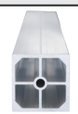
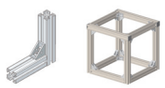
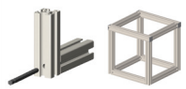
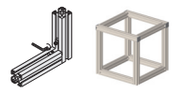
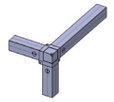
Aluminum Extrusion Types and Parts Selection

Aluminum Extrusion Types and Characteristics

	HFS Series	HFSL Series	EFS Series	NFS (NEFS, NFSL) Series	GFS Series	SLF Series
Photo						
Material	A6N01SS-T5	A6N01SS-T5	A6N01SS-T5	A6063S-T5	A6061SS-T6 Equivalent	A6063SS-T5
Features	Standard cross section shape.	Lightweight and economical extrusions. Suitable for use when light weight and economical price are given priority over strength.	Have rigidity equivalent to HFS Series yet lighter and more economical.	Material change to A6063S-T5 led to significant price reduction. The Cross Section Shape and Cross Sectional Moment of Inertia are the same as those of HFS, HFSL and EFS Series. Stress and tensile strength decrease due to material change. The color may vary slightly.*	These thick extrusions offer high rigidity and are suitable for use in high load.	Has 4 slotless flat enclosures. Excels in sanitary control since dust is not collected in slots. Various accessories for aluminum extrusions can be utilized by combining with Slot Type (SLFT6-4040, etc.)
Surface Treatment	Clear Anodize (HFS) Black Anodize (HFSB) Clear Coating (CAF) Baked Paint (Yellow) (HFSY)	Clear Anodize Black Anodize	Clear Anodize (EFS) Black Anodize (EFSB)	Clear Anodize Black Anodize	Clear Anodize	Clear Anodize
Representative Product	HFS8-4040	HFSL8-4040	EFS8-4040	NFS5-2020 (Different Material of HFS5-2020) NEFS8-4040 (Different Material of EFS8-4040) NFSL6-3030 (Different Material of HFSL6-3030)	GFS8-100100	SLF6-4040 (No Slot Type) SLFC6-4040 (1 Slot Type)

* Aluminum extrusion colors may slightly vary depending on the materials.

Aluminum Extrusions Connection Method

Connection Method	Bracket Connection	Blind Joint Connection	Blind Brackets Connection	Screw Connection	SLF Series Connection
Connection Examples					
Features	The standard and economical connection method. Cover plates can be mounted by adding taps on the brackets.	A connection method that produces clean corners. Suitable for sections where equipment is loaded and unloaded or doors are to be mounted. Note that alterations are required to the extrusions, and available for limited extrusion models only. For applicable extrusions, see each product page. ☞ P.551, 601, 659, 705	Brackets are hidden inside of slots producing clean corners. Alterations are not required. However, allowable load is smaller than that of bracket connections.	Connections only with screws can be achieved by applying tapping and counterbore alterations on the extrusions.	• Connection with dedicated joints • Screw Connection See "Features of SLF Series" for details. ☞ P.725
Representative Product	HBLFSN6, HBLTS6, etc.	HCJ6, HMJ6, etc.	HBLBS6, HABLBS6, etc.	-	-

Selection of Related Parts

Numbers of applicable related parts are decided at the time of selecting aluminum extrusions.
When selecting related parts, see No. as reference.

(Ex.) When assembling with HFS6-3030 aluminum extrusions of 6 series

Brackets
HBLFSN6
HBLTS6 or Others

Blind Brackets
Blind Joint
HBLBS6
HSJ6 or Others

Nut
HNTT6-Tapped Hole Dia.
HNTAT6-Tapped Hole Dia. or Others

Extrusion End Caps and Covers
HFC6-3030-Color
HSCA6-Color or Others

Casters and Leveling Mounts
HAJPS6
HCFT6-60 or Others

Door Parts
HHPSN6
HMGN6 or Others

Other Accessories
HFCC6
LCSA6-Shaft Hole Dia. or Others

Many products can be used for both 8 series and 8-45 series.

Pre-Assembly Insertion Nut HNTT8-8
→ It can be used with 8 series.
→ It can be used with 8-45 series.

• Various related parts can be installed to the aluminum extrusion structure according to the usage.

Aluminum Extrusion Tolerance Data

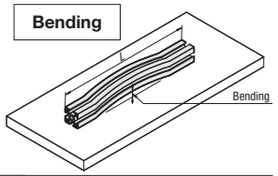
Aluminum Extrusion JIS Standards

• Bend Tolerance (Special Grade)

Unit: mm

Diameter of Circumscribed Circle mm	Minimum Thickness mm	Per Arbitrary Section of 300mm Length	per Full Length (L) mm
38 or less	2.4 or less	1.3 or less	1.3 x $\frac{L}{300}$ or Less
	Over 2.4	0.3 or less	0.3 x $\frac{L}{300}$ or Less
Over 38 to 300 or less	-	0.3 or less	0.3 x $\frac{L}{300}$ or Less
Over 300	-	0.5 or less	0.5 x $\frac{L}{300}$ or Less

Bending



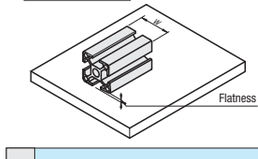
Note
• Given values are for extrusions placed on flat surfaces with minimized bends by own weight.
• When the overall length is not an integral multiple of 300mm, determine the tolerance by rounding up the remainder length to 300mm.

• Flatness Tolerance

Unit: mm

Shape Type / Minimum Thickness of Measurement Point Width	General Shape	Hollow Shape	
	-	4.7mm or Less	Over 4.7mm
25mm or Less	0.10 or less	0.15 or less	0.10 or less
Over 25mm	0.004xW or Less	0.006xW or Less	0.004xW or Less
Per Arbitrary Section of 25mm Width	0.10 or less	0.15 or less	0.10 or less

Flatness



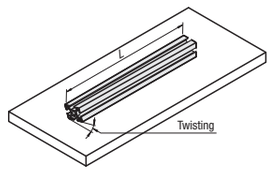
Note Not Applicable to the plane including open section.

• Twist Tolerance

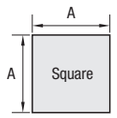
Unit: degree

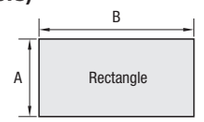
Diameter of Circumscribed Circle mm	Length	
	Per Arbitrary Section of 300mm Length	per Full Length (L) mm
38 or less	1 or less	1 x $\frac{L}{300}$ or Less; However, Max. Value is 7
Over 38 to 76 or less	1/2 or less	$\frac{1}{2}$ x $\frac{L}{300}$ or Less; However, Max. Value 5
Over 76	1/4 or less	$\frac{1}{4}$ x $\frac{L}{300}$ or Less; However, Max. Value 3

Twisting



Reference: Tolerance of Outer Dimension (JIS)





Unit: mm

Outer Dimension Tolerance (JIS)	A Dimension
HFS5-2020	±0.41
HFS5-4040	±0.54
HFS6-3030	
HFS6-6060	±0.86
HFS8-4040	±0.54
HFS8-8080	±0.86
HFS8-4545	±0.60
HFS8-9090	±0.86

Outer Dimension Tolerance (JIS)	A Dimension	B Dimension
HFS5-2040	±0.41	±0.54
HFS6-3060	±0.54	±0.86
HFS8-4080		
HFS8-4590	±0.60	

*MISUMI Aluminum Extrusions are within JIS dimension tolerance above.

Mechanical Properties of Aluminum Extrusions

	JIS Standard (Reference)	JIS Standard (Reference)	Actual Measurement	JIS Standard (Reference)
Series	HFS Series	GFS Series		NFS Series
Material (JIS Symbol)	A6N01SS-T5	A6061SS-T6 Equivalent		A6063S-T5
Tensile Strength (N/mm²)	245 or more	265 or more	278	155 or more
Proof Stress (N/mm²)	205 or more	245 or more	247	110 or more
Longitudinal Elastic Modulus (N/mm²)	69972	69972		69972
Brinell Hardness (HB)	88	88		88
Surface Treatment	Anodize 9μm or more	Anodize 9μm or more		Anodize 9μm or more

Brackets - Overview

For 6 Series (Slot Width 8mm) Aluminum Extrusions

There are two types of aluminum extrusions connections.

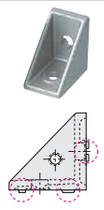
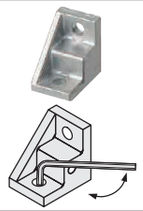
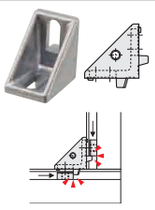
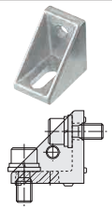
Bracket Connection		**Inserts nuts into the slots of aluminum extrusions and fix with screws. Economical and mountable at desired positions since alterations on extrusions are not required.**
Blind Joint Connection		**Adds hole alterations on the extrusion sides and connects with special joints. Connection without brackets produces clean corners. Recommended where interference needs to be avoided. * For details of Blind Joint Connection, see P.601.**

About Brackets

- For 1 Slot:Products effective to increase assembly workability and with different surface treatments are available. Various types other than representative ones are also available. See the table below to find the rough features and check the details on each product page. ☞ **P.585~590**

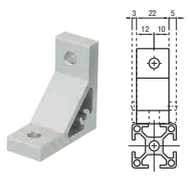
Tabbed Brackets

Mounting surfaces are tabbed to prevent rotations. Other than conventional "HBLFSN6", products with additional functions are also available.

Product Name	Tabbed Reversal Brackets	One-Side Rib Brackets	Nut Mounting Brackets	Brackets with Single Side Tab	Brackets with Slotted Hole on One side	Brackets with Cover
Product Photo						
Material	ADC12	ADC12	ADC12	ADC12	ADC12	ADC12
Features	Tabs on mounting surfaces enable easy positioing. Most conventional type.	One-Sided Tabbed (Side Face), easy to work with hex wrenches.	Nut position adjustment is not required since the long protrusion fixes nuts.	Only one side of bracket has tabs. Suitable when connecting extrusions and plates.	Brackets with Slotted Hole on one side. No interference between screw heads when using Screws with Captured Washer.	Brackets with cover type. Superior in sanitation since dust does not intrude.
Representative Product	HBLFSN6	HBLFSL6	HBLFSR6	HBLFSNK6 HBLFSNE6	HBLFSH6	HBLFSNT6
Page	P.585	P.585	P.586	P.586	P.586	P.587

Extruded Brackets

Surfaces are anodized. In addition to the conventional "NBLTS6/HBLTS6", products with additional functions are available.

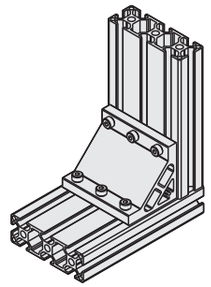
Product Name	Thick Brackets	Lateral Misalignment Brackets	Scalene Brackets	Thick Brackets	Assembly Brackets for Different Extrusion Sizes
Product Photo					
Material	·A6063S-T5 ·A6N01SS-T5	A6N01SS-T5	A6N01SS-T5	A6N01SS-T5	A6N01SS-T5
Features	Made of the same material as aluminum extrusions with anodizing. Suitable when uniform appearance with the extrusions is desired.	Hole positions are offset. Can be combined with plates of 3mm thickness when mounting plates on the side.	Length of two sides are scalene. Usable where space is narrow.	Two mounting holes are provided on one side. Extrusions can be connected more securely with 4 screws.	Staggered mounting holes Brackets to connect 30, 20 square Extrusions.
Representative Product	·NBLTS6 (A6063S-T5) ·HBLTS6(A6N01SS-T5)	HBLTH6	HBLTF6	HBLTSW6	HBLTS6-5L HBLTS6-5R
Page	P.588	P.589	P.589	P.590	P.590

Side surface and screw holes are not anodized for NBL□□Series (Material: A6063S-T5).

- For Multiple Slot Extrusions:Extrusions with 2 ~ 4 slots can be connected with one bracket.
  Check the details on each product page. ☞ **P.591~594**

Product Name	Tabbed Brackets - For 2 Slots	Extruded Brackets - For 2 Slots	Extruded Brackets - For 3 Slots	Extruded Brackets - For 4 Slots
Product Photo				
Material	ADC12	·A6063S-T5 ·A6N01SS-T5	·A6063S-T5 ·A6N01SS-T5	A6N01SS-T5
Representative Product	HBLFSD6	·NBLTD6 (A6063S-T5) ·HBLTD6 (A6N01SS-T5)	·NBLTT6 (A6063S-T5) ·HBLTT6 (A6N01SS-T5)	HBLUT6
Page	P.591	P.593	P.594	P.594

Side surface and screw holes are not anodized for NBL□□Series (Material: A6063S-T5).



- Special Shape:Products with special functions / shapes are also available. Check the details on each product page. ☞ **P.595~598**

Product Name	Post-Assembly Insertion Easy Brackets	Thin Brackets	Angled Brackets	Free Angle Brackets
Product Photo				
Features	2 aluminum extrusions can be connected with only 1 tightening screw.	Thin and compact type. Effective for space saving at mounting locations.	45°/135° angled type. Extrusions with 45° cut can be connected.	Extrusions can be connected at any arbitrary angle.
Representative Product	HABL6	HBLSS6	HBL45TS6 HBL135TS6	HBLTBC30
Page	P.595	P.596	P.597	P.598

Perpendicularity

Perpendicularity of Extruded Brackets is manufactured within ±1° tolerance based on JIS Standard H4100 Special Grade.
For applications where perpendicularly is important, use Perpendicularly Machined Type. ☞ **P.588**

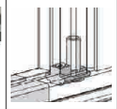
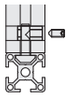
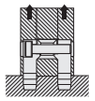
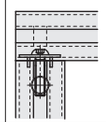
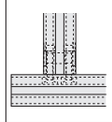
How to Specify Allowable Load of Bracket

Allowable load per one bracket is calculated with one beam extrusion between two vertical extrusions supported by a bracket under each side of the beam as shown on the left-side figure.

Allowable Load here means the load applied when all mounting holes of the brackets are fixed with screws and the brackets can hold the position (without break or sliding).

About Blind Joint Components

Blind Joint Connection is recommended where standard brackets and peripherals interfere.
See the table below and check the details on each product page. ☞ **P.599~614**

Product Name	Blind Brackets	Tapping Joints	Screw Joints	Simple Joints	Center Joint	Post-Assembly Insertion Double Joints	Single Joints	Pre-Assembly Insertion Double Joints	Parallel Joints
Product Photo									
Installation Diagram									
Material	S45C or SCS13	SWCH-18A	Steel or SUS304	S45C / SCM435	SCS13	SCS13 / SUS304 Equivalent	Steel or SUS304	SUS316 Equivalent / SUS304	SCS13 / SUS304
Features	No need for alterations to hide brackets inside of the slot.	· Tapping alteration is not required. · Most economical Blind Joints.	Joint Plate enables secure and economical connection.	Wrench holes are not required. Requires only one screw for tightening.	Most standard Blind Joints usable with various types of aluminum extrusions.	Connects securely at two locations. Tightest connection can be achieved of all Blind Joints.	D holes added on the extrusions do not penetrate to the flat surface. Blind Joints with very good appearance.	Can be used for various applications such as to extend extrusions as well as mounting to plates.	Extrusions can be connected in parallel.
Representative Product	HBLBS	HTJ	HCJ	HUJ	HMJ	HPJN	HSJ	HDJSN	HLJ
Page	P.600	P.602	P.603	P.604	P.605	P.607	P.609	P.611	P.613