

Anti-Loosening Function **V-LOCK SYSTEM**



Daekwang Metal Co., Ltd.

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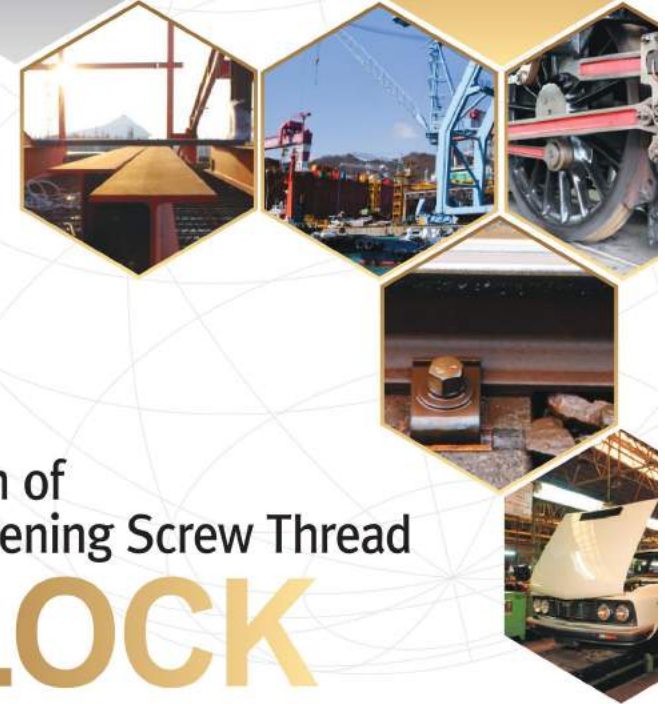
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www.dkmetal.co.kr

Thank you.

We will always make an effort to become a reliable company.

www.dkmetal.co.kr



Innovation of Anti-Loosening Screw Thread

V-LOCK

Anti-loosening **bolts and nuts**





Daekwang Metal Co., Ltd. is a fastener manufacturer that makes various bolts, nuts, washers, rivets, and other products.

We have been manufacturing and wholesaling fasteners for 40 years, and have a second-generation management. We promise to establish a solid foundation and aim to advance into the future.

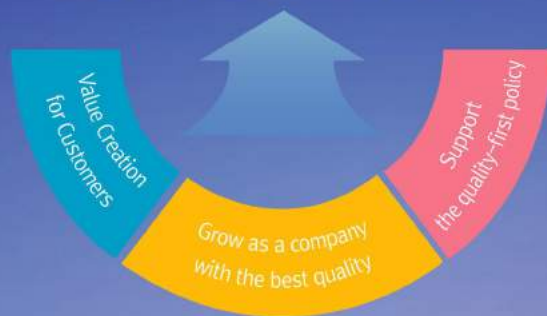
All our employees work together to meet the deadline, quality and cost that customers require, and do their best to constantly develop our technology, and improve our process and quality.

We will always do our best to offer the best products with the highest quality and the best service.

Hyeon-woo Seo, CEO of Daekwang Metal Co., Ltd.

Customized Quality Implementation

Daekwang Metal always puts its customers first and grows together with them through continuous value creation.



METAL DAEKWANG

HISTORY

- **June 1978.** Established Daekwang Bolt
- **April 2001.** Established Hyundai Special Steel
- **January 2002.** Established Daekwang Metal
- **July 2003.** Obtained the ISO 9001:2008 certification
- **April 2004.** Converted into a corporation, Daekwang Metal Co., Ltd. And moved to larger facilities
- **November 2007.** Obtained the ISO/TS 16949:2009 certification
- **August 2008.** Obtained the certification of a clean workplace (No. 50,891)
 - September** Selected as a Promising Small and Medium Business by Busan Bank (No. 2008097)
 - November** Selected as an INNO-BIZ company (No. 8111-2907)
- **November 2010** Selected as a military service company
- **March 2011.** Established a company-affiliated research institute (No. 1011310145)
 - May** Obtained a certificate of venture business (No. 20110102882)
 - June** Obtained the certification of components and materials manufacturing (No. 8403)
 - July** Selected as NEW EXPORTER 300 by the Gyeongnam Trade Association and became a member of the trade association
- **June 2012.** Obtained the certification of designation as a promising export firm
- **November 2014.** Obtained the certification of root industry
- **February 2015.** Obtained the classification certificate of DNV (V-LOCK)
- **April 2017.** Obtained a certificate of designation as a global IP star company (No. 2017-3)
- **November 2017.** Obtained a new technology certification from the Korea Expressway Corporation technology market (V-LOCK)





METAL
DAEKWANG
Major Clients

| Hyundai Heavy Industries |

- Bolts and nuts for shipbuilding and offshore-plant cable trays
- V-LOCK applied to Robot Business Division

| Chemical Plant Japan Mitsubishi Heavy Industries |

- Bolts and nuts for plant cable trays

| Shipbuilding and Offshore Plant Switchboard |

- Accessories of bolts and nuts
- Bolts and nuts used in vessel propellers
- Bolts and nuts used in vessel lighting fixtures

| Hanwha Techwin |

- Precision parts, bolts and pins for semiconductor chip manufacturing machines

| Renault Samsung Motors |

- Small parts and pins for the various blanks of the Door & Hood & Trunk hinge check link

| GM |

- Components of oil filters, steering system components: ball studs and ball joints; and many other products

| LG, Samsung |

- Supporting bolts for refrigerators, washer holding hub, and other metal components for home appliances

| Daelim, KR Motors |

- Accessories and small parts for motorcycle side mirrors

| Daewoo Shipbuilding & Marine Engineering |

- V-LOCK NUT used for shipbuilding cable trays

| STX Offshore & Shipbuilding |

- V-LOCK NUT

| Components for the Railroad Car Door System |

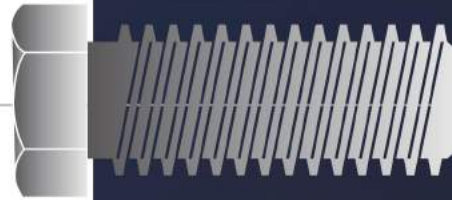
- Bolts used in the interior panel of high-speed railway and subway trains

| Farm Tractors, Rice Planting Machines |

- Small parts (processed parts, bolts, and nuts)

| Heat Exchanger |

- Stud bolts and nuts fixing plate



Are you still using
common bolts and nuts ?



V-LOCK
keeps you **safe!**

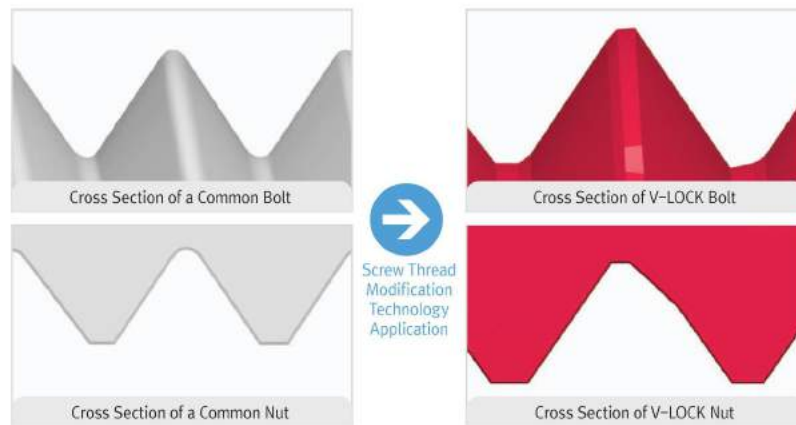


What is V-LOCK?

V-LOCK is a screw thread system with a perfect anti-loosening function. When fasteners are joined together with a specially threaded fastener, which has the V-LOCK screw thread on one of the bolt and nut, the loosening of bolts and nuts during vibration and impact is prevented.

Principle of V-LOCK

The screw thread of V-LOCK consists of two tangential parts (the first and second tangential parts) to induce double-contact point locking with the other object with a common screw thread. It maximizes the friction force between the bolt and nut screw threads through double-contact points and performs an anti-loosening function.



V-LOCK Features

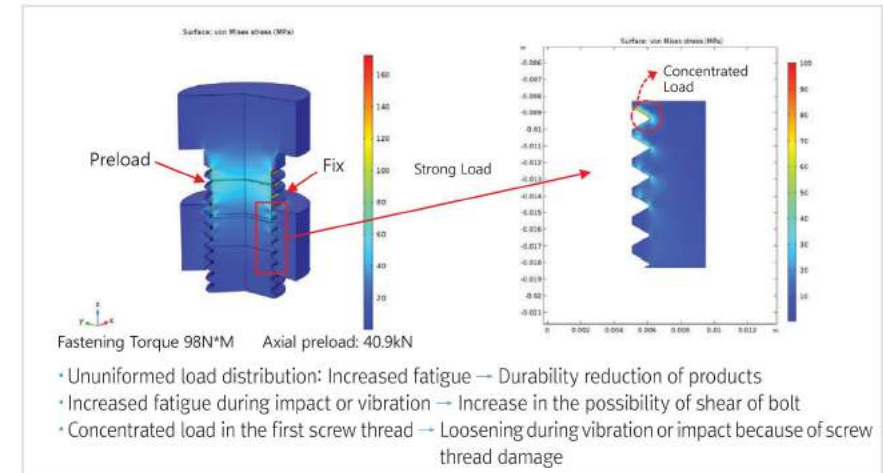
- Anti-loosening function when it is joined with fasteners with a common screw thread (V-LOCK bolt and common nut, V-LOCK nut and common bolt).
- Passed the maximum vibration test (NASA Standard: NAS 3350)
- Completed the anti-loosening function test that measures the change in axial force (Junker Test: DIN65151)
- Obtained the world's first DNV-GL classification certification for fasteners
- Daekwang Metal's patented technology
- Low unit price (same manufacturing process as the common bolts and nuts excluding the dies, tap and bite the form the V-LOCK screw thread)
- Wide range of applications (applicable regardless of the shape, material and plating of products)

V-LOCK Effects

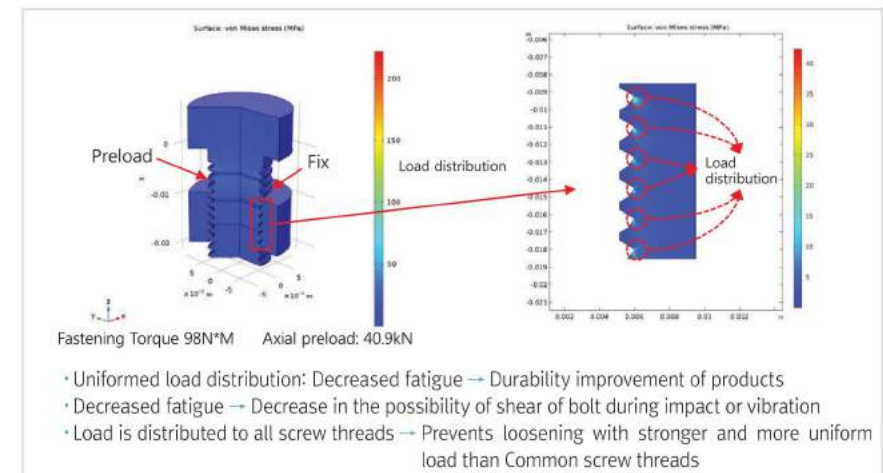
- Perfect anti-loosening effect during extreme vibration and impact
- Modifies the screw thread of the common bolt and nut specifications → Alternative for existing products
- Component parts, such as washers, double fastening, coating processes, screw adhesives, and others are not required. → Cost reduction due to the single fastening of the bolt and nut
- Same torque as the fastening and loosening of common bolts and nuts → Increases work efficiency

V-LOCK Screw Thread Structural Analysis

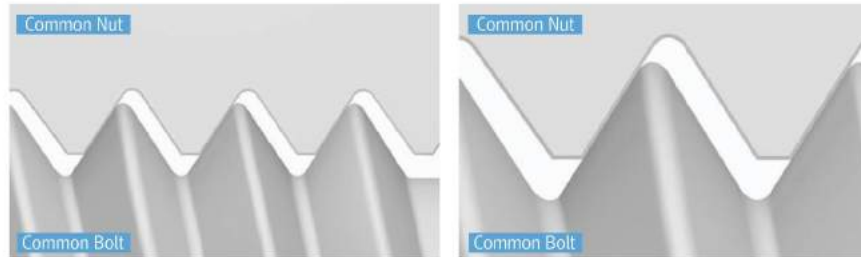
Common Screw Thread



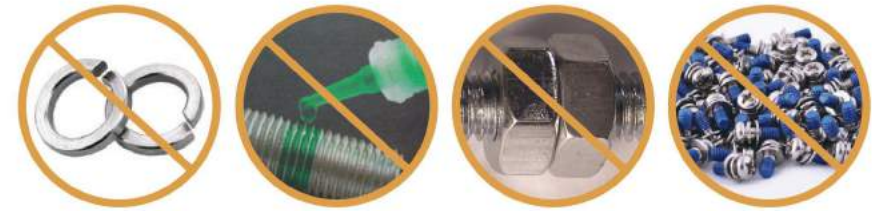
V-LOCK Screw Thread



Fastening with a Common Bolt and a Nut



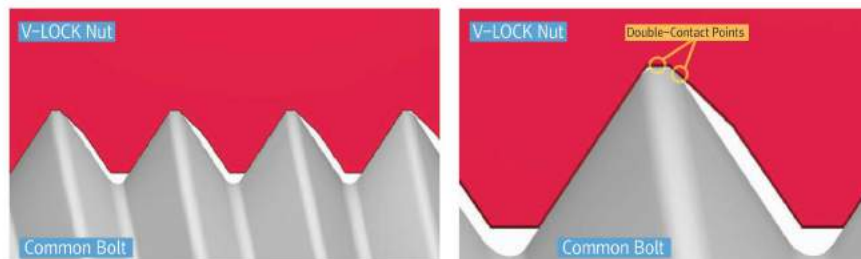
V-LOCK Superiority



Fastening with the V-LOCK Bolt and a Common Nut

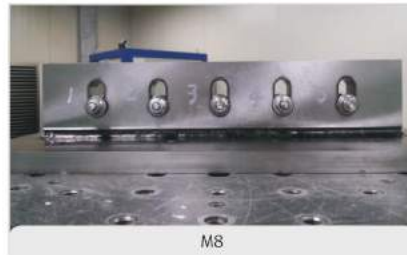
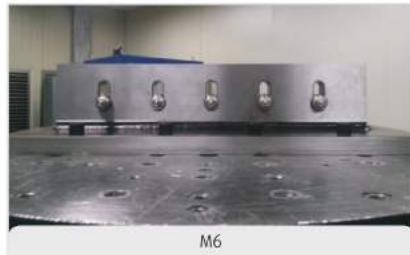


Fastening with the V-LOCK Nut and a Common Bolt



Applications	Common screw bolt	V-LOCK screw bolt
Price	Low Price	Low Price
Vibration-Impact	Loosening	Non-loosening
After fastening a spring washer and a flat washer	Loosening during vibration and impact	Loosening prevention during vibration and impact
	Cost increase	Cost reduction (Washers are unnecessary)
	Longer fastening time	Shorter fastening time
Using adhesives	Loosening prevention	Self-locking (single fastening of a bolt and a nut)
	Cost increase	Cost reduction
Applying nylon nuts, U-nuts and special washers	Loosening prevention	Self-locking (single fastening of a bolt and a nut)
	Price increase	Price reduction
Reusability after vibration and impact	Reusable but has a lower quality competitiveness	Easy release (disassembly) Reusable

KS W ISO 7481 (NAS 3350): A maximum vibration test in extreme conditions



Test Condition

- Test Level(p-p) : 0.45inch (11.43mm)
- Acceleration Peak : 20.7G
- Test Frequency : 30Hz (1,800 Cycle/min)
- Duration : 17 min (30,000 Cycle)

Result

- Maintains its fastening force even with 30% reduction in force compared with existing fastening torques to prevent loosening

DIN 65151: Junker Test



Test Description

- A mechanical vibration test for the anti-loosening property through the change of the preload of a fastened part when a shearing load is applied to the tightened bolt and nut
- When a graph slope is closer to 0°, it shows excellent fastening force maintenance.



Test Condition

- Test level : ± 1.0 mm
- Test frequency : 12.5 Hz
- Duration : 3min

Result

- ① Common screw threads fastening & ② Common screw thread and a plain washer fastening & ③ Common screw threads a plain washer and a spring washer fastening : Loosening within 1 min
- ④ Common nylon screw threads remain fastened with the end load that decreased by 71% compared to the initial load
 - High possibility of loosening as time passes because of unstable axial force
- ⑤ V-LOCK screw threads remain fastened with the end load that decreased by only 25% compared to the initial load

V-LOCK Bolt Manufacturing Process



V-LOCK Bolt Quality Control



V-LOCK Nut Manufacturing Process



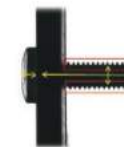
Inspection Items

Upper Camera



- Head part's external diameter and clogging
- Head and hexagonal concentricity
- Size
- Hexagonal shape
- Burr and scratch

Side Camera



- Whole length
- Head part's height
- Screw thread pitch
- Screw part's external diameter
- Screw shape (check double-screw thread angle)
- Occurrence of screw distortion

V-LOCK Nut Quality Control

Tapping Machine – Torque defect detection control method



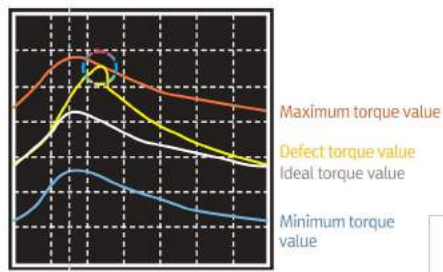
- ① RPM and tap forward/backward time setting
- ② Torque maximum and minimum value setting
- ③ Automatic notification in case the torque is out of the setting value during processing (stop operation)

When the torque is exceeded the setting value

- Abrasion of the nut tap
- Nut forging (internal diameter) defect
- Eccentric processing of tapping
- Jamming of the chip inside the screw

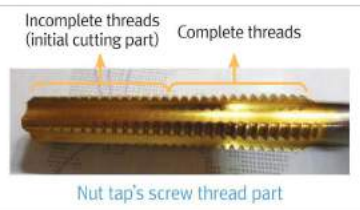
When the torque is under the setting value

- Feeder supply defect
- Nut forging (internal diameter) defect
- Tap damage



Nut tap's complete threads processing section
Nut tap's incomplete threads processing section

〈Torque Defect Detection Graph〉



Nut tap's screw thread part

V-LOCK Screw Thread Applied Products



Hexagon Head Bolt

Hexagon Wrench Bolt

Neck Square Bolt

Eye Bolt



U Bolt

Anchor Bolt

Set Anchor

Stud Bolt



Torque Share Bolt

Hot Dip Galvanized Bolt



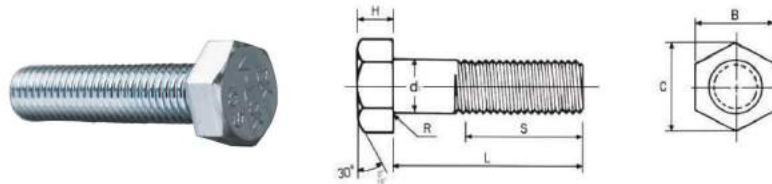
Hot Dip Galvanized Nut

Hexagon / Flange Nut

Processed Goods

Custom order available.

V-LOCK Hexagonal Bolt Specification



KS B 1002, JIS B 1180

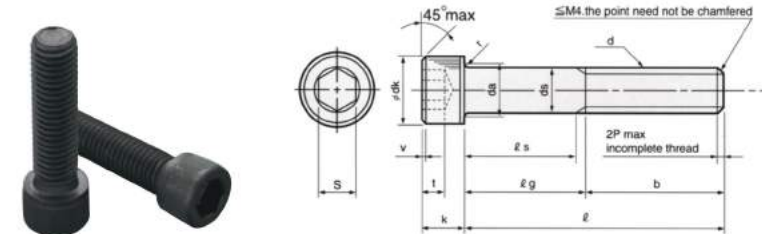
Unit : mm

Bolt diameter		d ₁			H				B				C		R		S	
Pitch		Basic	Tolerance		Basic	Tolerance			Basic	Tolerance			APP	Min				
Coarse	Fine		finish	semi finish	regular	finish	semi finish	regular	Basic	finish	semi finish	regular						
M6X1	-	6	0.3		0.18 0.15	4			10	0.2	0.6	0.6	11.5	0.25	18	-	-	-
(7MX1)	-	7				5			11				12.7	0.25	20	-	-	-
M8X1.25	M8X1	8	0.15	0.2	+0.7 -0.2	5.5			13	0.25	0.7	0.7	15	0.4	20	-	-	-
M10X1.5	M10X1.25	10				7			17				19.6	0.4	20	-	-	-
M12X1.75	M12X1.25	12				8			19				21.9	0.6	30	36	-	-
(M14X2)	(M14X1.5)	14			0.9 0.2	9			22				25.4	0.6	34	40	-	-
M16X2	M16X1.5	16				10			24	0.35	0.8	0.8	37.7	0.6	38	44	-	-
(M18X2.5)	(M18X1.5)	18				12			27				31.2	0.6	42	48	-	-
M20X2.5	M20X1.5	20				13			30				34.6	0.8	40	52	-	-
(M22X2.5)	(M22X1.5)	24				14			32				37	0.8	50	56	-	-
M24X3	M24X2	24			0.95 -0.35	15			36				41.6	0.8	54	60	-	-
(M27X3)	(M27X2)	27				17			41	0.4	1	1	47.3	1	60	66	79	
M30X3.5	M30X2	30				19			46				53.1	1	60	72	85	
(M33X3.5)	(M33X2)	33				21			50				57.7	1	72	78	91	
M36X4	M36X3	36				23			55				63.5	1	78	84	97	
(M39X4)	(M39X3)	39				25			60				69.3	1	84	90	103	
M42X4.5	-	42	0.25	0.4	-0.4	26			65				75	1.2	90	96	109	
(M45X4.5)	-	45				28			70	0.45	1.2	1.2	80.8	1.2	96	102	115	
M48X5	-	48				30			75				86.5	1.6	102	108	121	
(M52X5)	-	52			+12 0.7	33			80				92.4	1.6	-	116	129	
M5.6X5.5	-	56				35			85				98.1	2	-	124	137	
(M60X5.5)	-	60				38			90				104	2	-	132	145	
(M64X6)	-	64				40			95				110	2	-	140	153	
(M68X6)	-	68	0.3	0.45	-	43			100	0.55	1.4	-	115	2	-	148	161	
-	M27X6	72				45			105				121	2	-	156	169	
-	(M76X6)	76				48			110				127	2	-	164	177	
-	M80X6	80				50			115				133	2	-	172	185	

* Material: Steel (8.8 T or higher), SUS 304, SUS 316L, Special material available

* No restrictions on the materials, type and plating as long as the screw thread of V-LOCK is formable

V-LOCK Hexagonal Wrench Bolt Specification



Unit : mm

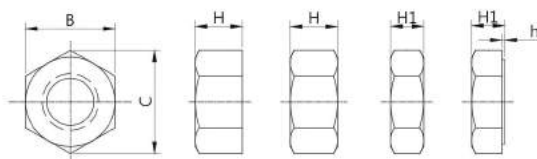
Nom Size d	Pitch P	Thread Length b	d ₁		dk		k		S		t	r	da	v
			최대	최소	최대	최소	최대	최소	최대	최소	최소	최소	최대	최대
M1.6	0.35	15	1.6	1.46	3.14	2.86	1.6	1.46	1.545	1.520	0.7	0.1	2	0.16
2	0.4	16	2	1.86	3.98	3.62	5	1.86	1.545	1.520	1	0.1	2.6	0.2
2.5	0.45	17	2.5	2.36	4.68	4.32	2.5	2.36	2.045	2.020	1.1	0.1	3.1	0.25
(2.6)	0.45	-	-	-	4.50	4.32	2.6	2.46	2.045	2.020	1.1	0.1	3.2	-
3	0.5	18	3	2.86	5.68	5.32	3	2.86	2.560	2.520	1.3	0.1	3.6	0.3
4	0.7	20	4	3.82	7.22	6.78	4	3.82	3.080	3.020	2	0.2	4.7	0.4
5	0.8	22	5	4.82	8.72	8.28	5	4.82	4.095	4.020	2.5	0.2	5.7	0.5
6	1	24	6	5.82	10.22	9.78	6	5.70	5.095	5.020	3	0.25	6.8	0.6
8	1.25	28	8	7.78	13.27	12.73	8	7.64	6.095	6.020	4	0.4	9.2	0.8
10	1.5	32	10	9.78	16.27	15.73	10	9.64	8.115	8.025	5	0.4	11.2	1
12	1.75	36	12	11.73	18.27	17.73	12	11.57	10.115	10.025	6	0.6	13.7	1.2
(14)	2	40	14	13.73	21.33	20.67	14	13.57	12.142	12.032	7	0.6	15.7	1.4
16	2	44	16	15.73	24.33	23.67	16	15.57	14.142	14.032	8	0.6	17.7	1.6
(18)	2.5	48	18	17.73	27.33	26.67	18	17.57	16.142	16.032	9	0.6	20.2	1.8
20	2.5	52	20	19.67	30.33	29.67	20	19.48	17.230	17.050	10	0.8	22.4	2
(22)	2.5	56	22	21.67	33.39	32.61	22	21.48	17.230	17.050	11	0.8	24.4	2.2
24	3	60	24	23.67	36.39	35.61	24	23.48	19.275	19.065	12	0.8	26.4	2.4
(27)	3	66	27	26.67	40.39	39.61	27	26.48	19.275	19.065	13.5	1	30.4	2.7
30	3.5	72	30	29.67	45.39	44.61	30	29.48	22.275	22.065	15.5	1	33.4	3
(33)	3.5	78	33	32.61	50.39	49.61	33	32.38	24.275	24.065	16.5	1	36.4	3.3
36	4	84	36	35.61	54.46	53.54	36	35.38	27.275	27.065	19	1	39.4	3.6
(39)	4	90	39	38.61	58.46	57.54	39	38.38	27.275	27.065	20	1	42.4	3.9
42	4.5	96	42	41.61	63.46	62.54	42	41.38	32.330	32.080	21	1.2	45.6	4.2
(45)	4.5	102	45	44.61	68.46	67.54	45	44.38	32.330	32.080	23	1.2	48.6	4.5
48	5	108	48	47.61	72.46	71.54	48	47.38	36.330	36.080	24	1.6	52.6	4.8
(52)	5	116	52	51.54	78.46	77.54	52	51.26	36.330	36.080	26	1.6	56.6	5.2

* Material: Steel (8.8 T or higher), SUS 304, SUS 316L, Special material available

* No restrictions on the materials, type and plating as long as the screw thread of V-LOCK is formable

V-LOCK Hexagonal Nut Specification

KS B 1012



Unit : mm

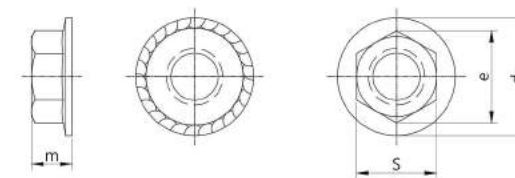
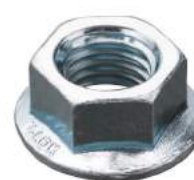
Products	Type	Size	Pitch	H	H1	B	C	D	h	D1(min)
V-LOCK NUT	Hex	M6	1	5	3.6	10	11.5	9.8	0.4	9.0
		M8	1.25	6.5	5	13	15.0	12.5	0.4	11.7
		M10	1.5	8	6	17	19.6	16.5	0.4	15.8
		M12	1.75	10	7	19	21.9	18	0.6	17.6
		M14	2	11	8	22	25.4	21	0.6	20.4
		M16	2	13	10	24	27.7	23	0.6	22.3
		M18	2.5	15	11	27	31.2	26	0.6	25.6
		M20	2.5	16	12	30	34.6	29	0.6	28.5
		M22	2.5	18	13	32	37.0	31	0.6	30.4
		M24	3	19	14	36	41.6	34	0.6	34.2
		M27	3	22	16	41	47.3	39	-	-
		M30	3.5	24	18	46	53.1	44	-	-
		M33	3.5	26	20	50	57.7	48	-	-
		M36	4	29	21	55	63.5	53	-	-
		M39	4	31	23	60	59.3	57	-	-
		M42	4.5	32	25	65	75	62	-	-

* Material: Steel (8.8 T or higher), SUS 304, SUS 316L, Special material available

* No restrictions on the materials, type and plating as long as the screw thread of V-LOCK is formable

V-LOCK Flange Nut Specification

KS B 1043



Unit : mm

Products	Type	Size	Pitch	S	e	dc	m
V-LOCK NUT	Flange	M6	1	10	11.05	14	6
		M8	1.25	12	13.25	17.5	8
		M10	1.5	14	15.51	21	10
		M12	1.75	17	18.90	25	11.5

* Material: Steel (8.8 T or higher), SUS 304, SUS 316L, Special material available

* No restrictions on the materials, type and plating as long as the screw thread of V-LOCK is formable

Application



Railroad Industry



Railroad



Wheel



Connection



Lower part



Automotive Industry (Excavator, specially equipped vehicle, farming implement)



Engine



Wheel



Chassis



Suspension

Application



Construction Industry



Electric wire construction



Steel-frame structure



Piping connection



Guardrail



Shipbuilding Industry



Blade



Engine unit



Cable tray



Switchboard

Certificates



Patent



V-LOCK