

INSTALLATION, OPERATING AND MAINTENANCE MANUAL



TORAFLEX® S50



TORAFLEX® S25

METAL EXPANSION COMPENSATORS

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1. GENERAL INFORMATION ON THE MANUAL

- This Manual provides information on safely using the product, being binding for preservation, storage, handling, transport, installation, commissioning, operation, maintenance, repair and disposal, and must be thoroughly observed at any step.
- Please contact the supplier or the manufacturer in case of issues which cannot be solved by reference to this Manual.
- Any deviation from this Manual and sound engineering practice or modification on the product shall be notified to manufacturer for advice or approval.
- In addition, regional safety requirements must be always applied and observed at any step.
- All the work related to the product must be carried out, supervised and inspected by specialist personnel. It is the owner's responsibility to define areas of responsibility and competence and to ensure the proper monitoring.
- This Manual is in accordance with Directive 2014/68/EU on Pressure Equipment (PED).
- For ATEX applications, please refer to ATEX Specific instructions.
- The manufacturer reserves the right to make technical modifications at any time.

2. NOTES ON POSSIBLE DANGERS

2.1 Significance of symbols



Warning of general danger.

2.2 Explanatory notes on safety information

In this Manual dangers, risks and items of safety information are highlighted to attract special attention.

Information marked with the symbol above describes practices, which if fail to comply with, can result in serious injury or danger of death for users or third parties or in material damage to the system or the environment. It is vital to comply with these practices and to monitor compliance.

The rest of information not specifically emphasized in this Manual, along with Data Sheet and product marking, must also be observed and complied with for safely using the product.

3. PRESERVATION, STORAGE, HANDLING AND TRANSPORT



ATTENTION!

- *Protect against external force (impacts, vibrations, etc.).*
- *Allow only skilled personnel; suitable handling and lifting equipment must be used. Use gloves and other protection equipment to avoid cutting with sharp edges of ends or rods. See Data Sheet for weights or consult manufacturer.*
- *Always use suitable protection equipment, and minimize the use of human body force at any step to avoid injuries.*
- *There is a risk of body member (hand, finger, arm...) crushed against any other solid element (wall, pipe, floor, etc.) during handling. Take this into account and handle with care.*

- Use proper packing for transportation.
- Keep storage protection before installation.
- Some steel parts are primer coated by a paint layer against corrosion during transport and storage, do not damage this layer.
- In order to prevent damage, corrosion or rust on the surface, avoid extreme temperatures (keep at 5°C to 50°C), avoid high environmental humidity or corrosive environment. Keep the compensators away from direct sunlight, dust, flames or rain. Do not pile up excessive weight. In case of severe bumping inspect the material for any damage and replace if necessary.

4. DESCRIPTION

4.1 General Description. Area of Application. Operating principles

Metal Compensators are flexible unions used on rigid pipe work systems to absorb axial thermal movements of compression and expansion. They consist of a corrugated omega shaped bellow, with welded ends (S25) or flanged ends (S50), and an internal sleeve, which protects the bellow from wear and turbulences, and thus they are unidirectional. Additionally S50 type incorporates limit rods as standard.

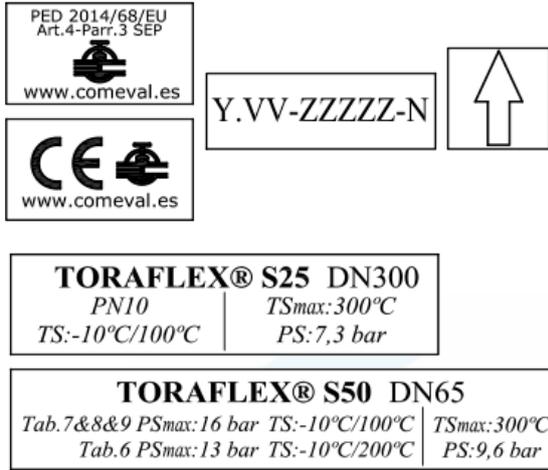
Compensators diagrams with parts can be seen at the end of the Manual.

4.2 Technical data – remarks

For data such as main features, duties/limits of use, dimensions, weights, allowable movements, etc. refer also to Data Sheet.

4.3 Marking/label

Description of labelling:



Mark	Description
	CE-Marking
	Manufacturer logo
www.comeval.es	Website of manufacturer
SEP	Sound Engineering Practice
PED 2014/68/EU	Directive 2014/68/EU
TORAFLEX®	Brand
S25 / S50	Compensators code
Y.VV	Manufacturing year (Y.16 = 2016)
ZZZZZ-N	Batch / Serial no.
	Arrow showing normal flow direction
Tab.	Applicable tables acc. to PED 2014/68/EU Annex II
PSmax	Max. pressure
TS	Min. / Max. temperature at max. pressure
PS	Max. pressure at max. temperature
TSmax	Max. temperature
PN	Nominal pressure, max. pressure in bar
DN	Nominal diameter

4.4 CE marking. Intended use acc. to PED

PS	DN					
	≤25	32-40	50	65	80-100	125-600
10						
13						
16						

Stable gases of group 1* compatible with materials of construction, acc. to Directive 2014/68/EU Annex II table 6 up to category I

PS	DN								
	≤50	65	80-100	125-150	200	250	300-350	400-500	600
3									
6									
10									
13									
16									

Stable gases of group 2* compatible with materials of construction, acc. to Directive 2014/68/EU Annex II table 7 up to category I

PS	DN			
	≤50	65-125	150	200
10				
13				
16				

Liquids of group 1* compatible with materials of construction, acc. to Directive 2014/68/EU Annex II table 8 up to category I

PS	DN	
	≤300	350-600
10		
16		

Liquids of group 2* compatible with materials of construction, acc. to Directive 2014/68/EU Annex II table 9 up to category I

* Classification of fluids (group 1 or 2) acc. to Directive 2014/68/EU, Article 13.

Check product selection, material compatibility, pressure and temperature limits and other essential parameters. Ensure proper safety devices/measures are implemented to prevent exceeding intended use. Contact the manufacturer for advice in case of pressure tests exceeding the intended use of the product. Refer to Data Sheet and consult the manufacturer for further information.

5. INSTALLATION

5.1 General remarks on installation

The following points should be taken into account in addition to the general principles governing installation work:



ATTENTION!

- Before installation, make sure previous chapters are thoroughly followed.
- Ensure safe access and working conditions for proper performance.
- Observe all applicable safety measures during installation.
- Remove flange covers or any other remaining packing/storage protection if present.
- Lay pipelines such that damaging transverse, bending and torsional forces are avoided.
- Protect equipment from dirt during construction work. The interior of the compensator and the pipeline must be free of foreign particles.
- Compensators are unidirectional, follow the arrow in the label for normal flow direction for installation. Compensators can be installed in horizontal and vertical pipelines.
- When installing the compensator, there is a crushing hazard between compensator and pipe system. Mind the hands to avoid it.

5.2 Requirements at the place of installation

- Aggressive environmental conditions may reduce the life span of the product. Consider special construction/protective measures in such a case.
- Consider the interaction between the system and the equipment. Foresee guides, anchoring and proper support according to the weight of the components.
- The system and operation protocol should be conceived in such a way to avoid high velocities. Prevent pulsing flow or water hammers, which are very harmful for the whole pipe system.
- Flooding of the product is not recommended.
- Allow enough space for compensator installation, operation and maintenance.

5.2.1 Reaction forces. Anchoring and Guiding. Limit Rods

REACTION FORCES

- Reaction force by internal pressure:

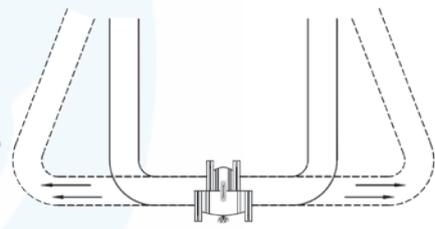
Metal compensators are flexible components which break the pipe system rigidity. A compensator acts as a piston by the forces arising from the internal pressure of the pipe. To prevent the pipes from damage they have to be properly anchored in order to absorb these reaction forces (Fr).

The reaction force caused by internal pressure in a compensator is calculated by the following formula:

$$Fr (N) = P (kg/cm^2) \times A (cm^2) \times 10$$

- Fr = Reaction Force caused by internal pressure
- P = Internal pressure
(Max. Working Pressure and Testing Pressure must be considered)
- A = Effective cross sectional area (given in our Data Sheet)

This reaction force can be absorbed by limit rods provided as standard for S50 compensators.



Joint under pressure acts as a piston.
Results shown when working without anchoring

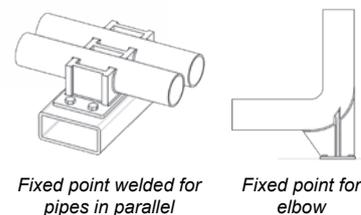
The rest of reaction forces to be absorbed by system anchors are as follows:

- Reaction forces caused by the innate compensator resistance to move, calculated through the compensator stiffness, normally given in N/mm (linear).
- Reaction forces caused by the friction of the guides.
- Reaction forces by the weight of the system not hold by the Guides.
- Centrifugal forces on bends caused by flow velocity.

ANCHORING. FIX POINTS

We call Fix Points to the anchors that hold the pipe and absorb reaction forces. Every compensator has to be installed between two Fix Points. Intermediate Fix Points are the ones just absorbing forces caused by compensator stiffness and friction of Guides, whereas Main Fix Points also absorb the forces caused by internal pressure, centrifugal forces and system weight not supported by Guides.

Main Fix Points are normally located in pump groups, valves, bends, crosses, line ending or flow change sections of the pipe work.



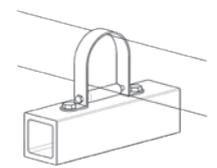
Fixed point welded for pipes in parallel

Fixed point for elbow

GUIDING

Guides not only support the pipe system weight, but also maintain correct alignment so that the compensators work adequately. It is important to notice that Guides supporting the pipe system are not Fixed points.

The Guides should be positioned according to certain rules given further on and they prevent buckling of the line.



Guide with roller stand

LIMIT RODS

Their purpose is to absorb the force caused by internal pressure, and release Fix Points from this reaction force. Fix Points are still necessary to hold the pipe and absorb the remaining reaction forces. Limit rods can help to control compensator presetting, as well as bellow over-extension and/or over-compression. S50 compensators have limit rods as standard.

5.2.2 Installation Guidelines for compensators working to balance thermal axial expansion/contraction

Selection of compensators and positioning of Fix Points and Guides in a pipeline must be studied at the same time. We recommend dividing the complete system into simple configurations. The whole selection depends on the movements to be absorbed, pipe system lay out, availability for setting Fix Points and Guides, and compensator type to be used. As above explained we have to differentiate between the Main and Intermediate Fix Points. Reaction forces to be absorbed by anchors have to be calculated and assigned to the Fix Points for their correct design. Since S25 compensators do not have Limit Rods, Fix Points must be sized to also absorb the total reaction force caused by internal pressure.

5.2.3 Calculation of movements to be absorbed by the compensator

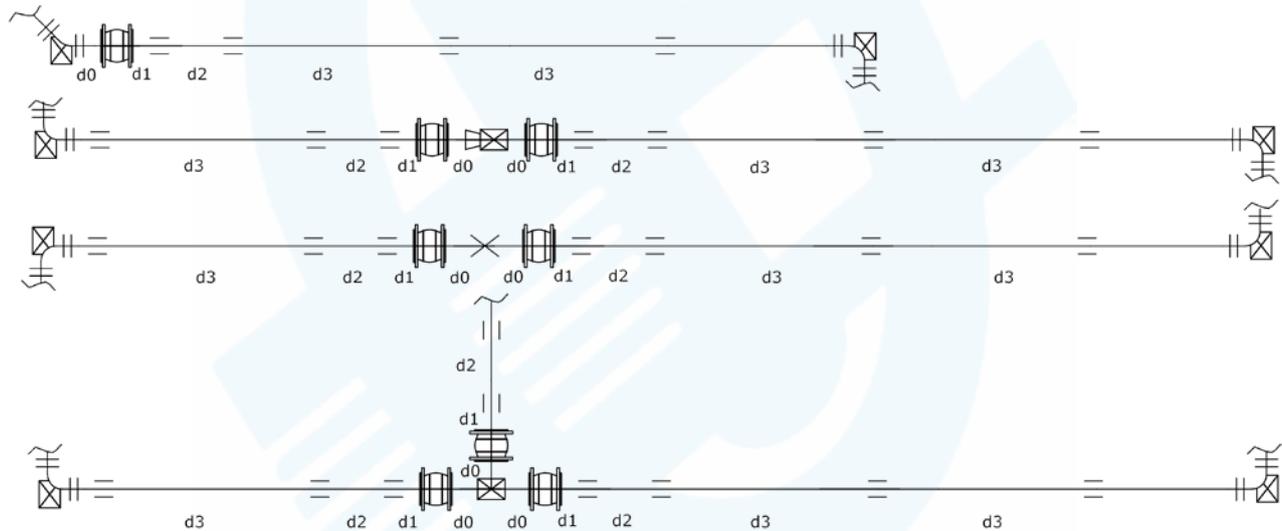
A pipe undergoes and increases in dimensions when its temperature changes. To calculate the change in length in a pipeline it is necessary to know what the temperature differential will be, the expansion coefficient of the pipe and the length of the pipe to be protected by the compensator. Maximum movements allowed for each compensator type are stated in our Data Sheet.

- Establishing the building installation length: when all or most of the movement is in one direction, the compensator can be installed with building length favouring the absorption in such direction.

This can reduce the number of compensators needed and thus the number of anchors and guides.

Allowed building length range for each compensator type is stated in our Data Sheet. Whatever the case, it must be taken into account that working close to the limit length reduces compensator life.

Herewith some examples and recommendations for compensators location with proper anchoring and guiding, when balancing thermal changes in a pipe work.



Simbol.

-  Compensador de dilatación Expansion joint
-  Punto Fijo Principal/ Main Fixed Point
-  Punto Fijo Intermedio/ Intermediate Fixed Point

-  Guía tubular / Guide
-  Codo / Elbow
-  Cambio de sección tubería/ Section change

Distancias recomendadas/Recommended Lengths

- d0 <= 4 x DN (mm), max. 300 mm
- d1 <= 4 x DN
- d2 <= 14 x DN (mm)
- d3 <= 400 x √DN (mm)

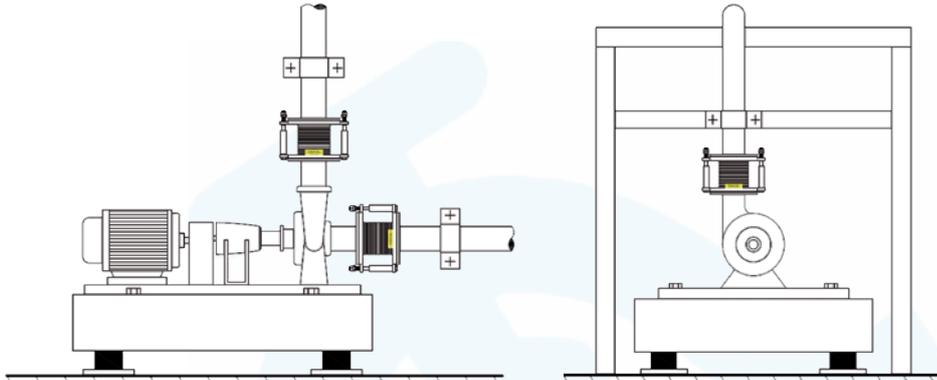
Anchoring and guiding for Expansion Compensators absorbing axial movements

5.2.4 Installation Guidelines for compensators working to absorb vibrations

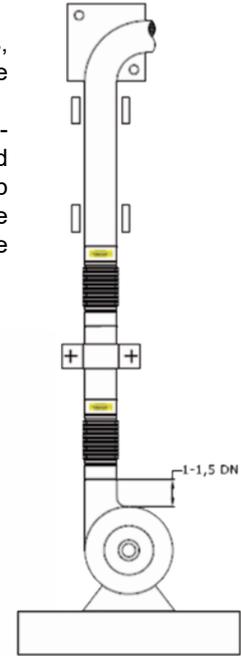
A compensator should work either as expansion compensator or to absorb vibrations, but not both functions at the same time; installation, pipe anchoring and guiding requirements are different.

Standard compensators S25 and S50 have a certain capacity to absorb low amplitude vibrations, but they are not designed for such purpose. We offer specific configurations for such purpose without internal sleeve.

The compensator must be installed in its rest position, near the source of vibrations (pump, compressor, etc.), leaving just 1-1,5 DN distance, or more in case the compensator could be affected by direct flow stream. The equipment source of vibrations must be properly anchored to absorb reaction forces and another Fix Point must be set immediately after the compensator to limit the vibrations amplitude onto the pipe. Proper guiding of the pipe work is also necessary to ensure the compensator works correctly.



Installation of compensators working to absorb vibrations



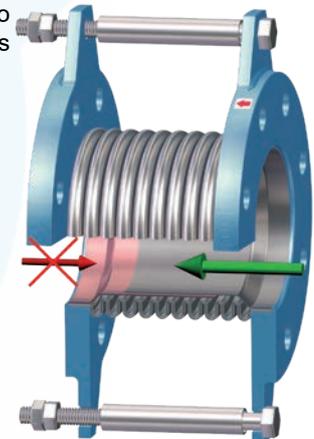
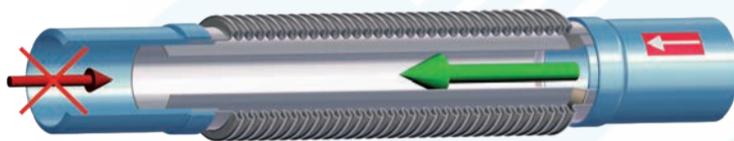
Installation of compensators to absorb vibrations

5.2.5 Assembling the compensator to the pipe

- Remove the remaining storage protection.
- Ensure that compensator and piping work are completely free from dirt, rust, pipe, scale, welding slag or any other foreign material. In case of use of cleaning products, make sure they are compatible with materials of construction.
- Start installation only once all work on the adjacent pipe (flanges welding, anchors setting, etc.) has been completed and cooled down.
- Make sure the free space for the compensator is according to the expected movements to be absorbed, taking into account the pipe temperature at installation time. Compensators with anti-vibratory function to be installed in their rest position.

Installation position:

- Metal compensators can be installed either in horizontal or vertical pipelines.
- Follow the arrow in the label according to flow direction.



5.2.6 Installation of S50 compensators (flanged ends)

- Make sure that counterflanges are compatible with standard of compensator flanges.
- Ensure that contact faces of compensator flanges and counterflanges are free of dirt and in good condition.
- Check correct pipe alignment, anchoring and guiding, in accordance to the recommendations of this Manual. Counterflanges should fit smoothly. Avoid gradients, rotation and pipe misalignment that could cause pipe and compensator stress and leakage once installed.
- Select the proper flange face gaskets according to duty and centre them on the flange face properly.
- Do not force the counterflanges and do not try to tighten the bolts when a gap exists between compensator and pipe or if misalignment is observed. Tighten in a crosswise, moderate and uniform manner. During start-up tighten again if leakage is noticed or replace gasket if necessary.

5.2.7 Installation of S25 compensators (butt weld ends)

- Ensure that compensator and pipe ends are compatible dimension and material wise.
 - Clean carefully compensator and pipe ends.
 - Check correct pipe alignment, anchoring and guiding, in accordance with recommendations of this Manual.
 - Use a suitable electrode in accordance to compensator and pipe ends materials.
 - Welding to be carried out by qualified personnel, controlling the source of heat to prevent bellows damage.
- Planners / construction companies or the owner are responsible for positioning and installing products.

6. COMMISSIONING & OPERATION



ATTENTION!

- Before commissioning the equipment, check the material, pressure, temperature, flow direction and other essential parameters. Always use the product within the scope of intended service and operating duties.
 - Before commissioning, make sure previous chapters have been thoroughly followed.
 - Regional safety instructions should be adhered to.
 - It is essential to flush the pipe system thoroughly to eliminate all the particles and impurities which could remain in the pipes and particularly welding residue, chips, tool remains, etc. that could damage the equipment during start-up. Ensure that during cleaning of the pipe system, any chemicals used and temperature are compatible with the compensator construction.
 - Temperatures above 50°C or below 0°C may cause personnel injuries if compensators are touched.
 - Leakage of media through compensator or between counterflanges may also cause scalding, health harm, pollution, fire or damage to other parts of the installation depending on the media.
- Use suitable protection equipment when approaching the compensator, ensure that the corresponding warning signs are displayed on the compensator or surrounding area, and/or isolate the equipment in case of danger.
- Before commissioning a new plant or restarting it after repairs or modification, always ensure that:
 - All work has been completed correctly.
 - The compensator is in the correct position for its function.
 - Safety devices/measures have been implemented.
 - The filling, warming-up and starting-up of the system shall be gradual so as to avoid any inadmissible stress. Check for tightness in compensator/pipe connections, and retighten crosswise and gradually if necessary until leakage elimination. If leakage persists, correct alignment and centring of the equipment should be checked, surfaces should be thoroughly cleaned and gaskets changed. If contact surfaces are irreversibly damaged replace them.

- Ensure compensator surface is in good condition and retouch coating protection if any when needed.
- In case of risk of media freezing inside the compensator, take due measures to avoid it.
- Make sure that all guides and anchors are firmly secured in their right place and working properly before and during first load.
- Inspect guides to discard jamming and anchors resistance.
- Maximum recommended hydraulic test pressure 1,1 x PN, with water at ambient temperature. Anchoring should be properly sized to bear with test pressure.

7. CARE AND MAINTENANCE

The operator must define maintenance and maintenance-intervals to meet requirements.

- Check for body and connections tightness and compensator good condition.



ATTENTION!

- Before disassembling the compensator, note chapters 3, 8 & 10.
- Only carry out maintenance work in the pipework when all safety measures have been taken.
- Check that compensator surface inside and outside is in a good condition and retouch coating protection if any when needed. If advanced corrosion or erosion is observed, double check service and compensator features and replace the compensator properly.
- If there is leakage through unions, refer to chapters 5 & 6.
- If there is leakage through the body, double check service, correct installation and compensator features and replace the equipment immediately.

- Check that compensator is working properly without jamming or damage of mechanical components (bellow, tie rods).
- Check that there is no dust or other deposits compromising the proper functioning of the equipment.
- Check that anchoring and guiding of the pipe work are in good condition.

After any maintenance work please refer to chapters 5 and 6 for installation / commissioning.

Recommended Spare parts:

Compensators have no spare parts; depending on service it is advisable to keep compensators in stock for quick replacement.

8. DISMANTLING THE COMPENSATOR



ATTENTION!

The following points must be observed:

- Pressureless pipe system.
- Medium must be cool.
- Plant must be drained.
- Note chapter 3 for proper handling and lifting.
- Additionally, in case of toxic, corrosive, flammable or caustic media:
 - Purge pipe system carefully.
 - Use proper protection equipment to avoid health harm.
 - Adopt proper actions to avoid pollution of the environment.

9. GOODS RETURN & DISPOSAL

- For any returned goods, the issuing company must provide information in written on any hazards and the precaution in case of potentially polluting or harmful residues, or any mechanical damage that could present a health, safety or environmental risk, as enforced by EU Health, Safety and Environment Law, including the Safety Data Sheets of the substances identified as potentially hazardous.
- Compensators are recyclable and not expected hazard to the environment.

10. WARRANTY / GUARANTEE

- The extent and period of warranty cover are specified in the "General Sales Terms" of COMEVAL VALVE SYSTEMS valid at the time of delivery or, by way of departure, in the contract of sale itself.
- We guarantee freedom of faults in compliance with state-of-the-art technology and the confirmed application.
- No warranty claims are accepted for any damage caused as the result of incorrect handling or disregard of this Manual, Data Sheet and relevant regulations.
- This warranty also does not cover any damage which occurs during operation under conditions deviating from those laid down by specifications or other agreements.
- Justified complaints will be eliminated by repair carried out by us or by a specialist appointed by us.
- No claims will be accepted beyond the scope of this warranty. The right to replacement delivery is excluded.
- The warranty shall not cover maintenance work.
- Our guarantee coverage does not cover for any commissioning, maintenance or installation of the product or external parts.
- Our guarantee does not cover products proved to have been tampered with or faulted by material wear and tear.
- The Purchaser is responsible for checking that the incoming product is received in good condition and conforms to the ordered specifications. In case of damage caused during transit it is necessary to immediately complain to the carrier within 24 hours. After this time carriers could not assume the derived costs. In case of any deviation in relation to order specifications, please contact us.

COMEVAL VALVE SYSTEMS, S.L. y CIA., Soc. Comanditaria

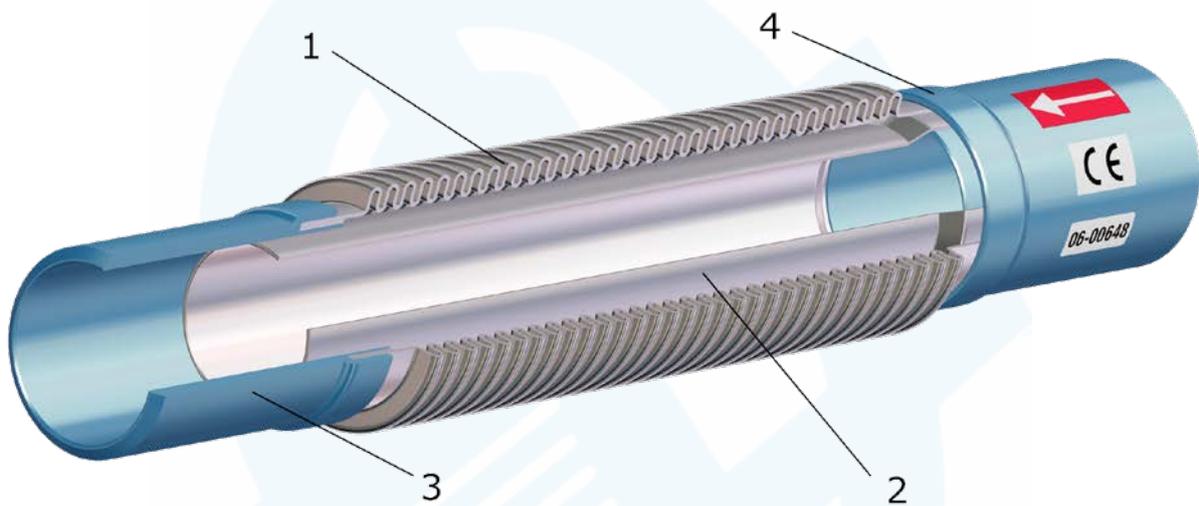
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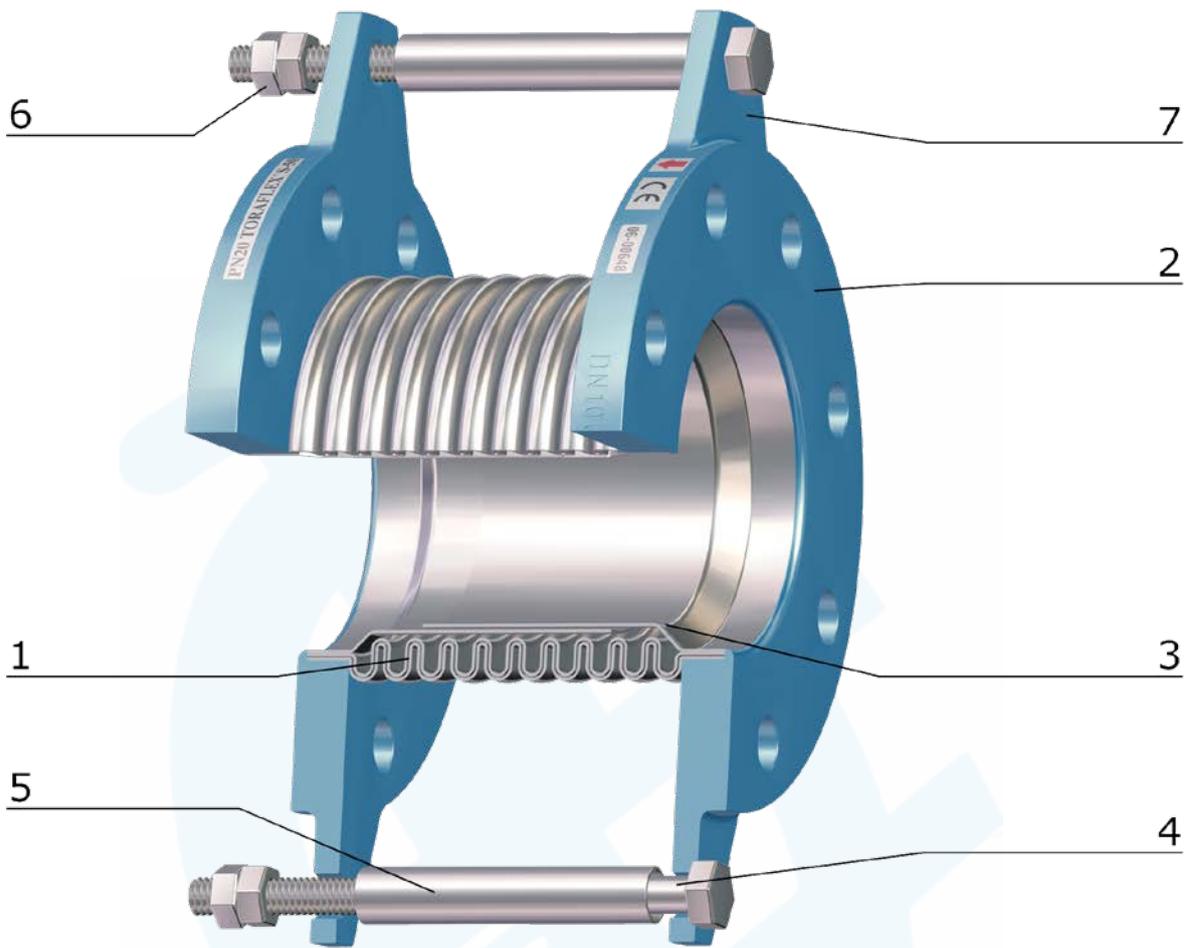
11. PARTS LIST

TORAFLEX® S25



N°	PART
1	Bellows
2	Internal sleeve
3	Tube ends
4	Seal ring

TORAFLEX® S50



Nº	PART
1	Bellows
2	Flange
3	Internal sleeve
4	Limit rod
5	Limit pipe
6	Nut
7	Lug

12. ANNEXES

- 12.1 Declaration of Conformity - DC12EN
- 12.2 Data Sheet DS12

Updated documents on www.comeval.es