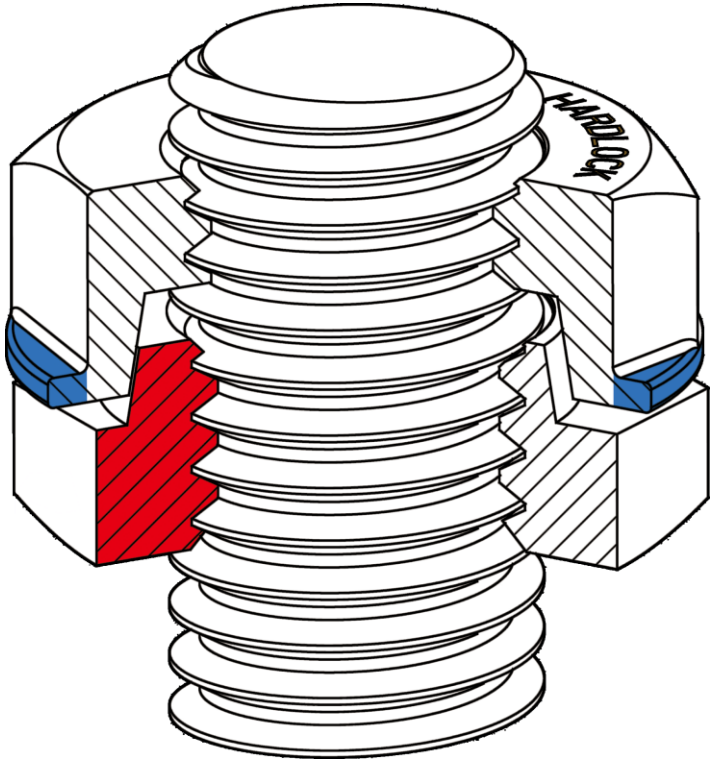
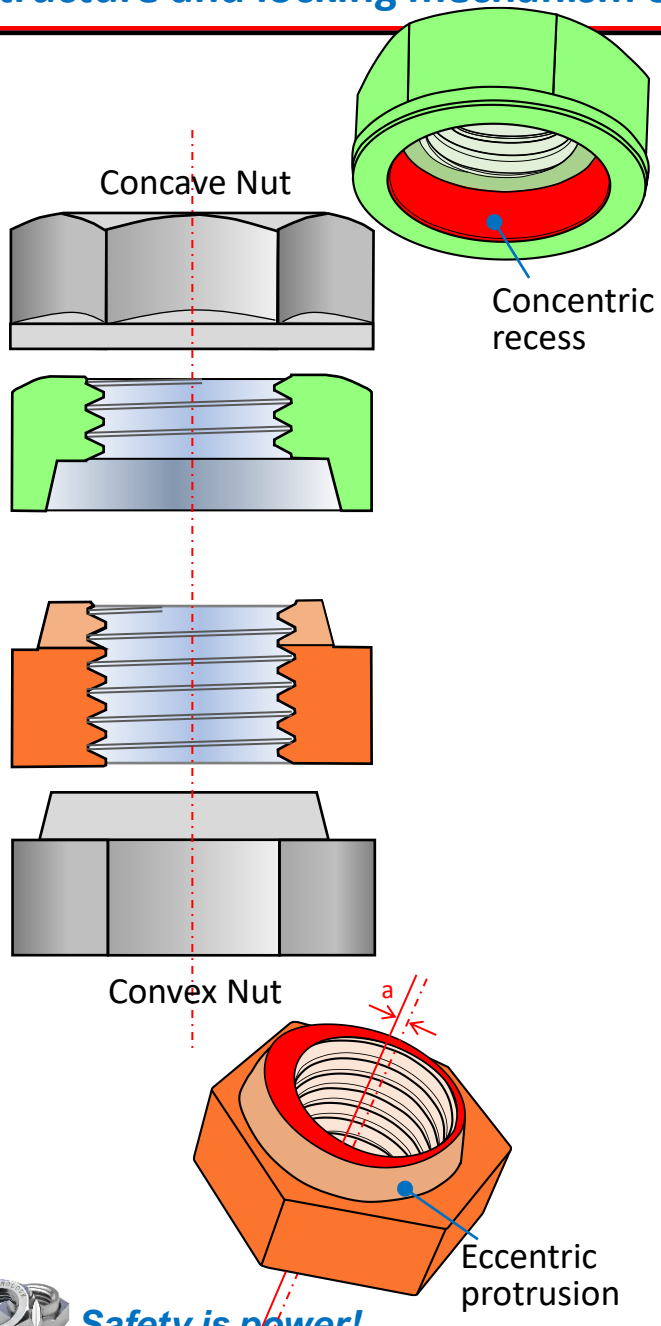
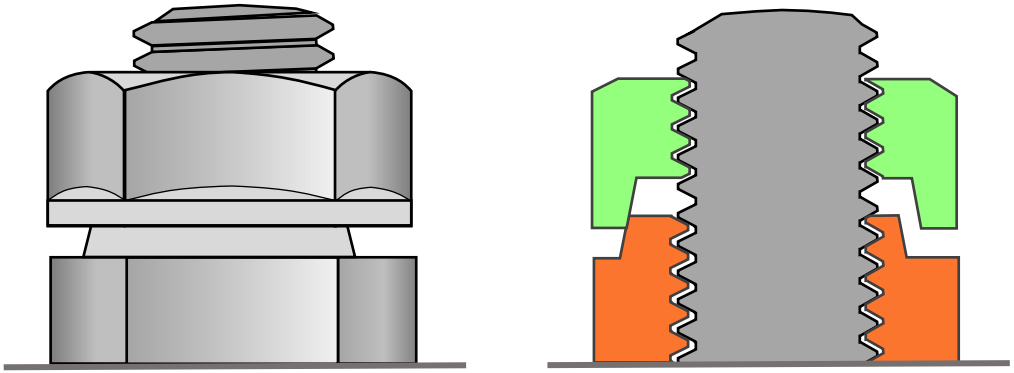


HARDLOCK® Solution

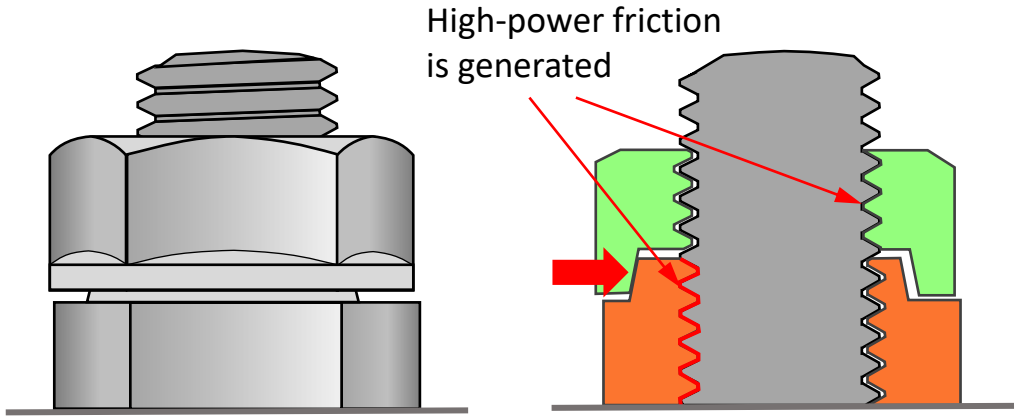
Structure and Locking Mechanism

Structure and locking mechanism of HARDLOCK Nut (HLN)





The first nut **Convex Nut** (clamping nut) has an eccentric conical protrusion on the upper surface. The Convex Nut that has the same strength class as a regular hexagon nut is to be tightened to the appropriate torque for the application. The Concave Nut is screwed down manually by hand until it no longer turns.



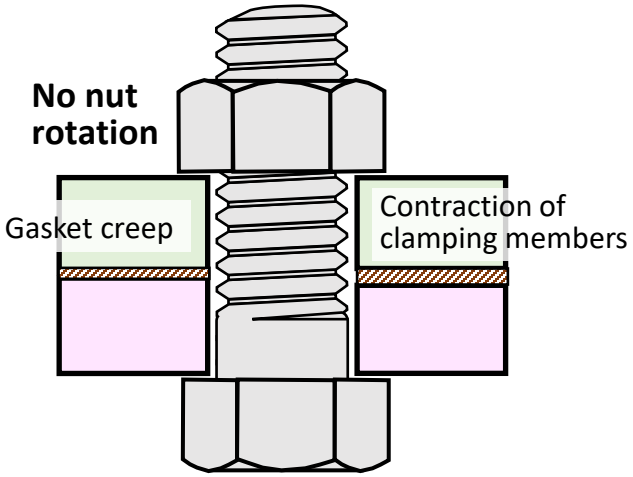
The second nut **Concave Nut** (locking nut) is designed with a concentric conical recess that contacts the protrusion of Convex Nut to generate a strong perpendicular load with resultant elimination of the play (gap) between the Convex Nut and bolt.

How self-loosening can occur

There are two types of loosening process; **Non-rotational loosening** is when no relative movement occurs between the internal and external threads but a preload loss occurs, and **Rotational loosening** is when the fastener rotates under the action of external loading.

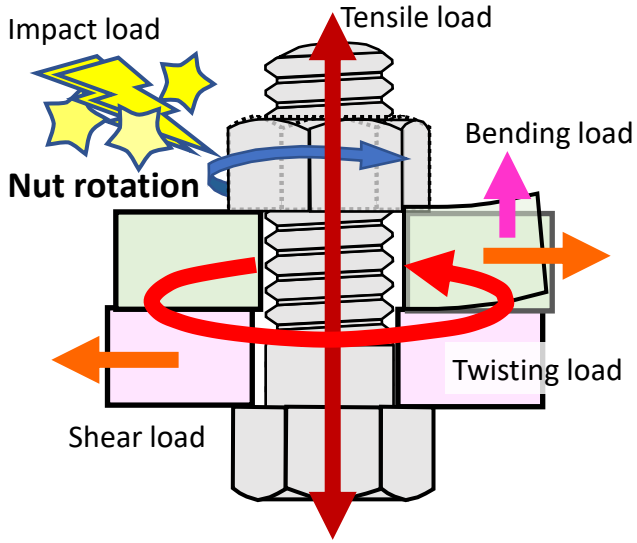
Loosening can be defined as a subsequent loss of preload

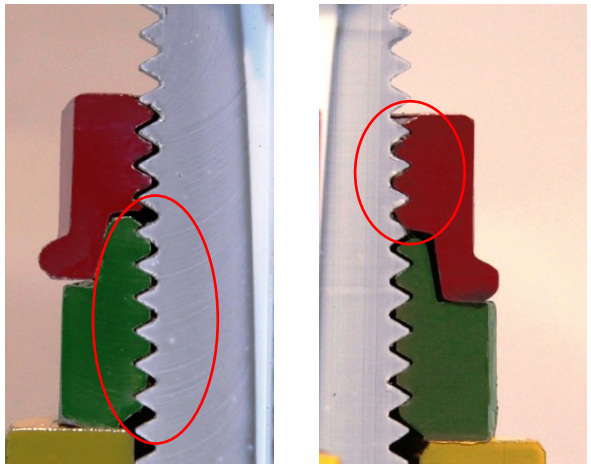
Non-Rotational Loosening



Differential thermal expansion between the bolt & joint

Rotational Loosening
affected by the external forces

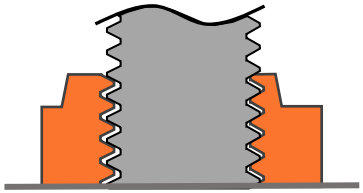




The picture shows the engagement between the threads of bolt and HLN Convex nut after tightening the Concave nut to apply enough compression to the protrusion of the Convex nut.
When the nut is fixed to the bolt without play (gap), very strong friction is generated in the contact areas, which prevents any external forces or vibrations from making the nut rotate.

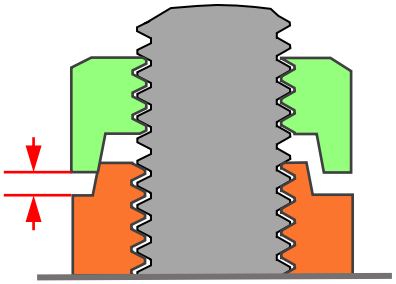
Installation of HARDLOCK Nut (HLN)

1



Use a tightening tool (spanner, torque wrench etc.) to tighten the Convex Nut to the appropriate torque for the application. The convex nut has the same strength class as a regular hexagon nut and can therefore be tightened to the maximum limit of a mating bolt.

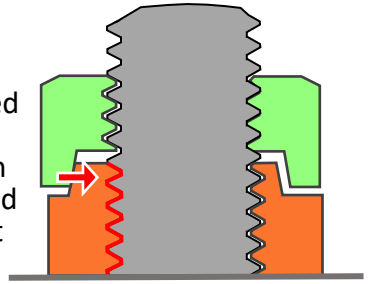
2



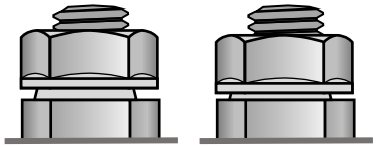
Install the Concave nut onto the Convex nut manually by hand until it no longer turns (in other words, until prevailing torque is generated). Make sure that there is a gap of more than 1 thread pitch between the nuts.
If the gap is less than 1 pitch, there may be a chance that sufficient locking effect will not be produced. Do not use such combination of HLN and the bolt. (The same conditions apply to reuse criterion.)

3

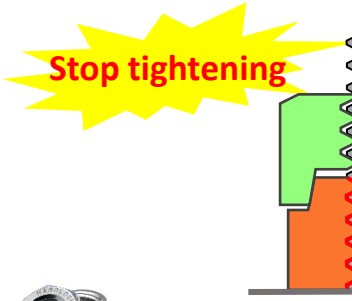
The recommended tightening torque generates enough perpendicular load to the Convex nut



Tighten the Concave nut within the **recommended torque set by HARDLOCK Industry** that is a guide to achieve the Concave nut being turned around 360 degrees. (HLN in Stainless and Hot Dip Galvanizing treatment have higher torque coefficient, they shall be tightened to the highest range of the recommended torque or more.)



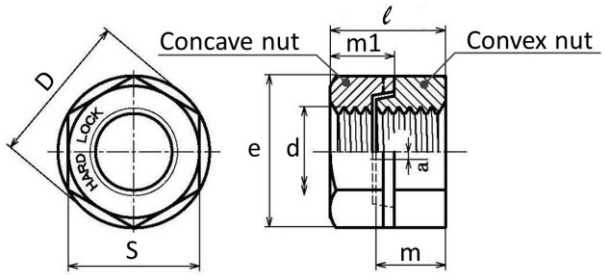
After proper tightening, the gap between the two nuts varies due to the difference in bolt tolerance or surface treatment.

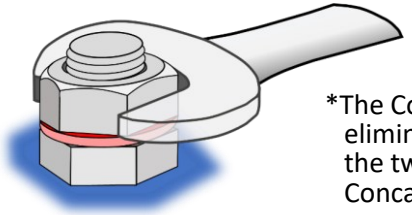


Further tightening beyond one-sided contact will generate strong frictional load to the threads

The Concave nut can be torqued until the both nuts come into contact beyond the recommended tightening torque. The Concave nut slightly inclines after the contact between the protrusion and the recess, and this status is referred as **'one-sided contact'**. When one-sided contact is achieved, the tightening torque rapidly increases. If further tightened, almost all the torque is absorbed in the thread friction between the Concave nut and the bolt, which leads to **bolt thread fracture**.

Availability of HARLOCK Nut Rim





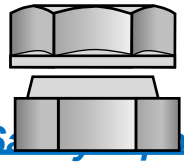
*The Concave Nut is equipped with a flange that eliminates the risk of "spanner slip" between the two nuts during the torqueing of the Concave nut (Upper nut).

Dimensional Table & Recommended Tightening Torque for Concave Nut

Unit: mm

Nominal Size	Pitch	Thickness				Width across flats		e	Overall height	Rim dia.	Unit Weight	Recommended tightening torque for Concave nut (N-m) For all materials (Min – Max)
		Convex nut		Concave nut								
d	P	m		m1		s			ℓ	D	(g)	
		Basic	Tolerance	Basic	Tolerance	Basic	Tolerance	approx.	approx.	approx.	approx.	
M5	0.8	4	0.1/-0.15	4	0.5/-0.2	8	0/-0.2	9.2	7.2	9.2	1.9	2 - 3
M6	1	5	±0.3	5	0/-0.3	10	0/-0.6	11.5	8.5	11.5	4	4 - 5
M8	1.25	6.5	0/-0.58	6.5	0/-0.58	13	0/-0.7	15.0	10.8	15.0	8.9	9 - 13
M10	1.5	8	0/-0.58	8	0/-0.58	17	0/-0.7	19.6	13.2	19.6	18	18 - 24
M12	1.75	10	0/-0.58	9.3	0/-0.58	19	0/-0.58	21.9	16.0	21.9	26	27 - 39
M16	2	13	±0.9	11	0/-0.7	24	0/-0.8	27.7	21.2	27.7	46	70 - 100
M20	2.5	16	±0.9	14.5	0/-0.7	30	0/-0.8	34.6	26.7	34.6	93	120 - 200
M22	2.5	18	±0.9	15.6	0/-1.2	32	0/-1	37.0	29.9	37.0	115	150 - 250
M24	3	19	±0.9	17.6	0/-1.2	36	0/-1	41.6	32.4	41.6	183	160 - 300
M27	3	21	±1.0	17.6	0/-1.2	41	0/-1	47.3	33.5	47.3	243	250 - 390
M30	3.5	23	±1.0	18.6	0/-1.2	46	0/-1	53.1	36.5	53.1	312	270 - 440

Class 10 HARDLOCK Nut Rim



* Class 10 HARDLOCK Nut Rim is composed of Convex nut in Class 10 SCM435 and Concave nut in Class 8 S45C. While the Convex nut generates a clamp force, the Concave nut just locks the Convex nut and the bolt and has no need to match its strength to that of the bolt.

Standard
-External dimensions: JIS B1181(2014) Annex JA (Width across flats only)
-Thread tolerances: JIS B0209(2001)/ISO 965 6H

Material
-Class 4 JIS SS400 equivalent 1.0044 (S275JR)
-Class 8 JIS S45C equivalent 1.1191 (C45E) - Heat treated
-Class 10 JIS SCM435 equivalent 1.7220 (34CrMo4) - Heat treated (JIS S45C is used as the material for Concave nut of Class10 HLN-R)
-A2-70 JIS SUS304 equivalent 1.4301 (X5CrNi18-10)
* HLN-R Class 8 and Class 10 are only available for M8 or bigger.
* HLN-R A2-70 is only available up to M16 (then A2-50)

Surface Treatment
-Class 4 with Trivalent Chromate or Hot-dip Galvanizing (HDZ 35) (for M8 or bigger)
-Class 8 with Manganese Phosphate coating or Zinc Trivalent Chromate
-Class 10 with Manganese Phosphate coating
-A2 in plain/uncoated
*Other surface treatments are available on made-to-order basis.

Advantage and Disadvantage of HARDLOCK Nut

<Advantage>

(1) Fail safe fastening performance in the most demanding environment

HARDLOCK mechanism creates no clearance between the male and female threads on the bolted joint that makes it resistant to vibrations and impacts from any directions.

(2) Reusable without almost any decrease in performance

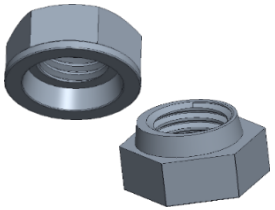
HARDLOCK Nuts are entirely made from metal only and do not use plastic deformation to create an interference fit, unlike prevailing torque nuts.

(3) Torque control tightening is possible

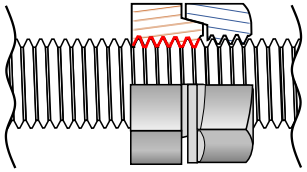
Tightening the Convex nut with appropriate torque will achieve a target clamp force. Can be fastened to a bolt even with zero (0) clamp force.

(4) Available in various materials and surface treatment

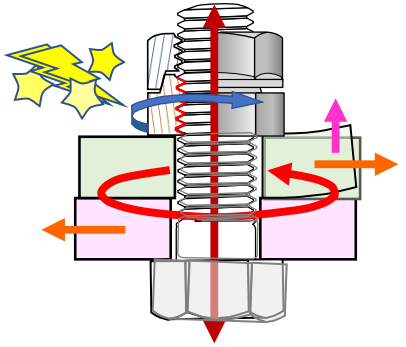
(5) No special tools are required for installation



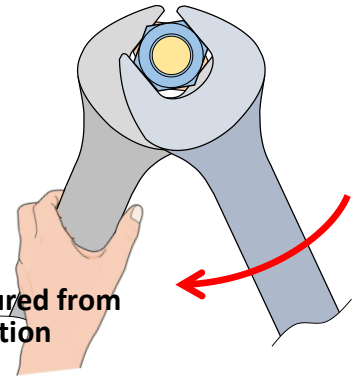
Made from all metal



Can be fixed in the middle of a bolt (No need of seating surface)



HARDLOCK Nut withstands external loads from any directions



When the Convex nut is not or very little preloaded, it shall be held not to turn while tightening the Concave nut.

<Disadvantage>

(1) The cost is much higher than ordinary nuts, even some types of self-locking nuts

(2) The overall height of two nuts may be too high for some applications

(3) Two nuts tightening is regarded as troublesome, especially for car industry

(4) Difficult to fasten in tight spaces

(5) If there are no loosening problems, no need to replace with HARDLOCK Nuts