

INSTALLATION, OPERATING AND MAINTENANCE MANUAL



TORAFLEX® S10/S15



TORAFLEX® S20



TORAFLEX® S30

RUBBER JOINTS

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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.
- 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. See Data Sheet for weights or consult manufacturer. Use gloves and other protection equipment to avoid cutting with sharp edges of ends or rods.*
- *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.
- Protect the equipment from sharp objects that could easily damage the rubber faces.
- 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 product away from direct sunlight, dust, flames or rain. Protect rubbers also against UV light. Do not pile up excessive weight. In case of severe bumping inspect the material for any damage and replace if necessary.
- Long storage periods have influence in the life expectancy.

4. DESCRIPTION

4.1 General Description. Area of Application

TORAFLEX® Rubber Joints are devised for piping works, consisting of a flexible main shell made of synthetic rubber with inner reinforcements to provide consistency, and pipe connections by means of loose flanges or threaded unions. They can be used either to absorb vibration and dampen noise caused by equipment such as pumps or compressors, or to balance thermal movements in pipe systems due to temperature changes. They also help at installation to balance slight misalignments or length deviations and reduce the effects caused by water hammers to a certain extent. They are widely used in HVAC, water treatments, process industry, ships, etc.

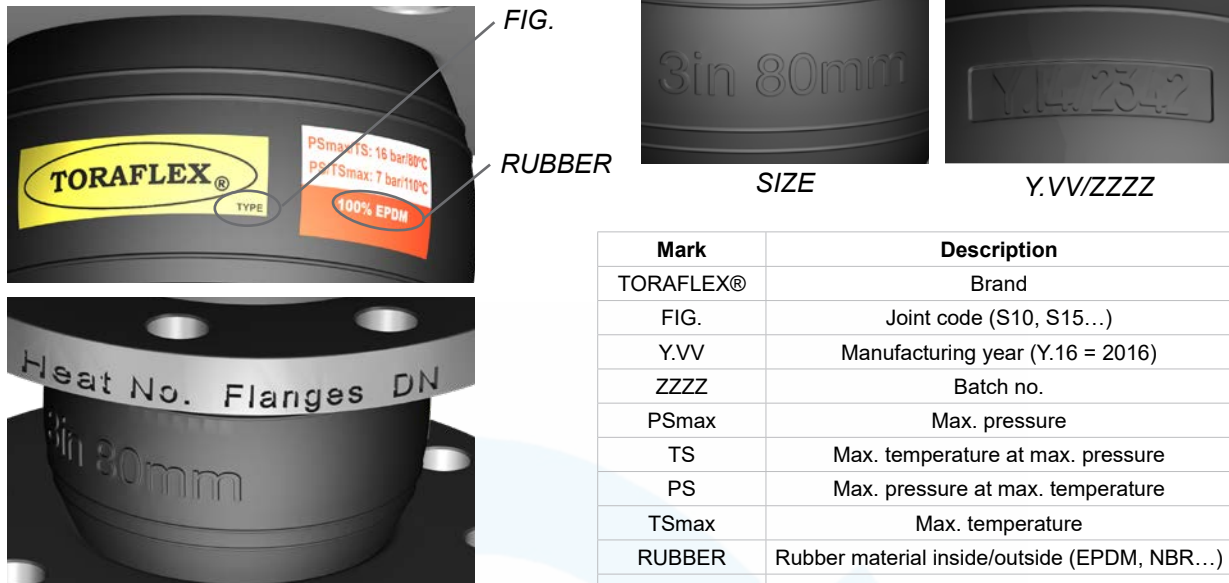
A drawing of each type can be seen at the end of the Manual.

4.2 Technical data - remarks

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 of the product. Refer to Data Sheet for data such as main features, duties/limits of use, dimensions, weights, etc and consult the manufacturer for further information.

4.3 Marking/label

Description of labeling/markings on the rubber:



| Mark | Description |
|-----------|---|
| TORAFLEX® | Brand |
| FIG. | Joint code (S10, S15...) |
| Y.VV | Manufacturing year (Y.16 = 2016) |
| ZZZZ | Batch no. |
| PSmax | Max. pressure |
| TS | Max. temperature at max. pressure |
| PS | Max. pressure at max. temperature |
| TSmax | Max. temperature |
| RUBBER | Rubber material inside/outside (EPDM, NBR...) |
| Flanges | Flanged connection |
| SIZE/DN | Rubber Joint size (80mm=DN80) |

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 Rubber Joint and the pipeline must be free of foreign particles.
- There is not preferred direction of flow. Rubber Joints are bidirectional. Rubber Joints can be installed in horizontal and vertical pipelines.
- When installing the rubber joint, there is a crushing hazard between rubber joint and pipe system. Mind the hands to avoid it.
- The introduction of electrical current, e.g. during electrical resistance welding, may cause the Joint to be destroyed. If there is a possibility that electrical currents may occur, the Joint shall be electrically bypassed.
- Elastomeric or fluoropolymer surfaces should be cleaned if necessary with a wet cloth to avoid electrostatic charge. Also consider the risk of electrostatic charges created by the flow.

- We recommend not to paint or lubricate the rubbers.

5.2 Requirements at the place of installation

- Rubber Joints exposed to weather and outdoors conditions (sunlight, ozone, UV light, etc.) age more prematurely. Consider special construction/protective measures in such a case.
- Minimize when possible strong thermal gradients. Apart for rubber aging, cyclic temperature fluctuations may also lead to loosening of unions.
- In Double Sphere Joints (i.e. S20 and S30 types), use of root rings might be necessary with big sizes, hot water and / or working pressures above 10 bar. Please check our Data Sheet or consult us.
- 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 Rubber Joint installation, operation and maintenance.
- Consider the interaction between the system and the equipment. Proper selection and location of the Joints, as well as proper guiding and anchoring of the system are essential for the safe and proper use of the Joint, as explained in detail here below.

5.2.1 Reaction forces. Anchoring and Guiding. Limit Rods

REACTION FORCES

- Reaction force by internal pressure:

Rubber Joints are flexible components which break the pipe system rigidity. A Rubber Joint 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 Rubber Joint is calculated by the following formula:

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

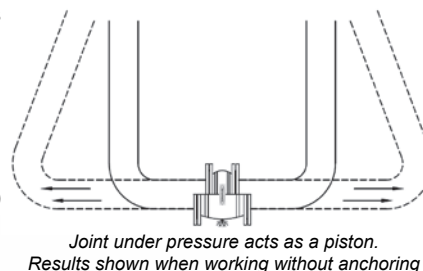
Fr = Reaction Force

P = Pressure

(Max. Working Pressure and Testing Pressure must be considered)

A = Effective cross sectional area

Effective area for each Joint type is given in our Data Sheet.



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

- Reaction forces caused by the innate Joint resistance to move, calculated through the Joint stiffness, normally given in N/mm (axial or lateral) and Nm/° (angular).
- Reaction forces caused by the friction of the guides.
- Apart from reaction forces caused by the Joint installation itself, pipe system weight and centrifugal forces on bends caused by velocity of the fluid must also be considered for anchoring.

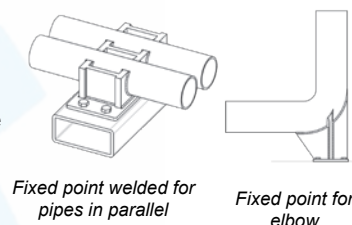
ANCHORING. FIX POINTS

We call Fix Points to the anchors that absorb reaction forces.

Every Rubber Joint has to be installed between two Fix Points within a straight pipe section.

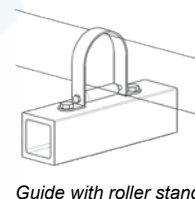
Intermediate Fix Points are the ones just absorbing forces caused by Joint stiffness and friction of guides, whereas Main Fix Points also absorb the forces caused by internal pressure, centrifugal forces and weights not supported by Guides.

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



GUIDING

Guides not only support the pipe system weight, but also maintain correct alignment so that the Joints 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. Special Guides can be used to allow movement in more than one direction.



LIMIT RODS

The main purpose of Limit Rods is to absorb the force caused by internal pressure, and avoid reaction force over Fix Points. Fix Points will be released but they are still necessary. A Joint with Limit Rods will work only with axial movements. They are normally used with high pressures and large DN, that may require very strong anchoring. They also relieve pump frames. Limit rods can control Joint bellow over-extension and/or over-compression.

5.2.2 Installation Guidelines for Rubber Joints absorbing vibration and noise

Rubber Joints are commonly installed in pump groups to absorb vibration and noise. The Rubber Joint be installed in its rest position. Do not overstretch it to fill a gap between counterflanges and Joint faces. Alternative measures should be taken in such a case (modify pipe arrangement, spacer, etc.).

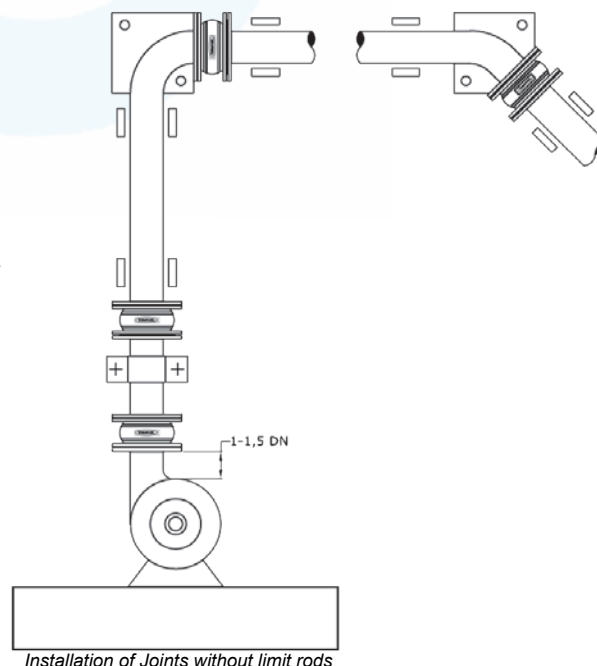
The Rubber Joint must be installed near the pump group, leaving just 1-1,5 DN distance. Leave more distance in case of abrasive media.

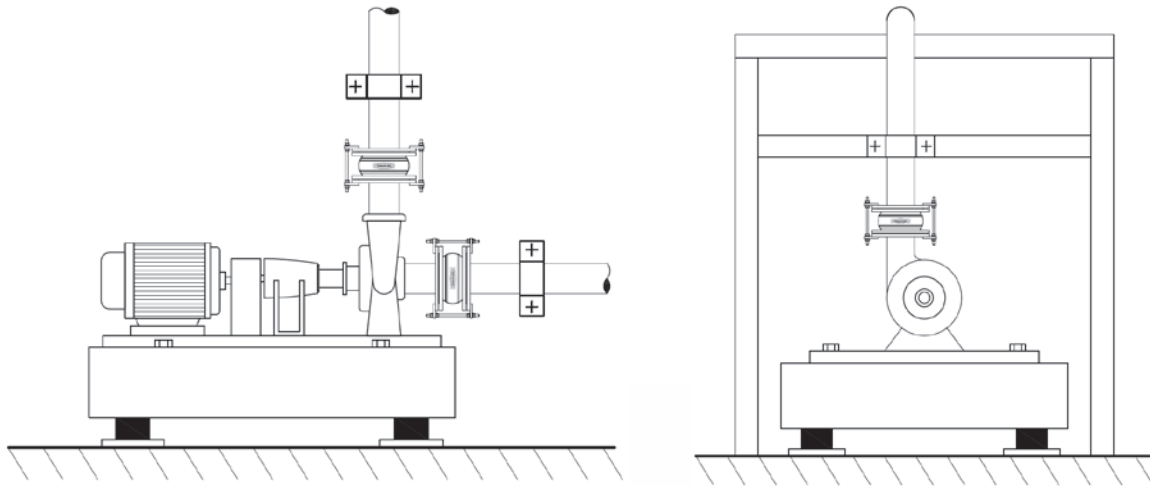
The Pump group frame must be properly anchored to absorb the reaction forces and another Fix Point must be set immediately after the Rubber Joint to limit the vibrations amplitude onto the pipe.

Proper guiding of the pipe is also necessary to ensure the equipment works correctly.

Absorbing pipe expansion/compression must be carried out independently.

In case Main Fix Points could not be sized to absorb the reaction force caused by internal pressure, limit rods can be used to relieve them from such forces.





Installation of Joints with limit rods

Limit Rods Assembly on Rubber Joints absorbing Vibration and Noise:

- 1) Set the Joint in its rest position.
- 2) Place the plates symmetrically on the external face of counterflanges, and equidistantly to the flange drillings. Fix plates with nuts and bolts as shown in the picture.
- 3) Introduce the rod through the third orifice of each plate until it remains centred with the Joint.
- 4) Introduce a rubber gasket from each side of the rod and then a metal washer.
- 5) Introduce nuts from each side of the rod, and fix them in the desired position (preferably limiting the Joint expansion to its rest position) by means of counter-nut or with a welding spot.



5.2.3 Installation Guidelines for Rubber Joints working as Expansion Joints

Selection of Expansion Joints and positioning of Fixed 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, possibilities for setting Fixed Points and Guides, and Expansion Joints type to be used.

As explained before we have to differentiate between the Main and Intermediate Fixed Points. Reaction forces to be absorbed by anchors have to be calculated and assigned to the Fixed Points for their correct design.

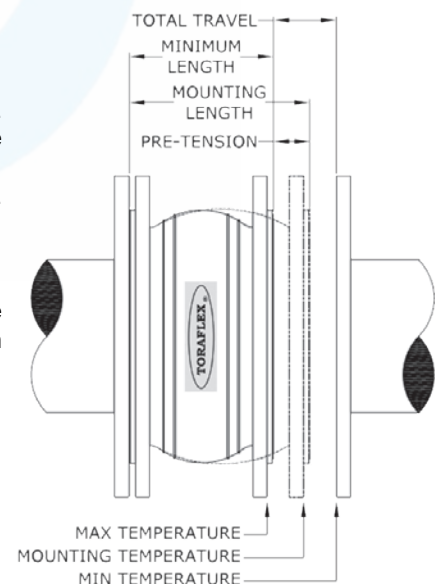
In case Main Fix Points could not be sized to absorb the reaction force caused by the internal pressure, Limit Rods can be used to relieve them from such forces.

- Calculation of movements to be absorbed by the Joint:

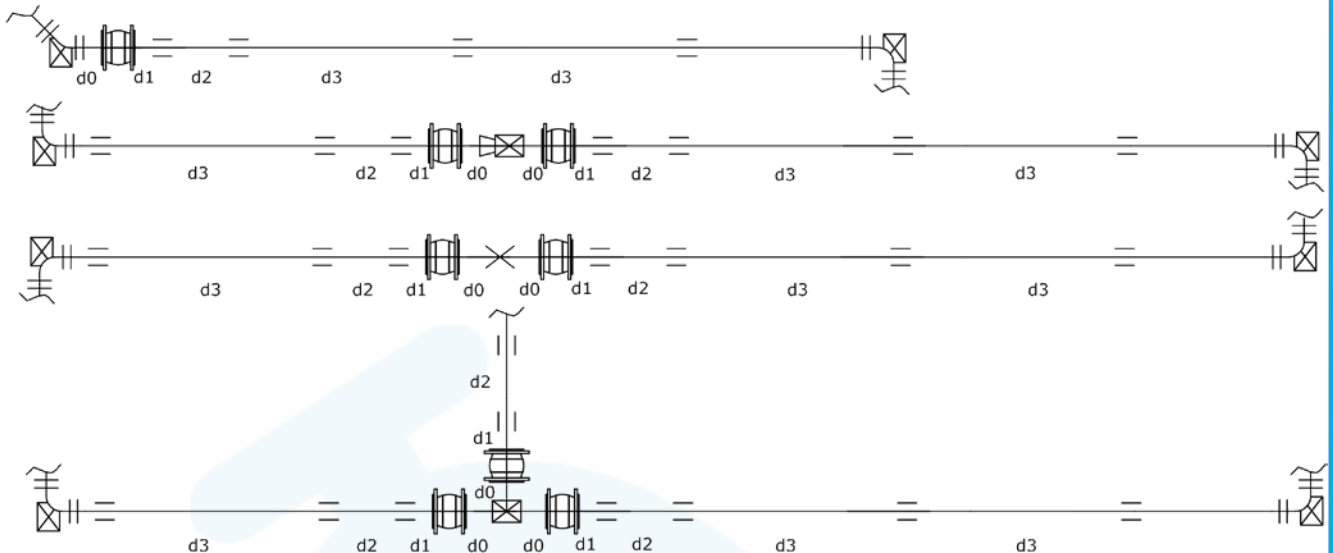
A pipe undergoes and increases in dimensions when its temperature changes. To calculate the change in length in a pipeline it is necessary to know what the temperature differential would be and the expansion coefficient of the pipe. Maximum movements allowed for each Joint type are stated in our Data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

- Establishing the building installation length:

The Joint may be installed in its rest position or slightly compressed to favor the absorption of movement under pipe contraction. Building length limits for each Joint type is shown in Data Sheet.



Herewith some examples and recommendations for location of Rubber Joints working as Expansion Joints with proper anchoring and guiding.



Symbol.

- 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

- $d0 \leq 4 \times DN \text{ (mm)}, \text{ max. } 300 \text{ mm}$
- $d1 \leq 4 \times DN$
- $d2 \leq 14 \times DN \text{ (mm)}$
- $d3 \leq 400 \times \sqrt{DN} \text{ (mm)}$

Anchoring and guiding for Joints working as Expansion Joints

Limit Rods Assembly on Rubber Joints working as Expansion Joints:

Installation according to drawings and following similar steps described above.

- To control Joint compression, inner rod nuts can be used, fixed with a welding spot or counter-nut, or alternatively a sleeve in the proper length can be set in the rod part between the plates.
- To control Joint expansion, outer rod nuts can be set with a welding spot or counter-nut.



ATTENTION!

- Make sure that Joint expansion/compression limits in our Data Sheet are not exceeded.

- Limit rods can also be used to pre-expand (with inner rod nuts) or pre-compress (with outer rod nuts). Tightening must be progressive and uniform.



ATTENTION!

- Make sure that Joint building length limits are not exceeded.
- Torsional strain is not permitted.

Limit Rods Assembly on Rubber Joints working with Vacuum

Description of limit rods use in vacuum service in our Data sheets in www.comeval.es.

Follow the same procedure explained above, but placing plates on the internal face of the Joint flanges. Internal nuts will prevent the Joint to shrink due to vacuum.

5.2.4 Assembling the Joint to the pipe

- Remove the storage protection carefully if any just before installation.



ATTENTION!

- Special care should be taken in order not to damage the soft parts.

- Ensure that the Joint interior and the piping system are 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 material of construction.

- Start installation of the Joint only once all work on the adjacent pipe (flanges welding, anchors setting, etc) has been completed and cooled down. Rubber Joints can easily be damaged by welding sparks or heat, sharp objects, etc.

- Avoid gradients, excessive rotation or pipe misalignment that could exceed the permissible movements of the Joint in use.



Installation position:

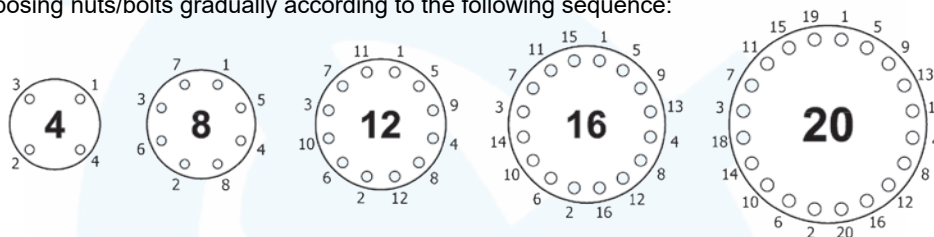
- TORAFLEX® Rubber Joints can be installed either in horizontal or vertical pipelines, subject to proper anchoring and guiding.

5.2.5 Installation of Rubber Joints with flanges



ATTENTION!

- Make sure that counterflanges are compatible with the standard of the Joint flanges.
- Ensure that contact faces of Joint flanges and counterflanges are free of grease and in good condition.
- Sealing surfaces of mating flanges shall be checked to ensure that there is no risk of the rubber bonds being damaged by sharp inside edges or projections or recesses. The screw length shall be selected to ensure that the rubber bellows cannot be damaged. During installation and operation, the Joints must be protected from radiated heat and welding heat.
- Ensure pipe alignment. Counterflanges should fit smoothly. Make sure that the gap between the 2 counterflanges has enough clearance to fit the equipment without damaging the rubber faces (carefully retract slightly counterflanges if necessary) but, no free gap shall exist between Rubber Joint faces and counterflanges faces. Joints may be damaged if stretched during assembly.
- The rubber shell itself acts as sealing gasket, so no additional gaskets have to be added.
- In case of any lubricant used, make sure it is compatible with rubber material.
- Types S10, S15, S20 have loose flanges, rotatable 360°, which eases assembly.
- Tighten opposing nuts/bolts gradually according to the following sequence:

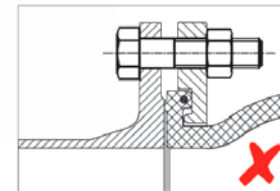
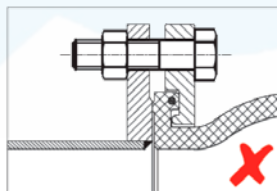
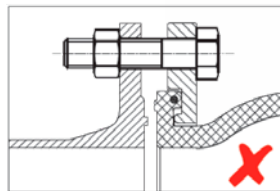
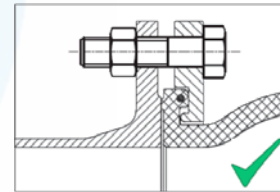
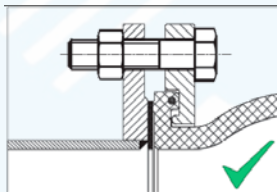
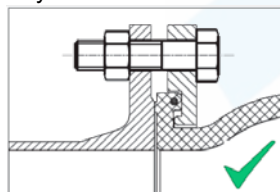


The maximum tightening values given under are for reference. After first tightening, the rubber relaxes and starting torque is lower again. Apply a moderate tightening torque at first and only retighten to correct any leakage. An excessive or irregular torque leads to rubber damage and shortens Joint life span.

- Maximum tightening torques:

| Rubber Joint Size (DN) | Maximum tightening torque (Nm) |
|------------------------|--------------------------------|
| ≤DN80 | 60-70 |
| DN100-300 | 80-90 |
| DN350-600 | 80-120 |
| DN700 | 150-230 |
| DN800-900 | 230-280 |
| DN1000 | 250-300 |

Pay attention to the following recommendations:



Counterflanges contact faces should be flat. Do not use grooved counterflanges.

Counterflanges should have correct ID to prevent damage to rubber contact face. Use a spacer with additional gasket between Joint and counterflange when installing slip-on flanges or counterflanges with different ID than Joint, in order to avoid damage on the rubber face. We strongly recommend the use of welding neck counterflanges with correct ID.

Rubber can swell under operation. Make sure bolts are set in such a way to avoid the contact with the Joint rubber.

It is always recommended that pipeline and counterflanges to have 90° angle and be perpendicular to each other. This is a must for working pressures above 10 bar to avoid rubber damages.

5.2.6 Installation of Rubber Joints with threaded ends



ATTENTION!

Make sure that the pipe screw has the correct finish and compatible cone with the Joint.

- Use proper sealant according to duty, such as hemp core, Teflon, etc.
- Check that pipe introduction in the Joint does not exceed valve thread, leave at least 1 mm as safety margin.
- Tighten with a plain or adjustable wrench on the hexagon end of the Joint only. Apply force to any other area may seriously damage it. Do not use hook spanners or other wrenches that could damage the hexagon surface. It should be threaded smoothly. If not, do not try to force the thread and avoid wrench extensions since this could lead to breaking the valve or damaging the thread. Tightening must be moderate. Overtightening the union could cause rubber break or stretching.
- 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, media and other essential parameters. Always use the product within the scope of intended service and operating duties. Check our Data Sheet.
- Water treatment chemicals may attack Joints materials. Before adding these kind of chemicals, make sure they will not damage the Joints and consult us and our Data Sheet when needed. In any case even chemicals suitable for elastomers may only be added in the proportions of ingredients specified by the manufacturer of chemicals.
- Before commissioning, make sure previous chapters have been thoroughly followed.
- 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 Joint construction.
- Regional safety instructions should be adhered to.
- Temperatures above 50°C or below 0°C may cause personnel injuries if Joints are touched.
- Leakage of media through Rubber Joint 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 rubber joint, ensure that the corresponding warning signs are displayed on the rubber joint 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 Joint is in the correct position for its function.
 - Safety devices/measures have been implemented.
- Check for tightness in Joint/pipe connections. For flanged Joints, retighten flange union bolts/nuts crosswise and gradually if necessary until leakage elimination. If leakage persists, correct alignment and centring of the equipment should be checked, and surfaces should be thoroughly cleaned. If contact surfaces are irreversibly damaged replace them. For threaded Joints in case of leakage between swivel unions, retighten slightly and progressively until leakage disappears.

- Inspect guides to discard jamming.
- In case of risk of media freezing inside the rubber joint, take due measures to avoid it.
- Maximum recommended hydraulic test pressure 1,1xPN (PSmax marked in the rubber bellow). Test Pressure medium to be water at room temperature.



ATTENTION!

- Overtightening the unions may cause rubber damage and reviews life span of the Joint. In case of leakage retighten only until achieving tightness.
- In case of hydraulic test above PSmax, please double check the reaction forces and anchoring sizing.
- Torsional strain to be avoided during commissioning and operation.

7. CARE AND MAINTENANCE

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

- Check for body and connections tightness.



ATTENTION!

- Only carry out maintenance work in the pipework when all safety measures have been taken.
- When inspecting and replacing the Joint check working parameters, material compatibility, anchoring and guiding, etc. In general note chapters 5 & 6.
- If there is leakage through unions, refer to chapters 5 & 6. Unions may loosen for example in case of temperature cycling or during shut-down times, and periodical retightening may be needed.

- Check that Joint 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.
- In case of limit rods are installed, check that the nuts on the rods limiting expansion/compression have not moved due to vibrations and that they are not weakened by corrosion. If gusset plates or threaded rods are bent or distorted, this is a symptom of over-elongation or over-compression.
- Rubber bellow should be preventively replaced. Corresponding intervals should be defined and scheduled by the plant operation personnel according to service level. There are many factors influencing the life expectancy, such as installation arrangement, temperature, pressure, movements absorbed, cycles, environmental exposure, media, flow rate, storage period prior to installation, etc. to be evaluated altogether. Life expectancy of a joint properly handled and installed and working under not harsh service conditions may be estimated in the range of 3-5 years.

Replacing the bellow rubber:

Joint should be carefully anchored to a bench. With the assistance of special shape wrenches (hook end type) the rubber neck must be slipped progressively under the flange by deformation. Repeat the operation at the other end. Place the new bellow inversely making sure it is not damaged during the assembly.

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



ATTENTION!

- Do not use wrenches or tools with sharp ends that could damage rubber surfaces.

Recommended Spare parts:

When it is needed to replace the rubber bellow, existing flanged unions can be reused if in good condition, although it is often more practical to replace the whole unit.

8. DISMANTLING THE JOINT



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

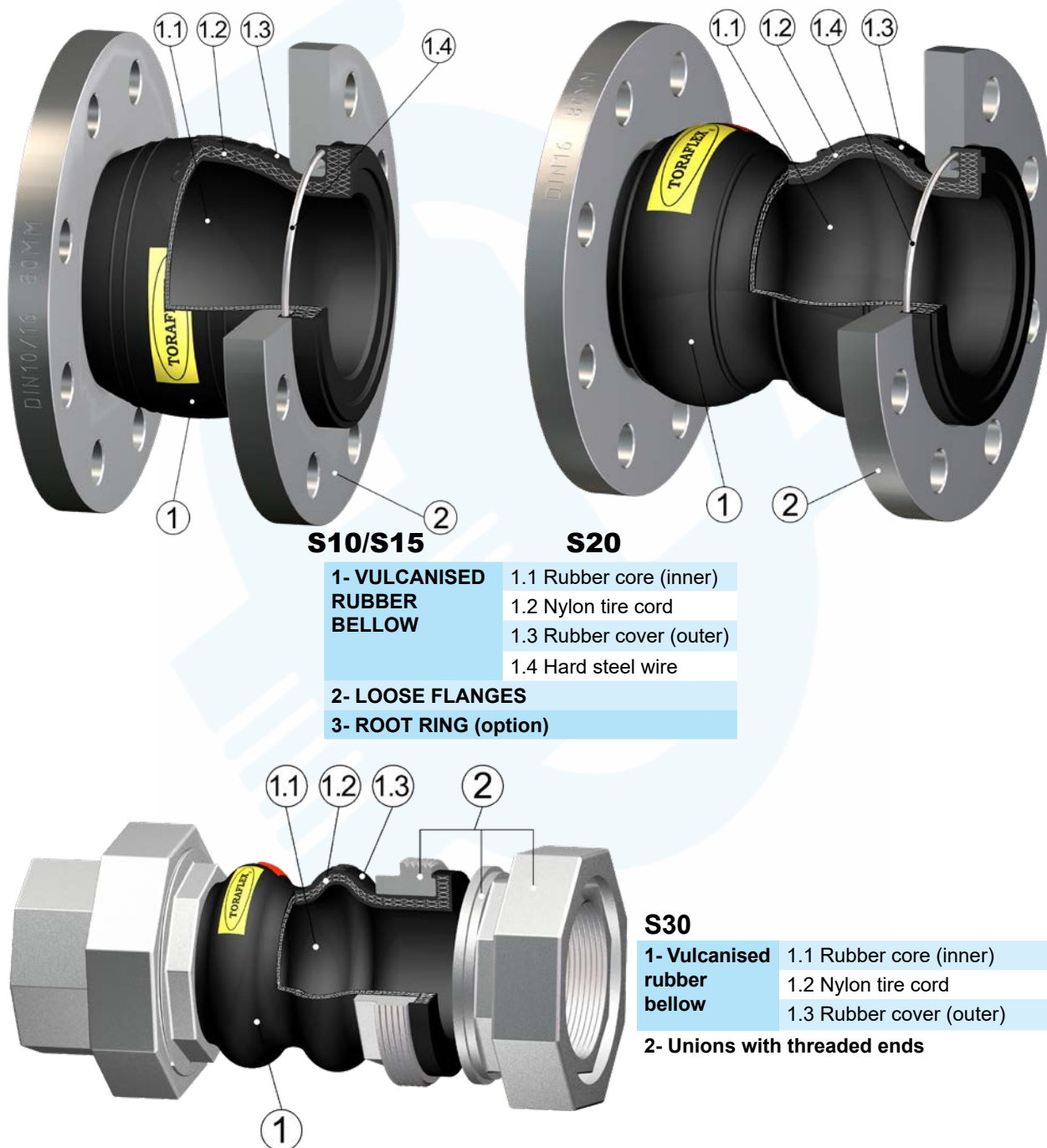
- For any returned goods, the issuing company must provide information in written on any hazards and the precaution in case of potentially polluting or harmful residues, or any mechanical damage that could present a health, safety or environmental risk, as enforced by EU Health, Safety and Environment Law, including the Safety Data Sheets of the substances identified as potentially hazardous.
- Rubber Joints materials represent a hazard to the environment and shall be disposed by specialized company by approved procedure. Incineration is not permitted.

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.

11. PARTS LIST



12. ANNEXES

12.1 Declaration of Conformity - DC13EN

12.2 Data Sheet - DS13

Updated documents on www.comeval.es