

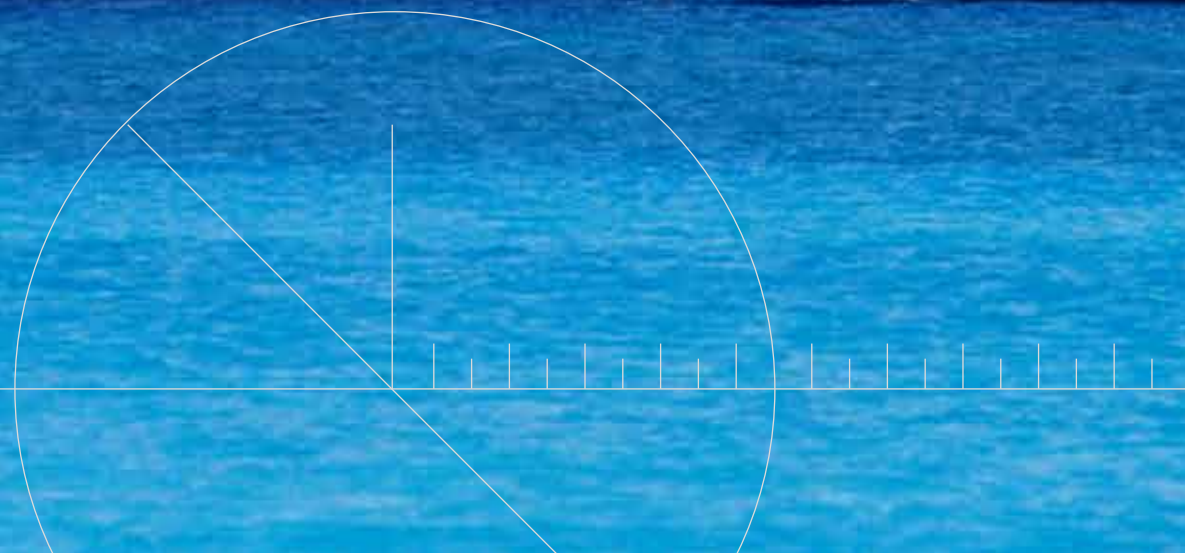
# ***Cooling System***

Less weight for a lighter future



Our mission is to downsize. When it comes to designing an engine, we are constantly striving to maximize engine weight loss to ultimately reduce the permeation rate. We are proud to say that with our newly designed cooling systems, we help our customers reach weight loss targets.

We believe that thinking smaller can make a big difference.







Customer Value through Innovation

NORMA Group's innovative Engineered Joining Technologies and applications know-how make cleaner, more efficient use of precious energy sources in areas such as Cooling System, Air Intake & Induction, Emission Control, Ancillary System and Infrastructure. Distribution of NORMA Group trademark products is undertaken via a network of carefully selected companies specializing in volume distribution in their national market segments to reach the industrial aftermarket segment.



Global needs for greater energy efficiency in key sectors like transport and industrial infrastructure offer excellent growth prospects across the group's broad portfolio of Engineered Joining Technology. Maintained investments in innovative solutions fund the continued development of new products and technologies.



We will continue to strengthen the close strategic cooperation that has helped clients use our Engineered Joining Technology solutions make a major impact on their businesses. At the same time as we develop forward-thinking partnerships for our mutual benefit.

- W1** = Zinc Plated Mild Steel
- W2** = Stainless Steel with Zinc Plated Mild Steel Fasteners
- W3** = Ferritic Stainless Steel
- W4** = Austenitic Stainless Steel
- W5** = High Temperature & High Corrosion Resistant Austenitic Stainless Steel
- W6** = Aluminum Alloy

*Note material descriptions apply to metal products only*

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# Hose Clamps

## The single supplier with many solutions

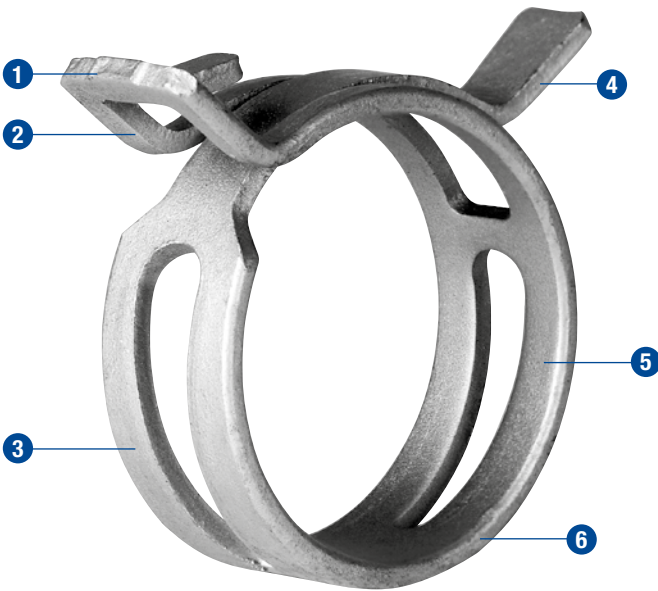
Choose Hose Clamps from NORMA Group and you gain more than just an optimized sealing solution, you also get a single supplier for all your needs. From standard products to special usage clips and heavy duty clamps, there is a product for even the most demanding applications.



FBS – SPRINGBAND HOSE CLAMPS TO DIN 3021

Because of their design, FBS springband hose clamps are particularly suitable for use with hose-spigot connections which are submitted to extreme temperature changes. Once assembled FBS provide a continuously readjusting dynamic tightening effect.

Also at low temperatures the radially acting tightening force is sufficient to assure a reliable tightness of the system. Even hoses when FBS are used.



The advantages at a glance

- Single-part hose clamps without screw
- Uniform distribution of clamping forces
- Optimal roundness
- Temperature resistance from –40°C up to 200°C
- Unmistakable tracing due to batch numbering
- Visual control of nominal diameters by color codes
- Corrosion resistance in salt spray – testing – 720 h on mandrel

- 1 **Batch number stamped on clamp band**  
– safe retraceability
- 2 **NORMA® logo** – the visible sign for high quality
- 3 **Inorganic/organic coating**  
– optimal protection against corrosion  
– coating in different color
- 4 **Nominal diameter stamped on the clamp**  
– prevents mistakes
- 5 **Special design** – uniform distribution of clamping forces and optimal roundness
- 6 **Round band edges**  
– optimal hose protection

Materials

C 75 S	Zinc-Aluminium Coating	Organic Coating
X	Basecoat	Topcoat

Variants

FBS

FBS TO DIN 3021

– is a space-saving clamp. It was designed with the aim of realizing the technical minimum overall height to allow its use in difficult assembly situations.



FBS HC

– is a pre-opened version secured by a plastic retaining clip. After slipping the clamp onto the hose, this clamp can be easily removed by hand.



FBS MC

– is a pre-opened (and, if desired, pre-positioned) clamp secured by a small metal clip. The retaining clip for this version is removed by using pliers.



FBS C

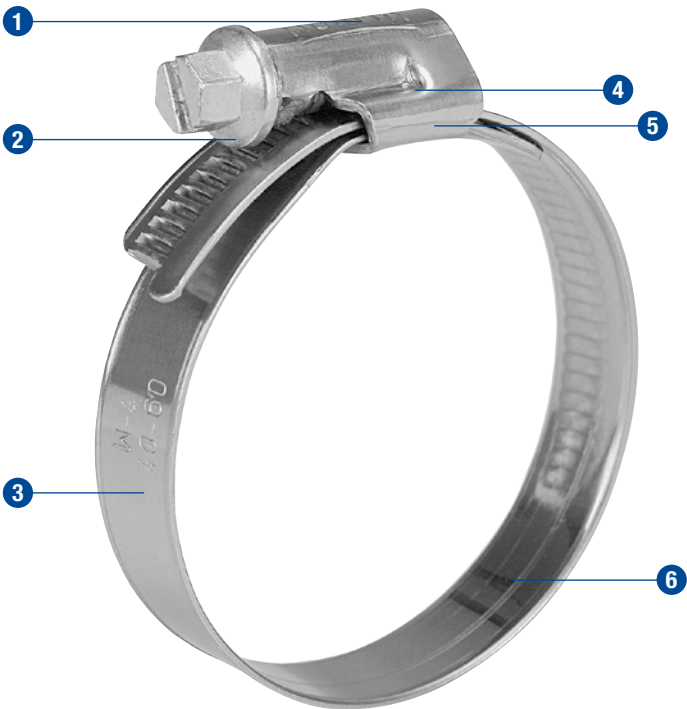
– is a pre-opened clamp which is pre-positioned on the hose. The retaining mechanism for this version is an integral part of the clamp band.



TORRO® – WORM DRIVE HOSE CLAMPS TO DIN 3017

TORRO® worm drive hose clamps are specially suitable for applications under high mechanical loads. Since we are continuously working to improve its features this clamp is still setting standards for modern hose clamp design.

The distinguishing feature of the TORRO® is the asymmetrical construction which tells you at first sight whether it is a genuine TORRO® or not.



The advantages at a glance

- Multi-range hose clamp
- Material: W1, W2, W3, W4, W5
- Chromium VI free: compliant with ROHS, WEEE and ELV Environmental Directives
- Clamping ranges to DIN 3017: 8–16 mm up to 140–160 mm
- Larger diameters on demand

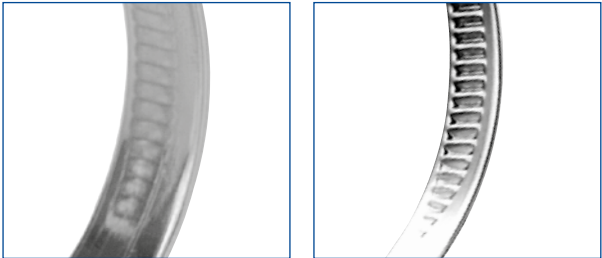
- 1 Improved asymmetric housing**  
– even distribution of forces and safe assembly
- 2 Screw support**  
– ease of assembly due to the safe guidance of the emerging band end
- 3 Material and clamping range stamped on the band**  
– prevents errors
- 4 Asymmetric extension**  
– prevents the housing from tilting over when the clamp is tightened
- 5 Short housing saddle**  
– even contact pressure  
– improved efficiency
- 6 Smooth or stamped inside of band**  
– optimal hose protection

Materials

W1*	W2*	W3	W4	W5
x	x	x	x	x

\* No chromium VI used for the coating of the closure components

Types of clamp band



- Band width 7.5 mm**
- W2, W3 with smooth inside
- Band width 9 mm**
- W1 with smooth inside
  - W2, W3, W4, W5 with stamped inside
- Band width 12 mm**
- W1, W2, W3 with smooth inside
  - W4, W5 with stamped inside

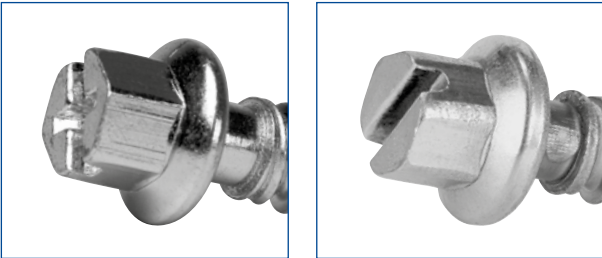
**High band tensile force and high fracture torque**  
As always, the new TORRO® features high tensile forces. However, when compared with competitors' products and the previous model, we now achieve significantly higher fracture torques. This provides for an increased assembly reliability.

**Even clamping force distribution**  
Thanks to its enhanced technical design, the new TORRO® range delivers an even distribution of clamping force. The clamp sits perfectly on the hose and ensures the optimal sealing of the connection.

Applications in combustion engines

- Cooling water lines
- Depressurized as well as pressurized fuel lines and vent lines
- Oil lines
- Air ducts, both vacuum and express pressure applications (e. g. charged air) up to 140–160 mm
- Larger diameters on demand

Screw



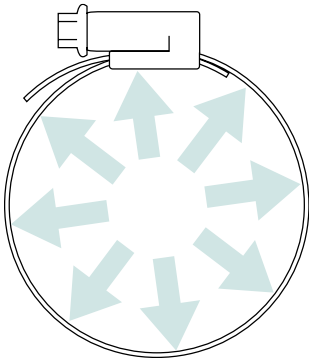
		W1	W2	W3	W4	W5
Phillips head	SW 7*	•	•			
Slotted head	SW 7**			•	•	•

\* Band width 7.5 mm = SW 6      \*\* Band width 16 mm = SW 8

Corrosion resistance

Material	Corrosion resistance in salt spray testing
W1	Min. 144 h
W2	Min. 72 h
W3	Min. 200 h*
W4	Min. 400 h
W5	Min. 1000 h

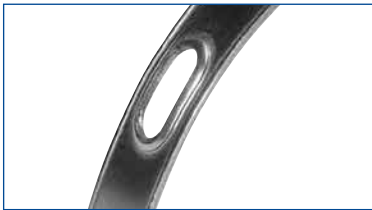
\* Max 10% corrosion of the base material allowed



Modular System

TORRO®

The TORRO® modular system offers several features that can be added to the clamp, in order to modify its technical characteristics. You are free to combine two or more of these accessories according to your requirements.



**The Notch**  
The notch is a clever option for pre-positioning the TORRO® hose clamp on the hose. In this case the oval hole in the clamp band finds its exact counterpart on the hose surface. Thus the TORRO® is safely and accurately kept in place prior to the final assembly.

- Safe pre-assembly on the hose
- Smart weight saving option without weakening the performance of the clamp



**The Prefix Clamp**  
With this accessory the TORRO® can also be pre-positioned on the hose. The two ‘teeth’ of this device keep the TORRO® hose clamp safely in place if it needs to be stocked or transported prior to its final assembly.

- Safe pre-assembly on the hose



**The Spring Insert**  
For this version of the TORRO® the standard hose clamp is equipped with a spring insert on the inside of the clamp band. When tightening the screw the spring is loaded and stores sufficient clamping force to ensure a long-lasting automatic retensioning effect. Thus the radial clamping force achieved will be sufficient even under extremely low temperatures. Therefore, the TORRO® is an optimal solution for applications under extreme temperature changes.

- Automatic re-tensioning effect in the event of hose relaxation
- Increased sealing reliability across a wide temperature range



**The PreFix System**  
The PreFix System is a concept for integrated clamps and clips on hoses and pipes. The demand for complete systems that include the appropriate sealing function is increasing.

- Safe pre-assembly on the hose



**The Radial Insert**  
The Radial® Insert Clamp consists of a Standard riveted clamp with a stainless steel liner. This insert in the Radial acts as a spring.

- Radial integrated element located on the inside of the clamp band
- High contact pressure due to the radially corrugated design
- There are also dynamic properties
- Only available in 9 mm bandwidth

Variants

TX

One more clamp type rounding off this range is the TX. These clamps are specially used in applications in the commercial vehicle sector where extremely high band tensile forces and high fracture torques are required. This is why TX hose clamps are only made with 12 mm band width and in W3 material quality.



The advantages at a glance

- 12 mm band width
- W3 material

Materials

W1	W2	W3	W4	W5
		x		

## ABA ORIGINAL

ABA Original clamps feature unique, one-piece housing, rolled-up band edges and a non-perforated (embossed) band that protect the hose. For added corrosion resistance the band in the 12 mm Standard is made of Aluzinc which gives three times the protection offered by conventional galvanized steel.

### ABA ORIGINAL

- Features high clamping force and high durability torque
- Aluzinc
- Also available in W5 material



### ABA ORIGINAL STAINLESS

– All parts in AISI 304 Stainless Steel



## The advantages at a glance

- Solid band
- Rolled up band edges
- Smooth inside
- House protected from pipe

## BREEZE CONSTANT-TORQUE®

The Breeze CONSTANT-TORQUE® is a breakthrough in clamping technology. A belleville spring mechanism permits the CONSTANT-TORQUE® clamp to automatically increase or decrease its own diameter due to changes in operational or environmental temperatures.

This unique design eliminates “cold flow” leaks. Both the Aero-Seal and Heavy Duty construction CT clamps have an extended inner liner which protects all types of hoses from damage and helps maintain consistent sealing pressure.



Constant-Torque - Aero Seal Construction  
Per SAE standard J1508 Type “SLF”



Constant-Torque - Heavy Duty Construction  
Per SAE standard J1508 Type “SLHD”

## The advantages at a glance

- The premium hose clamp for truck/heavy equipment/bus and performance industry
- Recommended for use on turbo exhaust sleeves, heater hoses, coolant hoses, intake systems
- Virtually unlimited product life – won’t rust or corrode and is reusable
- Soft hoses – cover gear slots in band to protect all types of hoses from damage
- No special tools needed for installation
- Eliminates the sometimes necessary replacement of expensive “single use” clamps during routine or emergency maintenance
- Prevents massive and costly loss of engine coolant



## BREEZE LINER

An integral extension of the band as an inner liner protects soft-surface hose (silicone and others) from damage caused by extrusion or shearing through the band slots. Liner clamps afford maximum protection to soft hoses while providing a true concentric seal.



### *The advantages at a glance*

- Protects soft silicone hose with an integral inner liner
- Alternative to embossed, non-perforated band clamps
- Full range of sizes available for all applications
- Heavy duty four piece Quadra-Lock construction
- Available in 1/2" (12.7 mm), 9/16" (14.2 mm) and 5/8" (15.8 mm) band widths

#### **Material options:**

- All – 316 Stainless Steel
- All – 300 Stainless Steel
- Carbon Screw

## BREEZE POWER-SEAL®

These BREEZE worm-gear clamps with heavy duty four-piece Quadra-lock construction are designed for use in general-purpose and industrial applications. The BREEZE Quadra-lock clamp is a significant upgrade from common three-piece SAE worm-gear designs, delivering the ultimate in both quality and value.

BREEZE Power-Seal Mini offers a compact streamlined design for fuel, air and transmission hose lines. Breeze Power-Seal Full size Quadra-Lock has a design featuring heavy duty four-piece, industrial aircraft construction. Here, the housing is clinched at four points for extra strength and stability, enabling the clamp to resist twist and housing tilt; a common factor during installation.



### *The advantages at a glance*

#### **Mini:**

- Three material grades
- High clamping force
- High destruction torque
- NAS 1922 specification

#### **Full Size:**

- Excellent clamp load
- Smooth housing underside ensures more even distribution of sealing pressure
- Exceeds SAE J 1508 specifications

## BREEZE AERO-SEAL®

The original perforated stainless steel worm-gear clamp. Heavy duty four-piece Quadra-Lock construction enables far more tightening torque to be delivered to the band perforations. Used for aircraft and heavy duty industrial applications.



Standard Hex Head Screw

### *The advantages at a glance*

- Original patented worm-gear clamp
- Heavy duty four piece Quadra-Lock construction
- Used for heavy-truck, industrial and aircraft applications
- Features wider 9/16" (14.2 mm) stainless steel band
- Available in a wide variety of materials and screw styles
- NAS 1924 Specification



Safety Collared Screw



Thumb / Wing Screw

## BREEZE SUPER-SEAL

The BREEZE Super-Seal is the latest breakthrough in clamping technology for EPDM rubber or silicone hose connections in fluid applications. Available with Belleville springs (Heavy Duty HD) or without, this next-generation clamp features a worm-drive closure mechanism with a high dynamic compensation range, as well as a high-pressure, double-bead profile designed to prevent leaks and secure hose connections.

As engine temperature and pressure requirements increase, customers in various industries require a clamp that will resist leaks in harsher environments. The Super-Seal clamp is equipped with two high-pressure sealing lines around the entire perimeter and a recessed hardware attachment that provides a 360-degree seal.



Super-Seal HD



Super-Seal

### *The advantages at a glance*

- High-performance compensating clamp allows use of lower cost hose material (EPDM)
- Increased blow-off strength
- Modular design allows for additional compensation when required
- Requires no special tools for installation – quick and easy assembly
- Provides a high degree of security in critical applications

#### Features

- Two screw options: 410 stainless or plated carbon steel
- Dual sealing beads with high radial load provide the highest available sealing pressure
- Recessed hardware package means no pressure gap around the periphery, reducing the possibility of leaks
- Worm-drive closure mechanism
- Unique band design acts as its own integral spring

#### Applications

- Suitable for coolant connections using rubber or silicone hose, from 36–118 mm
- Available with or without Belleville washer springs, which can be used on hoses with higher compression set to maintain adequate clamp load as the joint diameter contracts
- For usage on commercial vehicles, heavy equipment, agricultural and construction equipment and other applications



T-BOLT Series

HEAVY DUTY T-BOLT HOSE CLAMPS

T-Bolt Hose Clamps are intended for use where other hose clamps do not work. Typical applications include air intake systems, cold side charge air hose connections and a variety of hose, pipe and ducting joints.

- Available in diameters 1.75" (44.5 mm) and larger, T-Bolt Hose Clamps can be configured to suit almost any application and operating environment
- Also available: different materials and Quick Connect or Quick Release latch styles

T-BOLT SERIES

**Mini** – 9/16" (14.3 mm) wide stainless steel band with plated steel bridge, M5 or #10 T-bolt and hardware.

**SAE Type TB** – 3/4" (19 mm) wide stainless steel band and shoe with 1/4" (6.4 mm) plated steel T-bolt and hardware.

**SAE Type TB** – 3/4" (19 mm) wide stainless steel band with floating bridge, 1/4" (6.4 mm) plated steel T-bolt and hardware.

**SAE Type TB** – all stainless steel construction including, 3/4" (19 mm) wide band, floating bridge, 1/4" (6.4 mm) T-bolt and hardware.

**Super Duty** – 7/8" (22.2 mm) wide stainless steel band, shoe and trunnion with 5/16" (7.9 mm) plated steel T-bolt and nut.



T-bolt clamp with floating bridge



Heavy Duty Flex



T-bolt clamp with shoe



T-bolt clamp plain band



Flex Seal Channel



Flex Seal Standard



Flex Seal Mini

FLEX SEAL™ HOSE CLAMPS

FLEX SEAL™ Hose Clamps incorporate a compression spring to accommodate joint diameter changes resulting from hose set and thermal effects. They are accepted industry wide for use on charge air and coolant system hose connections.

- Heavy Duty T-Bolt and FLEX SEAL™ Hose Clamps usually have a diameter take up range of 5/16" (7.9 mm)
- Also available: different materials and Quick Connect or Quick Release latch styles

FLEX SEAL™ SERIES

**Mini** – 9/16" (14.3 mm) wide stainless steel band with plated steel bridge, M5 T-bolt and hardware.

**SAE Type SLTB** – 3/4" (19 mm) wide stainless steel band with floating bridge, 1/4" (6.4 mm) plated steel T-bolt and hardware.

**SAE Type SLTB** – 3/4" (19 mm) wide stainless steel band with floating bridge, 1/4" (6.4 mm) plated steel T-bolt and hardware, includes special long travel spring to accommodate larger changes in joint diameter.





# Retaining Products

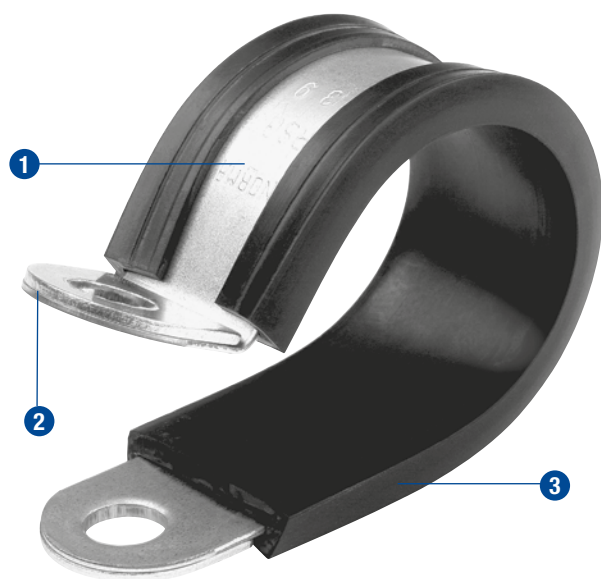
## Ready for any application

The NORMA Group Retaining Products range comprises a wide variety of products for the attachment and retaining of pipes, cables, cable harnesses and hoses.



RS/RSGU – PIPE RETAINING CLIPS TO DIN 3016

RS/RSGU pipe retaining clips are the ideal retaining elements for pipes, cables, cable harnesses, cable protection pipes, hoses and other applications.



Type 1

- 1 Form fitting and adjustable band**
  - ease of assembly
  - safe attachment
- 2 Reinforced band ends**
  - prevent the clip from tearing or loosening in cases where there is a high mechanical load
- 3 Optionally supplied with EPDM or Silicone Profile Remove Chloroprene**
  - vibration damping & protection against seepage water
  - sound insulation
  - clip fits tight on object

Materials

W1	W3	W4	W5
x	x*	x*	x*

\* On request

RSV/RSGU-V CLIP

In addition to the standard RS/RSGU designs we offer a V-feature. This special design, a variation of the standard RS/RSGU Type 1, is provided with an integrated mounting fastener. When the clip ends are compressed the fastener locks into place and locks the clip. Thus, the RS/RSGU clamp with V-feature can be easily pre-assembled on the pipe.

- Diameters and band widths will be furnished on request.

Materials

W1	W2	W3	W4*	W5*	W6*
		x	x	x	x

\* On request



RLGU CLIP

Recently a new type, the RLGU, was added to our Retaining Products range. It is also a variation of the standard Type 1, but without reinforced band ends and therefore suitable for use in applications submitted to only slight mechanical loads as, for example, the fastening of cables.

- RLGU are only available in band width 12 mm
- For the complete program please refer to the table of sizes



CLIP TYPES TO DIN 3016

All pipe retaining clips are available with a special sound damping rubber profile as optional equipment. The standard version RS/RSGU clips (**Type 1**) are also available in a round shape (RS/RSGU **Type 0**) or open shaped (RS/RSGU **Type 2**).



Type 0



Type 2





## Quick Connectors



### **Superior performance by saving weight**

When you use a PS3 Quick Connector from NORMA Group, you can expect weight savings, while also contributing to a reduction in fuel consumption. High-end materials maintain product quality and guarantee superior performance.



## PS3

PS3 “Push & Seal” plastic quick connectors are an ideal means for the secure connection of cooling water and heating hoses.



### The advantages at a glance

- Locking function
- Simple spigot
- O-ring is on the inside to prevent damage to seal
- Series experience since 1997, volume experience of a total of 70 million PS3
- New optimized version with reduced weight can be offered

- 1 Housing
- 2 O-ring
- 3 Retaining ring
- 4 Retainer (spring)

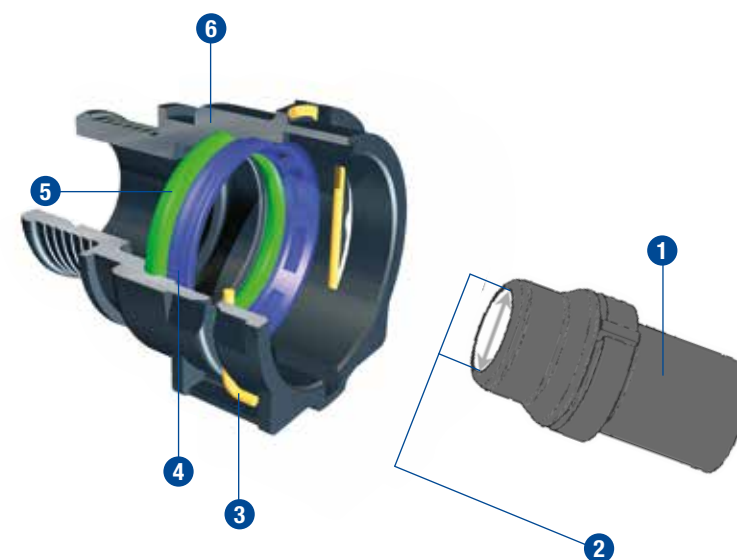
### Standard materials

PS3 quick connectors are made from recyclable materials. For our standard versions we use polyamide 6.6 with 30% glass fiber content.

The standard material for the O-rings consists of peroxide-cured EPDM which is resistant to hot water. For PS3 quick connectors that are likely to be used in direct contact with coolants we recommend PA 6.6 with 30% glass fiber content that has been stabilized against heat and hydrolysis.

## CONNECTING SPIGOT – TO VDA STANDARD

Please note that all PS3 quick connectors are delivered without spigot. However, we will be pleased to offer suitable VDA spigots for Line-to-Line connection on request.



### The advantages at a glance

- Snap assembly without tool – time and cost reduction
- Robot assembly possible – automated processes
- Compact structural dimensions – to be used in extremely narrow spaces
- Integrated seal – optimal tightness

- 1 Connection spigot
- 2 Diameter of bore – Nominal Width (NW)
- 3 Retainer (spring)
- 4 Retaining ring
- 5 O-ring
- 6 Connector

### Technical features

- **Medium/Fluid:** Cooling water
- **Operating pressure:** 0–2 bar excess pressure
- **Operating temperature:** Engine compartment: –40°C to +135°C, Short time up to +150°C (approx. 30 min.)

## C STYLE

Specialized plastic quick connectors developed for coolant applications. Test parameters are significantly higher than operation parameters. Special applications possible, contact us!



### *The advantages at a glance*

Media: Coolant

- Operating temperature:  $-40^{\circ}\text{C}$  to  $135^{\circ}\text{C}$ , short term higher
- Pressures: 0 to 2 bar pos. pressure, partially pulsating (sinusoidal)
- Vibrations: Usually engine vibrations 7–200 Hz, 0.2–20 g

- 1 Connector
- 2 O-ring
- 3 Retaining ring
- 4 Retainer (spring)
- 5 Housing
- 6 Diameter of bore = Nominal Width (NW)

#### Applications

Coolant, glycol and water applications

## SAE STYLE

Specialized plastic quick connectors developed for coolant applications. Test parameters are significantly higher than operation parameters. Special applications possible, contact us!



### *The advantages at a glance*

Media: Coolant

- Operating temperature:  $-40^{\circ}\text{C}$  to  $135^{\circ}\text{C}$ , short term higher
- Pressures: 0 to 2 bar pos. pressure, partially pulsating (sinusoidal)
- Vibrations: Usually engine vibrations 7–200 Hz, 0.2–20 g

#### Applications

Coolant, glycol and water applications



V3

The V3® is designed for coolant vent lines. To guarantee that the product can resist cooling-water, the V3® is made two-parted. The housing is made of materials resistant to cooling water, and the locking ring is made of flexible material. To ensure that you save space, the V3® only has a half locking ring and is designed with an anti-rotation feature.



TWIST II

TWIST II is a “Push & Seal” plastic quick connector; an ideal solution for connecting cooling water systems.



*The advantages at a glance*

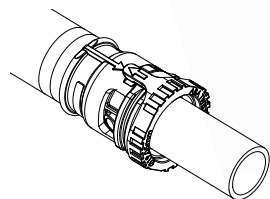
- Can be integrated in end-tanks as well as mounted on tubes or hoses
- A secure seal to the mating spigot with a low assembly force
- Robust and clear locking features with a click function to ensure a correct lock
- Easy operation for disassembly
- Temperature resistance of up to 180°C

Standard materials

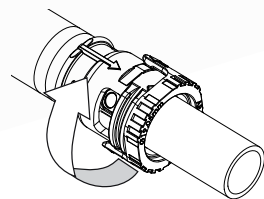
TWIST II quick connectors are made out of recyclable materials. As a standard solution polyamide 6.6 with 30% to 50% glass fiber reinforcement is used.

When an application requires, other engineering thermoplastic material can be used. Different reinforcement fillers and additional heat or hydrolysis resistance can also be added. Application-based design is possible when a minimum required quantity is ordered.

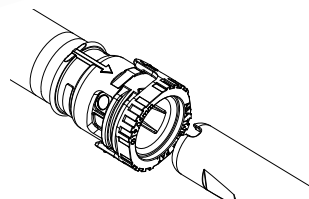
## TWIST II



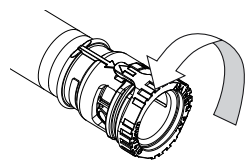
Assembly is in locked position.  
The arrow marks the closed position.



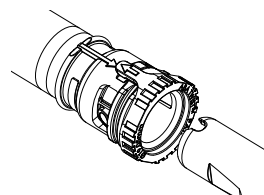
Turn connector ring to open position.



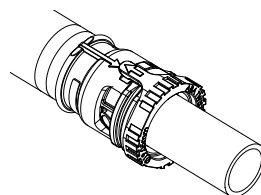
Pull connector backwards to disengage the joint. The connector is now released from its position.



Turn the connector ring back to its locked position. The arrow marks the closed position. Connector is now in a locked position and ready for engagement.



**IMPORTANT NOTICE**  
Notch in male part must be aligned with arrows marking "locked position" when engaging the female part to the male.



Listen for audible "click" or feel when connector is fully engaged. Connecting joint is now in a locked position.

## TWIST III

TWIST III is a quick connector series for charged air system applications. Developed to meet extremely tough requirements, especially in low-emission vehicles, it combines a low assembly effort with very good hydrolysis tolerance, temperature resistance and mechanical performance. TWIST III operates at approx. 2.75 bar excess pressure and engine compartment temperatures of -48°C up to +135°C. Standard design configurations are straight. Special designs are also available.



### Standard materials

Standard versions are made from recyclable polyamide 66 with 35% to 50% GF. O-rings are available in various materials, including AEM. Note that both plastic and metal spigots can be used.

TWIST III quick connectors have a 360° symmetrical design. As they can be opened from any angle, they are perfect for tight environments as well as spin-weld applications. Additional cut-outs or knobs are not necessary.

### Quick and safe assembly/disassembly

Assembling TWIST III is quick and easy. Press the self-locking spider ring onto the mating spigot and check that all the ring-locking tabs have passed the spigot's locking edge. Then pull the connector to verify the connection.

To disassemble the connector, turn the spider ring counterclockwise, hold it in the open position and pull it off the mating spigot. When the connector disengages from the spigot, release the spider ring to automatically return it to its relaxed (locked) position.



TWIST III

Standard sizes and designs

TWIST III connector size designations are determined by the sealing diameter (ØD1) of the TWIST III spigot. Current standard diameters are listed below. Larger diameters will be added in the future.

Five standard sizes are available. TWIST III SP (spin-weld) is for applications where the quick connector will be spin-welded to other injection or blow-molded plastic components. Based on recommendations from a spin-welding equipment supplier, this design includes weld surfaces, flash traps and support surfaces. This connector is tested using the GMW 15803 specification as reference.

Optional designs

A hot-plate weld design (TWIST III HP) is used for housings in PBT material, when the connector has to be welded to a flexible TPE / TPC-ET (HYTREL®) Duct, or with flexible plastic ducts. It is also the standard solution when hot-plate/mirror welding is applied. A further special design TWIST III AR) has an optional anti-rotation/assembly orientation feature. Other designs are also possible.

Standard sizes:

TWIST III Quick Connector	Ø D1 (mm)
TWIST III 48.40	48.40
TWIST III 56.40	56.40
TWIST III 67.40	67.40
TWIST III 71.40	71.40
TWIST III 80.00	80.00

Please ask for details

TWIST III V0 (straight) and TWIST III V90 (90° bend) are optional designs with a hose barb for applications where a hose will be crimped/clamped onto the barb. Both allow reinforcement with an optional metal sleeve when required.



Fluid Systems

Total flexibility and less weight

NORMA Group's Fluid Systems can achieve weight savings. This is thanks to excellent temperature and chemical resistance, that together with a high level of flexibility, create synergies between our wide range of clamps, quick connectors and retaining products.



## TOC – TRANSMISSION OIL COOLER

TOC (Transmission Oil Cooler) tube systems are designed for engine and transmission oil cooling.

The product has a flexible tube system connecting the transmission oil cooler and the automatic transmission, and the low push on force makes for easy and quick assembly. As the manufacturer of all components, NORMA Group provides you with one global development partner for the complete system.



### *The advantages at a glance*

- Fast assembly without tools – time and cost reduction
- Robot assembly possible – automated processes
- Compact building method – employment in extremely close installation conditions possible
- Integrated seal – optimal tightness
- Closing cone principle – S quick connector is protected from unintentional opening and cannot be unlocked under pressure



## CWS – COOLING WATER SYSTEMS

CWS are plastic systems used for cooling water. Combining a variety of products from the extensive NORMA Group portfolio, the CWS creates a cost-effective cooling water system. With an excellent media and chemical resistance especially against hydrolysis, the CWS has high system flexibility.



### *The advantages at a glance*

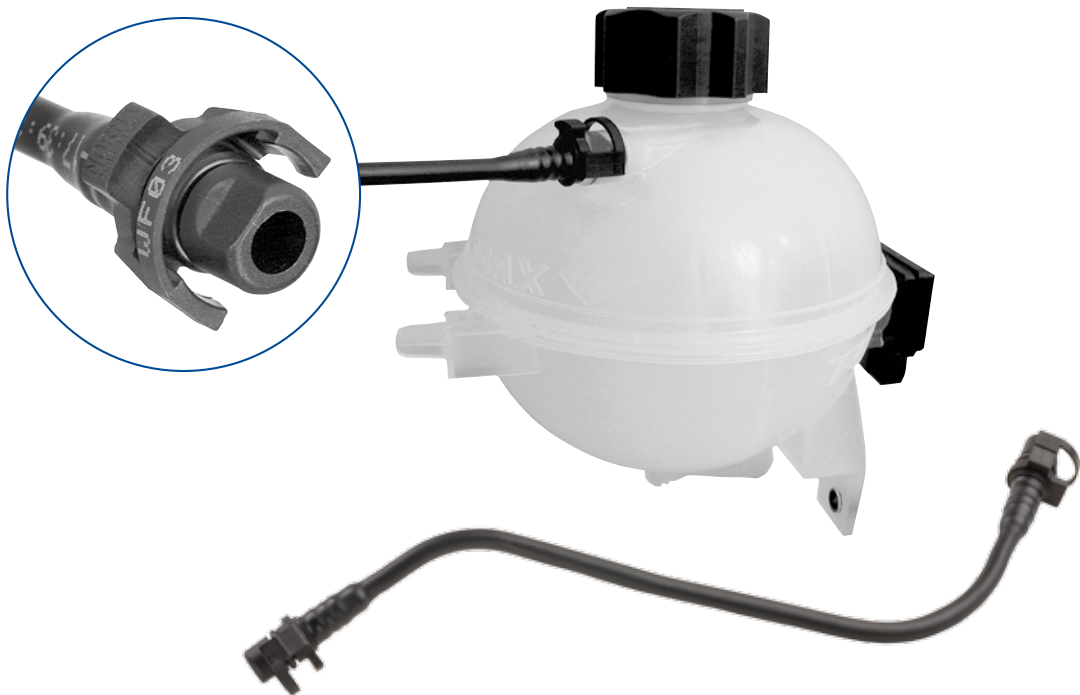
- Reduces number of joints
- Reduces weight (up to >75%)
- Realizes very small diameters
- High temperature stability -40°C to 135°C





## CWV – TO BE USED IN COOLING WATER TUBE SYSTEMS

The thermoformed lines ventilating the cooling water circuit is what we call cooling water ventilation (CWV). These thermoformed lines are connected to the cooling water lines at critical areas where air, which is in the cooling water line, can exhaust. If the lines fail to work, the air in the circuit cannot cool and the engine ultimately breaks. This product is recommended to be used in the engine bay of a passenger vehicle.



### *The advantages at a glance*

#### Technical features

- High temperature stability, from  $-40^{\circ}\text{C}$  to  $135^{\circ}\text{C}$
- Excellent media resistance compared with common medias
- Great chemical resistance, especially compared with hydrolysis
- High system flexibility

- Quality – reduces the number of joints
- Cost reduction (part price) by up to 40%
- Reduces assembly time
- Reduces weight by up to 75%
- Realizes very small diameters



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