer diameter (OD) to match any size locating hole
3. Selectable tips, including standard NAAMS bullet, half-bullet, and sphere for proper engagement
4. New oval pins so you can locate work not square to the grid, like hemming applications, and square pins for square holes with more than a line contact

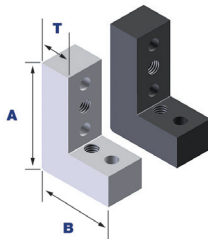
These configurations are offered in large head, small head, and retractable pins. All are available in NAAMS standard TiN coating, and are laser etched with the configurable part number.

Configurable L-Blocks

MISUMI USA's configurable L-Blocks are lighter and more compact to address the common issues of size and weight. MISUMI USA offers:

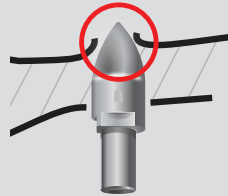
- Compact options for clearance, especially weld guns
- Easily configurable heights, useful for last-minute modifications
- A & B dimensions in 1 mm increments

All L-Blocks are available in NAAMS standard black oxide coating, configurable in 1 mm increments, and are laser etched with the configurable part number.

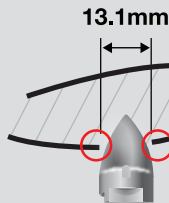


PROBLEM

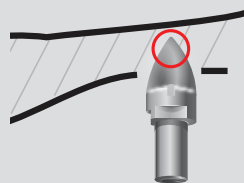
1. Too Long



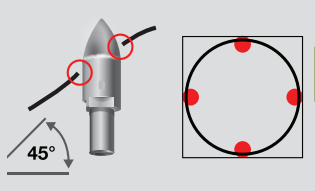
2. Custom OD



3. Tip Too Long

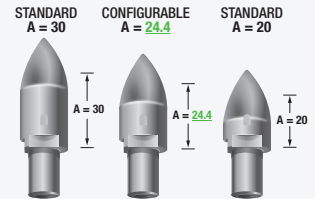


4. Oval & Square Holes



SOLUTION

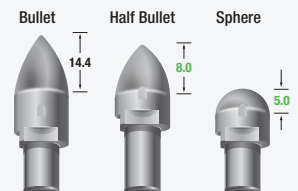
1. Configurable A



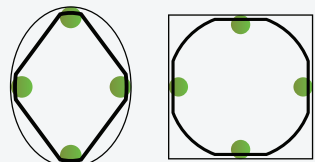
2. Configurable OD



3. Selectable Tips



4. Oval & Square Pins



COMING SOON!

MISUMI USA is continuing to develop more configurable NAAMS components and coatings.

Look for more product variety in:
**Locating Pins, L-Blocks, NC Blocks,
Pin Retainers, Rough Locators**

All new standard and *configurable*:
**Stop Blocks, Shims and
Spacers, Risers**

Visit www.misumiusa.com and search for NAAMS to check out all newly released components!



Ordering Configurable NAAMS is easy.

Only MISUMI USA offers fully configurable NAAMS.

Configuring your NAAMS components to your exact specifications is easy with our 3D CAD downloads, free engineering support, and over 10 million configurable components.

Tip Shape

Bullet Nose



Half Bullet Nose



Spherical



Head Shape

Configurable



4 Flat



Diamond



2 Diameter

Standard



Round



2 Flats

Lead Length

10-100mm
Increments as fine as 0.1mm

Pin O.D.

6-40mm
Increments as fine as 0.01 mm

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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 and configure, download CAD data and place orders. Just type the product Web Code or Product Keyword.

Insert Web Code (with the #) or Keyword (ex: #AFPB or Locating Pins)

The screenshot displays the Misumi USA website. At the top, the Misumi logo and tagline "Empowering Engineers with Configurable Components" are visible. Below this is a search bar with the placeholder text "Enter Keyword or Part Number" and a magnifying glass icon. A yellow callout box highlights the search bar and the text "Insert Web Code (with the #) or Keyword (ex: #AFPB or Locating Pins)".

On the left side, there is a navigation menu with the following categories:

- Automation Components
 - > Linear Motion
 - > Locating, Positioning, Jigs & Fixtures
 - > Rotary Motion
 - > Connecting Parts
 - > Motors
 - > Rotary Power Transmission
 - > Conveyors & Material Handling
 - > Pneumatics, Hydraulics
 - > Pipe, Tubes, Hoses & Fittings
 - > Aluminum Extrusions, Framing, Support & Posts
 - > Casters & Leveling Mounts
 - > Materials, Cover Panels
 - > Doors, Cabinet Hardware
 - > Adjusting, Fastening, Magnets
 - > Springs, Shock Absorbers
 - > Antivibration, Soundproofing Materials, Safety Products
 - > Inspection
 - > Sensors, Switches
 - > Heaters, Temperature Control
- Press Die Components
- Plastic Mold Components

The main content area features a grid of product categories with images and labels:

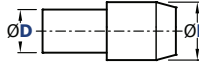
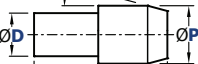
- Linear Motion
 - Linear Shafts
 - Shaft Supports
 - Shaft Collars
 - Linear Bushings
- Cable Carriers
- Locating, Positioning, Jigs & Fixtures
 - Locating Pins, Bushings
 - Stop Blocks
- Rotary Motion
 - Linear Shafts
 - Shaft Supports
 - Shaft Collars
 - Linear Bushings
- Linear Rails, V Guides, Oil Free Guides Units
- Actuators
- Plungers, Index Plungers
- Toggle Clamps

Two yellow callout boxes highlight specific search methods:

- One box points to the search bar and says "Search by # + Web Code (ex: #AFPB)".
- Another box points to a product image (a locating pin) and says "Search by Keyword or Category".

Locating Pins & Bushings Overview

← 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

Locating Pins & Bushings Overview

NEW NEW PRODUCT

★ BEST SELLER

✓ TYPICALLY IN STOCK



#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

NEW NEW PRODUCT

★ **BEST SELLER**

✓ **TYPICALLY IN STOCK**

Locating Pins & Bushings Overview

Locating Pins / Bushings



#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



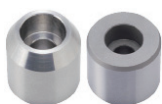
#FPJATD
Configurable Shoulder Thickness &
Diameter, Standard



#JPCJ
Shoulder, Setscrew 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
Resin Locating Pins, Tapered,
Standard



#KKB
Flanged 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 Shoulder



#SFPN
Small Diameter with Shoulder,
Threaded Shank



#FESM
Feed Pins – Standard



#FESG
Feed Pins – Tapped



#FEPS
Feed Pins – Threaded



#FEPN
Feed Pins with Shoulder – Standard

Locating Pins & Bushings Overview

NEW NEW PRODUCT

★ BEST SELLER

✓ TYPICALLY IN STOCK



#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



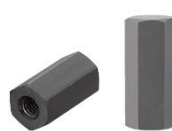
#SRPA
Support Pins – Pilot Shape Selectable, Stepped Pilot



#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

NEW NEW PRODUCT

★ BEST SELLER

✓ TYPICALLY IN STOCK

Locating Pins & Bushings Overview

Locating Pins / Bushings



#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, Setscrew



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



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



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



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



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



#SLNT
Precision (g6), Setscrew 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 Setscrew, Shouldered



#ELNS
Standard (h7) Setscrew, Circumference Groove



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



#ELNC
Locating Pins for Jigs – Standard (h7) Setscrew, 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

Locating Pins & Bushings Overview

NEW NEW PRODUCT

★ **BEST SELLER**

✓ **TYPICALLY IN STOCK**

Locating Pins / Bushings



#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 – Setscrew



#NUTK

Detection Pins for Weld Nuts



#PICP

Tapered Spring Loaded Locating Pins

CONFIGURABLE AND STANDARD LOCATING PINS

Round Head Shape: Standard/ A Configurable

16-23

APS Small Head	16
APS Large Head	17
ARP Small Head	18
ARP Large Head	19
APQ Small Head	20
APQ Large Head	21

Round Head Shape: Fully Configurable

22-23

APFL Large Head	22
APFS Small Head	23

Flat Head Shape: Standard/ A Configurable

24-28

APE Small Head	24
APE Large Head	25
ARE Small Head	26

Flat Head Shape: Fully Configurable

27-28

A&E Configurable Small Head	27
A&E Configurable Large Head	28

2 Diameter for Oval Holes

29-30

Two Diameter Small Head	29
Two Diameter Large Head	30

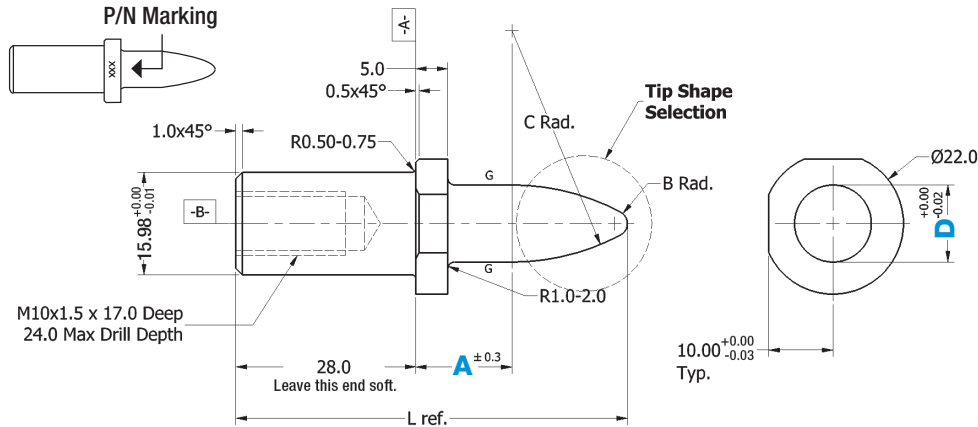


Locating Pins

APS SMALL HEAD



Configurable and Standard Locating Pins



$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

Type	Coating	Material	Hardness
APS	Standard NAAMS None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APSS	A Configurable P - Plain T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS														
Type	D Head Dia. Callout (Actual)	A Lead Length										Coating	B Rad	C Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm			
APS (Hole -0.15)	06 (5.85)	1M	2M	3M	4M	5M	6M	-	-	-	-	None - Plain T - TiN	1.0	18.0
	08 (7.85)	1M	2M	3M	4M	5M	6M	7M	8M	-	-		1.0	24.0
	10 (9.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		2.0	30.0
	12 (11.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		2.0	36.0
	13 (12.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		2.0	39.0
	16 (15.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		2.0	48.0
	19 (18.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		2.0	38.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)								
Type	Coating	Tip Shape	D Head Dia. Callout (Actual)	A Lead Length (1 mm Inc.)	B Rad	Tip A	C Rad Tip B	Tip C
APSS (Hole -0.15)	P - Plain T - TiN	A	6 (5.85)	10 ~ 60	1.0	18.0	9.0	D/2
			8 (7.85)	10 ~ 80		24.0	12.0	
			10 (9.85)	10~ 100		30.0	15.0	
		B	12 (11.85)		36.0	18.0		
		C	13 (12.85)		39.0	19.5		
			16 (15.85)		48.0	24.0		
			19 (18.85)		38.0	19.0		

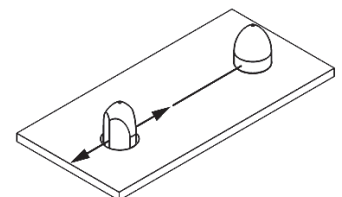
P/N Example (Standard NAAMS):

Part Number			
Type	D	A	Coating
APS	19	2M	
APS	08	4M	T

P/N Example (Configurable NAAMS):

Part Number					
Type	Coating	Tip Shape	D	-	A
APSS	P	B	16	-	A95
APSS	T	A	8	-	A25

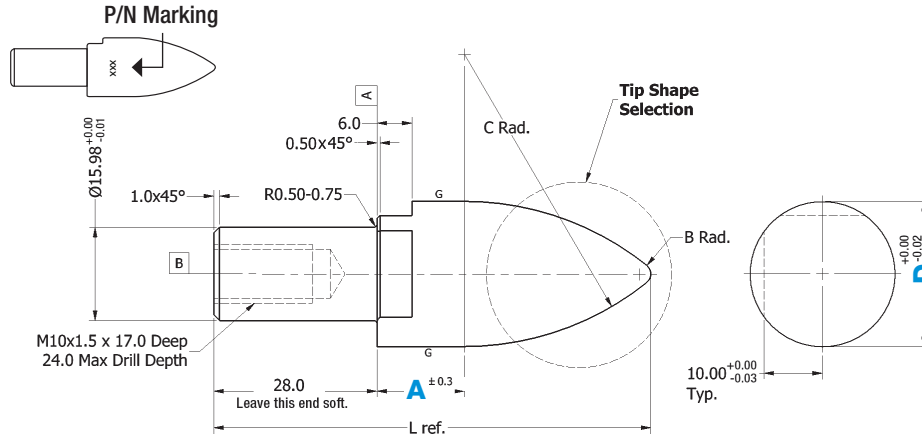
Application Example





Locating Pins

APS LARGE HEAD



3D CAD is available online.

Tip Shape Selection		
A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
APS	Standard NAAMS T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APSL	A Configurable P - Plain T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

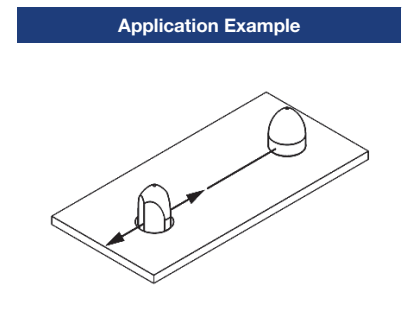
Standard NAAMS														
Type	D Head Dia. Callout (Actual)	A Lead Length										Coating	B Rad	C Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm			
APS (Hole -0.15)	25 (24.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M	None- Plain T - TiN	2.0	50.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)								
Type	Coating	Tip Shape	D Head Dia. Callout (Actual)	A Lead Length (1 mm Inc.)	B Rad	C Rad		
						Tip A	Tip B	Tip C
APSL (Hole -0.15)	P - Plain T - TiN	A B C	25 (24.85)	10 ~ 100	2.0	50.0	25.0	D/2

P/N Example (Standard NAAMS):			
Part Number			
Type	D	A	Coating
APS	25	6M	
APS	25	4M	T

P/N Example (Configurable NAAMS):					
Part Number				-	A
Type	Coating	Tip Shape	D		
APSL	P	A	25	-	A42
APSL	T	C	25	-	A79

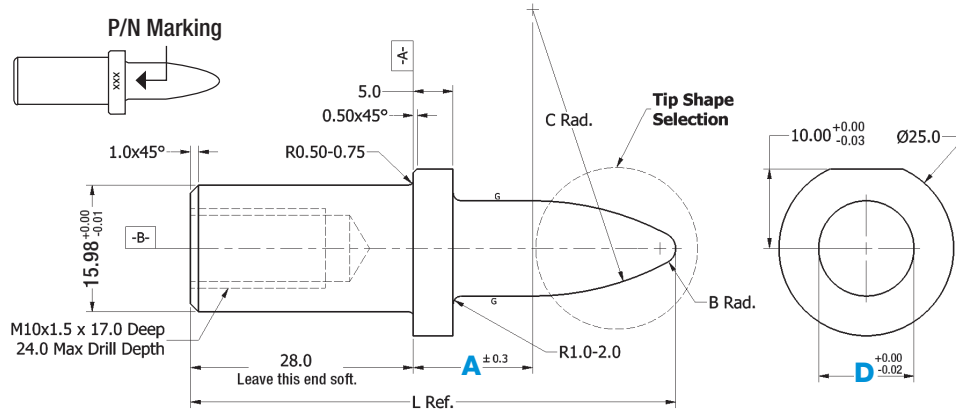


Respot Pins

ARP SMALL HEAD



Configurable and Standard Locating Pins



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
ARP	Standard NAAMS None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
ARPS	A Configurable P - Plain T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS

Type	D Head Dia. Callout (Actual)	A Lead Length										Coating	B Rad	C Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm			
ARP (Hole -0.28)	06 (5.72)	1M	2M	3M	4M	5M	6M	-	-	-	-	None - Plain T - TiN	1.0	18.0
	08 (7.72)	1M	2M	3M	4M	5M	6M	7M	8M	-	-		1.0	24.0
	10 (9.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		2.0	30.0
	12 (11.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		2.0	36.0
	13 (12.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		2.0	39.0
	16 (15.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		2.0	48.0
	19 (18.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		2.0	38.0

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Configurable NAAMS (A Configurable)

Type	Coating	Tip Shape	D Head Dia. Callout (Actual)	A Lead Length (1 mm Inc.)	B Rad	C Rad		
						Tip A	Tip B	Tip C
ARPS (Hole -0.28)	P - Plain T - TiN	A	6 (5.72)	10 ~ 60	1.0	18.0	9.0	D/2
			8 (7.72)	10 ~ 80		24.0	12.0	
			10 (9.72)	10 ~ 100		30.0	15.0	
		B	12 (11.72)		36.0	18.0		
			13 (12.72)		39.0	19.5		
		C	16 (15.72)		48.0	24.0		
			19 (18.72)	38.0	19.0			

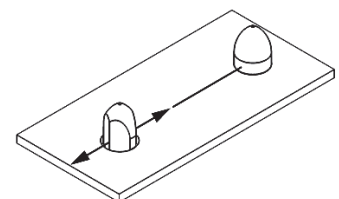
P/N Example (Standard NAAMS):

Part Number			
Type	D	A	Coating
ARP	19	2M	
ARP	10	9M	T

P/N Example (Configurable NAAMS):

Part Number				
Type	Coating	Tip Shape	D	
ARPS	P	B	6	-
ARPS	T	A	16	-

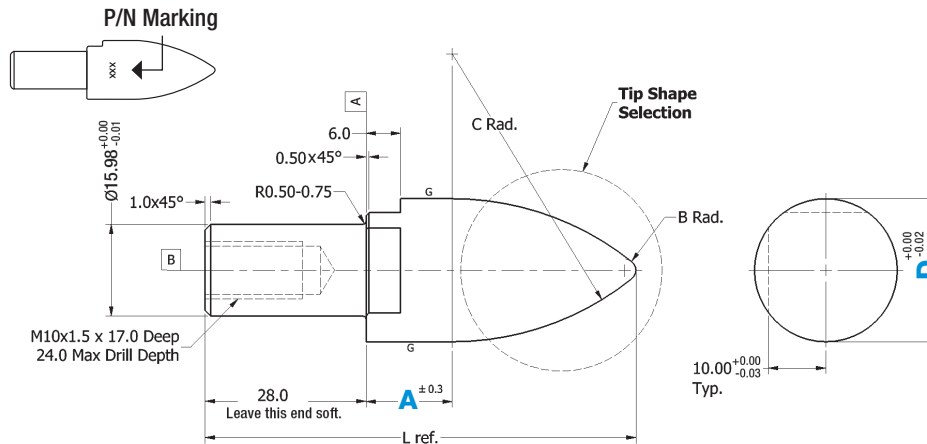
Application Example





Respot Pins

ARP LARGE HEAD



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
ARP	Standard NAAMS T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
ARPL	A Configurable P - Plain T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS														
Type	D Head Dia. Callout (Actual)	A Lead Length										Coating	B Rad	C Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm			
ARP (Hole -0.28)	25 (24.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M	None - Plain T - TiN	2.0	50.0

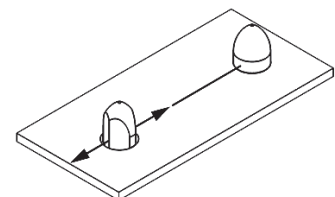
Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)								
Type	Coating	Tip Shape	D Head Dia. Callout (Actual)	A Lead Length (1 mm Inc.)	B Rad	C Rad		
						Tip A	Tip B	Tip C
ARPL (Hole -0.28)	P - Plain T - TiN	A B C	25 (24.72)	10 ~ 100	2.0	50.0	25.0	D/2

P/N Example (Standard NAAMS):			
Part Number			
Type	D	A	Coating
ARP	25	6M	
ARP	25	4M	T

P/N Example (Configurable NAAMS):					
Part Number				-	A
Type	Coating	Tip Shape	D		
ARPL	P	A	25	-	A42
ARPL	T	B	25	-	A67

Application Example

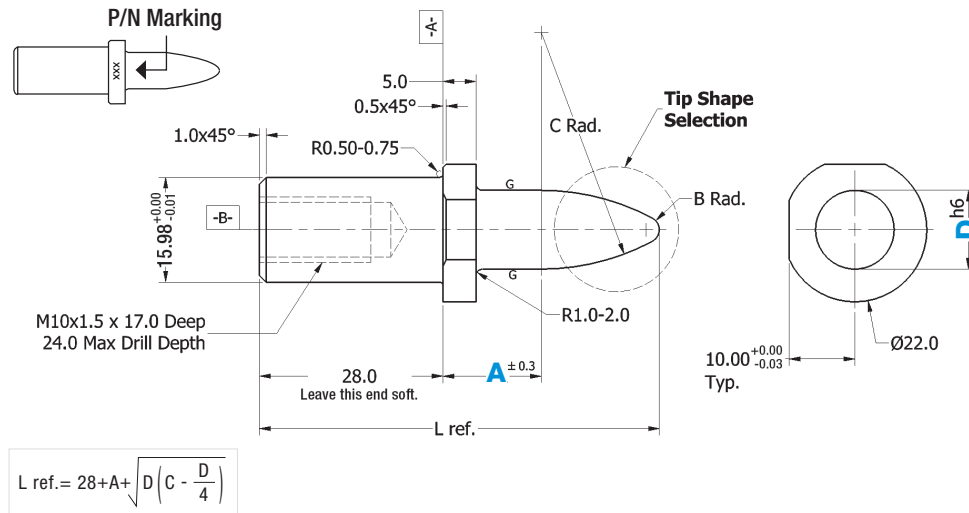


Locating Pins

APQ SMALL HEAD



Configurable and Standard Locating Pins



Type	Coating	Material	Hardness
APQ	Standard NAAMS	None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)
APQS	A Configurable	P - Plain T - TiN	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

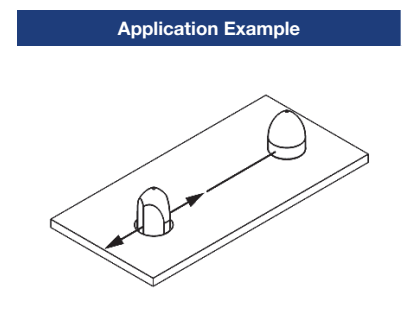
Standard NAAMS												
Type	D Head Dia.	A Lead Length								Coating	B Rad	C Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm			
APQ (Hole - h6)	08	1	2	3	4	5	6	-	-	None - Plain T - TiN	1.0	24.0
	10	1	2	3	4	5	6	7	8		1.0	30.0
	13	1	2	3	4	5	6	7	8		2.0	30.0
	16	1	2	3	4	5	6	7	8		2.0	48.0
	18	1	2	3	4	5	6	7	8		2.0	38.0
	20	1	2	3	4	5	6	7	8		2.0	38.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)								
Type	Coating	Tip Shape	D Head Dia.	A Lead Length (1 mm Inc.)	B Rad	C Rad		
						Tip A	Tip B	Tip C
APQS (Hole - h6)	P - Plain T - TiN	A B C	8	10 ~ 80	1.0	24.0	12.0	D/2
			10	10 ~ 100	2.0	30.0	15.0	
			13			30.0	15.0	
			16			48.0	24.0	
			18			38.0	19.0	
			20			38.0	19.0	

P/N Example (Standard NAAMS):			
Part Number			
Type	D	A	Coating
APQ	18	2	
APQ	08	4	T

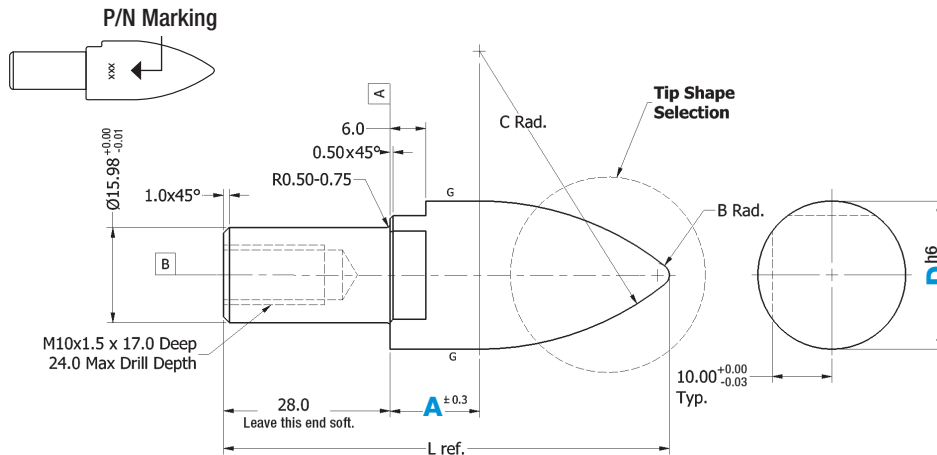
P/N Example (Configurable NAAMS):					
Part Number				-	A
Type	Coating	Tip Shape	D		
APQS	P	B	16	-	A42
APQS	T	A	20	-	A75





Locating Pins

APQ LARGE HEAD



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
APQ	Standard NAAMS	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APQL	A Configurable		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS											
Type	D Head Dia.	A Lead Length								Coating	B Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm		
APQ (Hole - h6)	25	1	2	3	4	5	6	7	8	None - Plain T - TiN	2.0
	30	1	2	3	4	5	6	7	8		2.0
	35	1	2	3	4	5	6	7	8		2.0
	40	1	2	3	4	5	6	7	8		2.0

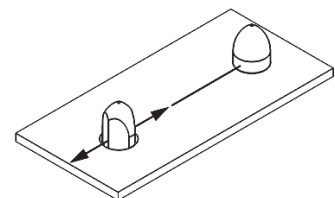
Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)								
Type	Coating	Tip Shape	D Head Dia.	A Lead Length (1 mm Inc.)	B Rad	C Rad		
						Tip A	Tip B	Tip C
APQL (Hole - h6)	P - Plain	A	25	10 ~ 100	2.0	50.0	25.0	D/2
	T - TiN	B	30					
		C	35					
			40					

P/N Example (Standard NAAMS):			
Part Number			
Type	D	A	Coating
APQ	30	05	
APQ	25	04	T

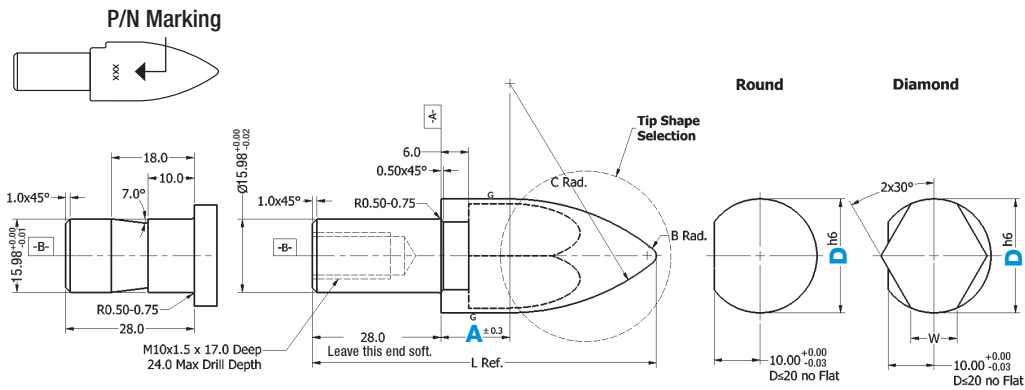
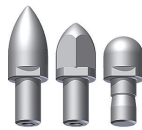
P/N Example (Configurable NAAMS):					
Part Number					
Type	Coating	Tip Shape	D	-	A
APQL	P	A	25	-	A42
APQL	T	B	30	-	A65

Application Example



Locating Pins

FULLY CONFIGURABLE LARGE HEAD



$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Head Shape	Material	Hardness
APFL	P - Plain	Round	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APFLD	T - TiN	Diamond		

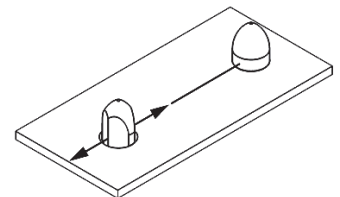
Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Configurable NAAMS (A & D Configurable)									
Type	Coating	Shank Style	Tip Shape	D (0.01 mm Inc.)		A Lead Length (0.1 mm Inc.)	W	B Rad	C Rad
				Dia.	Tol. H6				
APFL Round	P - Plain	B - Screw Mount	A	19.00 ~ 30.00	+0.000 -0.013	10.0 ~ 100.0	8.0	2.0	Tip A C=Dx3.0 (Ø≤16) C=Dx2.0 (Ø>16) Tip B C=Dx1.5 (Ø≤16) C=Dx1.0 (Ø>16) Tip C C=Dx0.5
APFLD Diamond	T - TiN	T - Setscrew	C	30.01 ~ 40.00	+0.000 -0.016		8.0-9.0		

When D≤20 there is no Flat.

P/N Example (Configurable NAAMS):							
Part Number				-	D	-	A
Type	Coating	Shank Style	Tip Shape				
APFLD	P	T	C	-	D37.15	-	A12.0
APFL	T	B	A	-	D19.05	-	A42.0

Application Example





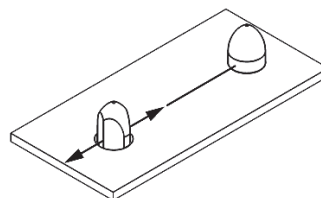
$$L_{ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Head Shape	Material	Hardness
APFS	P - Plain	Round	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APFSD	T - TiN	Diamond		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Configurable NAAMS (A&D Configurable)									
Type	Coating	Shank Style	Tip Shape	D (0.01 mm Inc.)		A Lead Length (0.1 mm Inc.)	W	B Rad	C Rad
				Dia.	Tol. h6				
APFS Round APFSD Diamond	P - Plain T - TiN	B - Screw Mount T - Setscrew	A B C	6.00 ~ 6.99	+0.000 -0.009	10.0 ~ 60.0	2.0	1.0	Tip A C=Dx3.0 (Ø≤16) C=Dx2.0 (Ø>16) Tip B C=Dx1.5 (Ø≤16) C=Dx1.0 (Ø>16)
				7.00 ~ 7.99		10.0 ~ 70.0	2.0		
				8.00 ~ 8.99		10.0 ~ 80.0	3.0		
				9.00 ~ 9.99		10.0 ~ 90.0	3.0		
				10.00 ~ 17.99	+0.000 -0.011	10.0 ~ 100.0	4.0-5.0	2.0	Tip C C=Dx0.5
				18.00 ~ 20.00	+0.000 -0.013				

P/N Example (Configurable NAAMS):							
Part Number				–	D	–	A
Type	Coating	Shank Style	Tip Shape				
APFSD	P	B	A	–	D6.05	–	A25.0
APFS	T	T	B	–	D16.05	–	A69.0

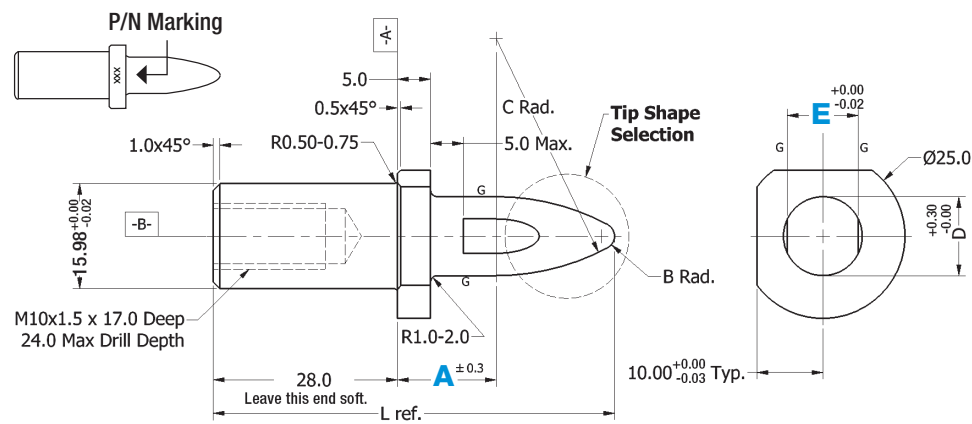


Locating Pins

APE SMALL HEAD



Configurable and Standard Locating Pins



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
APE	Standard NAAMS None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APES	A Configurable P - Plain T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS

Type	E Flat Callout (Actual)	A Lead Length										Coating	For Slot	D Diameter	B Rad	C Rad
APE (Slot -0.15)	06 (5.85)	1M	2M	3M	4M	5M	6M	-	-	-	-	None - Plain T - TiN	6x12	7.09	1.0	18.0
	08 (7.85)	1M	2M	3M	4M	5M	6M	7M	8M	-	-		8x14	8.81	1.0	24.0
	10 (9.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		10x16	10.63	2.0	30.0
	12 (11.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		12x18	12.50	2.0	36.0
	13 (12.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		13x19	13.46	2.0	39.0
	16 (15.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		16x22	16.35	2.0	48.0
	19 (18.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		19x25	19.27	2.0	38.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A & E Configurable)

Type	Coating	Tip Shape	E Flat Callout (Actual)	A Lead Length (1 mm Inc.)	For Slot	D Diameter	B Rad	C Rad		
APES (Slot -0.15)	P - Plain T - TiN	A	6 (5.85)	15 ~ 60	6x12	7.09	1.0	Tip A	Tip B	D/2
			8 (7.85)	15 ~ 80	8x14	8.81		18.0	9.0	
			10 (9.85)	15 ~ 100	10x16	10.63		24.0	12.0	
		B	12 (11.85)		12x18	12.50	2.0	30.0	15.0	
			13 (12.85)		13x19	13.46		36.0	18.0	
		C	16 (15.85)		16x22	16.35		39.0	19.5	
			19 (18.85)		19x25	19.27		48.0	24.0	
								38.0	19.0	

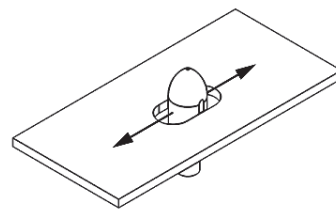
P/N Example (Standard NAAMS):

Part Number			
Type	E	A	Coating
APE	12	2M	
APE	19	4M	T

P/N Example (Configurable NAAMS):

Part Number					
Type	Coating	Tip Shape	D	-	A
APES	P	A	19	-	A42
APES	T	C	6	-	A15

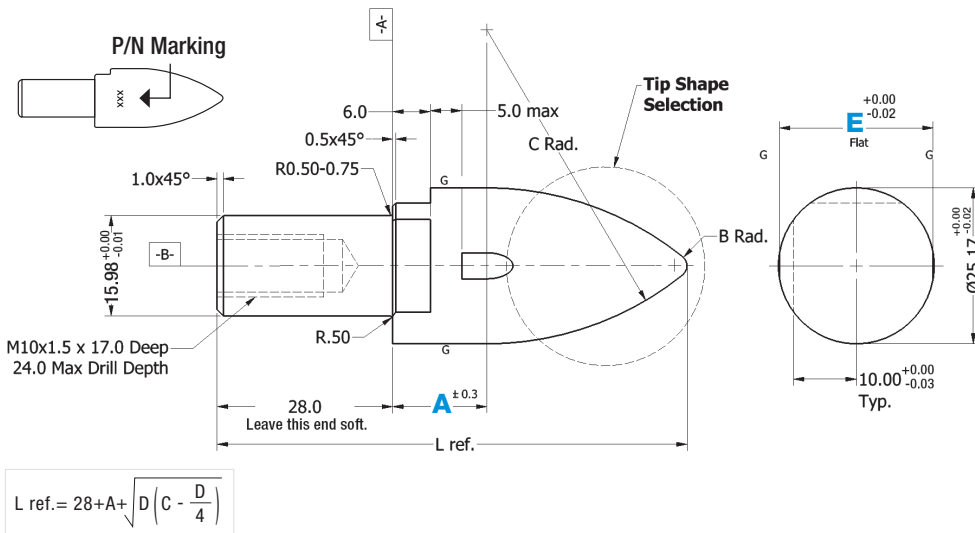
Application Example





Locating Pins

APE LARGE HEAD



Type	Coating	Material	Hardness
APE	Standard NAAMS	None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)
APEL	A Configurable	P - Plain T - TiN	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)

Tolerance			
Dim.	Tol.	Finish (Ra)	Geometric
0.0	± 0.3	6.0 µm	⊥
0.00	± 0.03	3.0 µm	∥
0.000	± 0.015	1.6 µm	⊙

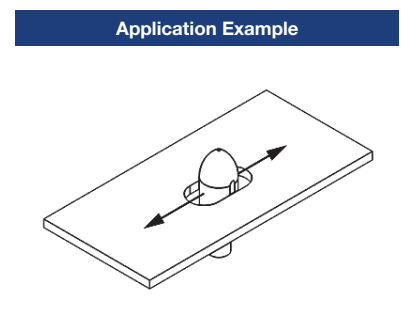
Standard NAAMS														
Type	E Flat Callout (Actual)	A Lead Length										Coating	For Slot	D Diameter
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm			
APE (Slot -0.15)	25 (24.85)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M	None - Plain T - TiN	25x31	25.17
														2.0
														50.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)										
Type	Coating	Tip Shape	E Flat Callout (Actual)	A Lead Length (1 mm Inc.)	For Slot	D Diameter	B Rad	C Rad		
								Tip A	Tip B	Tip C
APEL (Slot -0.15)	P - Plain T - TiN	A B C	25 (24.85)	15 ~ 100	25x31	25.17	2.0	50.0	25.0	D/2

P/N Example (Standard NAAMS):			
Part Number			
Type	E	A	Coating
APE	25	1M	
APE	25	4M	T

P/N Example (Configurable NAAMS):					
Part Number					
Type	Coating	Tip Shape	E		A
APEL	P	A	25	-	A42
APEL	T	B	25	-	A25

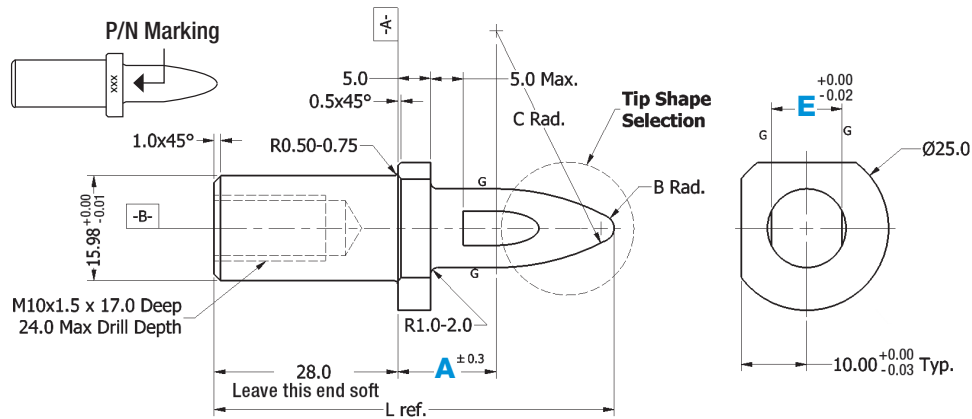


Respot Pins

ARE SMALL HEAD



Configurable and Standard Locating Pins



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
ARE	Standard NAAMS	None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)
ARES	A Configurable	P - Plain T - TiN	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS

Type	E Flat Callout (Actual)	A Lead Length										Coating	For Slot	D Diameter	B Rad	C Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm					
ARE (Slot -0.28)	06 (5.72)	1M	2M	3M	4M	5M	6M	-	-	-	-	None - Plain T - TiN	6x12	7.09	1.0	18.0
	08 (7.72)	1M	2M	3M	4M	5M	6M	7M	8M	-	-		8x14	8.81	1.0	24.0
	10 (9.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		10x16	10.63	2.0	30.0
	12 (11.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		12x18	12.50	2.0	36.0
	13 (12.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		13x19	13.46	2.0	39.0
	16 (15.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		16x22	16.35	2.0	48.0
	19 (18.72)	1M	2M	3M	4M	5M	6M	7M	8M	9M	0M		19x25	19.27	2.0	38.0

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Configurable NAAMS (A Configurable)

Type	Coating	Tip Shape	E Flat Callout (Actual)	A Lead Length (1 mm Inc.)	For Slot	D Diameter	B Rad	C Rad		
								Tip A	Tip B	Tip C
ARES (Slot -0.28)	P - Plain T - TiN	A	6 (5.72)	15 ~ 60	6x12	7.09	1.0	18.0	9.0	D/2
			8 (7.72)	15 ~ 80	8x14	8.81		24.0	12.0	
			10 (9.72)		10x16	10.63		30.0	15.0	
		B	12 (11.72)	15 ~ 100	12x18	12.50	2.0	36.0	18.0	
			13 (12.72)		13x19	13.46		39.0	19.5	
			16 (15.72)		16x22	16.35		48.0	24.0	
		C	19 (18.72)		19x25	19.27		38.0	19.0	

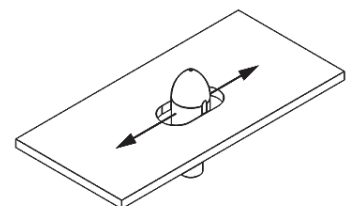
P/N Example (Standard NAAMS):

Part Number			
Type	E	A	Coating
ARE	19	2M	
ARE	10	9M	T

P/N Example (Configurable NAAMS):

Part Number				-	A
Type	Coating	Tip Shape	E		
ARES	P	B	16	-	A89
ARES	T	C	6	-	A55

Application Example

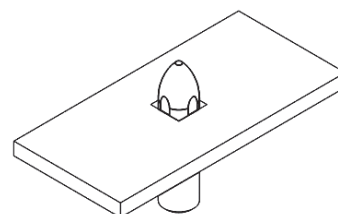



$$L_{ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Note: D Diameter is calculated on E or F Flat size (whichever is larger).

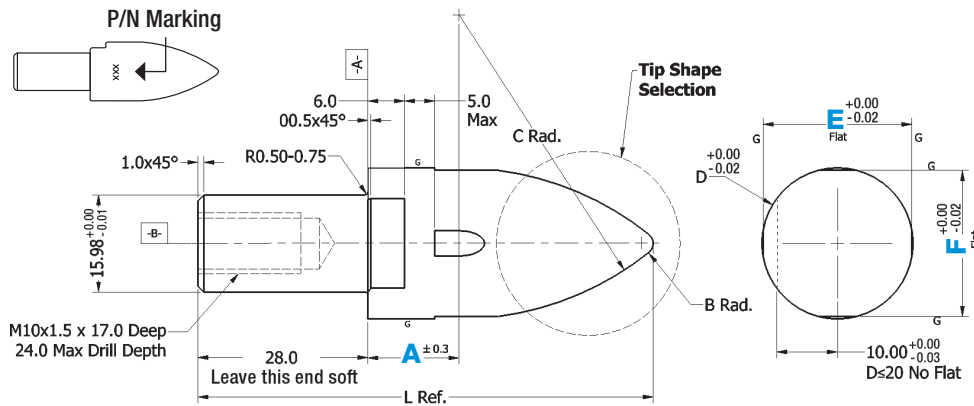
Application Example



For square holes,

Locating Pins

A&E CONFIGURABLE LARGE HEAD



$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Tip Shape Selection		
A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

Type	Coating	Material	Hardness
APFEL	P - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)

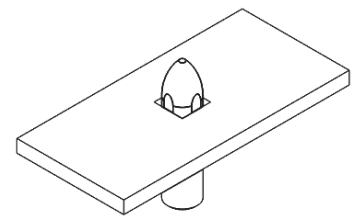
Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 μm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 μm		
0.000	± 0.015	1.6 μm		0.03 T.I.R

Configurable NAAMS (A & E Configurable)								
Type	Coating	Tip Shape	E Flat (0.01 mm Inc.)	F Flat (0.01 mm Inc.)	A Lead Length (1 mm Inc.)	D Diameter	B Rad	C Rad
APFEL	P - Plain T - TiN	A B C	19.00 ~ 25.00	19.00 ~ 25.00	15 ~ 100	D= E/F+0.40	2.0	Tip A C=Dx3.0 (Ø≤16) C=Dx2.0 (Ø>16) Tip B C=Dx1.5 (Ø≤16) C=Dx1.0 (Ø>16) Tip C C=Dx0.5

Note: D Diameter is calculated on E or F Flat size (whichever is larger).

P/N Example (Configurable NAAMS):								
Part Number			-	E	-	F	-	A
Type	Coating	Tip Shape						
APFEL	P	B	-	E21.58	-	F20.8	-	A95
APFEL	T	B	-	E19.05	-	F19.05	-	A12

Application Example

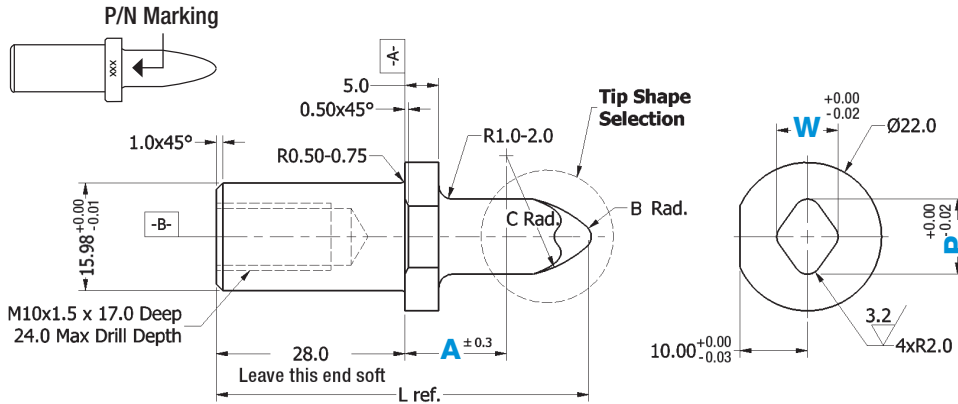


For square holes.



Locating Pins

TWO DIAMETER SMALL HEAD



3D CAD is available online.

Tip Shape Selection	
A Shape	Bullet
B Shape	Half Bullet
C Shape	Sphere

$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

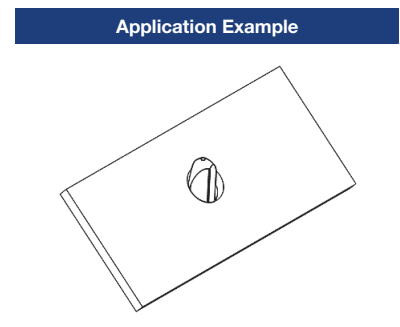
Type	Coating	Material	Hardness
APFSS	P - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)

Tolerance			
Dim.	Tol.	Finish (Ra)	Geometric
0.0	± 0.3	6.0 µm	⊥
0.00	± 0.03	3.0 µm	∥
0.000	± 0.015	1.6 µm	⊙

Configurable NAAMS (P, W, A Configurable)							
Type	Coating	Tip Shape	P (0.01 mm Inc.)	W (0.01 mm Inc.)	A (1 mm Inc.)	B Rad	C Rad
APFSS	P - Plain T - TiN	A	6.00 ~ 6.99	6.00 ~ 19.00	10 ~ 60	2.0	Tip A C=P/Wx3.0 (0≤16) C=P/Wx2.0 (0>16) Tip B C=P/Wx1.5 (0≤16) C=P/Wx1.0 (0>16) Tip C C=P/Wx0.5
			7.00 ~ 7.99		10 ~ 70		
			8.00 ~ 8.99		10 ~ 80		
			9.00 ~ 9.99		10 ~ 90		
			10.00 ~ 19.00		10 ~ 100		

Note: C Radius is calculated based on P or W (whichever is larger).

P/N Example (Configurable NAAMS):								
Part Number			-	P	-	W	-	A
Type	Coating	Tip Shape						
APFSS	P	A	-	P12.22	-	W8.40	-	A95
APFSS	T	C	-	P6.05	-	W16.75	-	A25

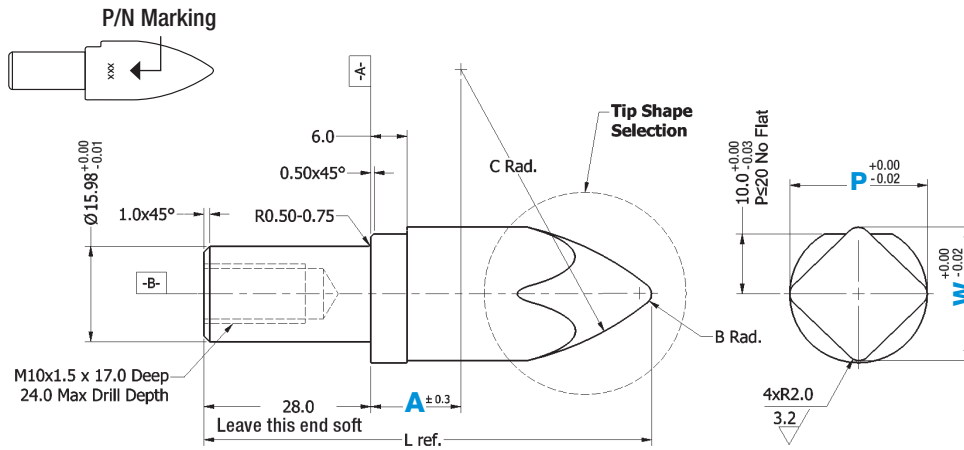


Locating Pins

TWO DIAMETER LARGE HEAD



Configurable and Standard Locating Pins



3D CAD is available online.

Tip Shape Selection		
A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 28 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
APFSL	P - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)

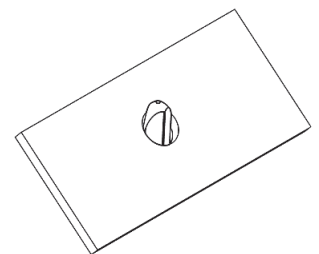
Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 μm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 μm		
0.000	± 0.015	1.6 μm		0.03 T.I.R

Configurable NAAMS (P, W, A Configurable)							
Type	Coating	Tip Shape	P (0.01 mm Inc.)	W (0.01 mm Inc.)	A (1 mm Inc.)	B Rad	C Rad
APFSL	P - Plain T - TiN	A B C	12.00 ~ 40.00	19.00 ~ 40.00	10 ~ 100	2.0	Tip A C=P/Wx3.0 (θ≤16) C=P/Wx2.0 (θ>16) Tip B C=P/Wx1.5 (θ≤16) C=P/Wx1.0 (θ>16) Tip C C=P/Wx0.5

Notes: 1) C Radius is calculated based on P or W (whichever is larger). 2) When P/W≤, there is No Flat (based on whichever is larger dimension). Check CAD for more details.

P/N Example (Configurable NAAMS):								
Part Number								
Type	Coating	Tip Shape		P		W		A
APFSL	P	A	-	P35.07	-	W39.98	-	A25
APFSL	T	C	-	P19.56	-	W22.55	-	A72

Application Example



STANDARD PIN RETAINERS

I Series

I-3 Facehole

I-3 Sidehole

I-4 Sidehole

L Series

L-3 Facehole

L-3 Sidehole

L-4 Facehole

L-4 Sidehole

32-34

32

33

34

35-38

35

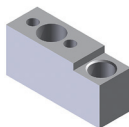
36

37

38



I-3 FACEHOLE



Technical drawing of a mechanical part, showing front and side views with dimensions and feature callouts.

Front View Dimensions:

- Overall Width: 66.0
- Overall Height: 9.0
- Distance from Left Face to Center of First Hole: 55.00
- Distance between Centers of First and Second Holes: 10.00
- Distance between Centers of Second and Third Holes: 30.000
- Distance between Centers of Third and Fourth Holes: 15.00
- Distance from Center of Fourth Hole to Right Face: 9.0
- Hole Diameter: $\varnothing 16.00^{+0.015}_{-0.000}$
- Distance from Top Face to Center of First Hole: 10.00

Side View Dimensions:

- Overall Width: 75.0
- Overall Height: 35.00
- Top Fillet: 1.0x45°
- Distance from Top Face to Center of First Hole: 20.0 (C/Bore C10)
- Distance from Top Face to Center of Second Hole: 25.0 (C/Bore C8)

Feature Callouts:

- 1-Hole Selection (A)
- M Tapped Hole
- C C'Bore Hole
- 2-Dowel Holes
- D

Type	Material	Finish
APR	A-36 Steel	Black Oxide
	304 Stainless Steel	-

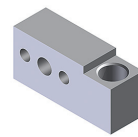
Part Number	
Type	Specification
APR	282M

Tolerance					
Dimension	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 µm		 Surfaces	0.015 T.I.R.
0.00	± 0.03	3.0 µm			
0.000	± 0.020	1.6 µm			

Type	Hole Selection (A) / Material				W	D Dowel Hole	
	M10		C10			Tolerance	
	A-36	304	A-36	304			
APR	060M	061M	062M	063M	25.0	8 H6	+0.000/+0.009

Type	Hole Selection (A) / Material				W	D Dowel Hole	
	M8		C8			Tolerance	
	A-36	304	A-36	304			
APR	265M	266M	267M	268M	30.0	8 F7	+0.013/+0.028
	280M	281M	282M	283M	25.0	8 F7	+0.013/+0.028

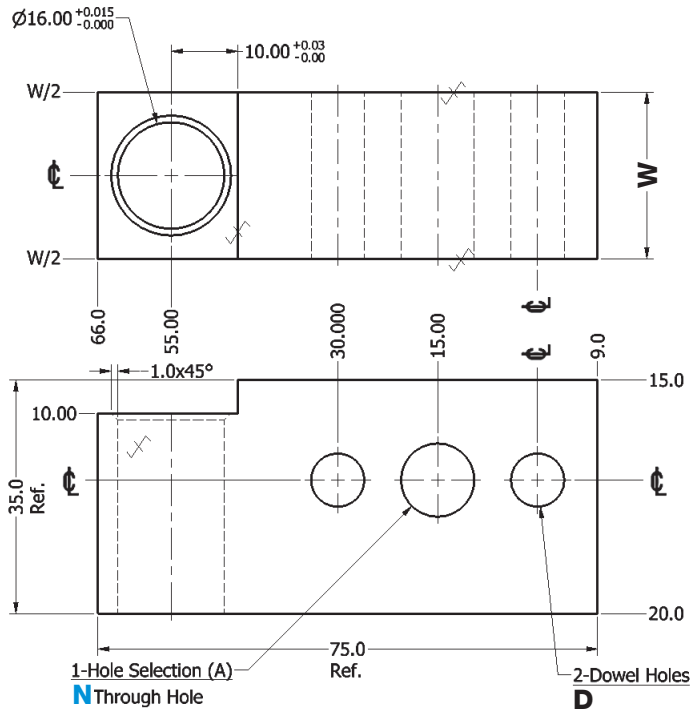
32



Pin Retainers

I-3 SIDEHOLE

3D CAD is available online.



Type	Material	Finish
APR	A-36 Steel	Black Oxide
	304 Stainless Steel	-

P/N Example (Standard NAAMS):	
Part Number	
Type	Specification
APR	260M

Tolerance					
Dimension	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 µm		 Surfaces	0.015 T.I.R.
0.00	± 0.03	3.0 µm			
0.000	± 0.020	1.6 µm			

Standard NAAMS (25 mm Series Pin Retainers)					
Type	Hole Selection (A) / Material		W	D Dowel Hole	
	N11			Tolerance	
	A-36	304			
APR	050M	051M	25.0	8 H6	+0.000/+0.009

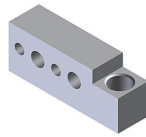
N11 (Ø11.0 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series Pin Retainers)					
Type	Hole Selection (A) / Material		W	D Dowel Hole	
	N9				Tolerance
	A-36	304			
APR	260M	261M	30	8 F7	+0.013/+0.028
	276M	277M	25		

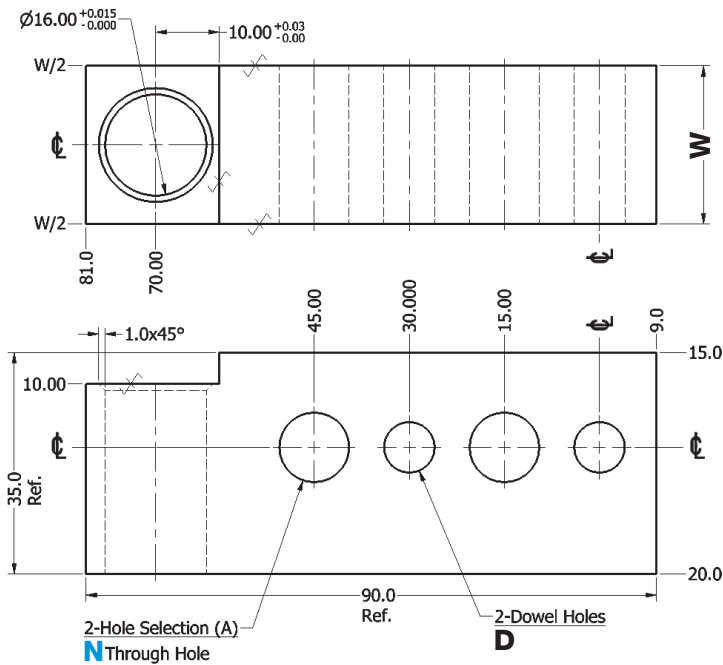
N9 (Ø9.0 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Pin Retainers

I-4 SIDEHOLE



3D CAD is available online.



Type	Material	Finish
APR	A-36 Steel	Black Oxide
	304 Stainless Steel	-

P/N Example (Standard NAAMS):	
Part Number	
Type	Specification
APR	242M

Tolerance					
Dimension	Tol.	Finish (Ra)		Geometric	
0.0	± 0.3	6.0 µm			0.015 T.I.R.
0.00	± 0.03	3.0 µm			
0.000	± 0.020	1.6 µm			

Standard NAAMS (25 mm Series Pin Retainers)					
Type	Hole Selection (A) / Material		W	D Dowel Hole	
	N11			8 H6	Tolerance
	A-36	304			
APR	070M	071M	25.0	8 H6	+0.000 / +0.009

N11 (Ø11.0 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series Pin Retainers)					
Type	Hole Selection (A) / Material		W	D Dowel Hole	
	N9				Tolerance
	A-36	304			
APR	075M	076M	30.0	6 F7	+0.010 / +0.022
	077M	078M	25.0	6 F7	+0.010 / +0.022
	221M	222M	30.0	8 F7	+0.013 / +0.028
	241M	242M	25.0	8 F7	+0.013 / +0.028

N9 (Ø9.0 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

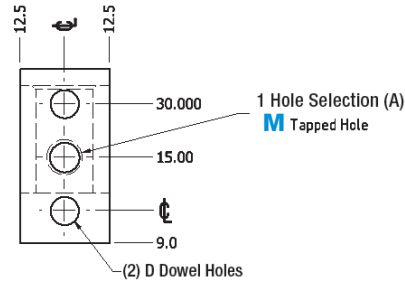
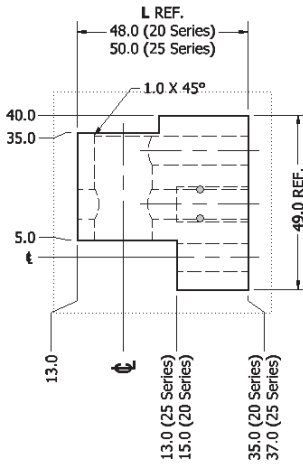
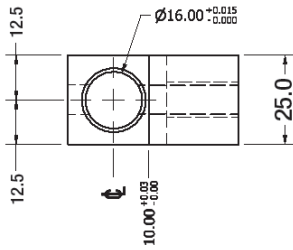


Pin Retainers

L-3 FACEHOLE

3D CAD is available online.

Standard Pin Retainers



Type	Material	Finish
APR	A-36 Steel	Black Oxide
	304 Stainless Steel	-

P/N Example (Standard NAAMS):	
Part Number	
Type	Specification
APR	020M

Tolerance					
Dimension	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 µm	Surfaces	0.015 T.I.R.	
0.00	± 0.03	3.0 µm			
0.000	± 0.020	1.6 µm			

Standard NAAMS (25 mm Series Pin Retainers)					
Type	Hole Selection (A) / Material		W	D Dowel Hole	
	M10			8 H6	Tolerance
	A-36	304			
APR	020M	021M	25	8 H6	+0.000/+0.009

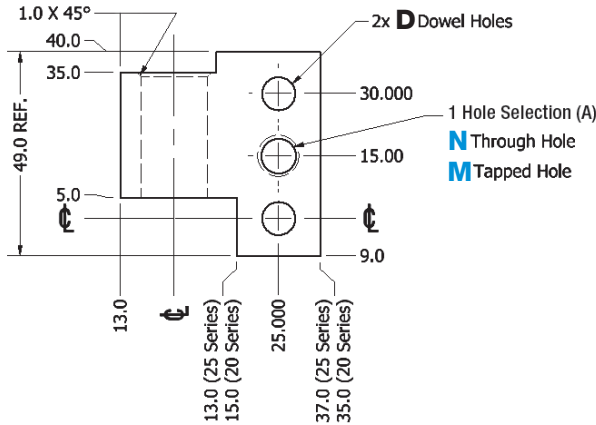
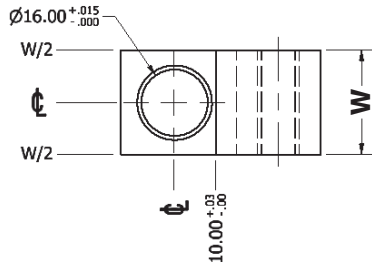
M10 (M10x1.5 Tapped Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series Pin Retainers)					
Type	Hole Selection (A) / Material		W	D Dowel Hole	
	M8			8 F7	Tolerance
	A-36	304			
APR	255M	256M	20	8 F7	+0.013/+0.028

M8 (M8x1.25 Tapped Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Pin Retainers

L-3 SIDEHOLE



3D CAD is available online.

Type	Material	Finish
APR	A-36 Steel	Black Oxide
	304 Stainless Steel	-

P/N Example (Standard NAAMS):	
Part Number	
Type	Specification
APR	271M

Tolerance					
Dimension	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 μm			0.015 T.I.R.
0.00	± 0.03	3.0 μm			
0.000	± 0.020	1.6 μm			

Standard NAAMS (25 mm Series Pin Retainers)							
Type	Hole Selection (A) / Material				W	D Dowel Hole	
	M10		N11			8 H6	Tolerance
	A-36	304	A-36	304			
APR	010M	011M	012M	013M	25	8 H6	+0.000 / +0.009

M10 (M10x1.5 Tapped Hole), **N11** (Ø11.0 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series Pin Retainers)							
Type	Hole Selection (A) / Material				W	D Dowel Hole	
	M8		N9			8 F7	Tolerance
	A-36	304	A-36	304			
APR	271M	272M	273M	274M	25	8 F7	+0.013/+0.028
	250M	251M	252M	253M	30		

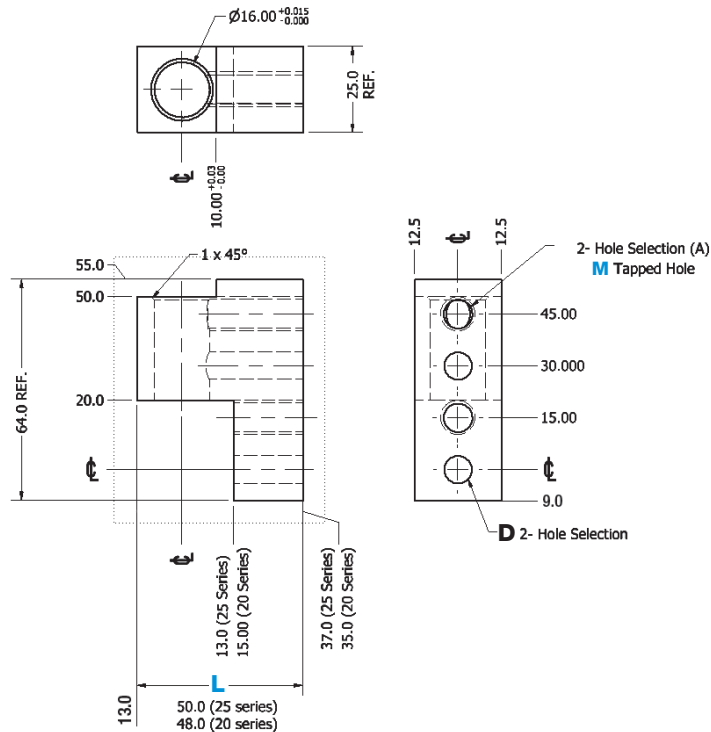
M8 (M8x1.25 Tapped Hole), **N9** (Ø9.0 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.



Pin Retainers

L-4 FACEHOLE

3D CAD is available online.



Type	Material	Finish
APR	A-36 Steel	Black Oxide
	304 Stainless Steel	-

P/N Example (Standard NAAMS):	
Part Number	
Type	Specification
APR	045M

Tolerance					
Dimension	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 µm			0.015 T.I.R.
0.00	± 0.03	3.0 µm			
0.000	± 0.020	1.6 µm			

Standard NAAMS (25 mm Series Pin Retainers)				
Type	Hole Selection (A) / Material		D Dowel Hole	
	M10			
	A-36	304		Tolerance
APR	040M	041M	8 H6	+0.000 / +0.009

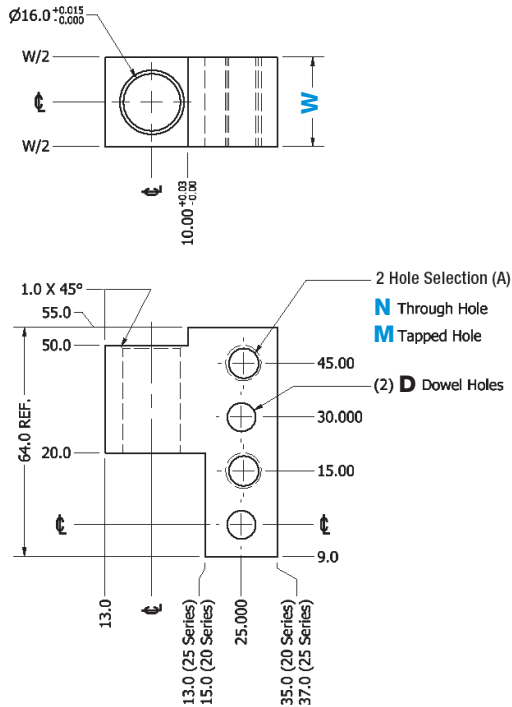
M10 (M10x1.5 Tapped Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series Pin Retainers)				
Type	Hole Selection (A) / Material		D Dowel Hole	
	M8			
	A-36	304		Tolerance
APR	045M	046M	6 F7	+0.010 / +0.022
	211M	212M	8 F7	+0.013 / +0.028

M8 (M8x1.25 Tapped Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Pin Retainers

L-4 SIDEHOLE



3D CAD is available online.

Type	Material	Finish
APR	A-36 Steel	Black Oxide
	304 Stainless Steel	-

P/N Example (Standard NAAMS):

Part Number	
Type	Specification
APR	337M

Tolerance					
Dimension	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 μm		 Surfaces	0.015 T.I.R.
0.00	± 0.03	3.0 μm			
0.000	± 0.020	1.6 μm			

Standard NAAMS (25 mm Series Pin Retainers)

Type	Hole Selection (A) / Material				W	D Dowel Hole	
	M10		N11			8 H6	Tolerance
	A-36	304	A-36	304			
APR	030M	031M	032M	033M	25	8 H6	+0.000 / +0.009

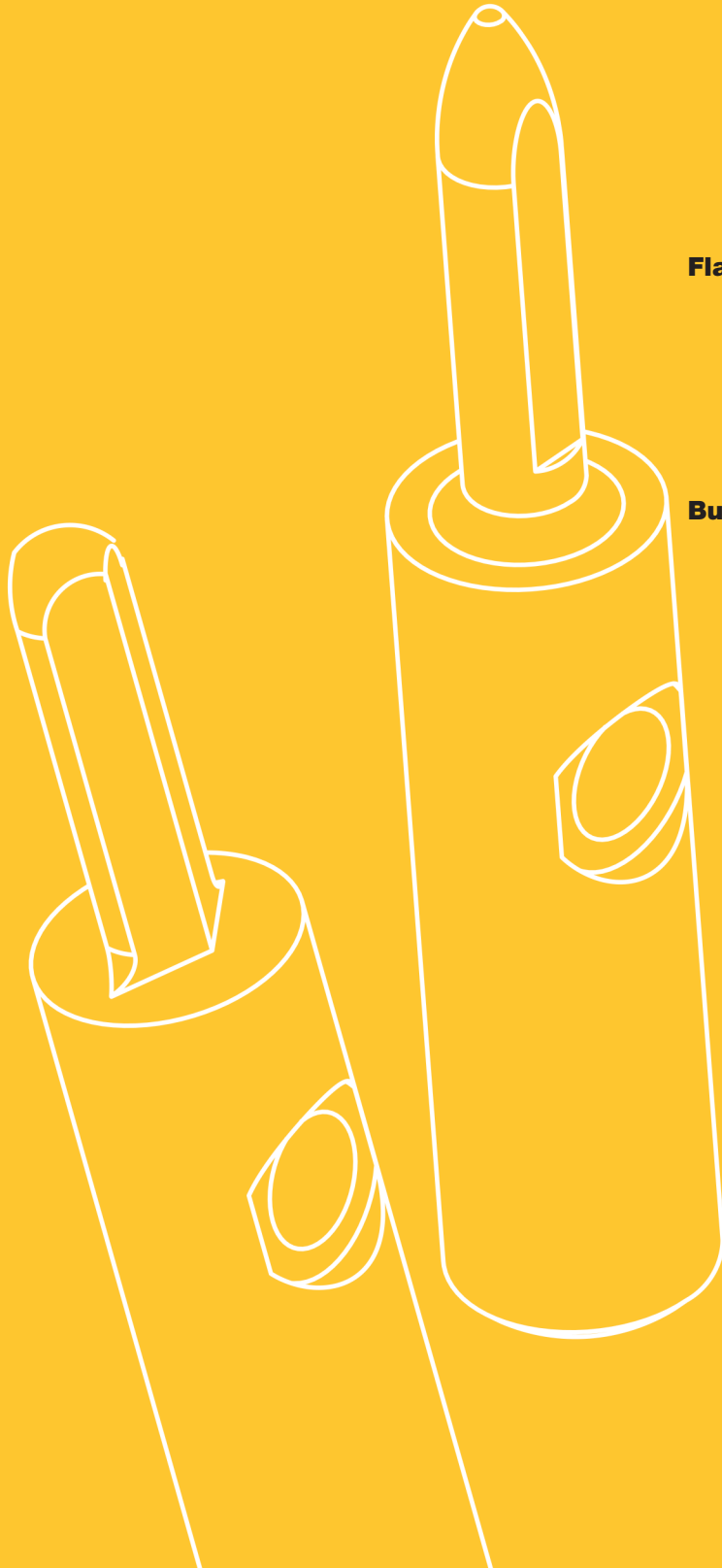
M10 (M10x1.5 Tapped Hole), **N11** ($\varnothing 11.0$ Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series Pin Retainers)

Type	Hole Selection (A) / Material				W	D Dowel Hole	
	M8		N9				Tolerance
	A-36	304	A-36	304			
APR	336M	337M	338M	339M	25	6 F7	+0.010 / +0.022
	231M	232M	233M	234M		8 F7	+0.013 / +0.028
	330M	331M	332M	333M	30	6 F7	+0.010 / +0.022
	201M	202M	203M	204M		8 F7	+0.013 / +0.028

M8 (M8x1.25 Tapped Hole), **N9** ($\varnothing 9.0$ Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

CONFIGURABLE AND STANDARD RETRACTABLE LOCATING PINS



Round Head Shape

40-45

APS Small R Head

40

APS Large R Head

41

ARP Small R Head

42

ARP Large R Head

43

APQ Small R Head

44

APQ Large R Head

45

Flat Head Shape

46-49

APE Small R Head

46

APE Large R Head

47

ARE Small R Head

48

ARE-R Large

49

Bullet Head Shape

50-53

Small Head Retractable
Fully Configurable

50

Large Head Retractable
Fully Configurable

51

Small Head Retractable
Fully Configurable

52

Large Head Retractable
Fully Configurable

53

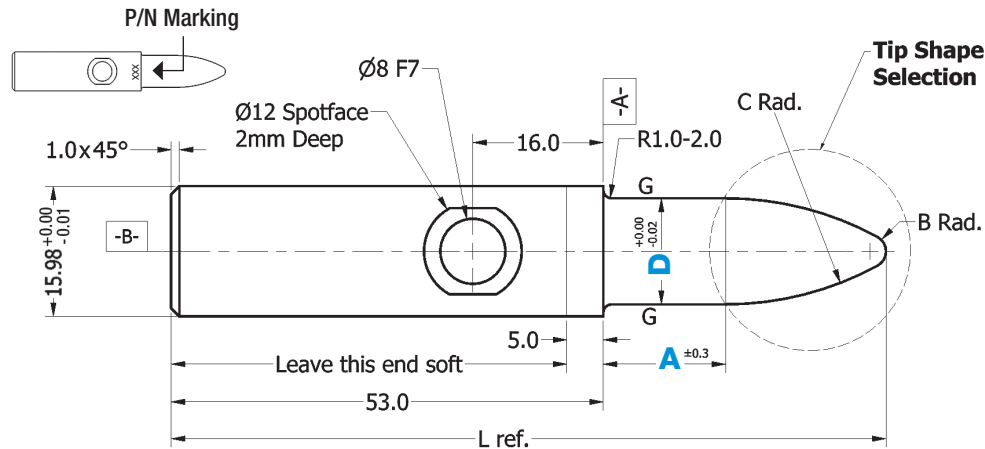


Locating Pins

APS-R SMALL HEAD



Retractable Locating Pins



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 53 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Head Shape	Material	Hardness
APS	Standard NAAMS	Round	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APSR	A Configurable			
	P - Plain T - TiN			

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS Pins

Type	D Head Dia. Callout (Actual)	A Lead Length										Retractable	Coating	B Rad	C Rad
		10 mm	15 mm	25 mm	35 mm	45 mm	55 mm	65 mm	75 mm	85 mm	95 mm				
APS (Hole -0.15)	06 (5.85)	1	2	3	4	5	6	-	-	-	-	R - Retractable	None - Plain T - TiN	1.0	18.0
	08 (7.85)	1	2	3	4	5	6	7	8	-	-			1.0	24.0
	10 (9.85)	1	2	3	4	5	6	7	8	9	0			2.0	30.0
	13 (12.85)	1	2	3	4	5	6	7	8	9	0			2.0	39.0
	16 (15.85)	1	2	3	4	5	6	7	8	9	0			2.0	48.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)

Type	Coating	Tip Shape	D Head Dia. Callout (Actual)	A Lead Length (1 mm Inc.)	B Rad	C Rad		
						Tip A	Tip B	Tip C
APSR (Hole -0.15)	P - Plain T - TiN	A	6 (5.85)	5 ~ 55	1.0	18.0	9.0	D/2
			8 (7.85)	5 ~ 75		24.0	12.0	D/2
		B	10 (9.85)	5 ~ 100	2.0	30.0	15.0	D/2
			13 (12.85)			39.0	19.5	D/2
		C	16 (15.85)			48.0	24.0	D/2

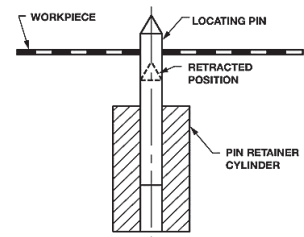
P/N Example (Standard NAAMS):

Part Number				
Type	D	A	Retractable	Coating
APS	08	4	R	T
APS	13	0		

P/N Example (Configurable NAAMS):

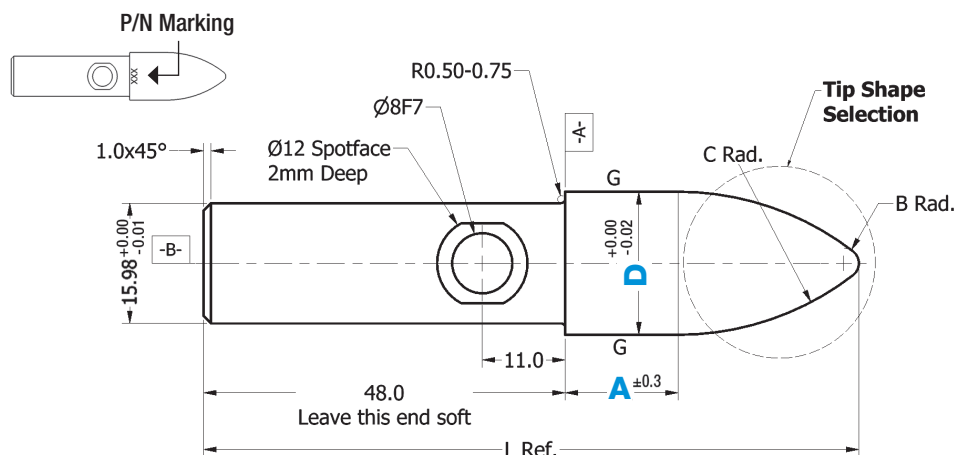
Part Number					
Type	Coating	Tip Shape	D	-	A
APSR	P	B	8	-	A35

Application Example



Locating Pins

APS-R LARGE HEAD



3D CAD is available online.

Tip Shape Selection		
A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L_{ref.} = 48 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
APS	Standard NAAMS	None - Plain T - TiN	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APSRL	A Configurable	P - Plain T - TiN	

Tolerance				
Dim.	Tol.	Finish (Ra)		Geometric
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

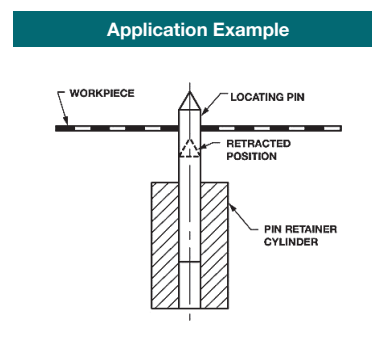
Standard NAAMS Pins															
Type	D Head Callout	A Lead Length										Retractable	Coating (Optional)	B Rad	C Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm				
APS (Hole -.015)	19 (18.85)	1	2	3	4	5	6	7	8	9	0	R - Retractable	None - Plain T - TiN	2.0	38.0
	25 (24.85)	1	2	3	4	5	6	7	8	9	0			2.0	50.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)								
Type	Coating	Tip Shape	D Head Dia. Callout (Actual)	A Lead Length (1 mm Inc.)	B Rad	C Rad		
						Tip A	Tip B	Tip C
APSR/L (Hole -0.15)	P - Plain	A B C	19 (18.85)	5 ~ 100	2.0	38.0	19.0	D/2
	T - TiN		25 (24.85)			50.0	25.0	D/2

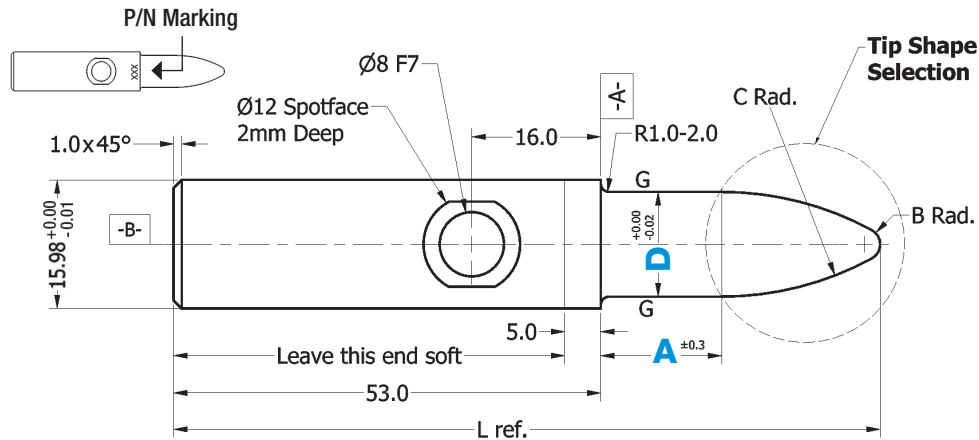
P/N Example (Standard NAAMS):				
Part Number				
Type	D	A	Retractable	Coating
APS	19	4	R	T

P/N Example (Configurable NAAMS):					
Part Number				—	A
Type	Coating	Tip Shape	D		
APSR	T	A	19	—	A42



Respot Pins

ARP-R SMALL HEAD



3D CAD is available online.

Tip Shape Selection		
A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 53 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
ARP	Standard NAAMS	None - Plain T - TiN	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
ARPRS	A Configurable	P - Plain T - TiN	

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS Pins															
Type	D Head Dia. Callout (Actual)	A Lead Length										Retractable	Coating	B Rad	C Rad
ARP (Hole -0.28)	06 (5.72)	1	2	3	4	5	6	-	-	-	-	R - Retractable	None - Plain T - TiN	1.0	18.0
	08 (7.72)	1	2	3	4	5	6	7	8	-	-			1.0	24.0
	10 (9.72)	1	2	3	4	5	6	7	8	9	0			2.0	30.0
	13 (12.72)	1	2	3	4	5	6	7	8	9	0			2.0	39.0
	16 (15.72)	1	2	3	4	5	6	7	8	9	0			2.0	48.0

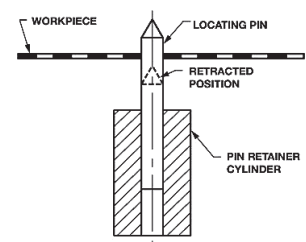
Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)								
Type	Coating	Tip Shape	D Head Dia. Callout (Actual)	A Lead Length (1 mm Inc.)	B Rad	C Rad		
ARP (Hole -0.28)	P - Plain T - TiN	A	6 (5.72)	5 ~ 55	1.0	Tip A	Tip B	Tip C
			8 (7.72)	5 ~ 75		18.0	9.0	D/2
		B	10 (9.72)	5 ~ 100	2.0	24.0	12.0	D/2
			13 (12.72)			30.0	15.0	D/2
		C	16 (15.72)			39.0	19.5	D/2
						48.0	24.0	D/2

P/N Example (Standard NAAMS):				
Part Number				
Type	D	A	Retractable	Coating
ARP	08	4	R	
ARP	08	4	R	T

P/N Example (Configurable NAAMS):				
Part Number				
Type	Coating	Tip Shape	D	
ARPRS	T	A	8	
				A42

Application Example

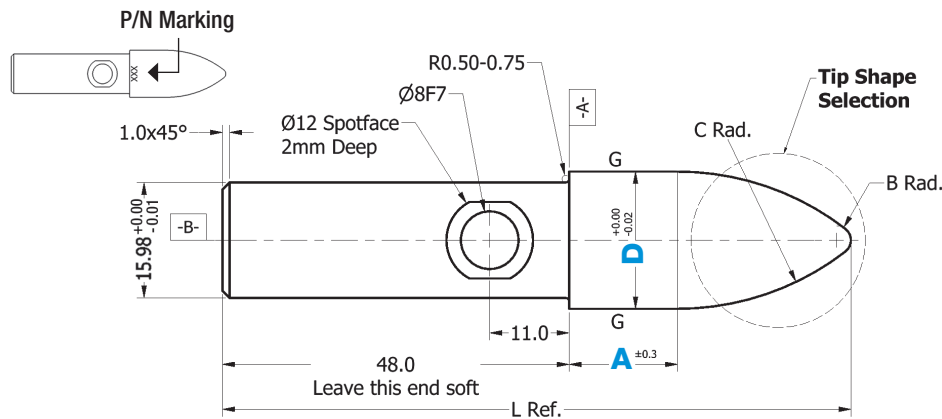




Respot Pins

ARP-R LARGE HEAD

Retractable Locating Pins



3D CAD is available online.

Tip Shape Selection	
A Shape	Bullet
B Shape	Half Bullet
C Shape	Sphere

$$L \text{ ref.} = 48 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
ARP	Standard NAAMS None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
ARPL	A Configurable P - Plain T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm	$\perp$	0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm	$\parallel$	
0.000	± 0.015	1.6 µm	$\odot$	0.03 T.I.R

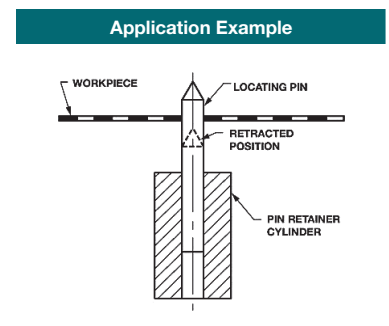
Standard NAAMS Pins															
Type	D Head Callout	A Lead Length										Retractable	Coating (Optional)	B Rad	C Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm				
ARP (Hole -0.28)	19 (18.72)	1	2	3	4	5	6	7	8	9	0	R - Retractable	None - Plain	2.0	38.0
	25 (24.72)	1	2	3	4	5	6	7	8	9	0		T - TiN	2.0	50.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)								
Type	Coating	Tip Shape	D Head Dia. Callout (Actual)	A Lead Length (1 mm Inc.)	B Rad	C Rad		
						Tip A	Tip B	Tip C
ARPL (Hole -0.28)	P - Plain	A	19 (18.72)	5 ~ 100	2.0	38.0	19.0	D/2
	T - TiN	B C	25 (24.72)			50.0	25.0	D/2

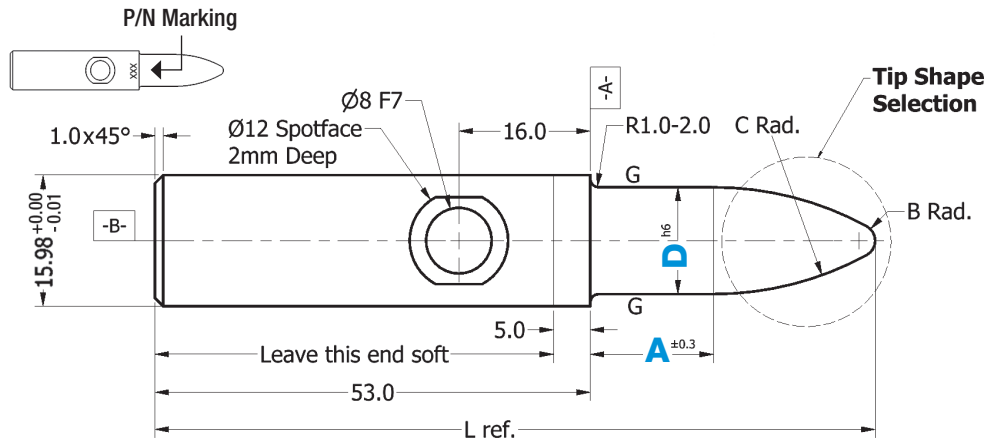
P/N Example (Standard NAAMS):				
Part Number				
Type	D	A	Retractable	Coating
ARP	19	4	R	T
	25	0		

P/N Example (Configurable NAAMS):					
Part Number					
Type	Coating	Tip Shape	D	-	A
APSL	P	A	19	-	A42
	T	C	25	-	A99



Locating Pins

APQ-R SMALL HEAD



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 53 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Coating	Material	Hardness
APQ	Standard NAAMS None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APQRS	A Configurable P - Plain T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS Pins

Type	D Head Callout	A Lead Length								Retractable	Coating (Optional)	B Rad	C Rad
		10 mm	15 mm	25 mm	35 mm	45 mm	55 mm	65 mm	75 mm				
APQ (Hole h6)	08	1	2	3	4	5	6	7	8	R - Retractable	None - Plain T - TiN	1.0	24.0
	10	1	2	3	4	5	6	7	8			2.0	30.0
	13	1	2	3	4	5	6	7	8			2.0	39.0

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Configurable NAAMS (A Configurable)

Type	Coating	Tip Shape	D Head Callout	A Lead Length (1 mm Inc.)	B Rad	C Rad		
						Tip A	Tip B	Tip C
APQRS (Hole h6)	P - Plain T - TiN	A B C	8	5 ~ 100	2.0	24.0	12.0	D/2
			10			30.0	15.0	D/2
			13			39.0	19.5	D/2

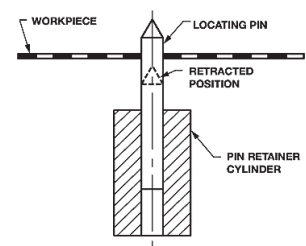
P/N Example (Standard NAAMS):

Part Number				
Type	D	A	Retractable	Coating
APQ	08	4	R	T

P/N Example (Configurable NAAMS):

Part Number				-	A
Type	Coating	Tip Shape	D		
APQRS	T	A	8	-	A42

Application Example

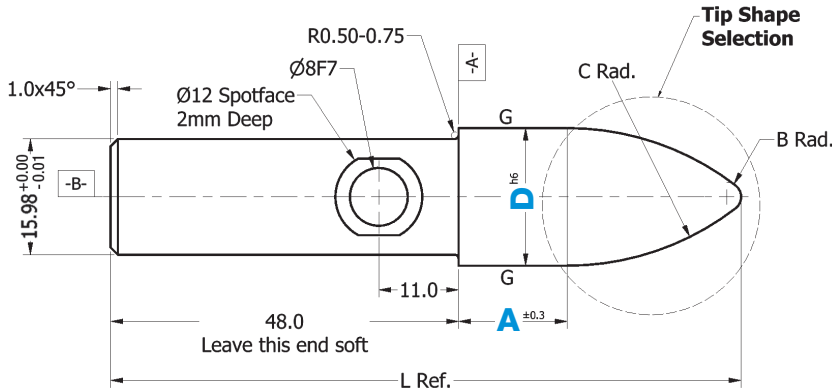




Locating Pins

APQ-R LARGE HEAD

3D CAD is available online.



$$L \text{ ref.} = 48 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$



Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

Type	Coating	Material	Hardness
APQ	Standard NAAMS None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APQRL	A Configurable P - Plain T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS Pins

Type	D Head Callout	A Lead Length								Retractable	Coating	B Rad	C Rad
		10 mm	15 mm	25 mm	35 mm	45 mm	55 mm	65 mm	75 mm				
APQ (Hole h6)	16	1	2	3	4	5	6	7	8	R - Retractable	None - Plain T - TiN	2.0	48.0
	18	1	2	3	4	5	6	7	8			2.0	38.0
	20	1	2	3	4	5	6	7	8			2.0	38.0
	25	1	2	3	4	5	6	7	8			2.0	50.0
	30	1	2	3	4	5	6	7	8			2.0	50.0
	35	1	2	3	4	5	6	7	8			2.0	50.0
	40	1	2	3	4	5	6	7	8			2.0	50.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)

Type	Coating	Tip Shape	D Head Callout	A Lead Length (1 mm Inc.)	B Rad	C Rad		
						Tip A	Tip B	Tip C
APQRL (Hole h6)	P - Plain T - TiN	A B C	16	5 ~ 100	2.0	48.0	24.0	D/2
			18			38.0	19.0	
			20			38.0	19.0	
			25			50.0	25.0	
			30			50.0	25.0	
			35			50.0	25.0	
			40			50.0	25.0	

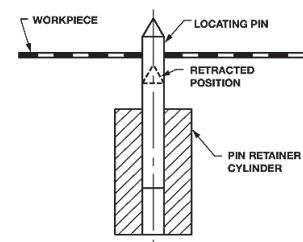
P/N Example (Standard NAAMS):

Part Number				
Type	D	A	Retractable	Coating
APQ	18	4	R	T

P/N Example (Configurable NAAMS):

Part Number				-	A
Type	Coating	Tip Shape	D		
APQRL	T	A	19	-	A42

Application Example

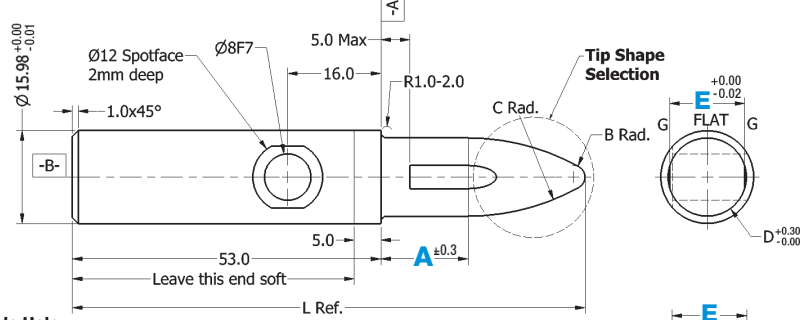


Locating Pins

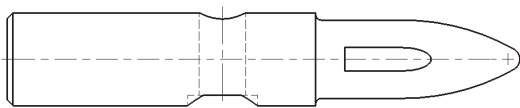
APE-R SMALL HEAD



-Front Hole



-Side Hole



$$L \text{ ref.} = 53 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$



P/N Marking

3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

Type	Retractable	Coating	Material	Hardness
APE	Standard NAAMS	R - Front Hole S - Side Hole	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APERS	A Configurable	Front Hole		
APESS		Side Hole		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS

Type	E Flat Callout (Actual)	A Lead Length										Retractable	Coating (Optional)	D Diameter	B Rad	C Rad
		10 mm	15 mm	25 mm	35 mm	45 mm	55 mm	65 mm	75 mm	85 mm	95 mm					
APE (Slot -0.15)	06 (5.85)	1	2	3	4	5	6	-	-	-	-	R - Front Hole	None - Plain T - TiN	7.09	1.0	18.0
	08 (7.85)	1	2	3	4	5	6	7	8	-	-			8.81	1.0	24.0
	10 (9.85)	1	2	3	4	5	6	7	8	9	0	S - Side Hole		10.63	2.0	30.0
	13 (12.85)	1	2	3	4	5	6	7	8	9	0			13.46	2.0	39.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)

Type	Coating	Tip Shape	E Flat Callout (Actual)	A Lead Length (1 mm Inc.)	D Diameter	B Rad	C Rad		
							Tip A	Tip B	Tip C
APERS (Front Hole) APESS (Side Hole) (Slot -0.15)	P - Plain	A	6 (5.85)	10 ~ 55	7.09	1.0	18.0	9.0	D/2
			8 (7.85)	10 ~ 75	8.81		24.0	12.0	D/2
	T - TiN	B	10 (9.85)	10 ~ 100	10.63	2.0	30.0	15.0	D/2
			13 (12.85)		13.46		39.0	19.5	D/2

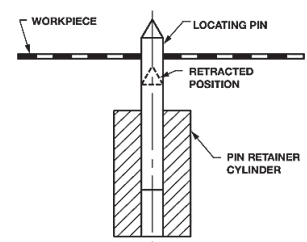
P/N Example (Standard NAAMS):

Part Number				
Type	E	A	Retractable	Coating
APE	08	4	R	T

P/N Example (Configurable NAAMS):

Part Number					
Type	Coating	Tip Shape	E	-	A
APERS	P	C	10	-	A22
APESS	T	A	8	-	A42

Application Example





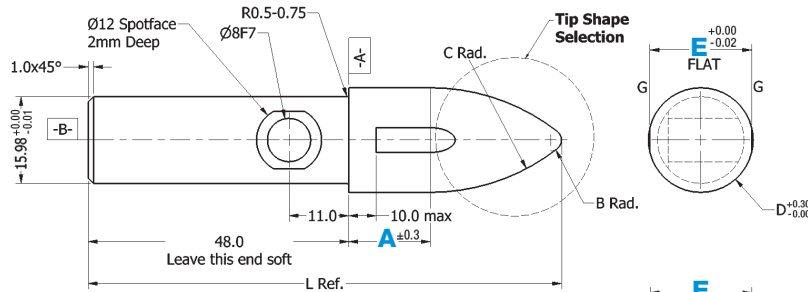
Locating Pins

APE-R LARGE HEAD

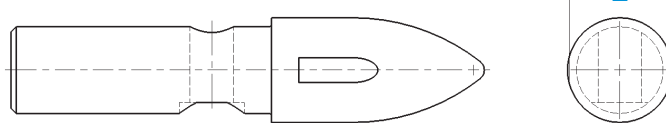
Retractable Locating Pins

3D CAD is available online.

-Front Hole



-Side Hole



$$L \text{ ref.} = 48 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$



Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

Type	Retractable	Coating	Material	Hardness
APE	Standard NAAMS	R - Front Hole S - Side Hole	None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)
APERL	A Configurable	Front Hole	P - Plain	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
APESL		Side Hole	T - TiN	

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS

Type	E Flat Callout (Actual)	A Lead Length										Retractable	Coating (Optional)	D Diameter	B Rad	C Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm					
APE (Slot -0.15)	16 (15.85)	1	2	3	4	5	6	7	8	9	0	R - Retractable Front Hole S - Retractable Side Hole	None - Plain T - TiN	16.35	2.0	48.0
	19 (18.85)	1	2	3	4	5	6	7	8	9	0			19.27	2.0	38.0
	25 (24.85)	1	2	3	4	5	6	7	8	9	0			25.17	2.0	50.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)

Type	Coating	Tip Shape	E Flat Callout (Actual)	A Lead Length (1 mm Inc.)	D Diameter	B Rad	C Rad		
							Tip A	Tip B	Tip C
APERL (Front Hole)	P - Plain T - TiN	A	16 (15.85)	10 ~ 100	16.35	2.0	48.0	24.0	D/2
APERL (Side Hole)		B	19 (18.85)		19.27		38.0	19.0	D/2
APESL (Side Hole) (Slot -0.15)		C	25 (24.85)		25.17		50.0	25.0	D/2

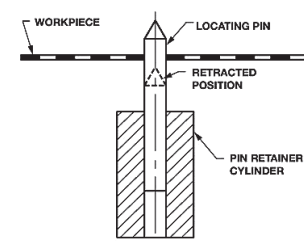
P/N Example (Standard NAAMS):

Part Number				
Type	E	A	Retractable	Coating
APE	19	4	R	T

P/N Example (Configurable NAAMS):

Part Number				
Type	Coating	Tip Shape	E	
APERL	T	A	19	A42

Application Example

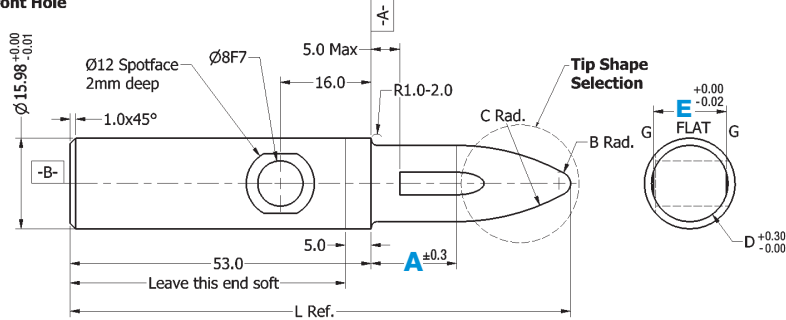


Respot Pins

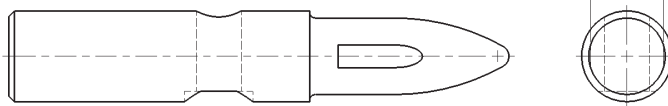
ARE-R SMALL HEAD



-Front Hole



-Side Hole



$$L \text{ ref.} = 53 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

Type	Retractable	Coating	Material	Hardness
ARE	Standard NAAMS	R - Front Hole S - Side Hole	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
ARERS	A Configurable	Front Hole		
ARESS		Side Hole		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS																	
Type	E Flat Callout (Actual)	A Lead Length										Retractable	Coating	For Slot	D Diameter	B Rad	C Rad
		10 mm	15 mm	25 mm	35 mm	45 mm	55 mm	65 mm	75 mm	85 mm	95 mm						
ARE (Slot -0.28)	06 (5.72)	1	2	3	4	5	6	-	-	-	-	R - Front Hole	None - Plain T - TiN	6x12	7.09	1.0	18.0
	08 (7.72)	1	2	3	4	5	6	7	8	-	-			8x14	8.81	1.0	24.0
	10 (9.72)	1	2	3	4	5	6	7	8	9	0	S - Side Hole		10x16	10.63	2.0	30.0
	13 (12.72)	1	2	3	4	5	6	7	8	9	0			13x19	13.46	2.0	39.0

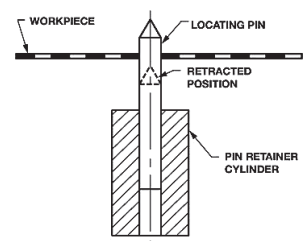
Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)										
Type	Coating	Tip Shape	E Flat Callout (Actual)	A Lead Length (1 mm Inc.)	For Slot	D Diameter	B Rad	C Rad		
								Tip A	Tip B	Tip C
ARERS (Front Hole)	P - Plain	A	6 (5.72)	10 ~ 55	6x12	7.09	1.0	18.0	9.0	D/2
			8 (7.72)	10 ~ 75	8x14	8.81		24.0	12.0	D/2
ARESS (Side Hole)	T - TiN	B	10 (9.72)	10 ~ 100	10x16	10.63	2.0	30.0	15.0	D/2
			13 (12.72)		13x19	13.46		39.0	19.5	D/2
(Slot -0.28)		C								

P/N Example (Standard NAAMS):				
Part Number				
Type	E	A	Retractable	Coating
ARE	08	4	R	
ARE	13	0	S	T

P/N Example (Configurable NAAMS):					
Part Number					
Type	Coating	Tip Shape	E		A
ARERS	P	A	6	-	A42
ARESS	T	C	10	-	A99

Application Example



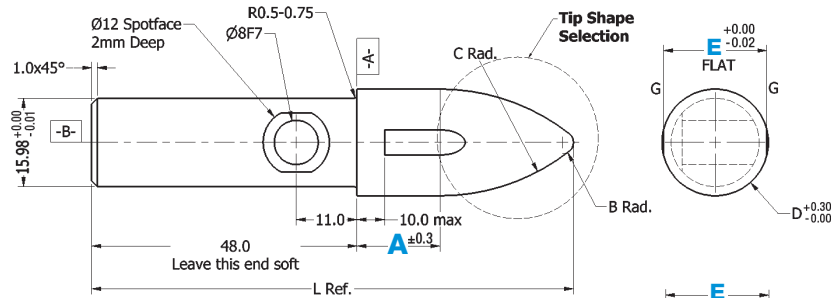


Respot Pins

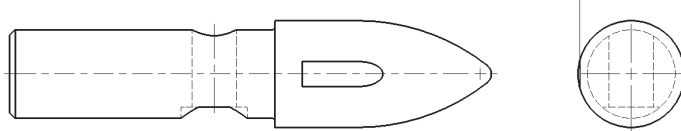
ARE-R LARGE

Retractable Locating Pins

-Front Hole



-Side Hole



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 48 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$



Type	Retractable	Coating	Material	Hardness
ARE	Standard NAAMS R - Front Hole S - Side Hole	None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
ARERL	A Configurable	Front Hole		
ARESL		Side Hole		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Standard NAAMS

Type	E Flat Callout (Actual)	A Lead Length										Retractable	Coating	For Slot	D Diameter	B Rad	C Rad
		15 mm	20 mm	30 mm	40 mm	50 mm	60 mm	70 mm	80 mm	90 mm	100 mm						
ARE (Slot -0.28)	16 (15.72)	1	2	3	4	5	6	7	8	9	0	R - Retractable Front Hole S - Retractable Side Hole	None - Plain T - TiN	16x22	16.35	2.0	48.0
	19 (18.72)	1	2	3	4	5	6	7	8	9	0			19x25	19.27	2.0	38.0
	25 (24.72)	1	2	3	4	5	6	7	8	9	0			25x31	25.17	2.0	50.0

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (A Configurable)

Type	Coating	Tip Shape	E Flat Callout (Actual)	A Lead Length (1 mm Inc.)	For Slot	D Diameter	B Rad	C Rad		
								Tip A	Tip B	Tip C
ARERL (Front Hole)	P - Plain T - TiN	A B C	16 (15.72)	10 ~ 100	16x22	16.35	2.0	48.0	24.0	D/2
ARESL (Side Hole)			19 (18.72)		19x25	19.27		38.0	19.0	D/2
(Slot -0.28)			25 (24.72)		25x31	25.17		50.0	25.0	D/2

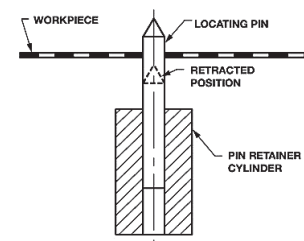
P/N Example (Standard NAAMS):

Part Number				
Type	E	A	Retractable	Coating
ARE	19	4	R	T
ARE	16	9	S	

P/N Example (Configurable NAAMS):

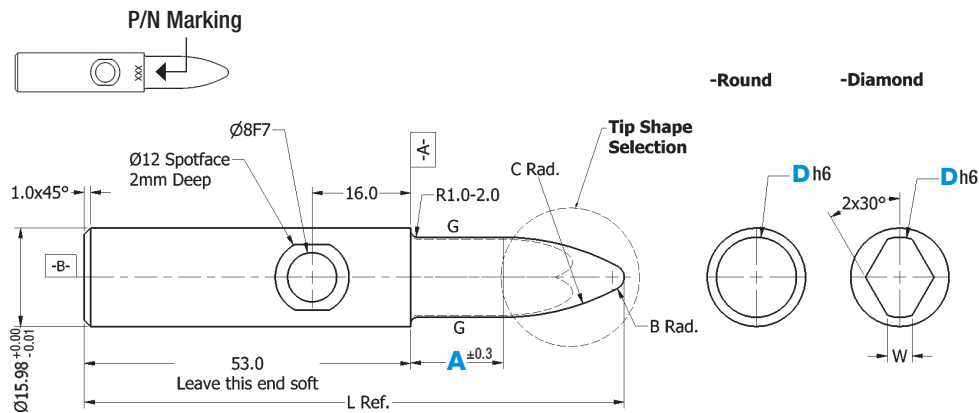
Part Number					
Type	Coating	Tip Shape	E	-	A
ARERL	P	A	25	-	A42
ARESL	T	C	16	-	A99

Application Example



Locating Pins

SMALL HEAD RETRACTABLE FULLY CONFIGURABLE



3D CAD is available online.

Tip Shape Selection		
A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

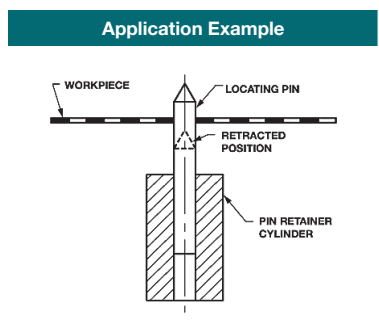
$$L \text{ ref.} = 53 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$

Type	Retractable	Coating	Material	Hardness
ARFS	Round	P - Plain	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
ARFSD	Diamond	T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Configurable NAAMS (A & D Configurable)								
Type	Coating	Tip Shape	D Head Dia. (0.01 mm Inc.)	D Tol.	A Lead Length (0.1 mm Inc.)	B Rad	W	C Rad
ARFS (Round) ARFSD (Diamond)	P - Plain T - TiN	A	6.00 ~ 6.99	+0.000 -0.009	5.0 ~ 55.0	1.0	2.0	Tip A C=Dx3.0 (Ø≤16) C=Dx2.0 (Ø>16)
		B	7.00 ~ 7.99		5.0 ~ 75.0			
		C	8.00 ~ 8.99		5.0 ~ 80.0			Tip B C=Dx1.5 (Ø≤16) C=Dx1.0 (Ø>16)
			9.00 ~ 9.99	+0.000 -0.011	5.0 ~ 100.0	2.0	3.0	
			10.00 ~ 16.00				4.0-5.0	

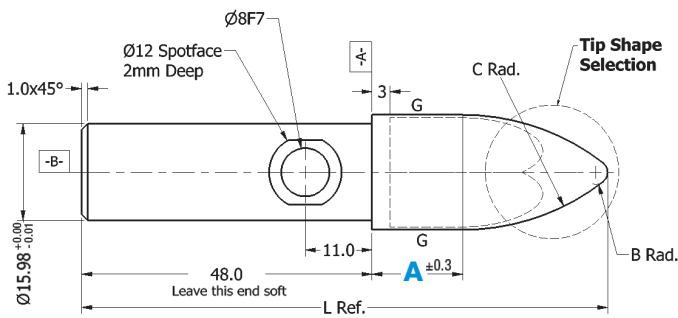
P/N Example (Configurable NAAMS):						
Part Number			-	D	-	A
Type	Surface Finish	Tip Shape				
ARFSD	P	C	-	D8.55	-	A42.1
ARFS	T	A	-	D8.55	-	A42.1





Locating Pins

LARGE HEAD RETRACTABLE FULLY CONFIGURABLE



-Round

-Diamond

3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 48 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$



Type	Retractable	Coating	Material	Hardness
ARFL	Round	P - Plain	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
ARFLD	Diamond	T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

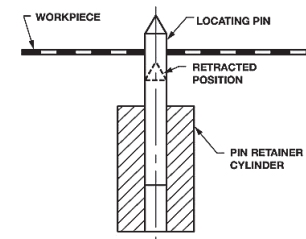
Configurable NAAMS (A & D Configurable)

Configurable NAAMS (A & D Configurable)								
Type	Coating	Tip Shape	D (0.01 mm Inc.)	D Tol.	A Lead Length (0.1 mm Inc.)	W	B Rad	C Rad
ARFL (Round)	P - Plain	A	16.10 ~ 25.00	h6	5.0 ~ 100.0	6.0	2.0	Tip A C=Dx3.0 (Ø≤16) C=Dx2.0 (Ø>16)
			25.01 ~ 40.00			7.0-9.0		Tip B C=Dx1.5 (Ø≤16) C=Dx1.0 (Ø>16)
								Tip C C=Dx0.5

P/N Example (Configurable NAAMS):

Part Number			-	D	-	A
Type	Surface Finish	Tip Shape				
ARFL	P	A	-	D17.78	-	A42.0
ARFLD	T	C	-	D31.78	-	A42.0

Application Example

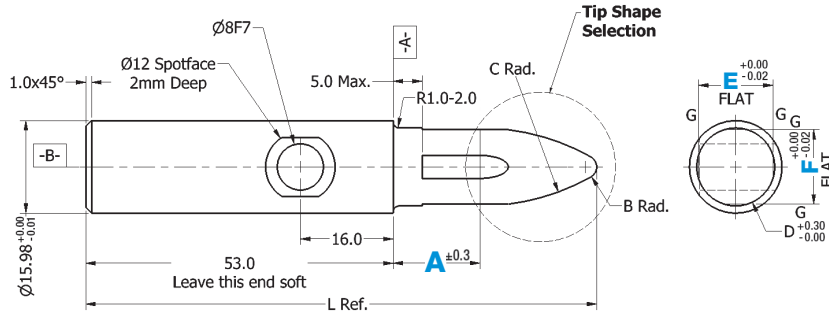


Locating Pins

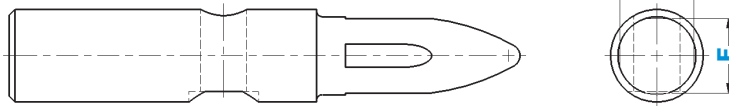
SMALL HEAD RETRACTABLE FULLY CONFIGURABLE



-Front Hole



-Side Hole



$$L \text{ ref.} = 53 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

Type	Retractable	Coating	Material	Hardness
ARFERS	Front Hole	None - Plain T - TiN	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
ARFESS	Side Hole	P - Plain T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Configurable NAAMS (A & D Configurable)

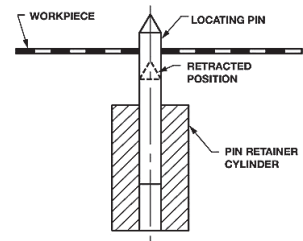
Type	Coating	Tip Shape	E Flat (0.01 mm Inc.)	F Flat (0.01 mm Inc.)	D Diameter	A Lead Length (1 mm Inc.)	B Rad	C Rad
ARFERS (Front Hole) ARFESS (Side Hole)	P - Plain T - TiN	A	6.00~10.00	6.00~ 16.00	D= E/F+1.0	10 ~ 100	2.0	Tip A C=Dx3.0 (Ø≤16) C=Dx2.0 (Ø>16)
		B	10.01~16.00	10.01 ~ 16.00	D= E/F+0.75			Tip B C=Dx1.5 (Ø≤16) C=Dx1.0 (Ø>16)
		C						Tip C C=Dx0.5

Note: D Diameter is calculated on E or F Flat size (whichever is larger).

P/N Example (Configurable NAAMS):

Part Number			-	E	-	F	-	A
Type	Coating	Tip Shape						
ARFESS	P	C	-	E12.01	-	F11.01	-	A42
ARFERS	T	A	-	E8.06	-	F11.01	-	A42

Application Example



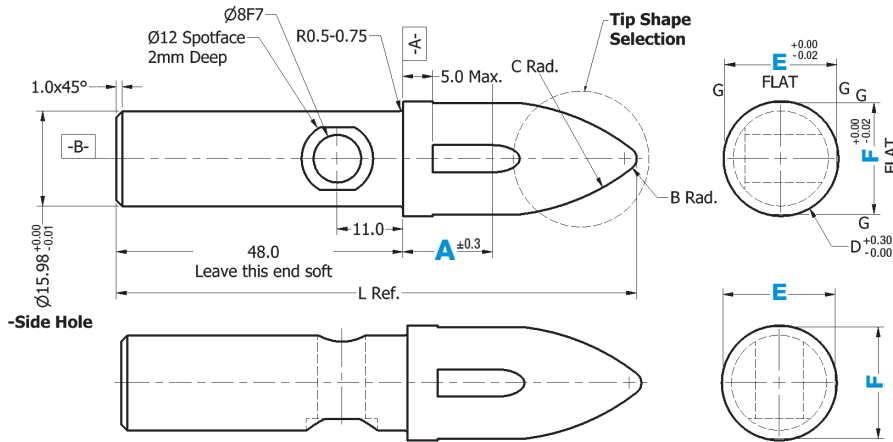
For square holes.



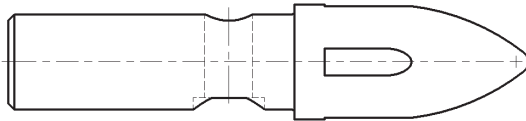
Locating Pins

LARGE HEAD RETRACTABLE FULLY CONFIGURABLE

-Front Hole



-Side Hole



3D CAD is available online.

Tip Shape Selection

A Shape	Bullet	
B Shape	Half Bullet	
C Shape	Sphere	

$$L \text{ ref.} = 48 + A + \sqrt{D \left(C - \frac{D}{4} \right)}$$



Type	Retractable	Coating	Material	Hardness
ARFERL	Front Hole	P - Plain	8620 Alloy Steel (JIS SNCM220)	Carburized 58 ~ 62HRC (Depth 0.5-0.7 after Grinding)
ARFESL	Side Hole	T - TiN		

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R to Datum A & B
0.00	± 0.03	3.0 µm		
0.000	± 0.015	1.6 µm		0.03 T.I.R

Configurable NAAMS (A & D Configurable)

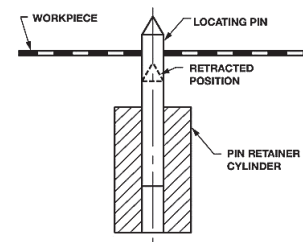
Type	Coating	Tip Shape	E Flat (0.01 mm Inc.)	F Flat (0.01 mm Inc.)	D Diameter	A Lead Length (1 mm Inc.)	B Rad	C Rad
ARFERL (Front Hole) ARFESL (Side Hole)	P - Plain T - TiN	A	16.10~20.00	16.10 ~ 25.00	D= E+0.45	10.0 ~ 100.0	2.0	Tip A C=Dx3.0 (θ≤16) C=Dx2.0 (θ>16)
		B	20.01~25.00	16.10 ~ 25.00	D= E+0.35			Tip B C=Dx1.5 (θ≤16) C=Dx1.0 (θ>16)
		C						Tip C C=Dx0.5

Note: D Diameter is calculated on E or F Flat size (whichever is larger).

P/N Example (Configurable NAAMS):

Part Number			-	E	-	F	-	A
Type	Surface Finish	Tip Shape						
ARFESL	P	A	-	E21.05	-	F17.50	-	A42
ARFERL	T	A	-	E16.70	-	F20.01	-	A42

Application Example



For square holes.



STANDARD NC BLOCKS

I Blocks **56-57**

I Shape 3 Holes **56**

I Shape 4 Holes **57**

L-Blocks **58-60**

L-Shaped 3 Holes **58**

L-Shaped 4 Holes (Through) **59**

L-Shape 4 Hole Type
(25mm Series, Through & Dowel) **59**

L-Shaped 4 Holes (Tapped) **60**

Rectangular Blocks **61-64**

3 Holes **61**

3 Holes Sideholes **62**

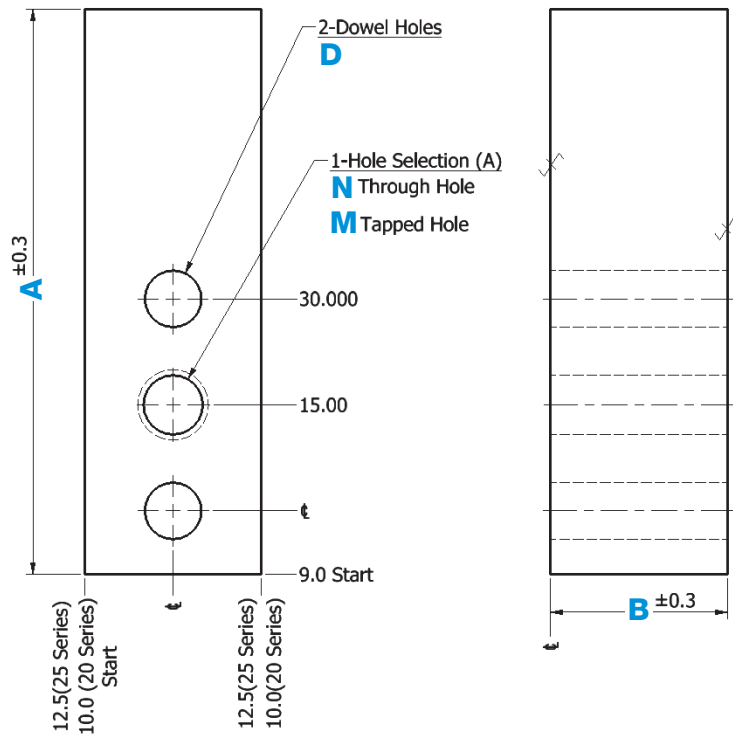
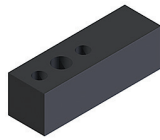
4 Holes **63**

4 Holes Sideholes **64**



NC Blocks

I SHAPED 3 HOLES



P/N Marking →



3D CAD is available online.

Type	Material	Coating
ANI	4140 Alloy Steel	Black Oxide
	304 Stainless Steel	-

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R.
0.00	± 0.03	3.0 µm		
0.000	± 0.02	1.6 µm		

Standard NAAMS (NC I-Shaped Block, 25 mm Series)

Type	Hole Selection (A) / Material				A Length	B Height	D Dowel Hole	
	M10		N11					
	4140	304	4140	304			Tolerance	
ANI	080	081	082	083	80.0	25.0	8F7	+0.013/+0.028
	120	121	122	123	120.0	25.0	8F7	+0.013/+0.028

M10 (M10x1.5 Tapped Hole), N11 (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

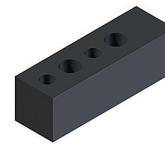
Standard NAAMS (NC I-Shaped Block, 20 mm Series)

Type	Hole Selection (A) / Material				A Length	B Height	D Dowel Hole	
	M8		N9					Tolerance
	4140	304	4140	304				
ANI	206	207	208	209	80.0	20.0	8F7	+0.013/+0.028
	216	217	218	219	120.0	20.0	8F7	+0.013/+0.028

M8 (M8x1.25 Tapped Hole), N9 (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):

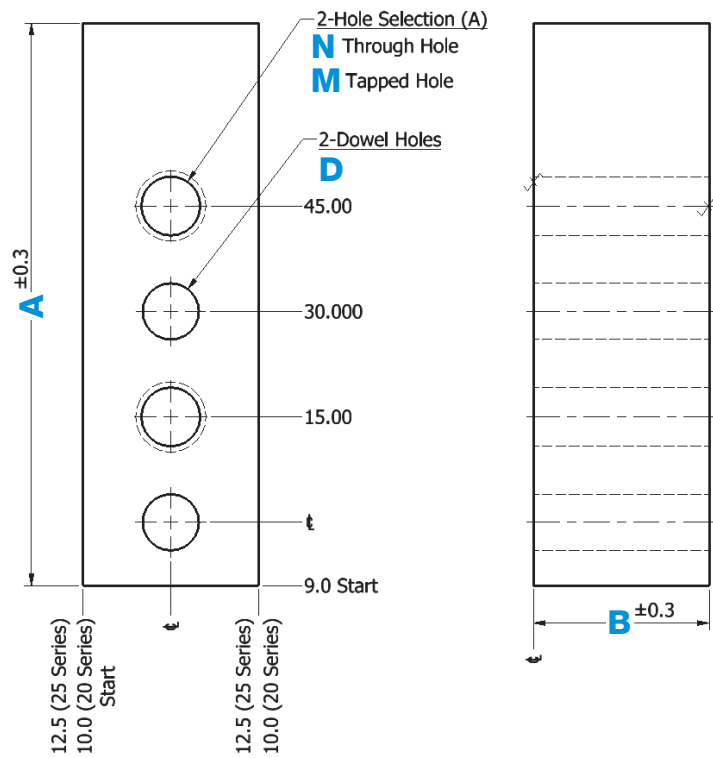
Part Number	
Type	Specification
ANI	120
ANI	207



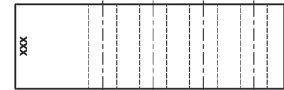
NC Blocks

I SHAPED 4 HOLES

Standard NC Blocks



P/N Marking →



3D CAD is available online.

Type	Material	Coating
ANI	4140 Alloy Steel	Black Oxide
	304 Stainless Steel	-

Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 μm			0.015 T.I.R.
0.00	± 0.03	3.0 μm			
0.000	± 0.02	1.6 μm			

Standard NAAMS (NC I-Shaped Block, 25 mm Series)

Type	Hole Selection (A) / Material				A Length	B Height	D Dowel Hole	
	M10		N11				Tolerance	
	4140	304	4140	304				
ANI	084	085	086	087	80.0	25.0	8F7	+0.013/+0.028
	126	127	128	129	120.0	25.0	8F7	+0.013/+0.028

M10 (M10x1.5 Tapped Hole), N11 (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (NC I-Shaped Block, 20 mm Series)

Type	Hole Selection (A) / Material				A Length	B Height	D Dowel Hole	
	M8		N9					
	4140	304	4140	304				Tolerance
ANI	201	202	203	204	80.0	20.0	8F7	+0.013/+0.028
	384	385	386	387	80.0	20.0	6F7	+0.010/+0.022
	211	212	213	214	120.0	20.0	8F7	+0.013/+0.028
	426	427	428	429	120.0	20.0	6F7	+0.010/+0.022

M8 (M8x1.25 Tapped Hole), N9 (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):

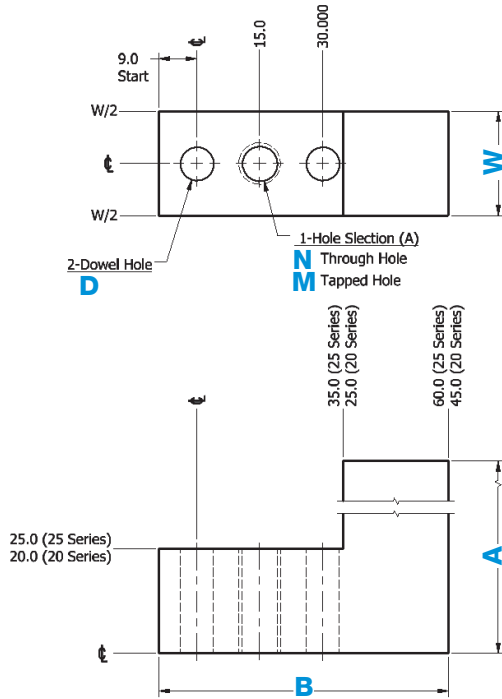
Part Number	
Type	Specification
ANI	126
ANI	201

NC Blocks

L-SHAPED 3 HOLES



Standard NC Blocks



3D CAD is available online.

Type	Material	Coating
ANL	4140 Alloy Steel	Black Oxide
	304 Stainless Steel	-

Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 µm			0.015 T.I.R.
0.00	± 0.03	3.0 µm			
0.000	± 0.02	1.6 µm			

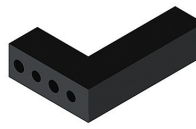
Standard NAAMS (NC L-Block, 25 mm Series)									
Type	Hole Selection (A) / Material				A	B	W	D Dowel Hole	
	M10		N11						
	4140	304	4140	304				Tolerance	
ANL	060	061	062	063	60	69	25	8 F7	+0.013/+0.028
	100	101	102	103	100				

M10 (M10x1.5 Tapped Hole), N11 (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (NC L-Block, 20 mm Series)									
Type	Hole Selection (A) / Material				A	B	W	D Dowel Hole	
	M8		N9						
	4140	304	4140	304				Tolerance	
ANL	215	216	217	218	60	54	20	8F7	+0.013/+0.028
	225	226	227	228	100				

M8 (M8x1.25 Tapped Hole), N9 (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):	
Part Number	
Type	Specification
ANL	061
ANL	102

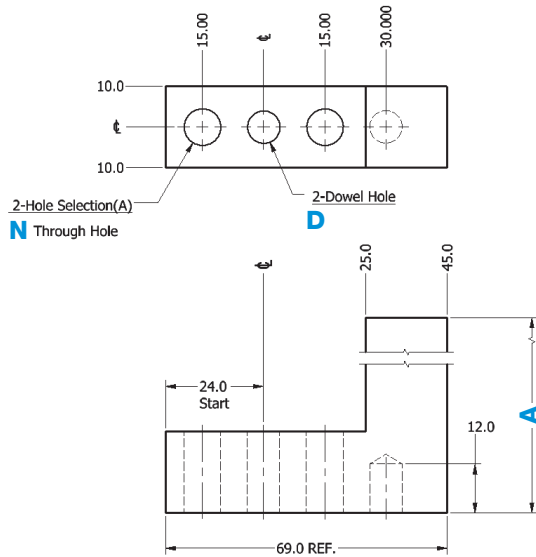


NC Blocks

L-SHAPED 4 HOLES (THROUGH)

3D CAD is available online.

Type	Material	Coating
ANL	4140 Alloy Steel	Black Oxide
	304 Stainless Steel	-

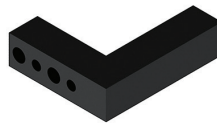


Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 μm			0.015 T.I.R.
0.00	± 0.03	3.0 μm			
0.000	± 0.02	1.6 μm			

Standard NAAMS (NC-L Block, 20 mm Series)					
Type	Hole Selection (A) / Material		A	D Dowel Hole	
	4140	304			Tolerance
ANL	221	222	60	8 F7	+0.013 ~ +0.028
	366	367		6 F7	+0.010 ~ +0.022
	406	407	100	6 F7	+0.010 ~ +0.022
	411	412		8 F7	+0.013 ~ +0.028

P/N Example (Standard NAAMS):	
Part Number	
Type	Specification
ANL	407

N9 (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

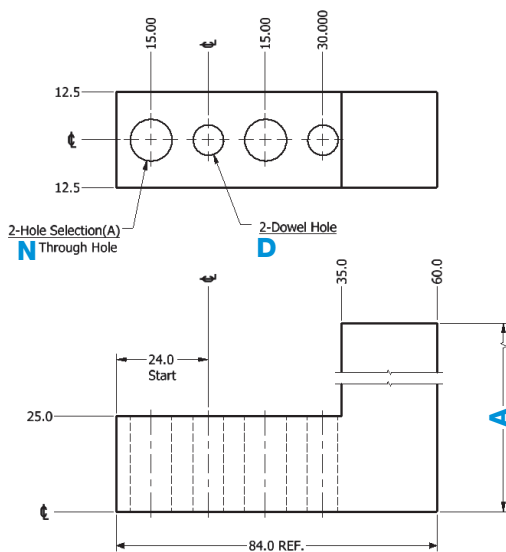


NC Blocks

L-SHAPE 4 HOLE TYPE (25MM SERIES, THROUGH & DOWEL)

3D CAD is available online.

Type	Material	Coating
ANL	4140 Alloy Steel	Black Oxide
	304 Stainless Steel	-



Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 μm			0.015 T.I.R.
0.00	± 0.03	3.0 μm			
0.000	± 0.02	1.6 μm			

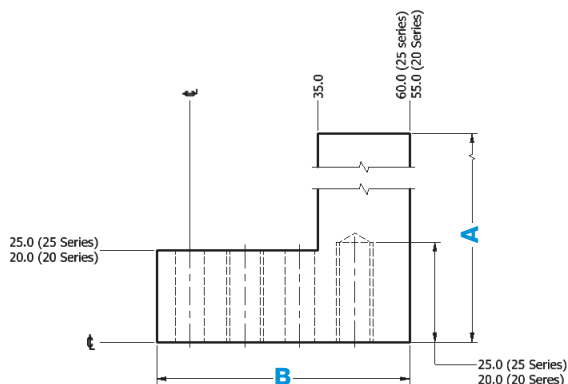
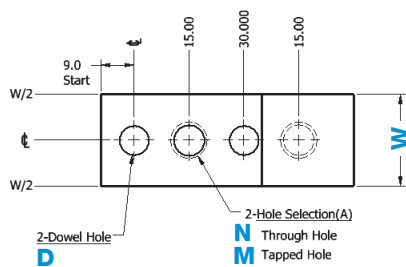
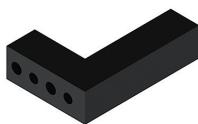
Standard NAAMS (25 Series NC L-Block)					
Type	Hole Selection (A) / Material		A Length	D Dowel Hole	
	4140	304			Tolerance
ANL	066	067	60	8 F7	+0.013/+0.028
	106	107	100		

P/N Example (Standard NAAMS):	
Part Number	
Type	Specification
ANL	106

N11 (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

NC Blocks

L-SHAPED 4 HOLES (TAPPED)



3D CAD is available online.

Type	Material	Coating
ANL	4140 Alloy Steel	Black Oxide
	304 Stainless Steel	-

Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 µm			0.015 T.I.R.
0.00	± 0.03	3.0 µm			
0.000	± 0.02	1.6 µm			

Standard NAAMS (NC L-Block, 25 mm Series)							
Type	Hole Selection (A) / Material		A	W	B		D Dowel Hole
	M10						
	4140	304					
ANL	064	065	60	25	69	8F7	+0.013/+0.028
	104	105	100				

M10 (M10x1.5 Tapped Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (NC L-Block, 20 mm Series)							
Type	Hole Selection (A) / Material		A	W	B	D Dowel Hole	
	M8					Tolerance	
	4140	304					
ANL	211	212	60	20	64	8 F7	+0.013/+0.028
	311	312	100			8 F7	
	364	365	60			6 F7	+0.010/+0.022
	404	405	100			6 F7	

M8 (M8x1.25 Tapped Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

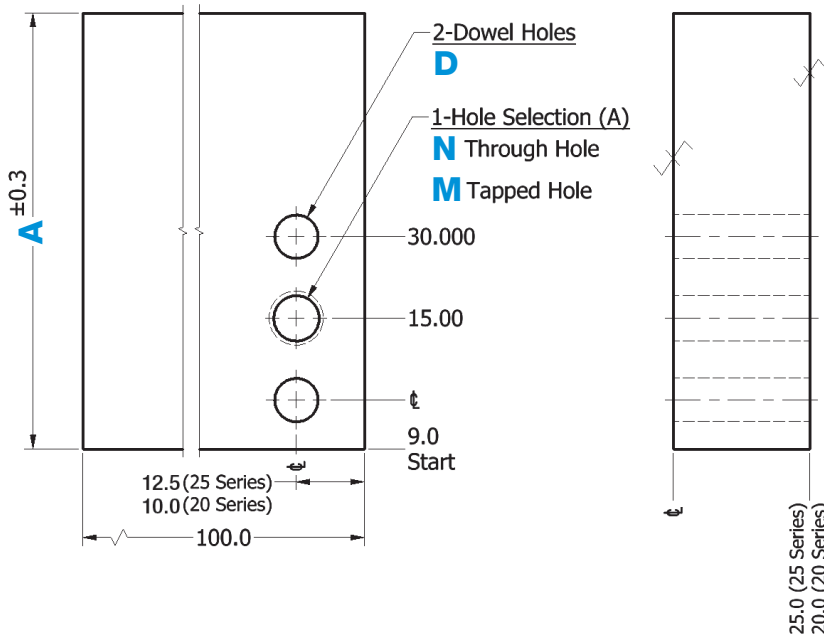
P/N Example (Standard NAAMS):

Part Number	
Type	Specification
ANL	105

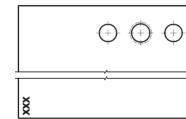


NC Blocks

RECTANGULAR SHAPED 3 HOLES



P/N Marking →



3D CAD is available online.

Type	Material	Coating
ANR	4140 Alloy Steel	Black Oxide
	304 Stainless Steel	-

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R.
0.00	± 0.03	3.0 µm		
0.000	± 0.02	1.6 µm		

Standard NAAMS (NC Rectangular Block, 25 mm Series)

Type	Hole Selection (A) / Material				A Length	D Dowel Hole	
	M10		N11				Tolerance
	4140	304	4140	304			
ANR	130	131	132	133	80.0	8F7	+0.013/+0.028
	134	135	136	137	120.0	8F7	+0.013/+0.028

M10 (M10x1.5 Tapped Hole), N11 (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (NC Rectangular Block, 20 mm Series)

Type	Hole Selection (A) / Material				A Length	D Dowel Hole	
	M8		N9				
	4140	304	4140	304		Tolerance	
ANR	600	601	602	603	80.0	8F7	+0.013/+0.028
	604	605	606	607	120.0	8F7	+0.013/+0.028

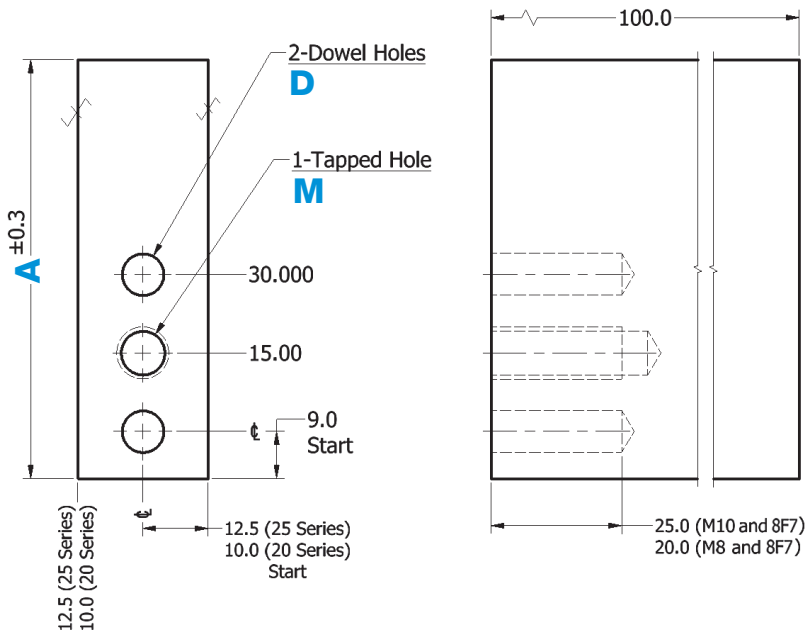
M8 (M8x1.25 Tapped Hole), N9 (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):

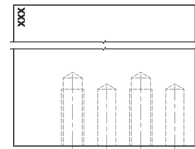
Part Number	
Type	Specification
ANR	130
ANR	320

NC Blocks

RECTANGULAR SHAPED 3 HOLES SIDEHOLES



P/N Marking →



3D CAD is available online.

Type	Material	Coating
ANR	4140 Alloy Steel	Black Oxide
	304 Stainless Steel	-

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R.
0.00	± 0.03	3.0 µm		
0.000	± 0.02	1.6 µm		

Standard NAAMS (25 mm Series, NC Rectangular Block)

Type	Tapped Hole / Material		A Length	D Dowel Hole	
	M10			Tolerance	
	4140	304			
ANR	230	231	80.0	8F7	+0.013/+0.028
	232	233	120.0	8F7	+0.013/+0.028

M10 (M10x1.5 Tapped Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series, NC Rectangular Block)

Type	Tapped Hole / Material		A Length	D Dowel Hole	
	M8			Tolerance	
	4140	304			
ANR	320	321	80.0	8F7	+0.013/+0.028
	322	323	120.0	8F7	+0.013/+0.028

M8 (M8x1.25 Tapped Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

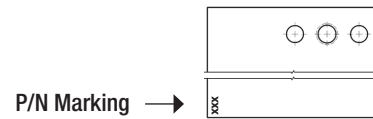
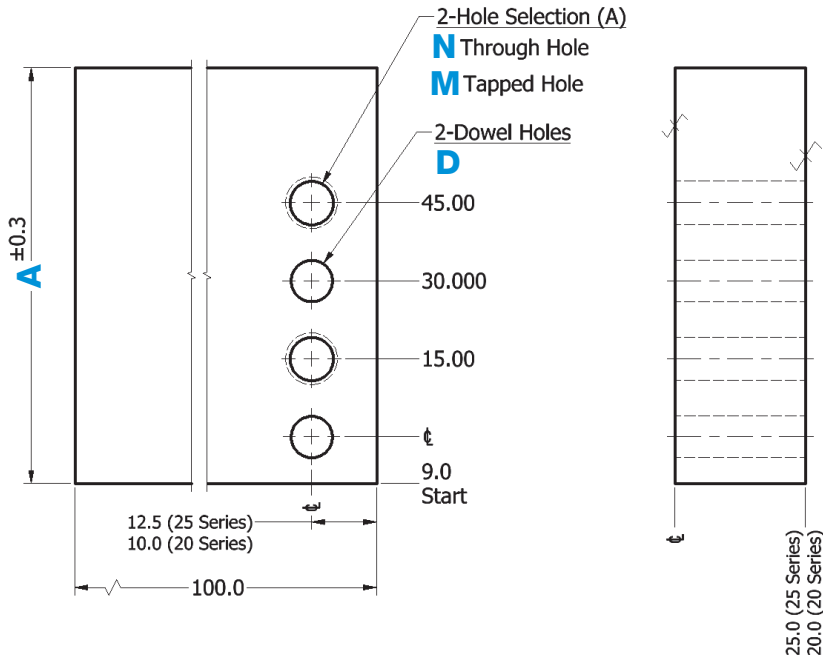
P/N Example (Standard NAAMS):

Part Number	
Type	Specification
ANR	230
ANR	321



NC Blocks

RECTANGULAR SHAPED 4 HOLES



3D CAD is available online.

Type	Material	Coating
ANR	4140 Alloy Steel	Black Oxide
	304 Stainless Steel	-

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		 0.015 T.I.R.
0.00	± 0.03	3.0 µm		
0.000	± 0.02	1.6 µm		

Standard NAAMS (NC Rectangular Block, 25 mm Series)

Type	Hole Selection (A) / Material				A Length	D Dowel Hole	
	M10		N11				Tolerance
	4140	304	4140	304			
ANR	140	141	142	143	80.0	8F7	+0.013/+0.028
	144	145	146	147	120.0	8F7	+0.013/+0.028

M10 (M10x1.5 Tapped Hole), N11 (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (NC Rectangular Block, 20 mm Series)

Type	Hole Selection (A) / Material				A Length	D Dowel Hole	
	M8		N9				Tolerance
	4140	304	4140	304			
ANR	440	441	442	443	80.0	6F7	+0.010/+0.022
	444	445	446	447	120.0	6F7	+0.010/+0.022
	301	302	303	304	80.0	8F7	+0.013/+0.028
	305	306	307	308	120.0	8F7	+0.013/+0.028

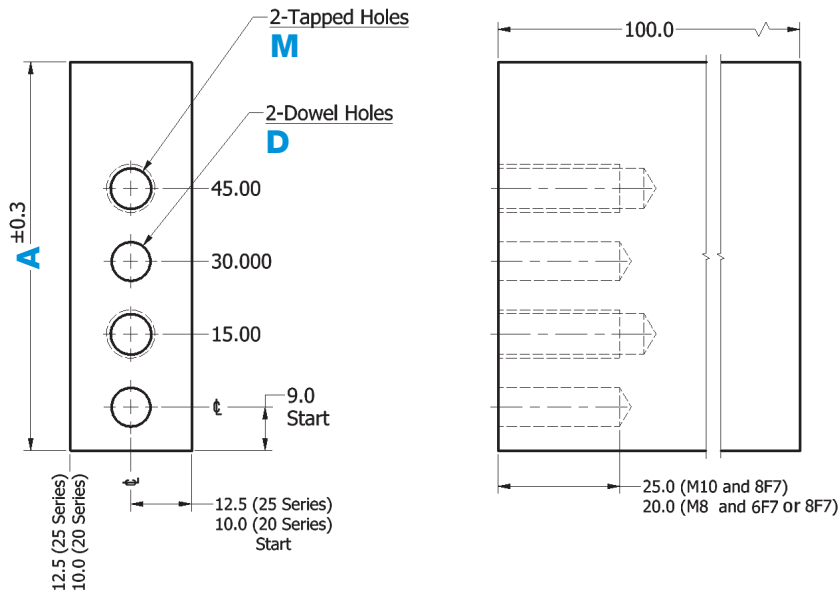
M8 (M8x1.25 Tapped Hole), N9 (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):

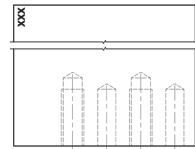
Part Number	
Type	Specification
ANR	140
ANR	440

NC Blocks

RECTANGULAR SHAPED 4 HOLES SIDEHOLES



P/N Marking →



3D CAD is available online.

Type	Material	Coating
ANR	4140 Alloy Steel	Black Oxide
	304 Stainless Steel	-

Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 μm	Surfaces	0.015 T.I.R.	
0.00	± 0.03	3.0 μm			
0.000	± 0.02	1.6 μm			

Standard NAAMS (NC Rectangular Block, 25 mm Series)

Type	Tapped Hole / Material		A Length	D Dowel Hole	
	M10			Tolerance	
	4140	304			
ANR	240	241	80.0	8F7	+0.013/+0.028
	242	243	120.0	8F7	+0.013/+0.028

M10 (M10x1.5 Tapped Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (NC Rectangular Block, 20 mm Series)

Type	Tapped Hole / Material		A Length	D Dowel Hole	
	M8			Tolerance	
	4140	304			
ANR	540	541	80.0	6F7	+0.010/+0.022
	542	543	120.0	6F7	+0.010/+0.022
	311	312	80.0	8F7	+0.013/+0.028
	313	314	120.0	8F7	+0.013/+0.028

M8 (M8x1.25 Tapped Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):

Part Number	
Type	Specification
ANR	240
ANR	540

CONFIGURABLE AND STANDARD L-BLOCKS

L-Blocks

3x3 Holes

4x3 Holes

4x4 Holes

L-T Blocks

T-Shape 3 Holes

T-Shape 4 Holes

L Wide Blocks

3 Holes

4 Holes Standard

4 Holes Opposite

66-68

66

67

68

69-70

69

70

71-73

71

72

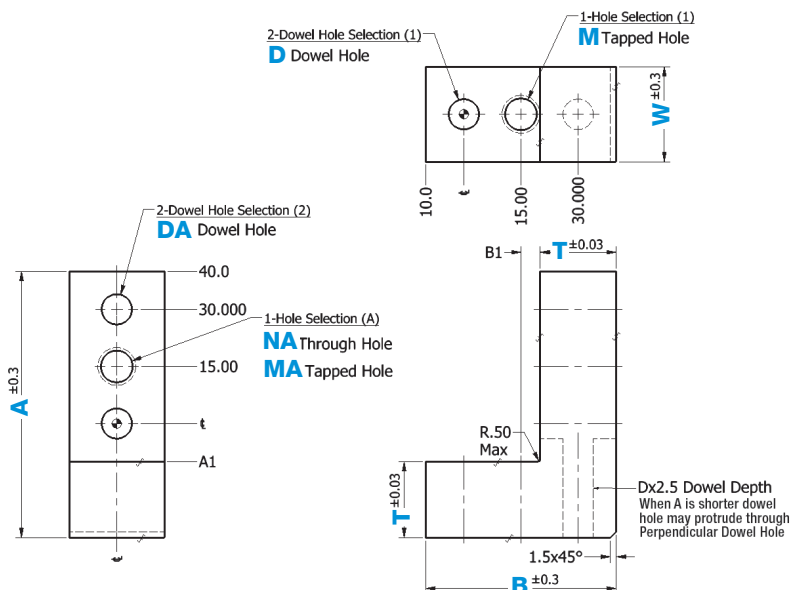
73



3X3 HOLES



Configurable and Standard L-Blocks



3D CAD is available online.

Type	Material	Coating
ALB/ALBFC	A-36 Steel	Black Oxide
ALB/SALBFC	304 Stainless Steel	-

Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 μm		 Surfaces	0.015 T.I.R.
0.00	± 0.03	3.0 μm			
0.000	± 0.02	1.6 μm			

Standard NAAMS (25 mm Series L-T block with Metric Holes)

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)			A	W	B	T	A1	B1
	MA10		NA11		DA Dowel Hole (2)		M Tapped Hole (1)	D Dowel Hole (1)							
	A-36	304	A-36	304		Tolerance			Tolerance						
ALB	050M	051M	060M	061M	8 H6	+0/+0.009	M10	8 F7	+0.013/+0.028	70	25	50	20	10	5

NA10/M10 (M10x1.5 Tapped Hole), **NA11** (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (25 mm Series L Blocks with Inch Holes)

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)			A	W	B	T	A1	B1
	MA3/8"		NA13/32"		DA Dowel Hole (2)		M Tapped Hole (1)	D Dowel Hole (1)							
	A-36	304	A-36	304		Tolerance			Tolerance						
ALB	050	051	060	061	5/16"	+0/-0.0005	3/8"-16	5/16"	+0/-0.0005	70	25	50	20	10	5

NA3/8" (3/8"-16 Tapped Hole), **NA13/32"** (Ø13/32" Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series L Blocks with Metric Holes)

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)			A	W	B	T	A1	B1
	MA8		NA9		DA Dowel Hole (2)		M Tapped Hole (1)	D Dowel Hole (1)							
	A-36	304	A-36	304		Tolerance			Tolerance						
ALB	560M	561M	562M	563M	8 H6	+0/+0.009	M8	8 F7	+0.013/+0.028	70	20	50	20	10	5

NA8/M8 (M8x1.25 Tapped Hole), **NA9** (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (L Blocks)

Configurable Nail (2 Blocks)												
Type	W Width	T Thickness (1 mm inc.)	A Length (1 mm inc.)	B Length (1 mm inc.)	Hole Selection (1)			Hole Selection (2)			A1	B1
					M Hole Selection (1)	D Dowel Hole (1)		NA/MA Hole Selection (A)	DA Dowel Hole (2)			
							Tolerance			Tolerance		
ALBFC SALBFC	20 25	14 ~ 20 (B1=5) 10 ~ 20 (B1≥20)	65 - 120	50 ~ 120 B1=5 or B1≥20	M8 M10	D6 F7 D8 F7	+0.010/+0.022 +0.013/+0.028	NA9 NA11 MA8 MA10	DA6 H6 DA8 H6	+0/+0.008 +0/+0.009	A-40-T	B-25-T B1=5 or B1≥20

Condition: B1=5 or B1≥20, **NA**- Through Hole, **M/MA**- Tapped Hole (Coarse Thread), **D/DA**- Dowel Hole, **NA9** for M8 Screw, **NA11** for M10 Screw, **MA8/M8** (M8x1.25 Tapped Hole), **MA10/M10** (M10x1.5 Tapped Hole)

P/N Example (Standard NAAMS):

Part Number	
Type	Specifications
ALB	060M
ALB	061
ALB	560M

P/N Example (Configurable NAAMS):

Part Number															
Type	Width	–	Thickness	–	A Length	–	B Length	–	Hole (M)	–	Dowel (D)	–	Hole (MA/NA)	–	Dowel (DA)
ALBFC	25	–	T10	–	A90	–	B65	–	M8	–	D8	–	NA9	–	DA6
SAI RFC	20	–	T19	–	A110	–	B110	–	M10	–	D6	–	MA8	–	DA8



Configurable and Standard L-Blocks

Type		Material	Coating		
ALB /ALBFA		A-36 Steel	Black Oxide		
ALB/ SALBFA		304 Stainless Steel	-		

Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 μm		 Surfaces	0.015 T.I.R.
0.00	± 0.03	3.0 μm			
0.000	± 0.02	1.6 μm			

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)			A	W	B	T	A1	B1
	MA10		NA11		DA Dowel Hole (2)	M Tapped Hole (1)	D Dowel Hole (1)								
	A-36	304	A-36	304			Tolerance	Tolerance							
ALB	020M	021M	022M	023M	8 H6	+0/+0.009	M10	8 H6	+0/+0.009	70	25	65	20	10	5

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)			A	W	B	T	A1	B1
	MA3/8"		NA13/32"		DA Dowel Hole (2)		M Tapped Hole (1)	D Dowel Hole (1)							
	A-36	304	A-36	304		Tolerance			Tolerance						
ALB	020	021	022	023	5/16"	+0/-0.0005	3/8"-16	5/16"	+0/-0.0005	70	25	65	20	10	5

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)		A	W	B	T	A1	B1	
	MA8		NA9		DA Dowel Hole (2)	M Tapped Hole (1)	D Dowel Hole (1)								
	A-36	304	A-36	304			Tolerance								Tolerance
ALB	320M	321M	322M	323M	6 H6	+0/+0.008	M8	6 F7	+0.010/+0.022	70	20	65	20	10	5
	540M	541M	542M	543M	8 H6	+0/+0.009		8 F7	+0.013/+0.028						

Type	W Width	T Thickness (1 mm inc.)	A Length (1 mm inc.)	B Length (1 mm inc.)	Hole Selection (1)			Hole Selection (A)/(2)			A1	B1
					M Hole Selection (1)	D Dowel Hole (1)		MA/NA Hole Selection (A)	DA Dowel Hole (2)			
						Tolerance			Tolerance			
ALBFA SALBFA	20 25	14 ~ 20 (B1=5) 10 ~ 20 (B1≥20)	65 - 120	65 - 120 B1=5 or B1≥20	M8 M10	D6 F7 D8 F7	+0.010/+0.022 +0.013/+0.028	NA9 NA11 MA8 MA10	DA6 H6 DA8 H6	+0/+0.008 +0/+0.009	A-40-T	B-40-T B1=5 or B1≥20

P/N Example (Standard NAAMS):	
Part Number	
Type	Specifications
ALB	020M
ALB	022
AI R	543M

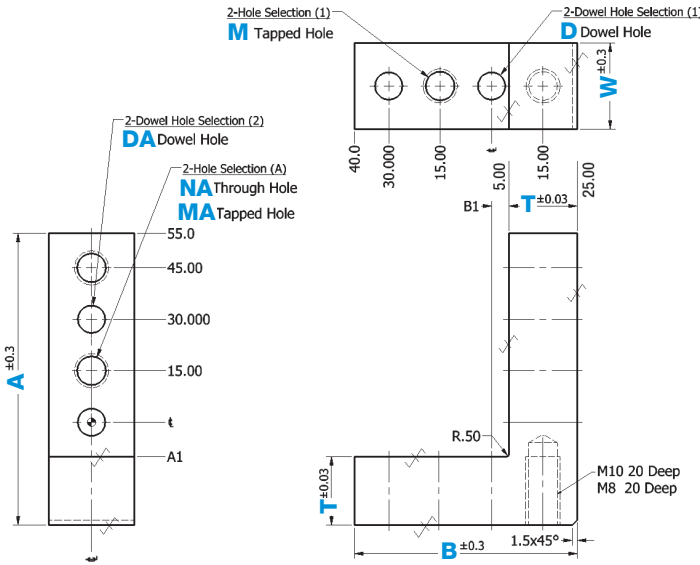
P/N Example (Configurable NAAMS):															
Part Number															
Type	Width	–	Thickness	–	A Length	–	B Length	–	Hole (M)	–	Dowel (D)	–	Hole (MA/NA)	–	Dowel (DA)
ALBFA	25	–	T10	–	A90	–	B65	–	M8	–	D8	–	NA9	–	DA6
SALBFA	20	–	T19	–	A110	–	B110	–	M10	–	D6	–	MA8	–	DA8

L Blocks

4X4 HOLES



Configurable and Standard L-Blocks



3D CAD is available online.

Type	Material	Coating
ALB /ALBFB	A-36 Steel	Black Oxide
ALB/ SALBFB	304 Stainless Steel	-

Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 µm	 Surfaces		
0.00	± 0.03	3.0 µm			
0.000	± 0.02	1.6 µm			

Standard NAAMS (25 mm Series L Blocks with Metric Holes)

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)			A	W	B	T	A1	B1
	MA10		NA11		DA Dowel Hole (2)	M Tapped Hole (1)	D Dowel Hole (1)								
	A-36	304	A-36	304			Tolerance	Tolerance							
ALB	080M	081M	070M	071M	8 H6	+0/+0.009	M10	8 H6	+0/+0.009	85	25	65	20	10	5

MA10/M10 (M10x1.5 Tapped Hole), NA11 (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (25 mm Series L Blocks with Inch Holes)

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)			A	W	B	T	A1	B1
	MA3/8"		NA13/32"		DA Dowel Hole (2)	M Tapped Hole (1)	D Dowel Hole (1)								
	A-36	304	A-36	304			Tolerance	Tolerance							
ALB	080	081	070	071	5/16"	+0/-0.0005	3/8"-16	5/16"	+0/-0.0005	85	25	65	20	10	5

MA3/8" (3/8"-16 Tapped Hole), NA13/32" (Ø13/32" Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series L Blocks with Metric Holes)

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)		A	W	B	T	A1	B1	
	MA8		NA9		DA Dowel Hole (2)	M Tapped Hole (1)	D Dowel Hole (1)								
	A-36	304	A-36	304											
ALB	380M	381M	370M	371M	6 H6	+0/+0.008	M8	6 H6	+0/+0.008	85	20	65	20	10	5
	510M	511M	512M	513M	8 H6	+0/+0.009		8 F7	+0.013 /+0.028						

MA8/M8 (M8x1.25 Tapped Hole), NA9 (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (L Blocks)

Type	W Width	T Thickness (1 mm inc.)	A Length (1 mm inc.)	B Length (1 mm inc.)	Hole Selection (1)			Hole Selection (A)/(2)		A1	B1	
					M Hole Selection (1)	D Dowel Hole (1)		MA/NA Hole Selection (A)	DA Dowel Hole (2)			
						Tolerance			Tolerance			
ALBFB SALBFB	20 25	14 ~ 20 (B1=5) 10 ~ 20 (B1≥20)	80 - 120	65 - 120 B1=5 or B1≥20	M8 M10	D6 F7 D8 F7	+0.010/+0.022 +0.013/+0.028	NA9 NA11 MA8 MA10	DA6 H6 DA8 H6	+0/+0.008 +0/+0.009	A-55-T	B-40-T B1=5 or B1≥20

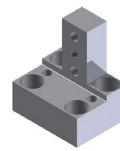
Condition: B1=5 or B1≥20, NA- Through Hole, M/MA- Tapped Hole (Coarse Thread), D/DA- Dowel Hole, NA9 for M8 Screw, NA11 for M10 Screw, MA8/M8 (M8x1.25 Tapped Hole), MA10/M10 (M10x1.5 Tapped Hole)

P/N Example (Standard NAAMS):

Part Number	
Type	Specifications
ALB	080M
ALB	081
ALB	512M

P/N Example (Configurable NAAMS):

Part Number															
Type	Width	—	Thickness	—	A Length	—	B Length	—	Hole (M)	—	Dowel (D)	—	Hole (MA/NA)	—	Dowel (DA)
ALBFB	25	—	T10	—	A90	—	B65	—	M8	—	D8	—	NA11	—	DA6
SALBFB	20	—	T19	—	A110	—	B110	—	M10	—	D6	—	MA10	—	DA8



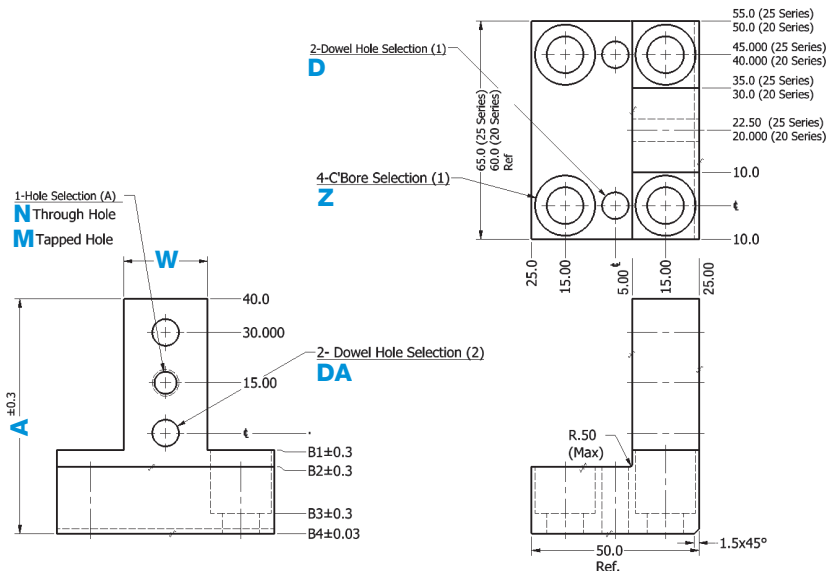
L-T Blocks

T-SHAPE 3 HOLES

3D CAD is available online.

Type	Material	Coating
ALB /ALBTFA	A-36 Steel	Black Oxide
ALB/ SALBTFA	304 Stainless Steel	-

Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 µm			0.015 T.I.R.
0.00	± 0.03	3.0 µm			
0.000	± 0.02	1.6 µm			



Standard NAAMS (25 mm Series L-T block with Metric Holes)

Type	Hole Selection (A) / Material				Hole Selection (1)			Hole Selection (2)		A	W	B1	B2	B3	B4
	M10		N11		D Dowel Hole (1)		Z C'Bore (1)	DA Dowel Hole (2)							
	A-36	304	A-36	304		Tolerance			Tolerance						
ALB	130M	131M	132M	133M	8 F7	+0.013 ~ +0.028	For M10 SHCS	8 H6	+0/+0.009	70	25	5	10	24	30

M10 (M10x1.5 Tapped Hole), **N11** (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (25 mm Series L-T block with Inch Holes)

Type	Hole Selection (A) / Material				Hole Selection (1)			Hole Selection (2)		A	W	B1	B2	B3	B4
	M3/8"		N13/32"		D Dowel Hole (1)	Z C'Bore (1)	DA Dowel Hole (2)								
	A-36	304	A-36	304				Tolerance	Tolerance						
ALB	130	131	132	133	5/16"	0/-0.0005	For 3/8-16 SHCS	5/16"	0/-0.0005	70	25	5	10	24	30

M3/8" (3/8"-16 Tapped Hole), **N13/32"** (Ø13/32" Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series L-T block with Metric Holes)

Type	Hole Selection (A) / Material				Hole Selection (1)			Hole Selection (2)		A	W	B1	B2	B3	B4
	M8		N9		D Dowel Hole (1)		Z C'Bore (1)	DA Dowel Hole (2)							
	A-36	304	A-36	304		Tolerance			Tolerance						
ALB	430M	431M	432M	433M	6 F7	+0.010/+0.022	For M8 SHCS	6 H6	0/+0.008	70	20	5	10	23	30
	580M	581M	582M	583M	8 F7	+0.013/+0.028	For M8 SHCS	8 H6	0/+0.009						

M8 (M8x1.25 Tapped Hole), **N9** (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (L-T Blocks)

Type	W Width	A Length (1 mm inc.)	M/N Mounting Hole Selection (A)	Hole Selection (1)		Hole Selection (2)		Z C'Bore Hole (1)	B1	B2	B3	B4
				D Dowel Hole (1)	Tolerance	DA Dowel Hole (2)	Tolerance					
ALBTFA SALBTFA	20 (Series)	70 - 120	N9, M8	D6 F7 D8 F7	+0.010/+0.022 +0.013/+0.028	DA6 H6 DA8 H6	0/+0.008 0/+0.009	For M8 SHCS	A-40-25	A-40-20	A-40-7	A-40
	25 (Series)	70 - 120	N11, M10	D8 F7	+0.013/+0.028	DA8 H6	0/+0.009	For M10 SHCS	A-40-25	A-40-20	A-40-6	A-40

N- Through Hole, **M**- Tapped Hole (Coarse Thread), **D/DA**- Dowel Hole, **N9** for M8 Screw, **N11** for M10 Screw, **M8** (M8x1.25 Tapped Hole), **M10** (M10x1.5 Tapped Hole)

P/N Example (Standard NAAMS):

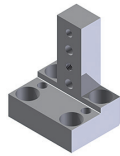
Part Number	
Type	Specifications
ALB	130M
ALB	130
ALB	580M

P/N Example (Configurable NAAMS):

Part Number									
Type	Width	-	A Length	-	Mount Hole (M)	-	Dowel (D)	-	Dowel (DA)
ALBTFA	25	-	A70	-	M10	-	D8	-	DA8
SALBTFA	20	-	A111	-	N9	-	D6	-	DA6

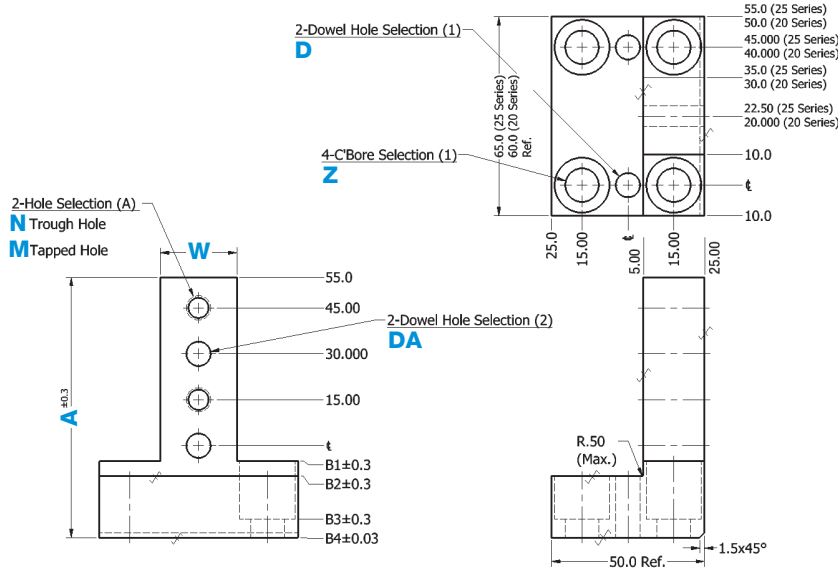
L-T Blocks

T-SHAPE 4 HOLES



Configurable and Standard L-Blocks

3D CAD is available online.



Type	Material	Coating
ALB / ALBTFB	A-36 Steel	Black Oxide
ALB/ SALBTFB	304 Stainless Steel	-

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R.
0.00	± 0.03	3.0 µm		
0.000	± 0.02	1.6 µm		

Standard NAAMS (25 mm Series L-T block with Metric Holes)

Type	Hole Selection (A) / Material				Hole Selection (1)			Hole Selection (2)		A	W	B1	B2	B3	B4
	M10		N11		D Dowel Hole (1)	Z C'Bore (1)	DA Dowel Hole (2)								
	A-36	304	A-36	304											
								Tolerance	Tolerance						
ALB	150M	151M	140M	141M	8 F7	+0.013/+0.028	For M10 SHCS	8 H6	+0/+0.009						

M10 (M10x1.5 Tapped Hole), **N11** (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (25 mm Series L-T block with Inch Holes)

Type	Hole Selection (A) / Material				Hole Selection (1)			Hole Selection (2)		A	W	B1	B2	B3	B4
	M3/8"		N13/32"		D Dowel Hole (1)	Z C'Bore (1)	DA Dowel Hole (2)								
	A-36	304	A-36	304				Tolerance	Tolerance						
ALB	150	151	140	141	5/16"	0/-0.0005	For 3/8"-16 SHCS	5/16"	0/-0.0005	85	25	5	10	24	30

M3/8" (3/8"-16 Tapped Hole), **N13/32"** (Ø13/32" Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series L-T block with Metric Holes)

Type	Hole Selection (A) / Material				Hole Selection (1)			Hole Selection (2)		A	W	B1	B2	B3	B4
	M8		N9		D Dowel Hole (1)		Z C'Bore (1)	DA Dowel Hole (2)							
	A-36	304	A-36	304		Tolerance			Tolerance						
ALB	330M	331M	340M	341M	6 F7	+0.010/+0.022	For M8 SHCS	6 H6	0/+0.008	85	20	5	10	23	30
	551M	552M	553M	554M	8 F7	+0.013/+0.028	For M8 SHCS	8 H6	0/+0.009						

M8 (M8x1.25 Tapped Hole), **N9** (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Configurable NAAMS (L-T Blocks)

Type	W Width	A Length (1 mm inc.)	M/N Mounting Hole Selection (A)	Hole Selection (1)		Hole Selection (2)		Z C'Bore Hole (1)	B1	B2	B3	B4
				D Dowel Hole (1)	Tolerance	DA Dowel Hole (2)	Tolerance					
ALBTFB SALBTFB	20 (Series)	85 - 120	N9, M8	D6 F7 D8 F7	+0.010/+0.022 +0.013/+0.028	DA6 H6 DA8 H6	0/+0.008 0/+0.009	For M8 SHCS	A-55-25	A-55-20	A-55-7	A-55
	25 (Series)	85 - 120	N11, M10	D8 F7	+0.013/+0.028	DA8 H6	0/+0.009	For M10 SHCS	A-55-25	A-55-20	A-55-6	A-55

N- Through Hole, **M**- Tapped Hole (Coarse Thread), **D/DA**- Dowel Hole, **N9** for M8 Screw, **N11** for M10 Screw, **M8** (M8x1.25 Tapped Hole), **M10** (M10x1.5 Tapped Hole)

P/N Example (Standard NAAMS):

Part Number	
Type	Specifications
ALB	140M
ALB	151
ALB	553M

P/N Example (Configurable NAAMS):

Part Number									
Type	Width	-	A Length	-	Mount Hole (A)	-	Dowel (D)	-	Dowel (DA)
ALBTFB	25	-	A85	-	N11	-	D8	-	DA8
SALBTFB	20	-	A111	-	N9	-	D6	-	DA8



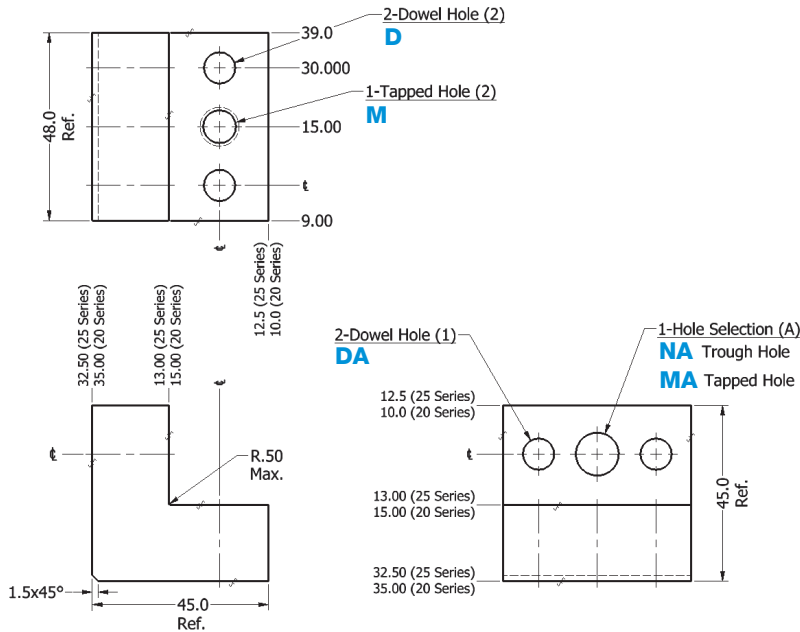
L Wide Blocks

3 HOLES

3D CAD is available online.

Type	Material	Coating
ALB	A-36 Steel	Black Oxide
	304 Stainless Steel	-

Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 µm			0.015 T.I.R.
0.00	± 0.03	3.0 µm			
0.000	± 0.02	1.6 µm			



Standard NAAMS (25 mm Series L Wide Blocks with Metric Holes)									
Type	Hole Selection (A) / Material				Hole Selection (1)		Hole Selection (2)		
	MA10		NA11		DA Dowel Hole (1)	Tolerance	M Tapped Hole (2)	D Dowel Hole (2)	
	A-36	304	A-36	304				Tolerance	
ALB	100M	101M	102M	103M	8 F7	+0.013/+0.028	M10 x 1.5	8 F7	+0.013/+0.028

MA10 (M10x1.5 Tapped Hole), NA11 (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (25 mm Series L Wide Blocks with Inch Holes)									
Type	Hole Selection (A) / Material				Hole Selection (1)		Hole Selection (2)		
	MA3/8"		NA13/32"		DA Dowel Hole (1)	Tolerance	M Tapped Hole (2)	D Dowel Hole (2)	
	A-36	304	A-36	304				Tolerance	
ALB	100	101	102	103	5/16"	+0.0005/+0.0010	3/8"-16	5/16"	+0.0005/+0.0010

MA3/8" (3/8"-16 Tapped Hole), NA13/32" (Ø13/32" Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series L Wide Blocks with Metric Holes)									
Type	Hole Selection (A) / Material				Hole Selection (1)		Hole Selection (2)		
	MA8		NA9		DA Dowel Hole (1)	Tolerance	M Tapped Hole (2)	D Dowel Hole (2)	
	A-36	304	A-36	304				Tolerance	
ALB	570M	571M	572M	573M	8 H6	0/+0.009	M8 x 1.25	8 F7	+0.013/+0.028

MA8 (M8x1.25 Tapped Hole), NA9 (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

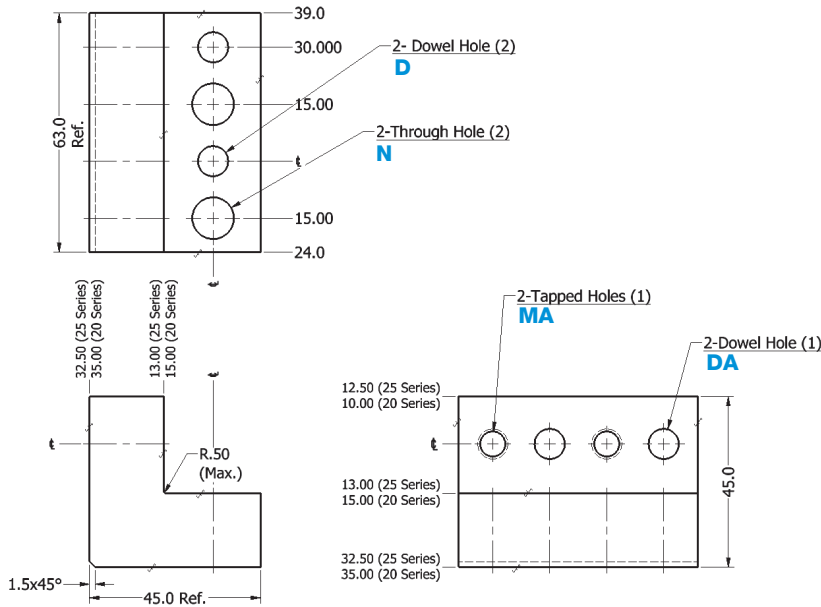
P/N Example (Standard NAAMS):	
Part Number	
Type	Specifications
ALB	100M
ALB	102
ALB	571M

L Wide Blocks

4 HOLES STANDARD



Configurable and Standard L-Blocks



3D CAD is available online.

Type	Material	Coating
ALB	A-36 Steel	Black Oxide
	304 Stainless Steel	-

Tolerance					
Dim.	Tol.	Finish (Ra)	Geometric		
0.0	± 0.3	6.0 µm	Surfaces	0.015 T.I.R.	
0.00	± 0.03	3.0 µm			
0.000	± 0.02	1.6 µm			

Standard NAAMS (25 mm Series L Wide Blocks with Metric Holes)

Type	Hole Selection (2) / Material		Hole Selection (2)		Hole Selection (1)	
	N11 / Material		D Dowel Hole (2)		DA Dowel Hole (1)	
	A-36	304		Tolerance	MA Tapped Hole (1)	Tolerance
ALB	115M	116M	8 F7	+0.013/+0.028	M10x1.5	8 F7 +0.013/+0.028

N11 (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (25 mm Series L Wide Blocks with Inch Holes)

Type	Hole Selection (2) / Material		Hole Selection (2)		Hole Selection (1)	
	N13/32" / Material		D Dowel Hole (2)		DA Dowel Hole (1)	
	A-36	304		Tolerance	MA Tapped Hole (1)	Tolerance
ALB	115	116	5/16"	+0.0005/+0.0010	3/8"-16	5/16" +0.0005/+0.0010

N13/32" (Ø13/32" Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

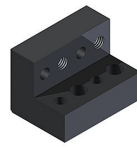
Standard NAAMS (20 mm Series L Wide Blocks with Metric Holes)

Type	Hole Selection (2) / Material		Hole Selection (2)		Hole Selection (1)	
	N9 / Material		D Dowel Hole (2)		DA Dowel Hole (1)	
	A-36	304		Tolerance	MA Tapped Hole (1)	Tolerance
ALB	415M	416M	6 H6	0/+0.008	M8x1.25	6 H6 0/+0.008
	531M	532M	8 H6	0/+0.009	M8x1.25	8 H6 0/+0.009

N9 (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):

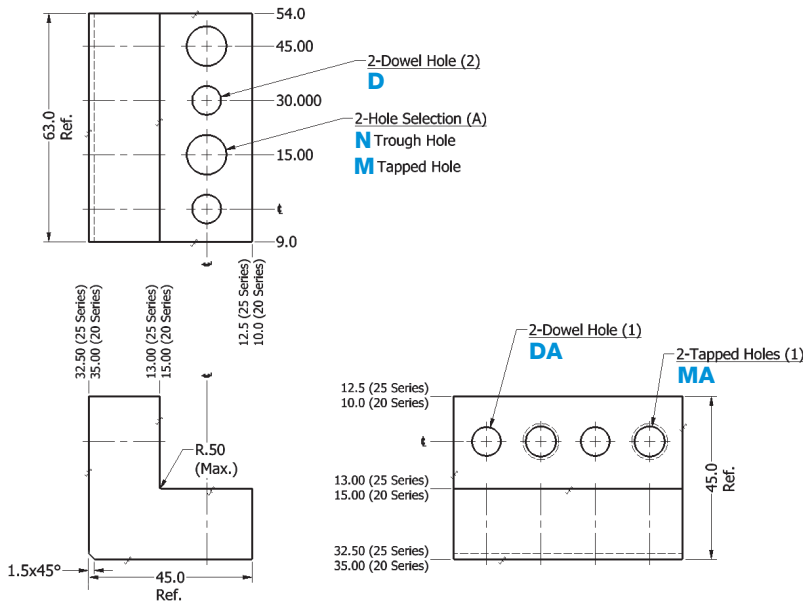
Part Number	
Type	Specifications
ALB	115M
ALB	116
ALB	532M



L Wide Blocks

4 HOLES OPPOSITE

3D CAD is available online.



Type	Material	Coating
ALB	A-36 Steel	Black Oxide
	304 Stainless Steel	-

Tolerance				
Dim.	Tol.	Finish (Ra)	Geometric	
0.0	± 0.3	6.0 µm		0.015 T.I.R. Surfaces
0.00	± 0.03	3.0 µm		
0.000	± 0.02	1.6 µm		

Configurable and Standard L-Blocks

Standard NAAMS (25 mm Series L Wide Blocks with Metric Holes)

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)		
	M10		N11		D Dowel Hole (2)	Tolerance	MA Tapped Hole (1)	DA Dowel Hole (1)	
	A-36	304	A-36	304				Tolerance	
ALB	110M	111M	112M	113M	8 F7	+0.013/+0.028	M10 x 1.5	8 F7	+0.013/+0.028

M10 (M10x1.5 Tapped Hole), **N11** (Ø11 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (25 mm Series L Wide Blocks with Inch Holes)

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)		
	M3/8"		N13/32"		D Dowel Hole (2)	Tolerance	MA Tapped Hole (1)	DA Dowel Hole (1)	
	A-36	304	A-36	304				Tolerance	
ALB	110	111	112	113	5/16"	+0.0005/+0.0010	3/8"-16	5/16"	+0.0005/+0.0010

M3/8" (3/8"-16 Tapped Hole), **N13/32"** (Ø13/32" Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

Standard NAAMS (20 mm Series L Wide Blocks with Metric Holes)

Type	Hole Selection (A) / Material				Hole Selection (2)		Hole Selection (1)		
	M8		N9		D Dowel Hole (2)	Tolerance	MA Tapped Hole (1)	DA Dowel Hole (1)	
	A-36	304	A-36	304				Tolerance	
ALB	410M	411M	412M	413M	6 H6	0/+0.008	M8 x 1.25	6 H6	0/+0.008
	521M	522M	523M	524M	8 H6	0/+0.009	M8 x 1.25	8 H6	0/+0.009

M8 (M8x1.25 Tapped Hole), **N9** (Ø9 Through Hole). Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):

Part Number	
Type	Specifications
ALB	110M
ALB	112
ALB	524M



STANDARD ROUGH LOCATORS

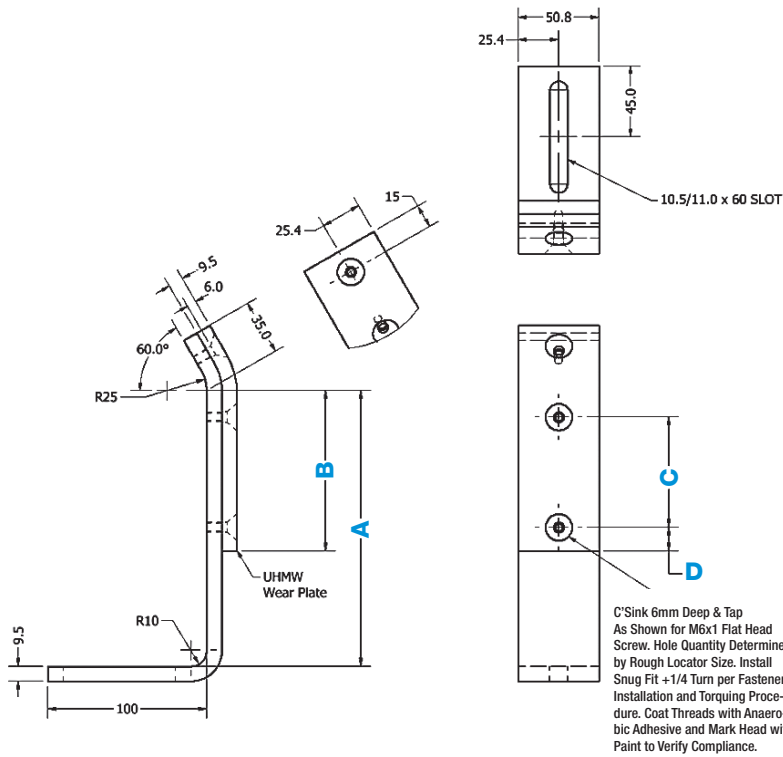


Rough Locators		76-81
L-Shape Inside with Resin Guide		76
L-Shape Inside		77
I-Shape with Resin Guide		78
L-Shape Outside with Resin Guide		79
L-Shape Outside		80
I-Shape		81



Rough Locator

L-SHAPED INSIDE WITH RESIN GUIDE



3D CAD is available online.

Type	Item	Material	Coating
ARL__RP	Wear plate	UHMW	-
	Main bracket	A-36 Steel	Black Oxide

Tolerance		
Dimension	Fabrication	Machining
0.0 mm	±1.5 mm	±0.3 mm

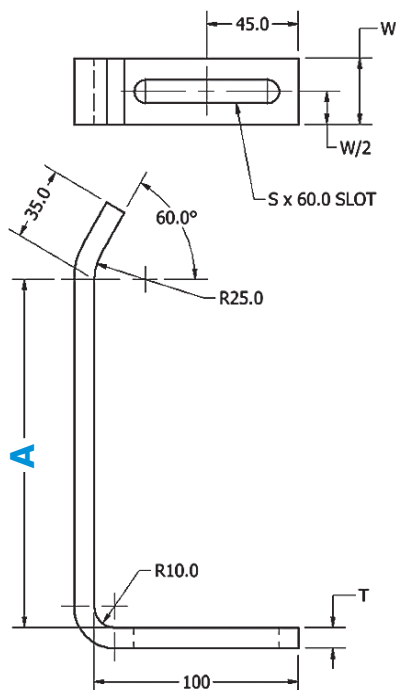
Standard NAAMS Rough Locators						
Type	A Length Selection	Spec	A	B	C	D
ARL	075	RP	65.0	55.0	N/A	25.0
	100		90.0			
	125		115.0			
	150		140.0			
	175		165.0	100.0	70.0	15.0
	200		190.0			
	225		215.0			
	250		240.0			

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):	
Part Number	
Type	Specifications
ARL	075RP
ARL	200RP

Rough Locator

L-SHAPE INSIDE



3D CAD is available online.

Type	Material	Coating
ARL___R	A-36 Steel	-
ARL___RH	A-36 Steel	Case hardened 58-62 Rc, 1.0-1.5mm deep.

Tolerance		
Dimension	Fabrication	Machining
0.0 mm	±1.5 mm	±0.3 mm

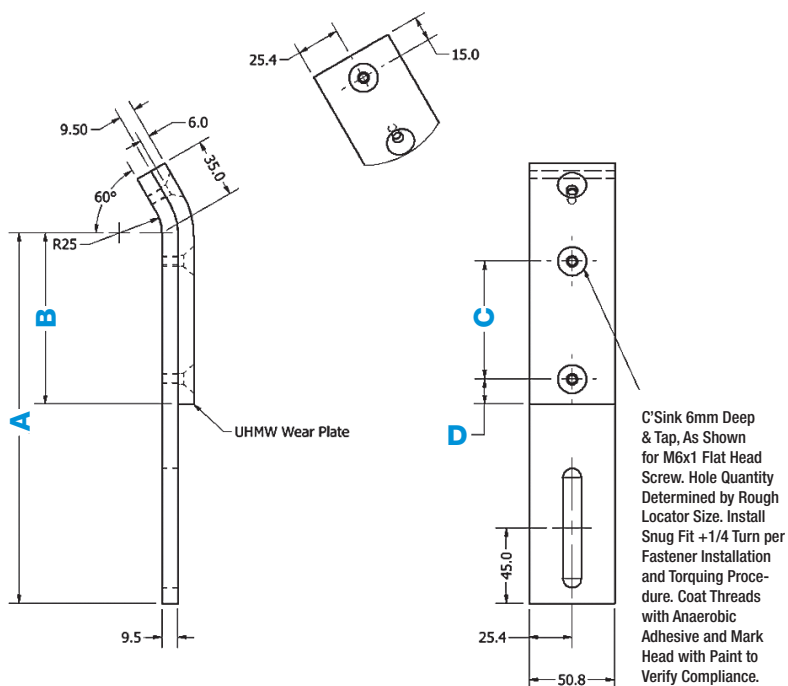
Standard NAAMS Rough Locators											
Type	A Length Selection/Material								T	W	S
	65.0	90.0	115.0	140.0	165.0	190.0	215.0	240.0			
ARL	075R	100R	125R	150R	175R	200R	225R	250R	9.0-10.0	32.0	10.5-11.0
	075RH	100RH	125RH	150RH	175RH	200RH	225RH	250RH	9.0-10.0	32.0	10.5-11.0
	076R	101R	126R	151R	176R	201R	226R	251R	6.0-7.0	19.0	9.0-9.5
	076RH	101RH	126RH	151RH	176RH	201RH	226RH	251RH	6.0-7.0	19.0	9.0-9.5

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):	
Part Number	
Type	Specifications
ARL	075R
ARL	151RH

Rough Locator

I-SHAPE WITH RESIN GUIDE



3D CAD is available online.

Type	Item	Material	Coating
ARL__P	Wear plate	UHMW	-
	Main bracket	A-36 Steel	Black Oxide

Tolerance		
Dimension	Fabrication	Machining
0.0 mm	±1.5 mm	±0.3 mm

Standard NAAMS Rough Locators						
Type	A Length Selection	Spec	A	B	C	D
ARL	145	P	145.0	55.0	N/A	25.0
	170		170.0			
	195		195.0			
	220		220.0	100.0	70.0	15.0
	245		245.0			
	270		270.0			
	295		295.0			
	320		320.0			

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):	
Part Number	
Type	Specifications
ARL	145P
ARL	295P



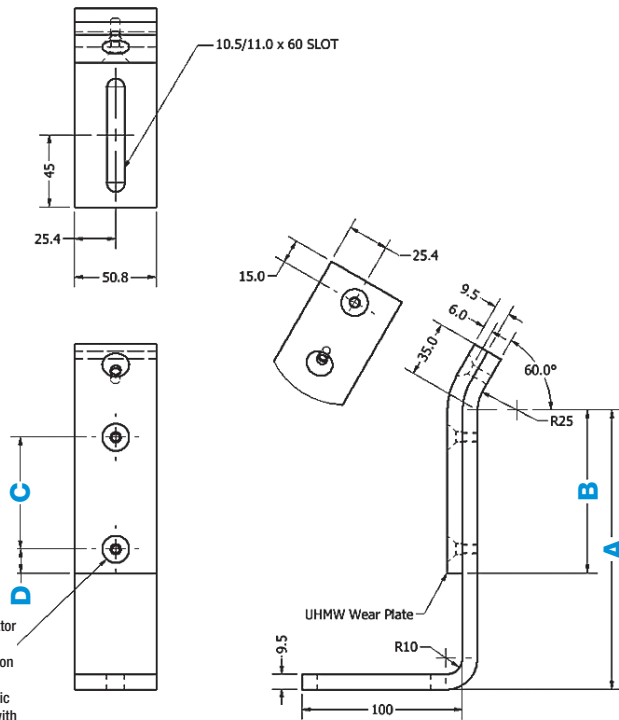
Rough Locator

L-SHAPED OUTSIDE WITH RESIN GUIDE

3D CAD is available online.

Type	Item	Material	Coating
ARL__LP	Wear plate	UHMW	-
	Main bracket	A-36 Steel	Black Oxide

Tolerance		
Dimension	Fabrication	Machining
0.0 mm	±1.5 mm	±0.3 mm



C/Sink 6mm Deep & Tap As Shown for M6x1 Flat Head Screw. Hole Quantity Determined by Rough Locator Size. Install Snug Fit +1/4 Turn per Fastener Installation and Torquing Procedure. Coat Threads with Anaerobic Adhesive and Mark Head with Paint to Verify Compliance.

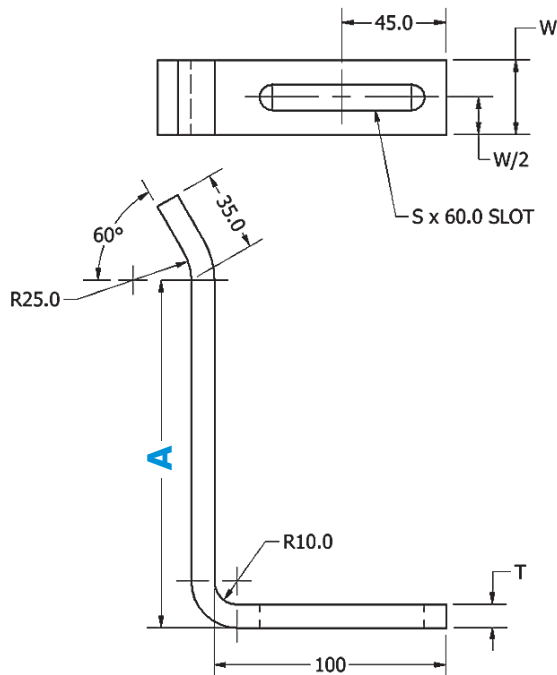
Standard NAAMS Rough Locators						
Type	A Length Selection	Spec	A	B	C	D
ARL	075	LP	75.0	55.0	N/A	25.0
	100		100.0			
	125		125.0			
	150		150.0			
	175		175.0	100.0	70.0	15.0
	200		200.0			
	225		225.0			
	250		250.0			

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):	
Part Number	
Type	Specifications
ARL	075LP
ARL	175LP

Rough Locator

L-SHAPED OUTSIDE



3D CAD is available online.

Type	Material	Coating
ARL__L	A-36 Steel	-
ARL__LH	A-36 Steel	Case hardened 58-62 Rc, 1.0-1.5mm deep.

Tolerance		
Dimension	Fabrication	Machining
0.0 mm	±1.5 mm	±0.3 mm

Standard NAAMS Rough Locators											
Type	A Length Selection/Material								T	W	S
	75.0	100.0	125.0	150.0	175.0	200.0	225.0	250.0			
ARL	075L	100L	125L	150L	175L	200L	225L	250L	9.0-10.0	32.0	10.5-11.0
	075LH	100LH	125LH	150LH	175LH	200LH	225LH	250LH	9.0-10.0	32.0	10.5-11.0
	076L	101L	126L	151L	176L	201L	226L	251L	6.0-7.0	19.0	9.0-9.5
	076LH	101LH	126LH	151LH	176LH	201LH	226LH	251LH	6.0-7.0	19.0	9.0-9.5

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

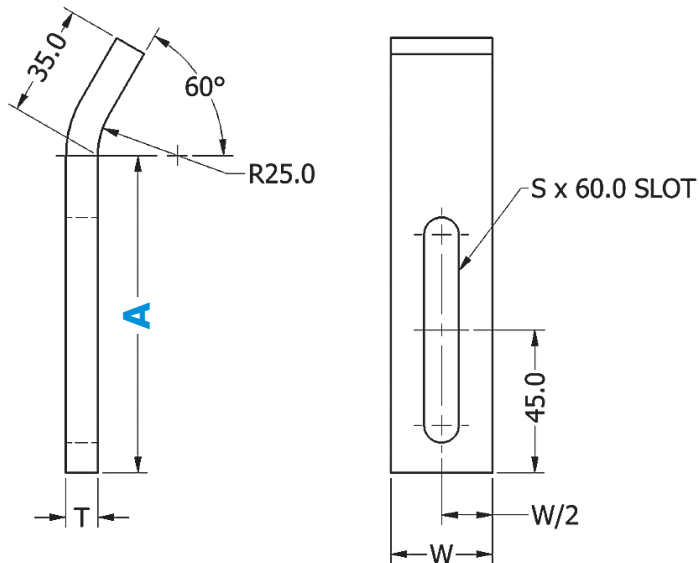
P/N Example (Standard NAAMS):	
Part Number	
Type	Specifications
ARL	176LH
ARL	201L



Rough Locator

I-SHAPE

3D CAD is available online.



Type	Material	Coating
ARL_ _ _	A-36 Steel	-
ARL_ _ _ H	A-36 Steel	Case hardened 58-62 Rc, 1.0-1.5mm deep.

Tolerance		
Dimension	Fabrication	Machining
0.0 mm	±1.5 mm	±0.3 mm

Standard NAAMS Rough Locators											
Type	A Length Selection/Material								T	W	S
	145.0	170.0	195.0	220.0	245.0	270.0	295.0	320.0			
ARL	145	170	195	220	245	270	298	320	9.0-10.0	32.0	10.5-11.0
	145H	170H	195H	220H	245H	270H	298H	320H	9.0-10.0	32.0	10.5-11.0
	146	171	196	221	246	271	299	321	6.0-7.0	19.0	9.0-9.5
	146H	171H	196H	221H	246H	271H	299H	321H	6.0-7.0	19.0	9.0-9.5

Standard NAAMS specifications are controlled by the NAAMS organization and the latest version of these products will be produced in compliance to: www.naamsstandards.org.

P/N Example (Standard NAAMS):	
Part Number	
Type	Specifications
ARL	146H
ARL	321



OTHER JIGS AND FIXTURES

Posts, Strut Clamps, Stands	84
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Other Jigs and Fixtures

NEW NEW PRODUCT

★ BEST SELLER

✓ TYPICALLY IN STOCK

Posts / Strut Clamps / Stands

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

NEW NEW PRODUCT

★ BEST SELLER

✓ TYPICALLY IN STOCK

Other Jigs and Fixtures

Gussets



#RBDA

Gussets – Through Hole, Standard Precision



#RBDP

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



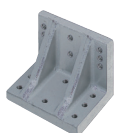
#IKCD

Angle Plates – Bottom Surface Ground, w/ Through 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

Gussets

Angle Plates

Welded Standoffs / Metal Boxes

Other Jigs and Fixtures

NEW NEW PRODUCT

★ BEST SELLER

✓ TYPICALLY IN STOCK

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/cm ³)	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
Metal 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
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



NEW NEW PRODUCT

★ BEST SELLER

✓ TYPICALLY IN STOCK

Other Jigs and Fixtures

Washers / Collars

Shims



#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



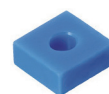
#DJB
Thermal Insulation Collars with
Flange



#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

Other Jigs and Fixtures

NEW NEW PRODUCT

★ BEST SELLER

✓ TYPICALLY IN STOCK

Shims

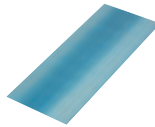
Metal Materials



#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)

LOW ACCURACY HIGH

Type	Unpolished (Drawn)	Milled Finish	Rotary Grinding 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

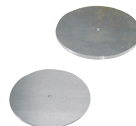
Material Selection

Carbon Steel	1018	1018 Annealed	1049	1055 Normalized	1049 Thermaly Refined	
Tool Steel	A2	D2	DC53	M2	O1	SKS93
Pre-Hardened Steel	PX5	NAK55	Toolox44	G-Star		
Alloy Steel	4140					
Stainless Steel	430			440C		
Aluminum Alloy	6061	50552	5052 High 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



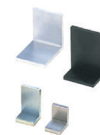
#MTRD
Metal Rods



#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

NEW NEW PRODUCT

★ BEST SELLER

✓ TYPICALLY IN STOCK

Other Jigs and Fixtures

Levers



#CLDF
Clamp Levers – Threaded



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



#CLCC
Miniature Clamp Levers –
Threaded



#CLDT
Flat Clamp Levers

Levers
Handles



#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
Safety Resin Clamp Levers



#CLRA
Ratcheting Clamp Levers



#CLCK
Cam Lever



#LFTM
Flat Tension Levers



#LFTF
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

Other Jigs and Fixtures

NEW NEW PRODUCT

★ BEST SELLER

✓ TYPICALLY IN STOCK

Handles

Crank Handles / Hand Wheels

Knobs / Screws



#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



#AHSK
Offset Handwheels – Solid



#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



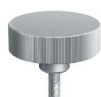
#NKBA
Knurled Knobs – Thick,
L Dimension Standard



#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

NEW NEW PRODUCT

★ **BEST SELLER**

✓ **TYPICALLY IN STOCK**

Other Jigs and Fixtures



#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

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



#WGHA

Guides – Straight



#WGLA

Guides – L-Shaped

Knobs / Screws

Locating / Guide Components

Other Jigs and Fixtures

NEW NEW PRODUCT

★ **BEST SELLER**

✓ **TYPICALLY IN STOCK**

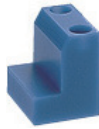
Locating / Guide Components

Toggle Clamps / Workpiece Clamps

Automotive Inspection Components



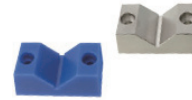
#WGDL
Guides – Height Adjusting



#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



#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

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



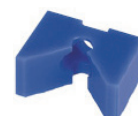
#SPCS
Spring Clamps – Small



#SPCP
Spring Clamp – Large



#GPH
Guide Plungers with Hexagon Sock



#GP
Nose Attachments for Guide
Plungers – V-Shaped

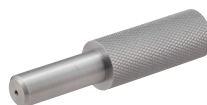


#SLDP
Slide Pushers

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

NEW NEW PRODUCT

★ **BEST SELLER**

✓ **TYPICALLY IN STOCK**

Other Jigs and Fixtures

Automotive Inspection Components



#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, Threaded End



#KJP4
Slot Pins for Inspection Jigs –
Tapered



#KJ02
Slot Pins for Inspection Jigs –
Tapped 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



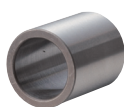
#KJPT
Slot Pins for Inspection Jigs –
Clamp Design, Straight and Taper



#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

Other Jigs and Fixtures

NEW NEW PRODUCT

★ **BEST SELLER**

✓ **TYPICALLY IN STOCK**



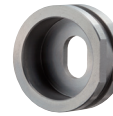
#KJB6
Bushings for Inspection Components – Square, Shouldered



#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



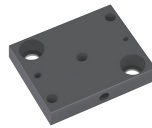
#KJTS
Inspection Jigs – L and T Shape Pin



#KJLP
Inspection Jigs – Locating Kits



#CRB
Inspection Jigs – Locating Ball



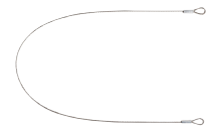
#CRBP
Inspection Jigs – Locating Pad



#CRBC
Inspection Jigs – Locating Pad Bracket



#CLIP
Inspection Jigs – Pin Clips



#KJW
Inspection Jigs – Wires for Pins



#KJWC
Inspection Jigs – Chains For Slot Pins

[illegible]

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 Meter	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·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	°C	1 °C =(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.)

Force	N	lbf	kgf
	1	0.22481	1.01972×10 ⁻¹
	4.448	1	0.4536
	9.806 65	2.205	1

Viscosity	Pa·s	cP	Lb/ft.S
	1	1×10 ³	0.0672
	1×10 ⁻³	1	0.000672
	14.88	1488	1

Note: 1P=1dyn·s/cm²=1g/cm·s
1Pa·s=1N·s/m², 1cP=1mPa·s

Stress	Pa or N/m ²	MPa or N/mm ²	PSI (lbf/in ²)	kgf/cm ²
	1	1×10 ⁻⁶	0.000145	1.01972×10 ⁻⁵
	1×10 ⁶	1	145	1.01972×10
	6894.76	0.006894	1	0.0703
	9.80665×10 ⁴	9.80665×10 ⁻²	14.22	1

Kinematic Viscosity	m ² /s	cSt	in ² /s
	1	1×10 ⁻³	1550.0031
	1×10 ⁻⁶	1	0.00155
	0.000645	645.16	1

Note: 1St=1cm²/s, 1cSt=1mm²/s

Note: 1Pa=1N/m², 1MPa=1N/mm²

Pressure	Pa	kPa	MPa	bar	kgf/cm ²	PSI (lbf/in ²)	mmH ₂ O	mmHg or Torr
	1	1×10 ⁻³	1×10 ⁻⁶	1×10 ⁻⁵	1.019 72×10 ⁻⁵	0.000145	1.019 72×10 ⁻¹	7.500 62×10 ⁻³
	1×10 ³	1	1×10 ⁻³	1×10 ⁻²	1.019 72×10 ⁻²	0.145	1.019 72×10 ²	7.500 62
	1×10 ⁶	1×10 ³	1	1×10	1.019 72×10	145	1.019 72×10 ⁵	7.500 62×10 ³
	1×10 ⁵	1×10 ²	1×10 ⁻¹	1	1.019 72	14.5	1.019 72×10 ⁴	7.500 62×10 ²
	9.806 65×10 ⁴	9.806 65×10	9.806 65×10 ⁻²	9.806 65×10 ⁻¹	1	14.22	1×10 ⁴	7.355 59×10 ²
	6894.76	6.894	0.006894	0.06894	0.0703	1	703.07	51.715
	9.806 65	9.806 65×10 ⁻³	9.806 65×10 ⁻⁶	9.806 65×10 ⁻⁵	1×10 ⁻⁴	0.001422	1	7.355 59×10 ⁻²
	1.333 22×10 ²	1.333 22×10 ⁻¹	1.333 22×10 ⁻⁴	1.333 22×10 ⁻³	1.359 51×10 ⁻³	0.01934	1.359 51×10	1

Note: 1Pa=1N/m²

Work, Energy, Heat Quantity	J	ft·lbs	kgf·m	kcal
	1	0.7376	1.019 72×10 ⁻¹	2.388 89×10 ⁻⁴
	1.356	1	0.1391	0.0003
	9.806 65	7.188	1	2.342 70×10 ⁻³
	4.186 05×10 ³	3088	4.268 58×10 ²	1

Note: 1Pa=1N/m², 1MPa=1N/mm²

Thermal Conductivity	W/(m·K)	kcal/(h·m ² ·°C)
	1	8.600 0×10 ⁻¹
	1.162 79	1

Coefficient of Heat Transfer	W/(m ² ·K)	kcal/(h·m ² ·°C)
	1	8.600 0×10 ⁻¹
	1.162 79	1

Power Heat Flow	W	fl·lbs	hp	kcal/h
	1	0.7376	0.00136	8.600 0×10 ⁻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,

Specific Heat	J/(kg·K)	kcal/(kg·°C) cal/(g·°C)
	1	2.388 89×10 ⁻⁴
	4.186 05×10 ³	1

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 Velocity=2πf Ohm:Unit of Electric Resistance (Uppercase)

Reference unless otherwise specified, lowercase letters are the norm.

■ Characteristics of Materials

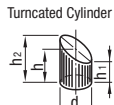
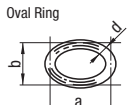
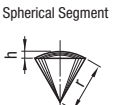
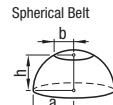
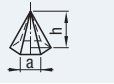
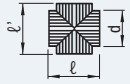
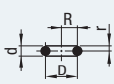
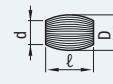
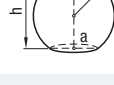
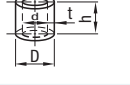
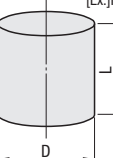
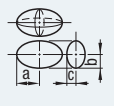
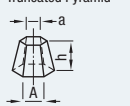
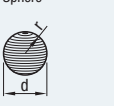
Material	Specific Gravity	Thermal Expansion Coefficient	Young's Modulus
		×10 ⁻⁶ /°C	{Kg/mm ² }
Mild Steel	7.85	11.7	21000
NAK80	7.8	12.5	20500
SKD11	7.85	11.7	21000
SKD61	7.75	10.8	21000
SKH51	8.2	10.1	22300
Carbide V30	14.1	6.0	56000
Carbide V40	13.9	6.0	54000
Cast Iron	7.3	9.2~11.8	7500~10500
SUS304	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	Solid	Volume V	Solid	Volume V	Solid	Volume V
 Turncated Cylinder $V = \frac{\pi}{4} d^2 h$ $= \frac{\pi}{4} d^2 \left(\frac{h_1 + h_2}{2} \right)$		 Oval Ring $V = \frac{\pi^2}{4} d^2 \frac{\sqrt{a^2 + b^2}}{2}$		 Spherical Segment $V = \frac{2}{3} \pi r^2 h$ $= 2.0944 r^2 h$		 Spherical Belt $V = \frac{\pi h}{6} (3a^2 + 3b^2 + h^2)$	
 Pyramid $V = \frac{h}{3} A = \frac{h}{6} \pi r^2$ 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		 Cross Cylinder $V = \frac{\pi}{4} d^2 \left(l + l' - \frac{d}{3} \right)$		 Torus $V = 2\pi^2 R r^2$ $= 19.739 R r^2$ $= \frac{\pi^2}{4} D d^2$ $= 2.4674 D d^2$		 Barrel When the circumference makes a curve equal to the circular arc, $V = \frac{\pi l}{12} (2D^2 + d^2)$ When the circumference makes a curve equal to a parabolic line, $V = 0.209 \ell (2D^2 D d + 1/4 d^3)$	
 Spherical Crown $V = \frac{\pi h^2}{3} (3r - h)$ $= \frac{\pi h}{6} (3a^2 + h^2)$ a is the radius.		 Hollow (Cylinder) $V = \frac{\pi}{4} h (D^2 - d^2)$ $= \pi h (D - t)$ $= \pi h (d + t)$		 Circular Cone $V = \frac{\pi}{3} r^2 h$ $= 1.0472 r^2 h$		■ How to Calculate the Weight Weight W[g] = Volume[cm³] × Specific Gravity [Ex.]Material: Mild Steel  D=Ø16 L=50mm the weight is: The specific gravity of W= $= \frac{\pi}{4} \times 1.6^2 \times 5 \times 7.85$ $= 79[g]$	
 Ellipsoid $V = \frac{4}{3} \pi abc$ In case of spheroid (b=c) $V = \frac{4}{3} \pi ab^2$		 Truncated Pyramid $V = \frac{h}{3} (A + a + \sqrt{Aa})$ A.a=Area of both ends		 Sphere $V = \frac{4}{3} \pi r^3 = 4.1888 r^3$ $= \frac{\pi}{6} d^3 = 0.5236 d^3$			

Technical Data

CALCULATION OF AREA, CENTER OF GRAVITY AND GEOMETRICAL MOMENT OF INERTIA

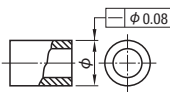
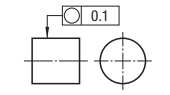
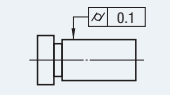
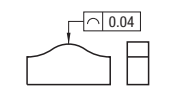
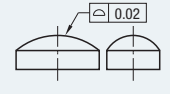
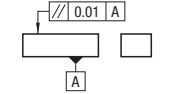
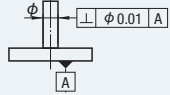
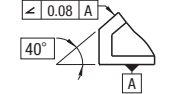
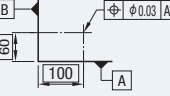
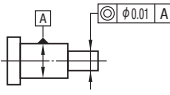
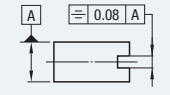
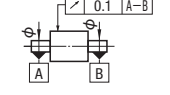
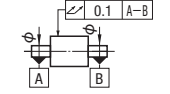
Cross Section	A	e	I	Z=I/e	Cross Section	A	e	I	Z=I/e
	bh	$\frac{h}{2}$	$\frac{bh^3}{12}$	$\frac{bh^2}{6}$		πab	a	$\frac{\pi}{4} ba^3 = 0.7854 ba^3$	$\frac{\pi}{4} ba^2 = 0.7854 ba^2$
	h ²	$\frac{h}{2}$	$\frac{h^4}{12}$	$\frac{h^3}{6}$		$\frac{\pi}{2} r^2$	$e_1 = 0.4244r$ $e_2 = 0.5756r$	$\frac{\pi}{8} - \frac{8}{9\pi} r^4$ $\approx 0.1098r^4$	$Z_1 = 0.2587r^3$ $Z_2 = 0.1908r^3$
	h ²	$\frac{h}{2} \sqrt{2}$	$\frac{h^4}{12}$	$0.1179h^3 = \frac{\sqrt{2}}{12} h^3$		$\frac{\pi}{4} r^2$	$e_1 = 0.4244r$ $e_2 = 0.5756r$	0.055r ⁴	$Z_1 = 0.1296r^3$ $Z_2 = 0.0956r^3$
	$\frac{bh}{2}$	$\frac{2}{3} h$	$\frac{bh^3}{36}$	$\frac{bh^2}{24}$		b(H-h)	$\frac{H}{2}$	$\frac{b}{12} (H^3 - h^3)$	$\frac{b}{6H} (H^3 - h^3)$
	$(2b+b_1) \frac{h}{2}$	$\frac{1}{3} \times \frac{3b+2b_1}{2b+b_1} h$	$\frac{6b^2+6bb_1+b_1^2}{36(2b+b_1)} h^3$	$\frac{6b^2+6bb_1+b_1^2}{12(3b+2b_1)} h^2$		A ² -a ²	$\frac{A}{2}$	$\frac{A^4-a^4}{12}$	$\frac{1}{6} \frac{A^4-a^4}{A}$
	$\frac{3\sqrt{3}}{2} r^2$ $= 2.598r^2$	$\sqrt{\frac{3}{4}} r = 0.866r$	$\frac{5\sqrt{3}}{16} r^4 = 0.5413r^4$	$\frac{5}{8} r^3$		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 - $\frac{\pi d^2}{4}$	$\frac{a}{2}$	$\frac{1}{12} \left(a^4 - \frac{3\pi}{16} d^4 \right)$	$\frac{1}{6a} \left(a^4 - \frac{3\pi}{16} d^4 \right)$
	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491d^4$ $\approx 0.05d^4$ $= 0.7854r^4$	$\frac{1+2\sqrt{2}}{6} r^4$ $= 0.6381r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982d^3$ $\approx 0.1d^3$ $= 0.7854r^3$	0.6906r ³		2b(h-d) + $\frac{\pi}{4} d^2$	$\frac{h}{2}$	$\frac{1}{12} \left\{ \frac{3\pi}{16} d^4 + b(h^3 - d^3) + b^3(h-d) \right\}$	$\frac{1}{6h} \left\{ \frac{3\pi}{16} d^4 + b(h^3 - d^3) + b^3(h-d) \right\}$
	$\pi r^2 = \frac{\pi d^2}{4}$	$\frac{d}{2}$	$\frac{\pi d^4}{64} = \frac{\pi r^4}{4}$ $= 0.0491d^4$ $\approx 0.05d^4$ $= 0.7854r^4$	$\frac{\pi d^3}{32} = \frac{\pi r^3}{4}$ $= 0.0982d^3$ $\approx 0.1d^3$ $= 0.7854r^3$		2b(h-d) + $\frac{\pi}{4} (d_1^2 - d^2)$	$\frac{h}{2}$	$\frac{1}{12} \left\{ \frac{3\pi}{16} (d_1^4 - d^4) + b(h^3 - d_1^3) + b^3(h-d_1) \right\}$	$\frac{1}{6h} \left\{ \frac{3\pi}{16} (d_1^4 - d^4) + b(h^3 - d_1^3) + b^3(h-d_1) \right\}$
	$r^2 \left(1 - \frac{\pi}{4} \right)$ $\approx 0.2146r^2$	$e_1 = 0.2234r$ $e_2 = 0.7766r$	0.0075r ⁴	$\frac{0.0075r^4}{e_2}$ $= 0.00966r^3$ $\approx 0.01r^3$	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 →	← Course →				
	Casting								← Precise →	← Course →				
	Die Casting								← Precise →					
	Hot Rolling								← Precise →					
	Cold Rolling								← Precise →					
	Drawing								← Precise →					
	Extruding								← Precise →					
	Tumbling								← Precise →					
	Sand Blasting								← Precise →					
	Rolling								← Precise →					
	Face Milling								← Precise →					
	Planing								← Precise →					
	Carving / Slotting								← Precise →					
	Milling								← Precise →					
	Precision Boring								← Precise →					
	Filing								← Precise →					
	Round Turning								← Precise →	← Fine →	← Medium →	← Course →		
	Boring								← Precise →					
	Drilling								← Precise →					
	Reaming								← Precise →					
	Broaching								← Precise →					
	Shaping								← Precise →					
	Milling								← Precise →	← Fine →	← Medium →	← Course →		
	Honing								← Precise →					
	Stone Lapping								← Precise →					
	Buff Finishing								← Precise →					
	Fine Sanding								← Precise →					
	Lapping								← Precise →					
	Hydro Honing								← Precise →					
	Burnishing								← Precise →					
	Roller Finishing								← Precise →					
	Sinker EDM								← Precise →					
	Wire EDM								← Precise →					
	Chemical Polishing								← Precise →					
	Electropolishing								← Precise →					

■ 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 ϕ 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 ϕ 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 ϕ 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	 Surface to be measured (Measured Surface) Toleranced Surface 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

Excerpts from JIS B 0405, 0419(1991)

REGULAR MACHINING DIMENSION TOLERANCE

1. Regular Cut Dimension Tolerance B 0405-1991-

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			
v	Extremely Coarse	±0.4	±1	±2

Note ⁽²⁾: A reference dimension less than 0.5 mm is followed by a tolerance.

3. Angle Tolerance

Unit: mm

Tolerance Class		Length of Shorter Side				
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'	±30'	±20'	±10'	±5'
m	Medium		±1°	±30'	±15'	±10'
c	Coarse		±2°	±1°	±30'	±20'
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

BASIS OF FITTING SELECTION/DIMENSIONAL TOLERANCES AND FITTING

		H6	H7	H8	H9	Applicable Part	Functional Classification	Application Example
Can be Moved Relatively	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.
	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
	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
	Fine 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
	Sliding 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	h5	h6	h7	h8	Fitting so as to permit movement by hand, with a lubricant applied. (high-quality positioning) Special High Precision Sliding Part Unimportant Stationary Part	Force cannot be transmitted by the fitting force alone.	Fitting a rim and a boss together Fitting the gear of a precision gear device
		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
		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
		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
		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)		Shaft of a Flexible Coupling and Gear (Passive Side) Precision Fitting Insertion of a Suction Valve and Valve Guide
	Interference Fit	n5	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.	Slight force can be transmitted by the fitting force alone.	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)
		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
		s6						Attaching and Fixing a Bearing Bushing
		t6						Insertion of a Suction Valve and Valve Box Fixing a Coupling Flange and a Shaft Together (High Torque)
		u6						Fixing the Rim of a Drive Gear and a Boss Together Attaching and Fixing a Bearing Bushing
		r5	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.	Hard to disassemble without damaging component parts.	
	Strong Press Fit, Shrinkage Fit, Freeze Fit							

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	n6*	p6*	r6*	s6	t6	u6	x6
H7					f6	g6	h6	js6	k6	m6						
H8					e7	f7	g7	h7	js7							
H9					e8	f8	g8	h8								
H10					d9	e9	f9	g9	h9							
					d8	e8	f8	g8	h8							
					d9	e9	f9	g9	h9							
					c9	d9	e9	f9	g9	h9						
					c9	d9	e9	f9	g9	h9						

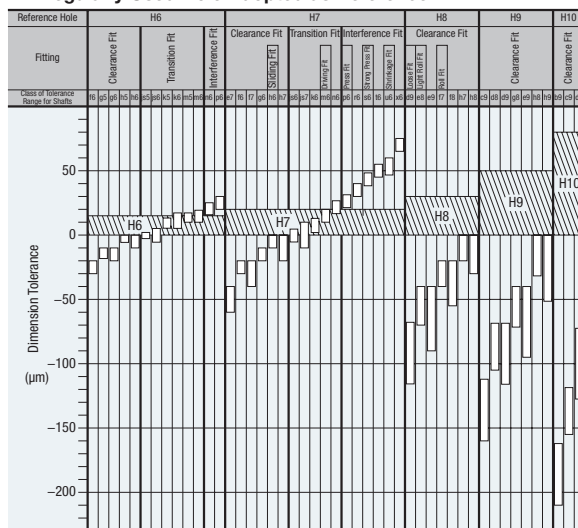
[Note]*An exception may arise according to the dimensional sectioning scheme.

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					JS6	K6	M6	N6*	P6							
h6					F6	G6	H6	JS6	K6	M6	N6	P6*	R7	S7	T7	U7
h7					E7	F7	G7	JS7	K7	M7	N7	P7*	R7	S7	T7	U7
h8					D8	E8	F8									
h9					D8	E8	F8									
					D9	E9	F9									
					D9	E9	F9									
					C9	D9	E9									
					B10	C10	D10									

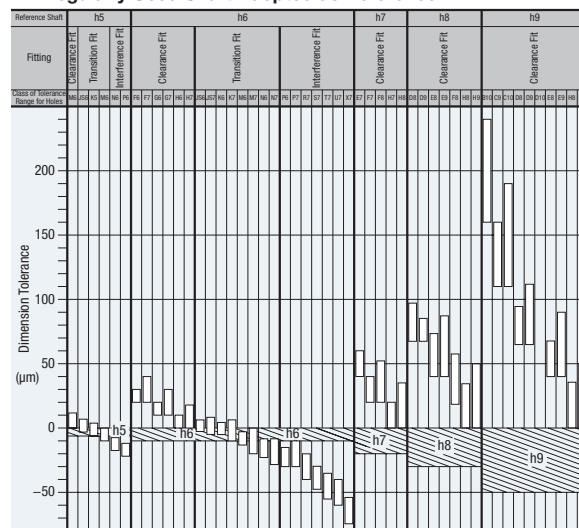
[Note]*An exception may arise according to the dimensional sectioning scheme.

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

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	-85 -110	-20 -45	-14 -39	-14 -39	-14 -39	-12 -37	-16 -41	-20 -45	-20 -45	-2 -27	-2 -27	0 -4	0 -6	0 -10	0 -14	0 -25	± 2	± 3	± 5	0 +4	0 +6	0 +6	0 +8	0 +10	0 +12	0 +14	0 +16	0 +18	0 +20	—	+24	+26
3	6	-140 -170	-85 -100	-30 -46	-30 -46	-20 -32	-20 -38	-20 -38	-20 -40	-20 -40	-10 -18	-10 -22	-10 -28	-4 -12	0 -5	0 -8	0 -12	0 -18	0 -30	± 2.5	± 4	± 6	+4 +6	+6 +9	+9 +11	+12 +14	+13 +15	+16 +18	+20 +22	+23 +27	—	+31	+36	
6	10	-150 -186	-90 -116	-40 -62	-40 -76	-25 -40	-25 -47	-25 -61	-25 -72	-25 -88	-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 +33	
10	14	-150 -193	-95 -138	-50 -77	-50 -93	-32 -53	-32 -59	-32 -75	-16 -41	-16 -43	-16 -43	-6 -14	-6 -17	0 -8	0 -11	0 -18	0 -27	0 -43	± 4	± 5.5	± 9	+9 +1	+12 +1	+15 +7	+18 +7	+20 +12	+23 +12	+29 +18	+34 +23	+39 +28	—	+44	+50	
14	18	-150 -212	-95 -162	-50 -98	-50 -117	-32 -61	-32 -73	-32 -92	-16 -43	-16 -53	-16 -53	-6 -16	-6 -20	0 -9	0 -13	0 -21	0 -33	0 -52	± 4.5	± 6.5	± 10.5	+9 +2	+12 +2	+15 +8	+18 +8	+20 +15	+23 +15	+29 +22	+34 +28	+39 +35	—	+44	+54	
18	24	-160 -232	-110 -182	-65 -98	-65 -117	-40 -61	-40 -73	-40 -92	-20 -53	-20 -53	-20 -53	-7 -16	-7 -20	0 -9	0 -13	0 -21	0 -33	0 -52	± 4.5	± 6.5	± 10.5	+11 +2	+15 +2	+17 +8	+21 +8	+24 +15	+28 +15	+35 +22	+41 +28	+48 +35	—	+54	+67	
24	30	-170 -232	-120 -182	-80 -119	-80 -142	-50 -75	-50 -89	-50 -112	-25 -41	-25 -50	-25 -64	-9 -20	-9 -25	0 -11	0 -16	0 -25	0 -39	0 -62	± 5.5	± 8	± 12.5	+13 +2	+18 +2	+20 +9	+25 +9	+28 +17	+33 +17	+42 +26	+50 +34	+59 +43	+64 +41	+76 +54	+86 +70	
30	40	-170 -232	-120 -182	-80 -119	-80 -142	-50 -75	-50 -89	-50 -112	-25 -41	-25 -50	-25 -64	-9 -20	-9 -25	0 -11	0 -16	0 -25	0 -39	0 -62	± 5.5	± 8	± 12.5	+13 +2	+18 +2	+20 +9	+25 +9	+28 +17	+33 +17	+42 +26	+50 +34	+59 +43	+64 +41	+76 +54	+86 +70	
40	50	-180 -242	-130 -192	-90 -129	-90 -141	-60 -75	-60 -89	-60 -114	-30 -49	-30 -60	-30 -76	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
50	65	-190 -264	-140 -214	-100 -146	-100 -174	-60 -90	-60 -106	-60 -134	-30 -49	-30 -60	-30 -76	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
65	80	-200 -274	-150 -224	-110 -146	-110 -174	-70 -90	-70 -106	-70 -134	-40 -49	-40 -60	-40 -76	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
80	100	-210 -284	-160 -234	-120 -156	-120 -184	-80 -100	-80 -116	-80 -144	-40 -49	-40 -60	-40 -76	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
100	120	-220 -294	-170 -244	-130 -166	-130 -194	-90 -110	-90 -126	-90 -154	-50 -58	-50 -70	-50 -86	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
120	140	-230 -304	-180 -254	-140 -176	-140 -206	-100 -120	-100 -136	-100 -164	-60 -68	-60 -80	-60 -96	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
140	160	-240 -314	-190 -264	-150 -186	-150 -216	-110 -130	-110 -146	-110 -174	-70 -78	-70 -90	-70 -106	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
160	180	-250 -324	-200 -274	-160 -196	-160 -226	-120 -140	-120 -156	-120 -184	-80 -88	-80 -100	-80 -116	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
180	200	-260 -334	-210 -284	-170 -216	-170 -246	-130 -150	-130 -166	-130 -194	-90 -98	-90 -110	-90 -126	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
200	225	-270 -344	-220 -294	-180 -226	-180 -256	-140 -160	-140 -176	-140 -204	-100 -108	-100 -120	-100 -136	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
225	250	-280 -354	-230 -304	-190 -236	-190 -266	-150 -170	-150 -186	-150 -214	-110 -118	-110 -130	-110 -146	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
250	280	-290 -364	-240 -314	-200 -246	-200 -276	-160 -180	-160 -196	-160 -224	-120 -128	-120 -140	-120 -156	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
280	315	-300 -374	-250 -324	-210 -256	-210 -286	-170 -190	-170 -206	-170 -234	-130 -138	-130 -150	-130 -166	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
315	355	-310 -384	-260 -334	-220 -266	-220 -296	-180 -200	-180 -216	-180 -244	-140 -148	-140 -160	-140 -176	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
355	400	-320 -394	-270 -344	-230 -276	-230 -306	-190 -210	-190 -226	-190 -254	-150 -158	-150 -170	-150 -186	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
400	450	-330 -404	-280 -354	-240 -286	-240 -316	-200 -220	-200 -236	-200 -264	-160 -168	-160 -180	-160 -196	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	
450	500	-340 -414	-290 -364	-250 -296	-250 -326	-210 -230	-210 -266	-210 -294	-170 -178	-170 -190	-170 -206	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	± 6.5	± 9.5	± 15	+15 +2	+21 +2	+24 +11	+30 +11	+33 +20	+39 +20	+51 +32	+60 +43	+72 +54	+85 +68	+106 +86	—	

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 +2	+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	-7 -20	-7 -24	-8 -28	-9 -32	-10 -36	-11 -40
3	6	+188 +140	+100 +70	+118 +80	+48 +30	+60 +30	+78 +20	+32 +20	+38 +20	+50 +10	+18 +10	+22 +10	+28 +4	+12 +4	+16 +0	+8 +0	+12 +0	+18 +0	+30 +0	+48 +0	± 4	± 6	+2 -6	+3 -8	-1 -8	-1 -12	-3 -9	-5 -13	-4 -16	-7 -20	-8 -23	-11 -27	-11 -31	-15 -36	—	-19 -44
6	10	+208 +150	+116 +80	+132 +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	-3 -15	-7 -16	-7 -19	-12 -21	-13 -24	-17 -28	-17 -32	-22 -32	-22 -37	-28 -44	—
10	14	+220 +150	+138 +95	+165 +77	+50 +30	+65 +50	+93 +32	+120 +32	+50 +32	+59 +32	+75 +32	+27 +16	+34 +16	+43 +6	+17 +6	+24 +6	+11 +0	+18 +0	+27 +0	+43 +0	+70 +0	± 5.5	± 9	+2 -9	+6 -12	-4 -15	0 -18	-9 -20	-5 -23	-15 -26	-19 -31	-16 -34	-21 -39	-21 -44	—	
14	18	+244 +180	+162 +110	+194 +110	+98 +65	+117 +65	+149 +65	+170 +61	+73 +40	+92 +33	+40 +20	+51 +21	+53 +20	+20 +7	+28 +7	+13 +0	+21 +0	+33 +0	+52 +0	+84 +0	± 6.5	± 10.5	-9 -11	+6 +5	-4 -17	0 -21	-11 -24	-7 -28	-18 -31	-14 -35	-20 -41	-27 -48	—	-33 -54		
18	24	+270 +170	+182 +120	+220 +119	+120 +80	+142 +80	+180 +50	+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 -59	-34 -61	-46 -86	—		
30	40	+280 +180	+192 +130	+230 +130	+80 +130	+120 +130	+160 +130	+50 +130	+60 +130	+80 +130	+30 +10	+40 +10	+60 +10	+25 +10	+34 +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	-37 -66	-42 -86	-59 -106	—		
50	65	+310 +190	+214 +140	+260 +140	+150 +146	+200 +174	+260 +170	+100 +100	+130 +60	+160 +60	+60 +30	+80 +30	+100 +30	+40 +10	+60 +10	+25 +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	-37 -66	-42 -86	-59 -106	—		
65	80	+320 +200	+224 +150	+270 +150	+160 +150	+210 +150	+270 +150	+100 +100	+130 +60	+160 +60	+60 +30	+80 +30	+100 +30	+40 +10	+60 +10	+25 +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	-37 -66	-42 -86	-59 -106	—		
80	100	+360 +220	+257 +170	+310 +170	+150 +170	+200 +207	+260 +170	+100 +100	+130 +60	+160 +60	+60 +30	+80 +30	+100 +30	+40 +10	+60 +10	+25 +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	-37 -66	-42 -86	-59 -106	—		
100	120	+380 +240	+267 +180	+320 +180	+170 +180	+210 +210	+270 +210	+100 +100	+130 +60	+160 +60	+60 +30	+80 +30	+100 +30	+40 +10	+60 +10	+25 +0	+30 +0	+46 +0	+74 +0	+120 +0	± 11	± 17.5	+4 -18	+10 -25	-6 -32	0 -35	-16 -38	-10 -45	-30 -52	-24 -59	-73 -141	-93 -166	-113 -191	—		
120	140	+420 +260	+300 +200	+360 +200	+180 +200	+220 +230	+280 +230	+100 +100	+130 +60	+160 +60	+60 +30	+80 +30	+100 +30	+40 +10	+60 +10	+25 +0	+30 +0	+46 +0	+74 +0	+120 +0	± 12.5	± 20	+4 -21	+12 -28	-8 -33	0 -40	-20 -45	-12 -52	-36 -61	-28 -68	-50 -93	-85 -133	-119 -171	—		
140	160	+440 +270	+310 +210	+370 +210	+200 +210	+240 +210	+300 +210	+100 +100	+130 +60	+160 +60	+60 +30	+80 +30	+100 +30	+40 +10	+60 +10	+25 +0	+30 +0	+46 +0	+74 +0	+120 +0	± 12.5	± 20	+4 -21	+12 -28	-8 -33	0 -40	-20 -45	-12 -52	-36 -61	-28 -68	-50 -93	-85 -133	-119 -171	—		
160	180	+470 +310	+290 +230	+350 +230	+210 +230	+250 +230	+310 +230	+100 +100	+130 +60	+160 +60	+60 +30	+80 +30	+100 +30	+40 +10	+60 +10	+25 +0	+30 +0	+46 +0	+74 +0	+120 +0	± 12.5	± 20	+4 -21	+12 -28	-8 -33	0 -40	-20 -45	-12 -52	-36 -61	-28 -68	-50 -93	-85 -133	-119 -171	—		
180	200	+525 +340	+355 +240	+425 +240	+240 +240	+280 +240	+340 +240	+100 +100	+130 +60	+160 +60	+60 +30	+80 +30	+100 +30	+40 +10	+60 +10	+25 +0	+30 +0	+46 +0	+74 +0	+120 +0	± 14.5	± 23	+5 -24	+13 -33	-8 -37	0 -46	-22 -51	-14 -60	-70 -73	-33 -69	-61 -109	-93 -159	-131 -191	—		
200	225	+565 +380	+375 +260	+445 +260	+242 +170	+285 +170	+355 +170	+146 +100	+172 +100	+215 +100	+50 +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	-70 -73	-33 -69	-61 -109	-93 -159	-131 -191	—		
225	250	+605 +420	+395 +280	+465 +280	+245 +280	+285 +280	+355 +280	+146 +100	+172 +100	+215 +100	+50 +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	-70 -73	-33 -69	-61 -109	-93 -159	-131 -191	—		
250	280	+690 +480	+430 +300	+510 +300	+290 +271	+320 +271	+400 +271	+162 +190	+191 +110	+240 +110	+58 +58	+108 +56	+137 +56	+49 +17	+69 +17	+32 +0	+52 +0	+81 +0	+130 +0	+210 +0	± 16	± 26	+5 -27	+16 -36	-9 -41	0 -52	-25 -57	-14 -66	-47 -73	-36 -86	-78 -126	-107 -178	—			
280	315	+750 +540	+460 +330	+540 +330	+290 +330	+320 +330	+400 +330	+162 +190	+191 +110	+240 +110	+58 +58	+108 +56	+137 +56	+49 +17	+69 +17	+32 +0	+52 +0	+81 +0	+130 +0	+210 +0	± 16	± 26	+5 -27	+16 -36	-9 -41	0 -52	-25 -57	-14 -66	-47 -73	-36 -86	-78 -126	-107 -178	—			
315	355	+830 +600	+500 +360	+590 +360	+330 +299	+360 +299	+440 +299	+182 +210	+214 +210	+265 +210	+98 +125	+119 +125	+151 +125	+54 +62	+75 +62	+36 +18	+57 +0	+89 +0	+140 +0	+230 +0	± 18	± 28.5	+7 -29	+17 -40	-10 -46	0 -57	-26 -62	-16 -73	-51 -87	-41 -98	-83 -150	-131 -191	—			
355	400	+880 +760	+400 +535	+490 +440	+330 +440	+360 +440	+440 +440	+182 +210	+214 +210	+265 +210	+98 +125	+119 +125	+151 +125	+54 +62	+75 +62	+36 +18	+57 +0	+89 +0	+140 +0	+230 +0	± 18	± 28.5	+7 -29	+17 -40	-10 -46	0 -57	-26 -62	-16 -73	-51 -87	-41 -98	-83 -150	-131 -191	—			
400	450	+1010 +1090	+535 +635	+630 +730	+440 +730	+480 +730	+560 +730	+214 +230	+246 +230	+299 +230	+125 +135	+151 +135	+182 +135	+62 +68	+98 +68	+119 +68	+151 +68	+182 +68	+214 +68	+246 +68	± 20	± 31.5	+8 -32	+18 -45	-10 -50	0 -63	-27 -67	-17 -80	-55 -95	-45 -108	-83 -150	-131 -191	—			
450	500	+1100 +1190	+565 +635	+730 +730	+440 +730	+480 +730	+560 +730	+214 +230	+246 +230	+299 +230	+125 +135	+151 +135	+182 +135	+62 +68	+98 +68	+119 +68	+151 +68	+182 +68	+214 +68	+246 +68	± 20	± 31.5	+8 -32	+18 -45	-10 -50	0 -63	-27 -67	-17 -80	-55 -95	-45 -108	-83 -150	-131 -191	—			

1. Varieties of Surface Roughness Indicators

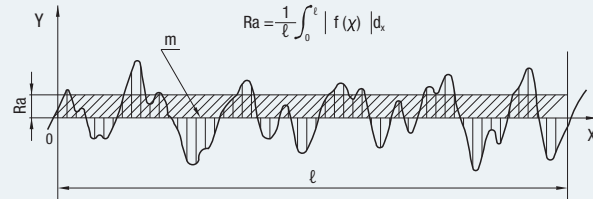
Definitions and presentations of arithmetic average roughness(Ra), maximum height(Ry), 10 spot average roughness(Rz), average concave to convex distance(Sm), average distance between local peaks S and load length rate tp are given as parameters indicating the surface roughness of an industrial product. 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

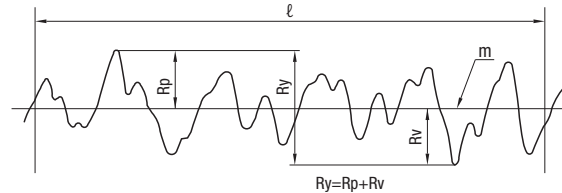
A portion stretching over a reference length in the direction in which the average line extends is cut out from the roughness curve. This portion is presented in a new graph with the X axis extending in the same direction as the average line and the Y axis representing the magnitude. Ra is represented by the equation shown at right, in microns(μm).



Maximum Height Ry

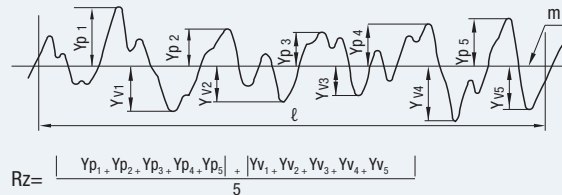
A portion stretching over a reference length in the direction in which the average line extends is cut out from the roughness curve. The gap between the peak line and the trough line is measured in the direction in which the magnitude axis extends, in microns(μm).

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).



Yp₁, Yp₂, Yp₃, Yp₄, Yp₅: Levels of the highest peak to the fifth highest peak in the said portion with the reference length ℓ.

Yv₁, Yv₂, Yv₃, Yv₄, Yv₅: 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	0.012/√ ~ 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				0.25	
	0.8				0.8	
	2.5				2.5	
	8				8	
0.4 a 0.8 a 1.6 a	0.8	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.

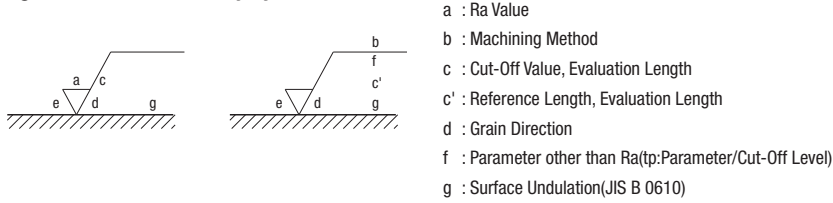
Technical Data

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

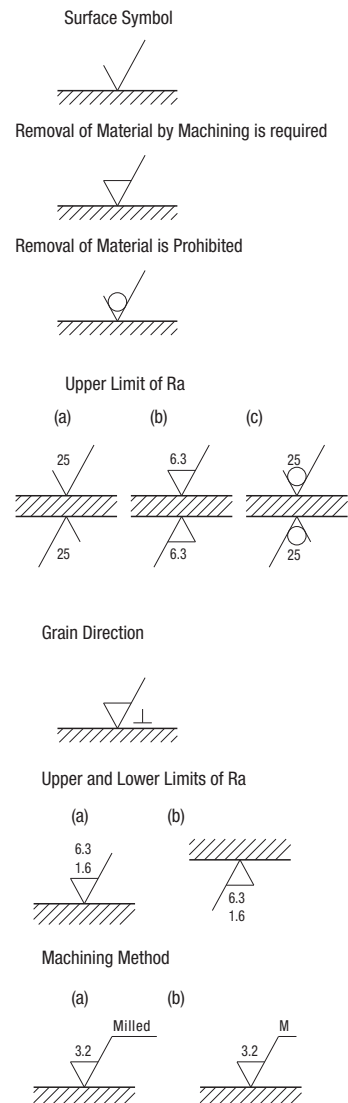


Reference These symbols except a and f are provided when they are needed.

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	
⊥	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	
X	The pattern left by a cutting instrument diagonally crosses the projection plane in the drawing. Ex. Honed Surface	
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



Technical Data

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 ⁽²⁾			Rockwell Superficial Hardness Diamond Cone Indenter			(Hs) Shore Hardness	Tensile Strength (Approximated Value) Mpa (kgf/mm ²) ⁽²⁾	Rockwell C-Scale Hardness ⁽³⁾
		Standard Sphere	Tungsten Carbide Sphere	(HRA) A Scale, Load 60kgf, Diamond Cone Indenter	(HRB) B Scale, Load 100kgf, 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			
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.

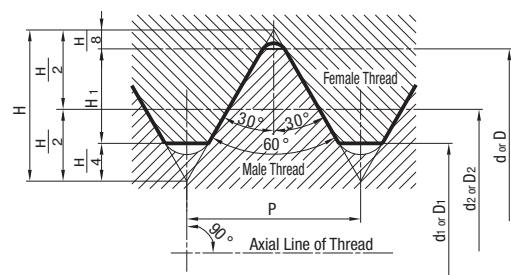
Moreover, 1MPa=1N/mm²

(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



$$H = 0.866025P$$

$$H_1 = 0.541266P$$

$$d_2 = d - 0.649519P$$

$$d_1 = d - 1.082532P$$

$$D = d$$

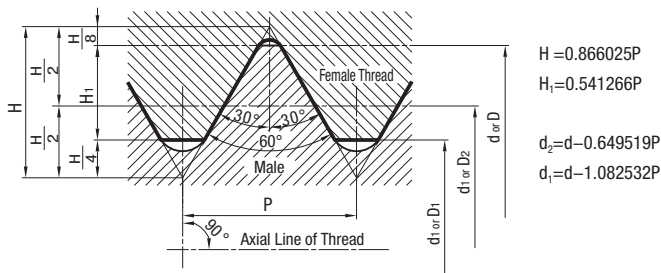
$$D_2 = d_2$$

$$D_1 = d_1$$

Unit:mm

Nominal of Thread(1)*			Pitch P	Height of Engagement H ₁	Female Thread		
					Minor Dia. D	Effective Dia. D ₂	Inner Dia. D ₁
Column 1	Column 2	Column 3			Male Thread		
					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
M1.6	M1.4		0.3	0.162	1.400	1.205	1.075
			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	M3.5w		0.5	0.271	3.000	2.675	2.459
			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
M5			0.8	0.433	5.000	4.480	4.134
M6			1	0.541	6.000	5.350	4.917
M8		M7	1	0.541	7.000	6.350	5.917
			1.25	0.677	8.000	7.188	6.647
		M9	1.25	0.677	9.000	8.188	7.647
M10		M11	1.5	0.812	10.000	9.026	8.376
			1.5	0.812	11.000	10.026	9.376
M12			1.75	0.947	12.000	10.863	10.106
M16	M14			2	1.083	14.000	12.701
			2	1.083	16.000	14.701	13.835
	M18		2.5	1.353	18.000	16.376	15.294
M20	M22		2.5	1.353	20.000	18.376	17.294
			2.5	1.353	22.000	20.376	19.294
M24			3	1.624	24.000	22.051	20.752
M30		M27		3	1.624	27.000	25.051
			3.5	1.894	30.000	27.727	26.211
	M33		3.5	1.894	33.000	30.727	29.211
M36	M39		4	2.165	36.000	33.402	31.670
			4	2.165	39.000	36.402	34.670
M42			4.5	2.436	42.000	39.077	37.129
M48		M45		4.5	2.436	45.000	42.077
			5	2.706	48.000	44.752	42.587
	M52		5	2.706	52.000	48.752	46.587
M56	M60		5.5	2.977	56.000	52.428	50.046
			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

*Priority should be given to Column 1. If required, select items in Column 2 and 3, in that order.



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	1.083	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

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 Duferrit 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

■ 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	ГОСТ 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 080M50	—	—	45Г
	S50C	C50 C50E4 C50M2	1049	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 C10R	XC10 XC18	—
	S15CK	—	—	—	C15E	XC12	—
	S20CK	—	—	—	—	XC18	—
JIS G 4106 Manganese Steel and Chromium- Manganese Steel for Machine Structural Use	SMn420	22Mn6	1522	150M19	—	—	—
	SMn438	—	1534	150M36	—	—	30Г 2 35Г 2
	SMn433	36Mn6	1541	150M36	—	—	35Г 2 40Г 2
	SMn443	42Mn6	1541	—	—	—	40Г 2 45Г 2
	SMn420 SMn443	—	—	—	—	—	—
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	—	—	—	—
	SMn420H SMn443H	—	—	—	—	—	—
	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	—	—	—	—	—	—
	SN415H	—	—	—	—	—	—
	SN631H	—	—	—	—	—	—
	SNCR15H	15NiCr13	—	65SH13	15NiCr13	—	—
	SNCM220H	20NiCrMo2 20NiCrMoS2	8617H 8620H 8622H	80SH17 80SH20 80SH22	—	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	ГОСТ 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 8637 8640	80S420 80S420 80S422 80S422	20NiCrMo2 20NiCrMoS2	20NCD2	—
	SNCM240	41CrNiMo2 41CrNiMoS2	—	—	—	—	—
	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 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
	SCM415	—	—	—	—	—	—
	SCM418	18CrMo4 18CrMoS4	—	—	18CrMo4 18CrMoS4	—	20XM
	SCM420	—	708M20	—	—	—	20XM
	SCM421	—	—	—	—	—	—
JIS G 4105 Chromium Molybdenum Steel	SCM430	—	4131	—	—	—	30XM 30XMA
	SCM432	—	—	—	—	—	—
	SCM435	34CrMo4 34CrMoS4	4137	34CrMo4 34CrMoS4	34CrMo4 34CrMoS4	34CrMo4 34CrMoS4	35XM
	SCM440	42CrMo4 42CrMoS4	4140 4142	709M40 709M40 42CrMo4 42CrMoS4	42CrMo4 42CrMoS4	42CrMo4 42CrMoS4	—
	SCM445	—	4145 4147	—	—	—	—
	SCM822	—	—	—	—	—	—
	SNB5	—	501	—	—	—	—
	SNB7	42CrMo4 42CrMoS4	4140 4142 4145	708M40 709M40 42CrMo4(1)	42CrMo4(2)	42CrMo4(4)	—
	SMB16	—	—	40CrMoV4—6(1)	40CrMoV4(73)	40CrMoV4—6(4)	—
	SNB21—1-5	—	—	40CrMoV4—6(1)	40CrMoV4(73)	40CrMoV4—6(4)	—
JIS G 4108 Steel Bar for Special- Purpose Alloy Bolts	SNB22—1-5	42CrMo4 42CrMoS4	4142H	—	42CrMo4(2)	—	—
	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 Normung

NF: Norme Française

AISI: American Iron and Steel Institute

BS: British Standards

EN: European Standards

ГОСТ: National Standards of Former USSR

Names of Tool Steels

Rolled Steel for General Structure SS400 Steel, Structure, 400N/mm²

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)

SKS3 Steel, Tool (Kogu, in Japanese), Special, Type 3

SKD11 Steel, Tool (Kogu, in Japanese), Dies, Type 11

SKH51 Steel, Tool (Kogu, in Japanese), High Speed, Type 51

SUJ2 Steel, Use, Bearing, Type 2

SUS304 Steel, Use, Stainless, Type 304

FC250 Ferrum (Iron), Cast, 250N/mm²

COMPARISONS OF MATERIALS BETWEEN JIS AND FOREIGN STANDARDS 2

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 Bar Hot-Rolled Plate and Band Cold-Rolled Plate and Band JIS G 4308-4309	SUS 201	12	S20100	201			Z12CMN17-07aZ		X12CMnNi17-7-5	1.4372	
	SUS 202		S20200	202	284S16				X12CMnNi18-9-5	1.4373	
	SUS 301	5	S30100	301	301S21	X12CNi17 7	Z11CN17-08	12X17 T 9AH4 07X16H6	X2CNi17-7	1.4319	
	SUS 301L	4				X2CNi18-7			X2CNi18-7	1.4318	
Wire Rod Wire	SUS 301L1					X12CNi17 7					
	SUS 302		S30200	302	302S25		Z12CN18-09	12X18H9			
	SUS 302S	13	S30215	302S	S303S21	X10CNi18 9	Z8CNF18-09		X8CNi18-9	1.4305	
	SUS 303		S30300	303	303S41						
JIS G 4313-4315 Band for Spring Wire for Spring Wire for Cold Forging JIS G 4317-4320	SUS 303Cu		S30323	303Se				12X18H10E			
	SUS 304	6	S30400	304	304S31	X5CrNi18 10	Z7CN18-09	08X18H10	X4CNi18-10	1.4301	
	SUS 304L	2	S30403	304L	304S11	X2CrNi19 11	Z3CN19-11	03X18H11	X2CNi19-11	1.4302	
	SUS 304N1	10	S30451	304N			Z6CN19-09aZ		X2CNi18-9	1.4306	
Hot-Rolled Equal-Leg Angle Cold-Finished Bar Steel Piece for Forged Article Cold-Rolled Equal-Leg Angle	SUS 304L2	3	S30452						X2CNi18-9	1.4306	
	SUS 304L4N		S30453	304LN		X2CNi18 10	Z3CN18-10aZ		X2CNi18-10	1.4311	
	SUS 304J1										
	SUS 304J2										
SUS 304J3											
	SUS 305	8	S30500	305	305S19	X5CrNi18 12	Z8CN18-12	06X18H11	X4CNi18-12	1.4303	
	SUS 305L1										
	SUS 305S	X6CrNi23-21	S30908	309S			Z10CN24-13				
SUS 310S											
	SUS 315L1	X6CrNi25-14	S31008	310S	310S31		Z8CN25-20	10X23H18	X6CNi25-20		
	SUS 315L2										
	SUS 316	26	S31600	316	316S31	X5CrNiMo17 12 3	Z7CN17-12-02		X4CNiMo17-12-2	1.4401	
SUS 316F											
	SUS 316L	19	S31603	316L	316S11	X5CrNiMo17 12 3	Z6CN18-12-03		X4CNiMo17-13-3	1.4436	
	SUS 316L1	20	S31603	316L	316S11	X2CrNiMo17 13 2	Z3CN17-12-02		X2CNiMo17-12-2	1.4402	
	SUS 316L2	20				X2CrNiMo17 14 3	Z3CN17-13-03	03X17H14M3	X2CNiMo17-13-3	1.4434	
SUS 316N											
	SUS 316LN	22	S31651	316N							
	SUS 316Ti	28	S31653	316LN		X2CrNiMo17 12 3	Z3CN17-11aZ		X2CNiMo17-11-2	1.4406	
SUS 316Ti1											
	SUS 316Ti1L	23	S31653	316LN		X2CrNiMo17 12 3	Z6CN17-12aZ		X2CNiMo17-12-2	1.4429	
	SUS 316Ti1L1										
	SUS 316Ti1L2										
SUS 317L											
	SUS 317LN	21	S31703	317L	317S12	X2CrNiMo18 16 4	Z3CN19-15-04		X2CNiMo18-15-4	1.4438	
	SUS 317J1	24	S31753				Z3CN19-14aZ		X2CNiMo18-12-4	1.4434	
	SUS 317J2								X2CNiMo17-13-5	1.4439	
SUS 317J3L											
	SUS 317J3L1										
	SUS 317J3L2										
	SUS 317J3L3										
SUS 317J3L4											
	SUS 317J3L5										
	SUS 317J3L6										
	SUS 317J3L7										
SUS 317J3L8			</								

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: zzzzzzzzzzzzzzzzzzEN 10088-1:1995
4. European countries: BS, DIN, NF, etc. These national standards are to be abolished in favor of EN
5. OCT: 5632

Japan Industrial Standards			Steel Type Related to Foreign Standards					
Standard Number	Code	ISO	AISI ASTM	BS	DIN VDeh	NF	Γ OCT	
JIS G 4401 Carbon Tool Steel	SK140(Old SK1)	TC140	—	—	—	C140E3U	Y13	
	SK120(Old SK2)	TC120	W1-11 1/2	—	—	C120E3U	Y11	
	SK105(Old SK3)	TC105	W1-10	—	C105W1	C105E2U	Y12	
	SK95(Old SK4)	TC 90	W1-9	—	—	C90 E2U	Y10	
	SK85(Old SK5)	TC 80	W1-8	—	C 80W1	C80 E2U	Y8 Γ	
	SK75(Old SK6)	TC 80	—	—	C 80W1	C80 E2U	Y8	
	SK65(Old SK7)	TC 70	—	—	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 4-1	HS18-0-1-10	T 5	BT5	—	HS18-2-9	—	
	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	M4	BM35	S 6-5-2-5	HS 6-5-2-5HC	PBM5K5	
	SKH56	—	M36	—	—	—	—	
JIS G 4404 Alloy Tool Steel	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	—	
	SKS11	—	F2	—	—	—	XB4	
	SKS 2	105WC1	—	—	105WC6	105WC5	XB Γ	
	SKS21	—	—	—	—	—	—	
	SKS 5	—	—	—	—	—	—	
	SKS51	—	L6	—	—	—	—	
	SKS 7	—	—	—	—	—	—	
	SKS 8	—	—	—	—	C140E3UC4	13X	
JIS G 4404 Alloy Tool Steel	SKS 4	—	—	—	—	—	—	
	SKS41	—	—	—	—	—	—	
	SKS43	TCV105	W2-9 1/2	BW2	—	100W2	—	
	SKS44	—	W2-8	—	—	—	—	
	SKS 3	—	—	—	—	—	9XB Γ	
	SKS31	105WC1	—	—	105WC6	105WC5	XB Γ	
	SKS93	—	—	—	—	—	—	
	SKS94	—	—	—	—	—	—	
	SKS95	—	—	—	—	—	—	
	SKD 1	210C12	D3	BD3	X210C12	X200C12	X12	
	SKD11	—	D2	BD2	—	X160CrMoV12	—	
	SKD12	100CrMoV5	A2	BA2	—	X100CrMoV5	—	
	SKD 4	30WCrV9	H2	—	—	X32CrWV9	—	
	SKD 5	30WCrV9	H11	BH11	X38CrMoV51	X38CrMoV5	4X5M0C	
	SKD 6	40CrMoV5	H13	BH13	X40CrMoV51	X40CrMoV5	4X5M01C	
SKD62	—	H12	BH12	—	X35CrWMoV5	3X3M30		
SKD 7	30CrMoV3	H10	BH10	X32CrMoV33	32CrMoV12-18	—		
SKD 8	—	H19	BH19	—	—	—		
SKT 3	—	—	—	—	55NiCrMoV4	—		
SKT 4	55NiCrMoV2	—	BH224/5	55NiCrMoV6	55NiCrMoV7	50XM		

Japan Industrial Standards		Steel Type Related to Foreign Standards					
Standard Number Name	Code	ISO	SAE AISI	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	55Si3	5155	—	55Si3	55Si3	—
	SUP 9A	—	5160	—	—	60C3	—
	SUP10	51CrV4	6150	735A51,735H51	50CrV4	51CrV4	X0A50X Г А
	SUP11A	60CrB3	51860	—	—	—	50X F P
	SUP12	55SiCr63	9254	685A57,685H57	54SiCr6	54SiCr6	—
	SUP13	60CrMo33	4161	70SA60,70SH60	—	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	11SMnP28	12L13	—	9 SMnP28	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	УХ15
	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		QK3	YK3	K3				K990
	SKS93				YCS3	SK301		QKSM	YK30	K3M	SK3M		ARNE	K460
	SKS3				SGT	SKS3		QKS3	GOA	KS3	SKS3	RS3	SVERKER3	K100
	SKD1	D3		X210Cr12	CRD	SKD1		QC1	DC1	KD1			SVERKER3	K107
Alloy Tool Steel	SKD11	D2	X210Cr12	X210Cr12W12	SLD	SKD11		QC11	DC11	KD11	CDS11	RD11	SVERKER21	K105
	SKD11(Modification)				SLD8			QCM8	DCS3	KD11S	MDS9		SLEIPNER	K340
	Matrix Group CrSKD				SLD10	AUD15		QCM10	DCX	KD12			RIGOR	K305
	SKD12			X100CrMoV5	AKR1	SKACE		QCM7	DC12	KAP65			IMPAX	
	Pre-Hardened 40HRC	A2			SCD	SKD12			GO40F	RC55				
	Pre-Hardened 50HRC or more				HPM2T				CK1					
	Flame-Hardened Steel				PRE2									
	Low Temperature Air Cooled Steel				HMD5	SK105V		QF3	GO5	FH5			FERN0	
	Shock Resistance Steel				HMD1	SK4			GO4	KSM				
					ACD37	AKS3								
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	RHM5		S705
	SKH57 Group		S10-4-3-10	HS10-4-3-10	XVC5				MH8	MV10	HS93R	RHM7		S700
	Matrix Group				YXR33			QHZ	MH85	KKM	MDS1			
P/M High Speed Tool Steel	SKH40			HS6-5-3-8	YXR3				MH88	KKM2	MDS3			
	Matrix Group				YR7					KMX3	MDS7			
					HAP40	KHA30			DEX40		FAX38		ASP30	S590
					HAP5R	KHA3VN			DEX-M1					
					HAP10				DEX-M3					
						KHA32	SPM23		DEX21		FAX31		ASP23	S690
					HAP50				DEX90					S790
									DEX61		FAX55			S390
					HAP72	KHA60	SPM60		DEX80		FAXG1		ASP60	
						KHA77					FAX18			
						KHA30N					FAXG2			
						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	Tool	Material			Machined Material											
									Non-Ferrous Metal		Untreated		Thermal Refined		Hardening/Tempered					
								For Press Die	(Al)	(Al–alloil) SS400(SS41) S45C S50C	SKD11 DC53	(Be–Cu) HPM2T	SCM435	DC53(Carbide)						
														S45C	SKD11 SKS3 SKH51	SUJ2				
For Plastic Mold	CU BsBM2	SKD61		HPM7 PX5 NAK5 HPM1 NAK80 HPM50 FDAC DH2F	(Electroforming-Outside) ORAVAR SUPREME (Age-Hardened)MAS1C				(Electroforming-Inside)											
		RIGOR(SKD12 Group)		STAVAX ESR		HPM38 S–STAR STAVAX ESR	HPM38 S–STAR		MAS1C											
						SKD61	STAVAX ESR	RIGOR (SKD12 Group)												
							HRC	10	20	30	40	50	60	70						
Machining	Hole Machining Side and Bottom	General Purpose Milling Cutter NC Milling Cutter Machining Center	Drills Reamer End Mills Cutting Tools	Drills	High-Speed Steel	SKH–														
					Carbide	Wn–Co														
	Hole Machining	Drilling Machine Drill Press Boring Machine Jig Borer	Drills Tapped Reamer Cutting Tools	Tapped	High-Speed Steel	SKH–														
					Carbide	Wn–Co														
	Machining Cylinders	General Purpose Lathe NC Lathe Turning Center	Drills Reamer Tapped Cutting Tools	End Mills	High-Speed Steel	SKH–														
					Carbide	Wn–Co														
Grinding	Surface Grinder Cylindrical Grinder Jig Grinder Profile Grinder Forming Grinder	Grindstone	Grindstone	Cutting Tools	Boron	CBN														
					Diamond	D														
Electric Discharging	EDM	Electrode Master	Wire	Electrode Master	Electrolytic Copper, Brass	CU–														
					Copper Tungsten, Silver Tungsten	–Wn														
					Brass	CU–Zn														
	WEDM	Wire	Wire	Tungsten	Wn															

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 Period, 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 Warranty.

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.

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THIS LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY FOR THE PRODUCT. COMPANY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR OTHERWISE. PRODUCTS ARE SOLD BUSINESS TO BUSINESS AND NOT TO CONSUMERS, RENDERING ANY CONSUMER LAW INAPPLICABLE. IN NO EVENT SHALL COMPANY’S LIABILITY WITH REGARD TO THE SALE OF PRODUCT EXCEED THE ORIGINAL PURCHASE PRICE PAID BY CUSTOMER.

G. ENTIRE AGREEMENT

This Limited Warranty contains and represents the only warranty extended by Company for the Product. No employee or agent of Company or any other party is authorized to make any other warranty in addition to those made in this Limited Warranty. This Limited Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

H. MODIFICATION OR DISCONTINUATION OF PRODUCTS.

Company reserves the right to discontinue or modify the Product at any time without notice. In the event that repair or replacement of the Product pursuant to this Limited Warranty is not possible, Company will fulfill any repair or replacement obligation under this Limited Warranty with a product of equal or greater value.

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