WÜRTH

Wuerth Industrial Services Malaysia

W.TEC® SECURING

Wedge lock washers • Ring lock washers

Wedge lock nuts • Wheel nuts

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Dear customer of Würth Industrie Service,

Within the Würth Group, Würth Industrie Service GmbH & Co. KG is responsible for delivering industrial customers. In 1999, the company was separated from the parent group Adolf Würth GmbH & Co. KG and became an independent company. Since that date, Würth Industrie Service is operating from their location at the Industrial Park in Bad Mergentheim/Germany.

The wide range of C-Parts adapted to the needs of specific target groups and the unique supply concept make Würth Industrie Service be your competent partner for C-Parts. The product range of Würth Industrie Service is focused on industrial requirements for production needs, small parts and assembly material for the construction of plants, machines and vehicles as well as the maintenance equipment.

Würth Industrie Service provides market support and consequently analyses the current needs and the future requirements of all customers.

The wedge lock washers, ring lock washers, wedge lock nuts and wheel nuts expand our standard range of locking elements and meet the requirements of the automotive industry as well as the machinery and plant engineering. In addition to the products, Würth Industrie Service provides competent and individual technical customer service.

Learn more about these securing elements in our brochure W.TEC®SECURING.

We are looking forward to a cooperative partnership and thank you for your confidence.

i.V. Martin Jauss
Head of Product Divisons and Marketing
Würth Industrie Service GmbH & Co. KG

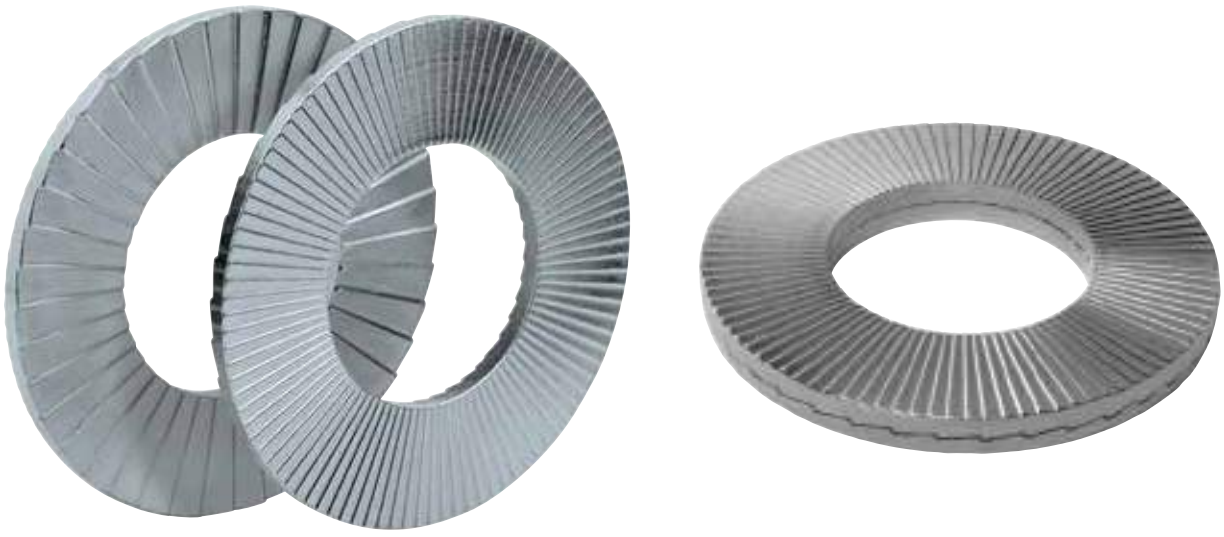
Wedge lock washers

The wedge lock washers provide a high-quality locking system for demanding bolted joints that s a reliable locking ven in case of extreme vibrations or dynamic loads and ensures a maximum of security. An important rence between wedge lock washers and already available other systems is that preload instead of friction is used for securing bolted joints.

The wedge lock washers have got radial teeth on the outside and a wedge-shaped surface on the inside. The washers already stick together in pairs and are placed underneath the bolt head and/or the nut. When tightening the bolt, the radial teeth grab into the respective mating surface so that movement is only possible between the inner wedge-shaped surfaces. The displacement of the wedge-shaped surfaces ensures that the clamping force in the bolted joint is increased.

Advantages

- Easy installation and removal (the wedge lock washers already stick together in pairs)
- Certified system for securing bolts (locking system), in case of high or low preload
- Particularly suitable for dynamic loads – even if lubricants are used
- Reusable multiple times without loosing quality
- Gentle to the surface
- Also possible for use with high-tensile bolts 8.8, 10.9 and 12.9 and the respective nuts
- Available in steel or stainless steel (other materials are available on request)
- With narrow and wide bearing surface



Ring lock washers

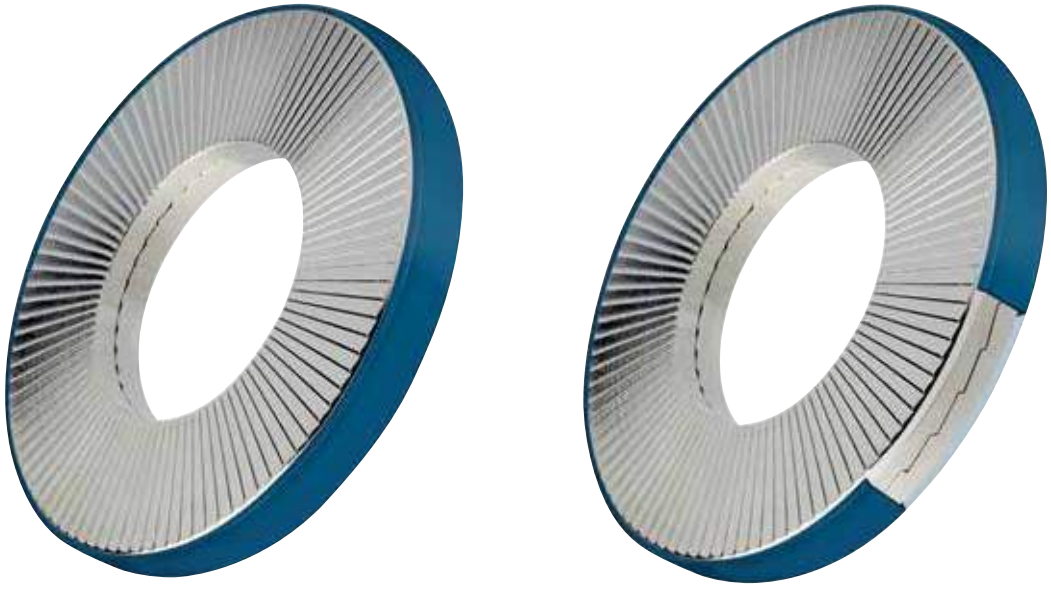
Ring lock washers provide high-quality and user-friendly securing for demanding bolted joints - especially in case of multiple use. The ring locking system ensures a permanent fastening and a correct positionning of both washer halves. This makes it possible that even non-specialists can install the bolt locking system safely and quickly at any time.

Structure of the ring locking system

The ring lock washers are already pre-assembled on delivery. The ring locking system consists of a polyamide ring (PA) and the already known wedge lock washers. Whereas the wedge lock washers secure the bolted connections in the proven way, the ring permanently fixes both individual washers in the correct position.

Advantages

- Easy installation and removal (the ring lock systems are already pre-assembled)
- Certified system for securing bolts (locking system), in case of high or low preload
- Particulary suitable for dynamic load – even if lubricants are used
- Reusable multiple times without loosing quality
- Gentle to the surface
- Also possible for use with high-tensile bolts 8.8, 10.9 and 12.9 and the respective nuts
- Available in steel and stainless steel (other materials are available on request)
- With narrow and wide bearing surface
- No risk of wrong installation in case of multiple use due to the ring locking system



Wedge lock nuts and wheel nuts

Especially in case of multiple use, wedge lock nuts and wheel nuts ensure a high-quality, assembly- and user-friendly securing system for demanding bolted joints. The combination of a wedge lock washer and a nut to one unit makes securing bolted joints easier and more efficient even under extreme vibrations and dynamic loads.

Structure of a wedge lock nut and a wheel nut

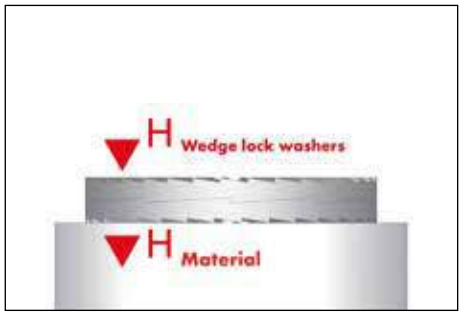
The wedge lock nuts and wheel nuts are already pre-assembled. Consisting of a flange nut and a conventional wedge lock washer, these two elements form a unit so that they are combined in a captive and rotary way. Similar to the ring lock washers, this pre-assembled connection ensures a correct positioning and arrangement of the wedge lock nut during every installation at any time. The wedge lock nuts and wheel nuts provide a securing effect according to the proven principle of the wedge lock washer.

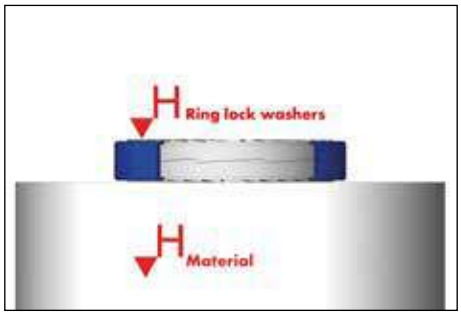
Advantages

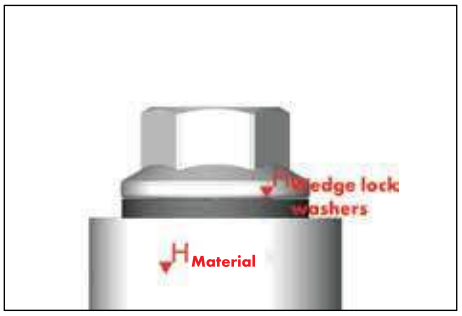
- Minimized error risk already during the design phase
- Minimized risk of operating failures and production downtimes caused by defective bolted connections
- Permanent securing and correct positioning of the wedge lock washers
- Reduction of assembly time and effort
- Handling advantages, especially in places difficult to access
- Reduction of components
- Easy, reliable and quick installation, even for non-specialists
- Reusable multiple times without loosing quality
- Gentle to the surface
- The wedge lock nuts and wheel nuts have got property class 10 and are therefore suitable for bolted joints in property class 8.8 and 10.9.

Function principle

ence in hardness

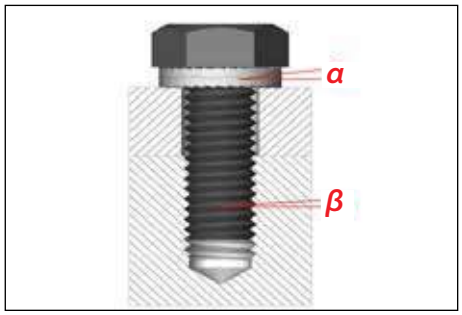


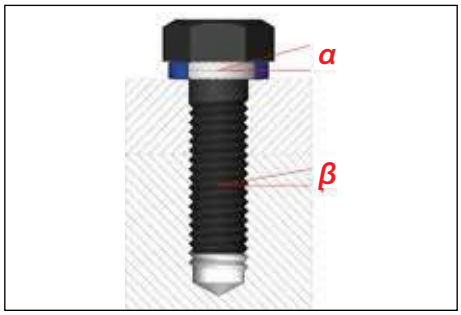


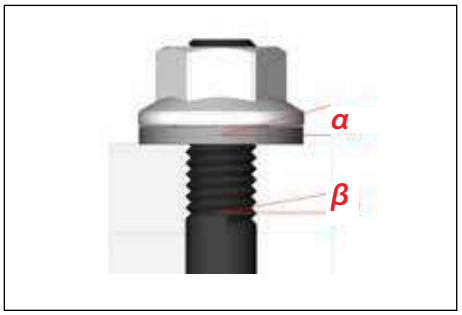


- The surface hardness of lock washers is higher than that of standard bolts (property class 8.8, 10.9 and 12.9).
  - Ha dness Steel (completely hardened) 485 ± 25 HV0.3
  - Ha dness Stainless steel (surface hardened) > 520 HV0.05
- The radial teeth on the outside of the wedge lock washer grab into the mating material. The result is an interlocking effect when tightening the bolted joint.

ence in angles $\alpha > \beta$

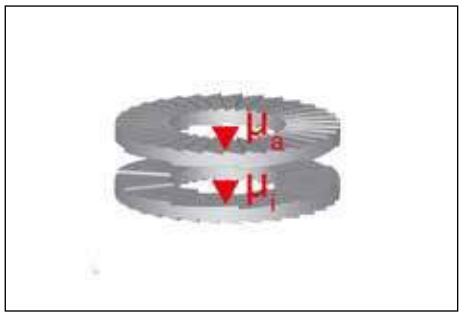


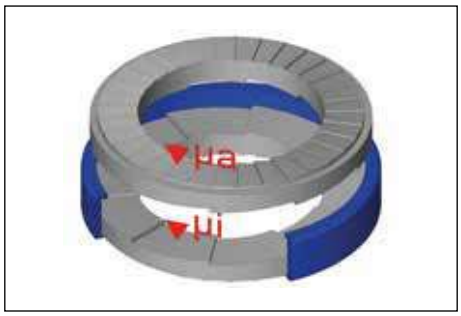


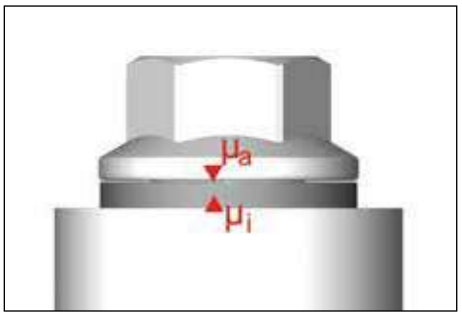


- The pitch angle of the wedge-shaped surfaces (α) is bigger than the pitch angle of the bolt thread (β) and is adapted to the pitch of the respective bolt sizes (ISO standard thread and UNC thread).
- Therefore, the locking principle bases on the angle α of the wedge-shaped surfaces. In case the bolt completely self-loosens, there will be a self-locking effect due to the wedge-locking action and the related angle difference $\alpha > \beta$.

ence in friction $\mu_a > \mu_i$

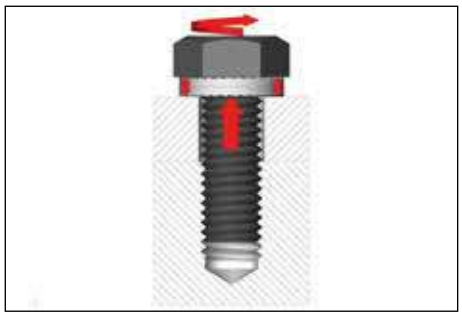






- The wedge-shaped surfaces of both halves have a considerably lower coefficient of friction (μ_i) than the toothed outside (μ_a) of the washers.
- Due to the above mentioned properties, loosening (caused by dynamic loads) always leads to movement between the two washer halves and not to movement between the washer and the mating material or the washer and the nut/bolt.

ence in preload $F_{dyn} > F_{stat}$



- The wedge-shaped surfaces of both halves have a considerably lower coefficient of friction (μ_i) than the toothed outside (μ_a) of the washers.
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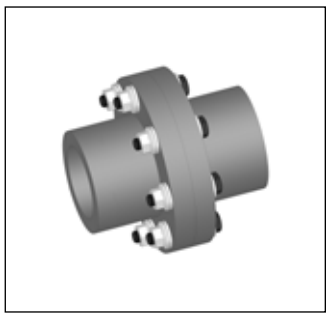
Application examples

Hexagon bolt in a through hole secured on both sides

Hexagon bolt secured in a blind hole

Countersunk socket head bolt secured in position

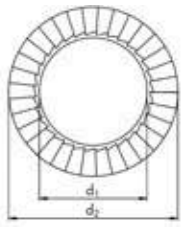
No locking function in combination with flat washers



Application example for wedge lock nuts

WEDGE LOCK WASHERS

Steel, narrow shape



Surface: Zinc flake coating (Delta Protekt)*

Hardness: 485 ± 25 HV0.3

* chromium(VI)-free

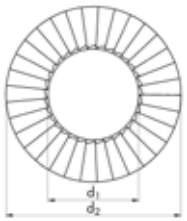
For metric threads	For inch threads	Inner Ø d_1 [mm]	Outer Ø d_2 [mm]	Thickness h_1 [mm]	Art.- no.
M3	#5	3.4	7.0	1.7	**0401780003**
M3.5	#6	3.9	7.6	1.7	**0401780035**
M4	#8	4.4	7.6	1.7	**0401780004**
M5	#10	5.4	9.0	1.7	**0401780005**
M6	–	6.5	10.8	1.7	**0401780006**
–	1/4 inch	7.2	11.5	1.7	**0401781025**
M8	5/16 inch	8.6	13.5	2.7	**0401780008**
–	3/8 inch	10.3	16.0	2.7	**0401781037**
M10	–	10.7	16.6	2.7	**0401780010**
M11	7/16 inch	11.4	18.5	2.7	**0401780011**
M12	–	13.0	19.5	2.7	**0401780012**
–	1/2 inch	13.5	19.5	3.7	**0401781050**
M14	9/16 inch	15.2	23.0	3.7	**0401780014**
M16	5/8 inch	17.0	25.4	3.7	**0401780016**
M18	–	19.5	29.0	3.7	**0401780018**
–	3/4 inch	20.0	30.7	3.7	**0401781075**
M20	–	21.4	30.7	3.7	**0401780020**
M22	7/8 inch	23.4	34.5	3.7	**0401780022**
M24	–	25.3	39.0	3.7	**0401780024**
–	1 inch	27.9	39.0	3.4	**0401781100**
M27	–	28.4	42.0	5.4	**0401780027**
M30	1 1/8 inch	31.4	47.0	5.7	**0401780030**
M33	1 1/4 inch	34.4	48.5	5.5	**0401780033**
M36	1 3/8 inch	37.4	55.0	6.5	**0401780036**
M39	1 1/2 inch	40.4	58.5	6.2	**0401780039**
M42	–	43.2	63.0	6.3	**0401780042**
M48	–	49.6	75.0	6.5	**0401780048**

The dimension h_1 was measured in clamped condition.

Further dimensions up to M76 are available on request.

WEDGE LOCK WASHERS

Steel, wide shape



Surface: Zinc flake coating (Delta Protekt)*

Hardness: 485 ± 25 HV0.3

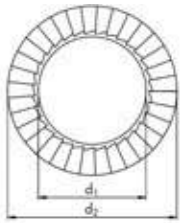
* chromium(VI)-free

For metric threads	For inch threads	Inner Ø d_1 [mm]	Outer Ø d_2 [mm]	Thickness h_1 [mm]	Art.- no.
M3.5	#6	3.9	9.0	1.7	**0401770003**
M4	#8	4.4	9.0	1.7	**0401770004**
M5	#10	5.4	10.8	1.7	**0401770005**
M6	–	6.5	13.5	2.7	**0401770006**
–	1/4 inch	7.2	13.5	2.7	**0401773025**
M8	5/16 inch	8.6	16.6	2.7	**0401770008**
–	3/8 inch	10.3	21.0	2.7	**0401773037**
M10	–	10.7	21.0	2.7	**0401770010**
M12	–	13.0	25.4	3.7	**0401770012**
–	1/2 inch	13.5	25.4	3.7	**0401773050**
M14	9/16 inch	15.2	30.7	3.7	**0401770014**
M16	5/8 inch	17.0	30.7	3.7	**0401770016**
M18	–	19.5	34.5	3.7	**0401770018**
–	3/4 inch	20.0	39.0	3.8	**0401773075**
M20	–	21.4	39.0	3.8	**0401770020**
M22	7/8 inch	23.4	42.0	4.7	**0401770022**
M24	–	25.3	48.5	4.7	**0401770024**
–	1 inch	27.9	48.5	4.7	**0401773100**
M27	–	28.4	48.5	6.7	**0401770027**
M30	1 1/8 inch	31.4	58.5	6.7	**0401770030**
M33	1 1/4 inch	34.4	58.5	6.7	**0401770033**
M36	1 3/8 inch	37.4	63.0	6.7	**0401770036**

The dimension h_1 was measured in clamped condition.

WEDGE LOCK WASHERS

Stainless steel, narrow shape



Material: Stainless steel A4 (1.4404)
Hardness: >520 HV0.05

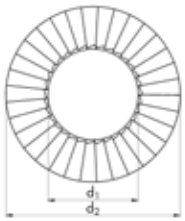
For metric threads	For inch threads	Inner Ø d_1 [mm]	Outer Ø d_2 [mm]	Thickness h_1 [mm]	Art.- no.
M3	#5	3.4	7.0.	1.6	**0404701003**
M3.5	#6	3.9	7.6	1.6	**0404701035**
M4	#8	4.4	7.6	1.6	**0404701004**
M5	#10	5.4	9.0	1.6	**0404701005**
M6	–	6.5	10.8	1.6	**0404701006**
–	1/4 inch	7.2	11.5	1.6	**0404713025**
M8	5/16 inch	8.6	13.5	2.6	**0404701008**
–	3/8 inch	10.3	16.0	2.6	**0404713037**
M10	–	10.7	16.6	2.6	**0404701010**
M11	7/16 inch	11.4	18.5	2.6	**0404701011**
M12	–	13.0	19.5	2.6	**0404701012**
–	1/2 inch	13.5	19.5	2.6	**0404713050**
M14	9/16 inch	15.2	23.0	3.6	**0404701014**
M16	5/8 inch	17.0	25.4	3.6	**0404701016**
M18	–	19.5	29.0	3.6	**0404701018**
–	3/4 inch	20.0	30.7	3.6	**0404713075**
M20	–	21.4	30.7	3.6	**0404701020**
M22	7/8 inch	23.4	34.5	3.6	**0404701022**
M24	–	25.3	39.0	3.6	**0404701024**
–	1 inch	27.9	39.0	3.4	**0404713100**
M27	–	28.4	42.0	5.3	**0404701027**
M30	1 1/8 inch	31.4	47.0	5.6	**0404701030**
M33	1 1/4 inch	34.4	48.5	5.6	**0404701033**
M36	1 3/8 inch	37.4	55.0	6.1	**0404701036**
M39	1 1/2 inch	40.4	58.5	6.0	**0404701039**
M42	–	43.2	63.0	6.2	**0404701042**
M48	–	49.6	75.0	6.6	**0404701048**
M64	–	67.1	95.0	6.6	**0404701064**

The dimension h_1 was measured in clamped condition.

Further dimensions up to M76 are available on request.

WEDGE LOCK WASHERS

Stainless steel, wide shape



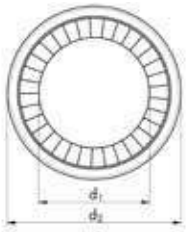
Material: Stainless steel A4 (1.4404)
Hardness: >520 HV0.05

For metric threads	For inch threads	Inner Ø d_1 [mm]	Outer Ø d_2 [mm]	Thickness h_1 [mm]	Art.- no.
M3.5	#6	3.9	9.0	1.6	**0404701103**
M4	#8	4.4	9.0	1.6	**0404701104**
M5	#10	5.4	10.8	1.6	**0404701105**
M6	–	6.5	13.5	2.6	**0404701106**
–	1/4 inch	7.2	13.5	2.6	**0404712025**
M8	5/16 inch	8.6	16.6	2.6	**0404701108**
–	3/8 inch	10.3	21.0	2.6	**0404712037**
M10	–	10.7	21.0	2.6	**0404701110**
M12	–	13.0	25.4	3.6	**0404701112**
–	1/2 inch	13.5	25.4	3.6	**0404712050**
M14	9/16 inch	15.2	30.7	3.6	**0404701114**
M16	5/8 inch	17.0	30.7	3.6	**0404701116**
M18	–	19.5	34.5	3.6	**0404701118**
–	3/4 inch	20.0	39.0	3.8	**0404712075**
M20	–	21.4	39.0	3.8	**0404701120**
M22	7/8 inch	23.4	42.0	4.6	**0404701122**
M24	–	25.3	48.5	4.6	**0404701124**
–	1 inch	27.9	48.5	4.6	**0404712100**
M27	–	28.4	48.5	6.6	**0404701127**
M30	1 1/8 inch	31.4	58.5	6.6	**0404701130**
M33	1 1/4 inch	34.4	58.5	6.6	**0404701133**
M36	1 3/8 inch	37.4	63.0	6.6	**0404701136**

The dimension h_1 was measured in clamped condition.

RING LOCK WASHERS

Steel, narrow shape



Surface: Zinc flake coating (Delta Protekt)*

Hardness: 485 ± 25 HV0.3

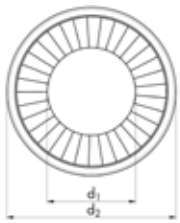
* chromium(VI)-free

For metric threads	For inch threads	Inner Ø d_1 [mm]	Outer Ø d_2 [mm]	Thickness h_1 [mm]	Art.- no.
M5	#10	5.4	9.0	1.5	**0401792005**
M6	–	6.5	10.8	1.5	**0401792006**
M8	5/16 inch	8.6	13.5	2.5	**0401792008**
M10	–	10.7	16.6	2.5	**0401792010**
M12	–	13.0	19.5	2.5	**0401792012**
–	1/2 inch	13.5	19.5	2.5	**0401794050**
M16	5/8 inch	17.0	25.4	3.5	**0401792016**
–	3/4 inch	20.0	30.7	3.5	**0401794075**
M20	–	21.4	30.7	3.5	**0401792020**
M24	–	25.3	39.0	3.5	**0401792024**
–	1 inch	27.9	39.0	3.5	**0401794100**

The dimension h_1 was measured in clamped condition.

RING LOCK WASHERS

Steel, wide shape



Surface: Zinc flake coating (Delta Protekt)*

Hardness: 485 ± 25 HV0.3

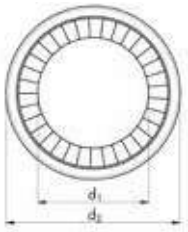
* chromium(VI)-free

For metric threads	For inch threads	Inner Ø d_1 [mm]	Outer Ø d_2 [mm]	Thickness h_1 [mm]	Art.- no.
M4	#8	4.4	9.0	1.5	**0401791004**
M5	#10	5.4	10.8	1.5	**0401791005**
M6	–	6.5	13.5	2.5	**0401791006**
–	1/4 inch	7.2	13.5	2.5	**0401793025**
M8	5/16 inch	8.6	16.6	2.5	**0401791008**
M10	–	10.7	19.5	2.5	**0401791010**
M12	–	13.0	25.4	3.5	**0401791012**
M14	9/16 inch	15.2	30.7	3.5	**0401791014**
M16	5/8 inch	17.0	30.7	3.5	**0401791016**
–	3/4 inch	20.0	39.0	3.5	**0401793075**
M20	–	21.4	39.0	3.5	**0401791020**

The dimension h_1 was measured in clamped condition.

RING LOCK WASHERS

Stainless steel, narrow shape



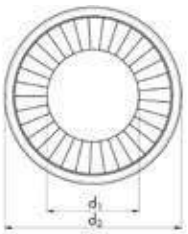
Material: Stainless steel A4 (1.4404)
Hardness: >520 HV0.05

For metric threads	For inch threads	Inner Ø d_1 [mm]	Outer Ø d_2 [mm]	Thickness h_1 [mm]	Art.- no.
M5	#10	5.4	9.0	1.5	**0404792005**
M6	–	6.5	10.8	1.5	**0404792006**
M8	5/16 inch	8.6	13.5	2.5	**0404792008**
M10	–	10.7	16.6	2.5	**0404792010**
M12	–	13.0	19.5	2.5	**0404792012**
–	1/2 inch	13.5	19.5	2.5	**0404794050**
M16	5/8 inch	17.0	25.4	3.5	**0404792016**
–	3/4 inch	20.0	30.7	3.5	**0404794075**
M20	–	21.4	30.7	3.5	**0404792020**
M24	–	25.3	39.0	3.5	**0404792024**
–	1 inch	27.9	39.0	3.5	**0404794100**

The dimension h_1 was measured in clamped condition.

RING LOCK WASHERS

Stainless steel, wide shape



Material: Stainless steel A4 (1.4404)
Hardness: >520 HV0.05

For metric threads	For inch threads	Inner Ø d_1 [mm]	Outer Ø d_2 [mm]	Thickness h_1 [mm]	Art.- no.
M4	#8	4.4	9.0	1.5	**0404791004**
M5	#10	5.4	10.8	1.5	**0404791005**
M6	–	6.5	13.5	2.5	**0404791006**
–	1/4 inch	7.2	13.5	2.5	**0404793025**
M8	5/16 inch	8.6	16.6	2.5	**0404791008**
M10	–	10.7	19.5	2.5	**0404791010**
M12	–	13.0	25.4	3.5	**0404791012**
M14	9/16 inch	15.2	30.7	3.5	**0404791014**
M16	5/8 inch	17.0	30.7	3.5	**0404791016**
–	3/4 inch	20.0	39.0	3.5	**0404793075**
M20	–	21.4	39.0	3.5	**0404791020**

The dimension h_1 was measured in clamped condition.

WEDGE LOCK NUTS

Steel

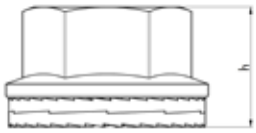
Surface: Zinc flake coating (Delta Protekt)*

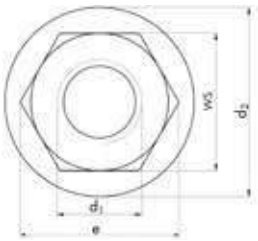
Property class: 10

* chromium(VI)-free

Nominal Ø d_1	Pitch	External drive WS	Height h [mm]	Flange Ø d_2 [mm]	Art.- no.
M6	1.0	WS10	9.2	14.2	**5140550106**
M8	1.25	WS13	12.2	17.9	**5140550108**
M10	1.5	WS16	15.2	21.8	**5140550110**
M12	1.75	WS18	17.2	26.0	**5140550112**
M14	2.0	WS21	19.2	29.9	**5140550114**
M16	2.0	WS24	21.2	34.5	**5140550116**
M18	2.5	WS27	23.2	38.0	**5140550118**
M20	2.5	WS30	25.2	42.8	**5140550120**
M22	2.5	WS32	27.25	46.0	**5140550122**
M24	3.0	WS36	29.2	51.0	**5140550124**
M27	3.0	WS41	32.2	56.0	**5140550127**

The dimension h was measured in clamped condition.





WHEEL NUTS

Steel

Surface: Zinc flake coating (Delta Protekt)*

Property class: 10

* chromium(VI)-free

Nominal Ø d_1	Pitch	External drive WS	Height h [mm]	Flange Ø d_2 [mm]	Art.- no.
M20	1.5	WS30	25.2	42.8	**5140550220**
M22	1.5	WS32	27.25	46.0	**5140550222**

The dimension h was measured in clamped condition.

Wedge lock washers and ring lock washers

- Design Steel, fully hardened, 485 ± 25 HV0.3
  - Surface Zinc flake coating Delta-Protekt KL 100 + Sliding coating VH302*
  - Co rosion resistance: 600 hours without Fe corrosion, salt spray test according to ISO 9227
- Design Stainless steel A4, 1.4404, surface hardened, >520 HV0.05
- Special materials: INCONEL®718 or 254SMO®(1.4547) possible on request
- Polyamide ring PA (only for ring lock washers)

Wedge lock nuts and wheel nuts

- Steel, property class 10
  - Surface Zinc flake coating Delta-Protekt KL 100 + Sliding coating VH302*
  - Co rosion resistance: 600 hours without Fe corrosion, salt spray test according to ISO 9227

Securing method

These locking elements are so-called mechanical locking devices.

Important characteristics:

- the bolted joint does not loosen
- the preload is almost entirely maintained
- the locking element remains in its basic position
- the joint remains "stable"

Note

- To ensure the locking function, the hardness of the mating material has to be lower than that of the washer.
- No securing effect if additional washers are used.

* chromium(VI)-free

General information

The Junker vibration test according to DIN 65151 is a common and proven method for testing and comparing the locking effect of dynamically loaded bolted joints under vibrations. This test method uses a load cell for continuously measuring and recording the preload of the bolted joint while applying continuous load transversely to the bolt axis.[1]

Supplementary to the test described in the standard DIN 65151, a precise description of the testing procedure to be carried out was added to DIN 25201 („Design guide for railway vehicles and their components – Bolted joints – Securing of bolted joints") and defined in an extension of DIN 25201-4 /6/ .[1]

The wedge lock washers, ring lock washers, wedge lock nuts and wheel nuts of our partner HEICO Befestigungstechnik have already been tested according to the newly added instructions for testing locking elements according to DIN 25201-4 and have been classified and evaluated as completely effective.[1]

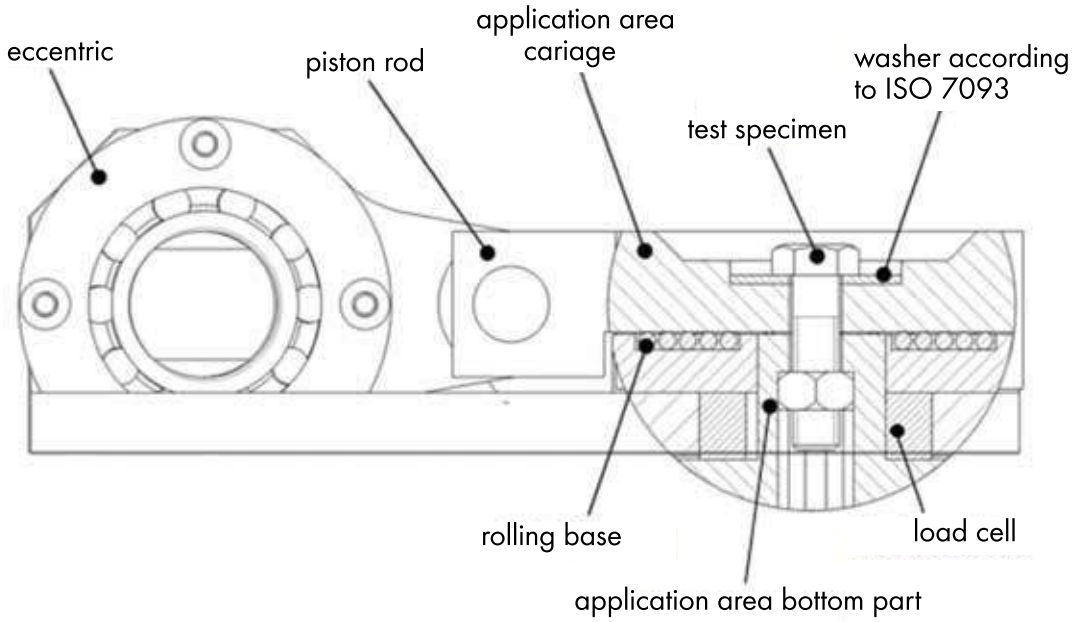


Figure 1: Sectional drawing Vibration test bench according to DIN 65151[1]

On the next two pages you will two Junker vibration tests carried out which compare wedge lock washers and wedge lock nuts with other washers and nuts.

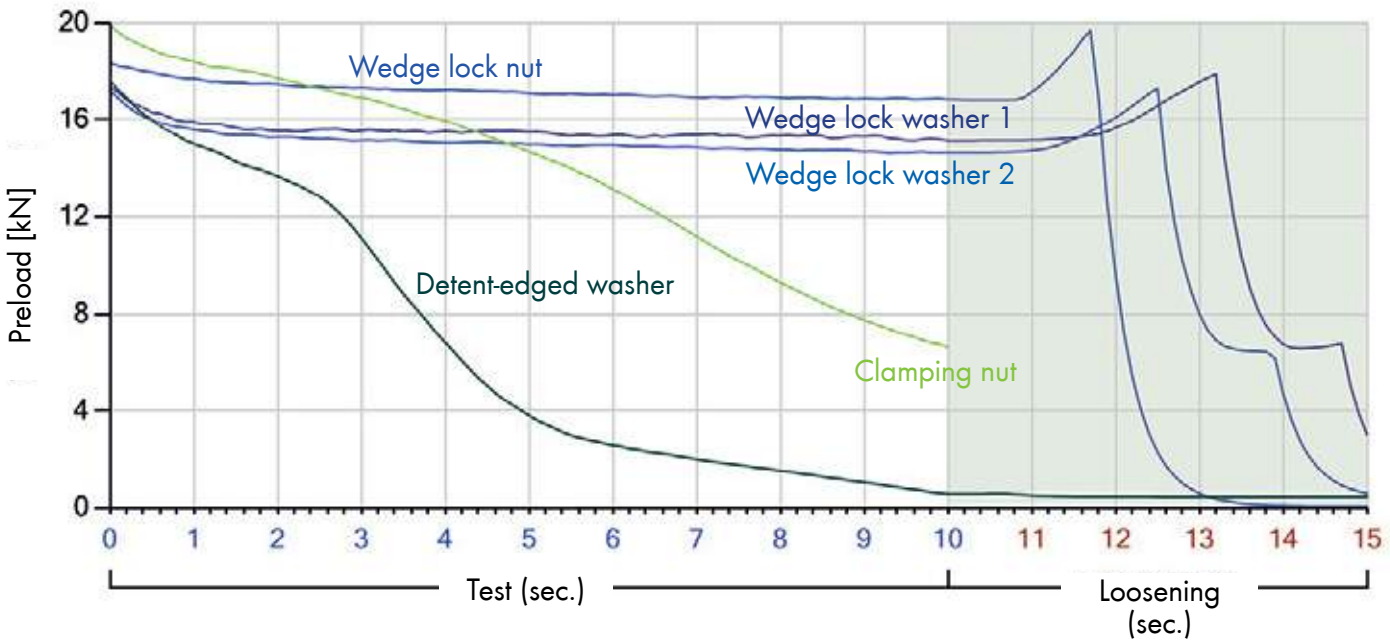
[1] HEICO Befestigungstechnik GmbH

Test result 1

Technical information

90% exploitation Rp0.2

Dimension:	M8
Property class:	8.8
Lateral displacement:	+/- 0.4 mm
Factor for clamping length:	lk/d = 1.7



Legend

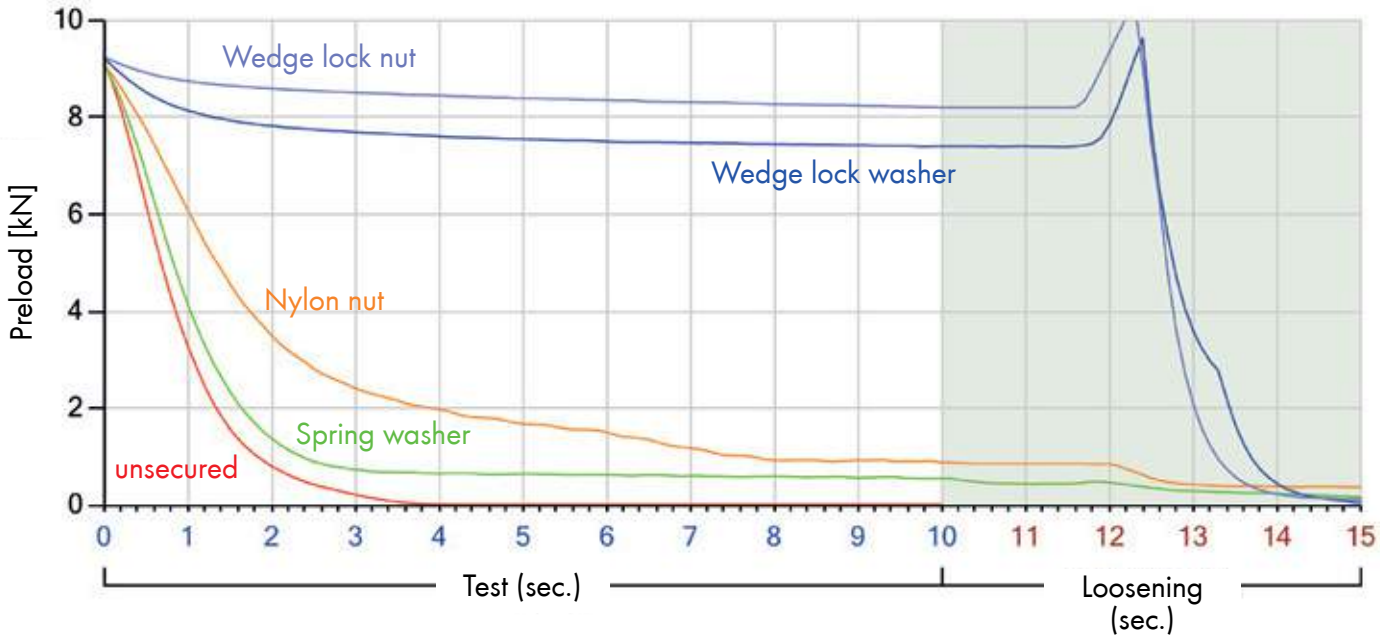
- Wedge lock washer 1
- Wedge lock washer 2
- Wedge lock nut
- Clamping nut
- Detent-edged washer

Test result 2

Technical information

45% exploitation Rp0.2

Dimension:	M8
Property class:	8.8
Lateral displacement:	+/- 0.4 mm
Factor for clamping length:	lk/d = 1.7



Legend

- Wedge lock nut
- Wedge lock washer
- Nylon nut
- Spring washer
- unsecured

Released factory standards (Extract)

• Siemens AG	KUN607.07
• Enercon GmbH	MK 06 007-1
• Alstom Transport AS	DTRF150213 – Annex 5
• Deutsche Bahn AG/DB Systemtechnik GmbH	General approval of HEICO-LOCK®

HEICO-LOCK® is also approved at further customers such as e.g. Knorr-Bremse and Hübner.

Institutes

• German Institute for Structural Engineering	General building approval (abZ) no. Z-14.4-702
• TÜV* Rheinland	RoHS approval according to Directive 2002/95/EG
• TÜV* Süd	Approval of HEICO-LOCK® wheel nuts
• DNV GL	Whitness tests of HEICO-LOCK®wedge lock washers

Furthermore, additional tests such as tests according to DIN25201-4 were carried out at different official institutes.

Version: June 2016

* TÜV: Technical Inspection Association

If you need further information on the above listed or other approvals, please do not hesitate to contact us: produktmarketing@wuerth-industrie.com

WEDGE LOCK WASHERS AND RING LOCK WASHERS

Steel, 8.8

Torque recommendations for mechanical engineering

Wedge lock washers and ring lock washers with zinc coating (with bolt 8.8, electrogalvanized)				
Bolt diameter	**Assembly paste, GF = 0.75 µG = 0.10 / µK = 0.16**		**dry, GF = 0.62 µG = 0.15 / µK = 0.18**	
	Torque [Nm]	**Preload [kN]**	**Torque [Nm]**	**Preload [kN]**
M3	1.3	2.4	1.3	2.0
M4	3.1	4.2	3.1	3.5
M5	6.0	6.8	6.0	5.6
M6	10.5	9.7	10.5	8.0
M8	25.0	18.0	25.0	15.0
M10	49.0	28.0	50.0	23.0
M12	85.0	40.0	85.0	33.0
M14	135.0	55.0	136.0	46.0
M16	205.0	75.0	208.0	62.0
M18	288.0	92.0	291.0	76.0
M20	402.0	118.0	408.0	97.0
M22	548.0	146.0	557.0	120.0
M24	693.0	169.0	703.0	140.0
M27	1010.0	221.0	1028.0	182.0
M30	1379.0	269.0	1401.0	222.0
M33	1855.0	333.0	1889.0	275.0
M36	2394.0	392.0	2436.0	324.0
M39	3087.0	468.0	3145.0	387.0
M42	3820.0	538.0	3890.0	445.0

GF = Degree of preload (exploitation of the yield strength [%])
µG = Coefficient of friction between the threads
µK = Coefficient of friction between the wedge lock washer and the nut or the bolt thread

WEDGE LOCK WASHERS AND RING LOCK WASHERS

Steel, 10.9 and 12.9

Torque recommendations for mechanical engineering

Wedge lock washers and ring lock washers with zinc coating (with bolt 10.9, uncoated)			Wedge lock washers and ring lock washers with zinc coating (with bolt 12.9, uncoated)		
Bolt diameter	**Assembly paste, GF = 0.75 µG = 0.10 / µK = 0.16**		**Bolt diameter**	**Assembly paste, GF = 0.75 µG = 0.10 / µK = 0.16**	
	Torque [Nm]	**Preload [kN]**		**Torque [Nm]**	**Preload [kN]**
M3	1.8	3.2	M3	2.0	3.9
M4	4.1	5.6	M4	4.6	6.7
M5	8.1	9.1	M5	9.1	10.9
M6	14.1	12.9	M6	15.8	15.4
M8	34.0	23.0	M8	38.0	28.0
M10	67.0	37.0	M10	75.0	44.0
M12	115.0	54.0	M12	128.0	65.0
M14	183.0	74.0	M14	204.0	89.0
M16	279.0	100.0	M16	311.0	120.0
M18	391.0	123.0	M18	437.0	148.0
M20	547.0	156.0	M20	610.0	188.0
M22	745.0	194.0	M22	831.0	233.0
M24	942.0	225.0	M24	1052.0	270.0
M27	1375.0	294.0	M27	1533.0	352.0
M30	1875.0	358.0	M30	2091.0	430.0
M33	2526.0	443.0	M33	2815.0	532.0
M36	3259.0	522.0	M36	3633.0	626.0
M39	4203.0	624.0	M39	4683.0	748.0
M42	5202.0	716.0	M42	5799.0	860.0

GF = Degree of preload (exploitation of the yield strength [%])
µG = Coefficient of friction between the threads
µK = Coefficient of friction between the wedge lock washer and the nut or the bolt thread

WEDGE LOCK WASHERS AND RING LOCK WASHERS

Stainless steel

Torque recommendations for mechanical engineering

Wedge lock washers and ring lock washers, stainless steel, 1.4404 (with bolt A4)				
Bolt diameter	**A4-70, MoS2, GF = 0.65 μG = 0.14 / μK = 0.15**		**A4-80, MoS2, GF = 0.65 μG = 0.14 / μK = 0.15**	
	Torque [Nm]	**Preload [kN]**	**Torque [Nm]**	**Preload [kN]**
M3	0.9	1.5	1.2	2.0
M4	2.0	2.6	2.7	3.4
M5	3.9	4.2	5.3	5.5
M6	6.9	5.9	9.2	7.8
M8	17.0	11.0	22.0	14.0
M10	33.0	17.0	43.0	23.0
M12	56.0	25.0	75.0	33.0
M14	89.0	34.0	119.0	45.0
M16	136.0	46.0	181.0	61.0
M18	191.0	56.0	254.0	75.0
M20	267.0	72.0	356.0	96.0
M22	351.0	89.0	468.0	118.0
M24	460.0	103.0	613.0	138.0
M27	671.0	134.0	895.0	179.0
M30	915.0	164.0	1220.0	219.0
M33	1233.0	203.0	1644.0	271.0
M36	1591.0	239.0	2121.0	319.0
M39	2053.0	285.0	2737.0	381.0
M42	2585.0	333.0	3447.0	443.0

GF = Degree of preload (exploitation of the yield strength [%])
μG = Coefficient of friction between the threads
μK = Coefficient of friction between the wedge lock washer and the nut or the bolt thread

WEDGE LOCK NUTS AND WHEEL NUTS

There are higher tightening torques for bolts of property class 10.9 as they can be higher tensioned due to a higher yield strength. The pull-out strength of the nut thread has been according to ISO 898-2 and therefore corresponds to property class 10. This means, the nuts can maximally bear preloads of a property class 10.9 bolt.

Wedge lock nut with zinc coating (with bolt 8.8, blank or phosphated)		
Bolt diameter	**dry, GF= 0.62, µG = 0.15 / µK = 0.18**	
	Torque* [Nm]	**Preload [kN]**
M6	**13.6**	8.0
M8	**31.9**	14.5
M10	**62.0**	23.0
M12	**106.1**	33.4
M16	**255.5**	62.2
M22x1.5	**650.0**** (730.8)	(136.3)

GF = Degree of preload (exploitation of the yield strength [%])
µG = Coefficient of friction between the threads
µK = Coefficient of friction between the wedge lock washer and the nut or the bolt thread

* The values printed in bold type have to be used for examination.
** According to the specifications tightening torque wheel nuts TÜV-SÜD.

W.TEC® SECURING

Wedge lock washers • Ring lock washers
Wedge lock nuts • Wheel nuts

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