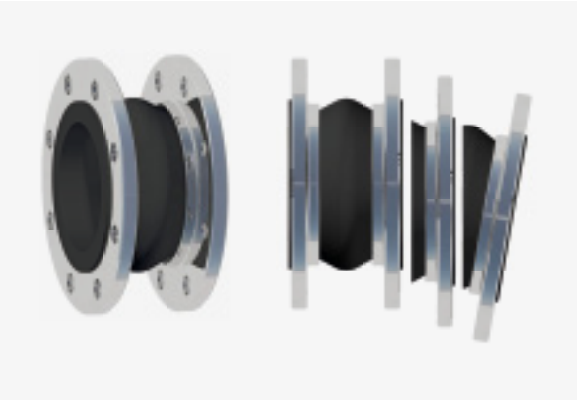
Model variants

HKS rubber expansion joints are available in different models (**universal, lateral and angular expansion joints**), rubber bellows qualities (depending on medium) and the bellows design (depending on pressure and temperature).

Universal rubber expansion joints



Design:

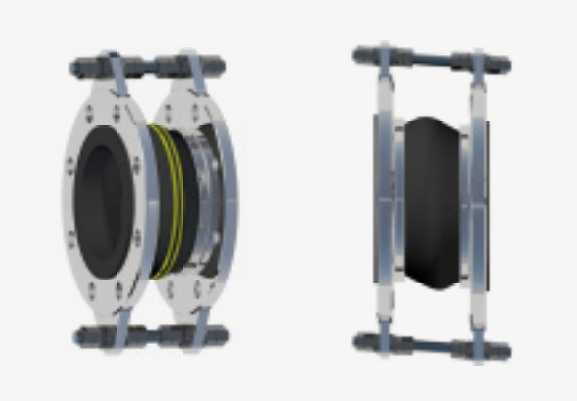
Rubber bellows with flange or threaded connection.

Movement absorption:

Absorbing axial, lateral and angular movement as well as combinations of all three movement types.

The universal rubber expansion joint absorbs the heat-cold expansion of a pipe section in all planes between two fixpoints. These have to be designed to withstand the pressure and spring forces of the universal rubber expansion joint, the friction forces of the guides and the flow forces.

Lateral rubber expansion joint



Design:

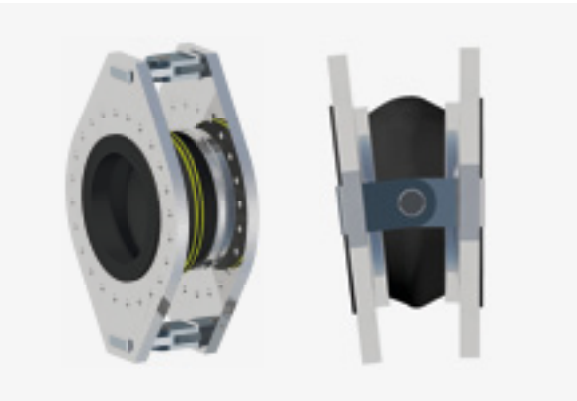
Rubber bellows with laterally movable tensioning (joints or threaded rods) and flange connection.

Movement absorption:

Absorption of lateral movement all around for threaded rods and unilateral for hinged tensioners.

Axial reaction forces are absorbed by the tie rods and the anchors are relieved. Lighter fixpoints than for universal expansion joints are required for absorbing adjustment and reaction forces. A much larger lateral movement absorption is possible with two bellows, one intermediate pipe and tensioners.

Angular rubber expansion joint



Design:

Rubber bellows with angular moving hinged tensioner and flange connection.

Movement absorption:

Absorption of angular movement Unilateral movement possible through single joint and all-around movement with cardan joint.

Axial reaction forces are absorbed by the hinged tensioners and the anchors are relieved. Lighter fixpoints than for universal expansion joints are required for absorbing adjustment and reaction forces.

Rubber bellows

The rubber bellows, the heart of the rubber expansion joint, is crucial to the movability. Reinforced with support liners (casing) and a barrelshaped bellows, axial, lateral and angular movements can be implemented even with small sizes. Pressurebearing fabric layers are vulcanised in between an inner and outer rubber layer. Depending on the application, a variety of different natural and synthetic rubber compounds (elastomers) are used for the rubber layer. To provide resistance to pressure and temperature, nylon, aramid and steel cord are used as support liners. In individual cases, additional PTFE liners are used to improve resistance to media. The rubber bellows are marked with a colour coding according to the rubber compound and support lining used.

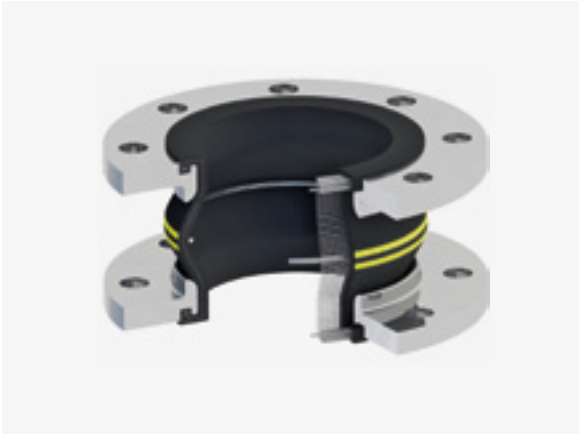
Material qualities

The actual elastomer materials listed in the table are the primary products for manufacturing a rubber compound. Vulcanised into a rubber bellows with strength support, filler materials and additives, the stated properties may differ. The permitted application and temperature ranges are stated in the detailed data sheets.

Designation	Properties and areas of application
CSM Chlorosulfonyl polyethylene rubber Hypalon®	› Very good chemical resistance, especially to many oxidising media, acids, bases, lyes and aggressive chemical wastewater › Good resistance to mineral oils and greases, even at higher temperatures › Good ozone, ageing and weather resistance › Temperature range (depending on media) -20 °C to +100 °C, briefly up to +110 °C
CR Chloroprene rubber Neoprene®, Bayprene®	› Good mechanical properties and elasticity › Resistant to different inorganic and organic chemicals, cold and hot water (swimming pool water), seawater, wastewater (lightly acidic or alkaline), also with low oil content, and cooling water with corrosion protection agents containing oil; impermeable to gas for hydrocarbons › Very good ozone, ageing and weather resistance › Temperature range (depending on media) -25 °C to +90 °C, briefly up to +100 °C
NBR Nitrile butadiene rubber Perbunan®, Buna-N®, Nipol®	› Very good resistance to fuels, mineral oils, lubricants, plant and animal fat as well as hydrocarbons › Resistance, elasticity and cold flexibility depends on acrylonitrile content › Impermeable to gas for hydrocarbons › Satisfactory ageing and weather resistance › Temperature range (depending on media) -20 °C to +90 °C, briefly up to +100 °C
HNBR Hydrogenated nitrile butadiene rubber Therban®, Zetpol®	› Very good resistance to oil and petrol, comparable to NBR › Hydrogenated form of NBR is less responsive and has better ageing and weather resistance as well as higher temperature resistance › Temperature range (depending on media) -35 °C to +100 °C, briefly up to +120 °C
IIR Isobutylene isoprene rubber (butyl rubber) Butyl, Bucar®	› Very good resistance to weak acids and lyes, saline solutions and suitable for drinking water according to German KTW guideline › No resistance to oil and grease › Very good ozone, ageing and weather resistance › Good elastic behaviour at very low temperatures › Temperature range (depending on media) -40 °C to +100 °C, briefly up to +120 °C
EPDM Ethylene propylene diene monomer rubber Keltan®, Nordel®, Vistalon®	› Good heat resistance even under constant stress from hot heating or cooling water, hot air or steam, alkaline wastewater and some oil-free chemicals; good gastight properties except hydrocarbons › Very good ozone, ageing and weather resistance › Temperature range (depending on media) -40 °C to +130 °C, briefly up to +150 °C
FPM Fluoro rubber Viton®	› Very high resistance to heat and chemicals as well as low gas permeability, also suitable for aggressive media › Very good resistance to oils, benzene, xylene, toluene, fuels with an aromatics content over 50 %, bio diesel, aromatic/chlorinated hydrocarbons and mineral acids. › Excellent ozone, ageing and weather resistance › Temperature range (depending on media) -20 °C to +180 °C, briefly up to +200 °C
CO (ECO) Chlorohydrin rubber (polyepichlorohydrin, possibly copolymer with ethylene oxide) Hydrin®	› High resistance to hydrocarbon compounds, oil, grease and bio fuel › Electrically dissipative › Good ozone and weather resistance › Temperature range (depending on media) -40 °C to +125 °C, briefly up to +150 °C

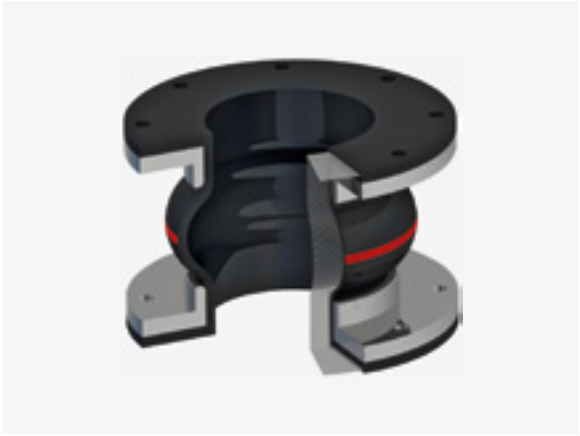
Connection types

Flanges are used for connection to pipes, pumps or containers, screw fittings only for small Nominal diameters. Flange connections are divided into two connection types. On the first type, the rubber bellows surrounds the flange into a continuous recess (groove) to form a rubber sealing collar. An additional seal is therefore not required for the connection with the counter flange. The second type is used for larger Nominal diameters: The rubber bellows ends are moulded into flat flanges and backed with steel flanges. On both connection types, moulded beads or welded-on support collars (brims) are included for stabilising.



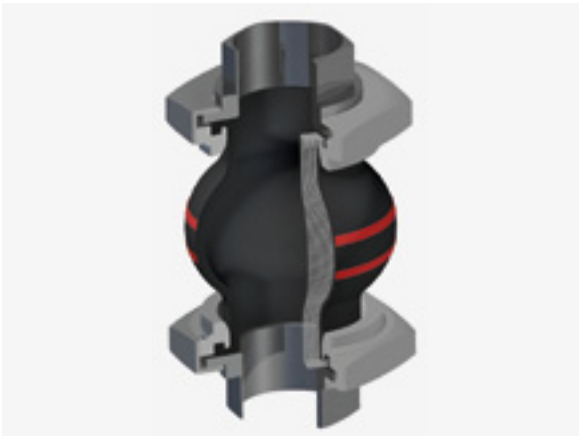
Design of a type 1 model GS

Inner layer:	NBR (nitrile butadiene rubber)
Pressure support liner:	Galvanised steel wire cord
Outer layer:	CR (chloroprene rubber)
Flange:	Rotating flange with rubber sealing collar
Identification:	2 yellow rings, ERV DN.., PN.., date of manufacture
Accessories:	vacuum support ring



Design of a type 2 model R

Inner layer:	EPDM
Pressure support liner:	Nylon cord
Outer layer:	EPDM
Flange:	Backing flange with solid rubber flat flange
Identification:	1 red ring, DN.., PN.., date of manufacture



Design of a type 3 model HZR

Inner layer:	EPDM
Pressure support liner:	Aramid cord
Outer layer:	EPDM
Screw fitting:	PR internal thread (right), cylindrical
Identification:	2 red rings, DN.., PN.., date of manufacture

Flanges

Flanges for rubber expansion joints of type 1 and type 2 can be manufactured to all common international standards such as DIN, EN, ANSI, AWWA, BS, JIS or special dimensions. Flange holes can be produced as through holes or threaded holes. As a standard, flanges are made of unalloyed steel, galvanised or coated with a corrosion protection primer. To meet higher corrosion protection requirements, high-alloy stainless CrNi steel is used. Special materials such as aluminium or special surface coatings (two pack epoxy, two component PUR) in line with customer specifications are also possible.

Material group	Material designation
Standard (unalloyed steel)	1.0038 (S235JR)
Stainless steel	1.4301 (X5CrNi18-10) 1.4541 (X6CrNiTi18-10) 1.4571 (X6CrNiMoTi17-12-2)
Aluminium	3.3535 (AlMg3) 3.3547 (AlMg4.5Mn)

Flange versions for type 1 rubber expansion joints

Universal expansion joint
Standard flange with groove and support collar

Lateral expansion joint
Oval flange with tabs for 2 tension rods (small Nominal diameter)

Lateral expansion joint
Flange with additional pitch circle for tension rods

Angular expansion joint
Flange with tabs for joint connections

Flange versions for type 2 rubber expansion joints

Universal expansion joint
Backing flange with support collar

Lateral expansion joint
Flange with several tabs or additional pitch circle for tension rods

Angular expansion joint
Flange with tabs for joint connections

Tie rods

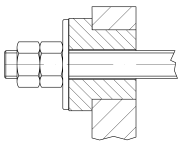
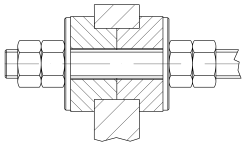
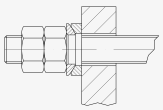
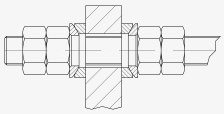
Rubber expansion joints under pressure (operating or test conditions) develop an axial reaction force across the effective bellows cross section area which acts on adyescent plain and fixed bearings. This bearing stress in the pipe system is drastically reduced by using lateral and/or angular expansion joints with tie rods. Only the adjustment forces and moments from the lateral or angular movement are introduced into the pipe system and absorbed by lightweight fixed points.

External tie rods

External and internal tie rods

Tension rods

This type of tensioning is used for lateral expansion joints or can be used to limit the element length on universal expansion joints. Threaded rods are placed symmetrically around the circumference and supported either with rubber bushes or with spherical washers, conical washers and nuts. Using rubber bushes creates a noise absorbing connection to the flange; this is done up to a Nominal diameter of maximum DN 300. For absorbing excess pressure (internal pressure), only external tensioning is required and additional internal tensioning for negative pressure (vacuum). All metal components such as threaded rod, nut, spherical washer and conical washer are galvanised as a standard. Versions mode from corrosion resistant materials or with hot galvanising are available on customer request.

Bearing type	External Tensioning	External and internal Tensioning
Rubber bush		
Spherical and conical washers		

Material group	Material designation		
	Moulded parts/tabs	Spherical/conical washers	Tension rods/nuts
Standard (unalloyed steel)	1.0038 (S235JR)	1.0401 (C15)	5.6, 8.8 / 5, 8
Stainless steel	1.4301 (X5CrNi18-10) 1.4541 (X6CrNiTi18-10) 1.4571 (X6CrNiMoTi17-12-2)	1.4305 (X8CrNiS18-9)	A2, A4

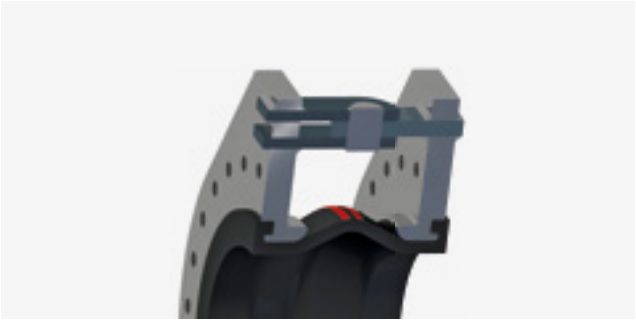
Single joint tensioners

Cardan joint tensioners with ring

Cardan joint tensioners with frame

Hinged tensioners

Single joint or cardan joint tensioners are installed on angular rubber expansion joints for transferring axial reaction forces. The link joints are placed at the centre of the bellows axis in pairs and can absorb unilateral or all-around rotations. Single joint tensioners use an oval flange with connected tabs and bolts to form a two-shear connection which allows angular rotation only around the centre bolt axis. On cardan joint tensioners, the oval flanges are placed with tabs offset by 90° and connected with a gimbal ring or box. This allows an angular rotation around the bellows centre point in all directions. All metal, unalloyed components are galvanised or treated with a corrosion protection primer. Versions mode from corrosion resistant materials or with special coatings are available on customer request.



Detail of single joint tensioner

Detail of cardan joint tensioner

Material group	Material designation	
	Moulded parts/tabs	Bolts
Standard (unalloyed steel)	1.0038 (S235JR)	1.0038 (S235JR) 1.0401 (C15)
Stainless steel	1.4301 (X5CrNi18-10) 1.4541 (X6CrNiTi18-10) 1.4571 (X6CrNiMoTi17-12-2)	

Vacuum support rings

Rubber bellows resist small to medium levels of negative pressure, depending on Nominal diameter, design and application. For higher levels of negative pressure or full vacuum it is usually necessary to install vacuum support rings. These support the inner surface of the bellows curve and are made of stainless steel as a standard. Different designs are available, from a single open support ring and support rings with lock to a ring which is vulcanised into the bellows during production. The latter design is only available for type 2 rubber expansion joints. As a rule, the permitted movement absorption is reduced by approx. 50 % Precise data for vacuum stability can be found in the tables or supplied on request.

VSD – vacuum support ring

VSD+S – vacuum support ring with lock

Vacuum support ring
(type 2 only)

PTFE lining

If no resistant rubber compound is available due to aggressive media or combination of chemical media components, a seamless inner PTFE lining can be installed to increase the chemical resistance. This lining is approx. 1 mm thick, protects the inside of the rubber bellows against media contact and can be used for almost all media without limitations. A PTFE lining can only be installed at the factory, retrofitting is not possible. Heat resistance usually depends on the rubber bellows material. The permitted pressure load is usually reduced to approx. 6 bar and the permitted movement absorption is decreased by approx. 50 %. For use with vacuum, the PTFE lining is only suitable in connection with a PTFE support ring.

PTFE lining

PTFE lining with vacuum support ring

Inner sleeves

Rubber expansion joints feature a flow-optimised convolution geometry on the inside to reduce flow-related resistance (pressure loss) and turbulences. They can normally be used without an inner sleeve. An inner sleeve or guide pipe is required for abrasive media or high flow rates. The rubber bellows is not in direct contact with the flowing medium. It is therefore protected and sediment in the bellows convolution is reduced. The straight shape of the inner sleeve lets the medium flow with more direction, developing less turbulence. As a standard, inner sleeves are made from stainless steel and consist of a cylindrical or conical pipe with a collar which is welded or moulded on. An additional seal has to be used between inner sleeve collar and counter flange.

Cylindrical inner sleeve
(axial movement absorption)

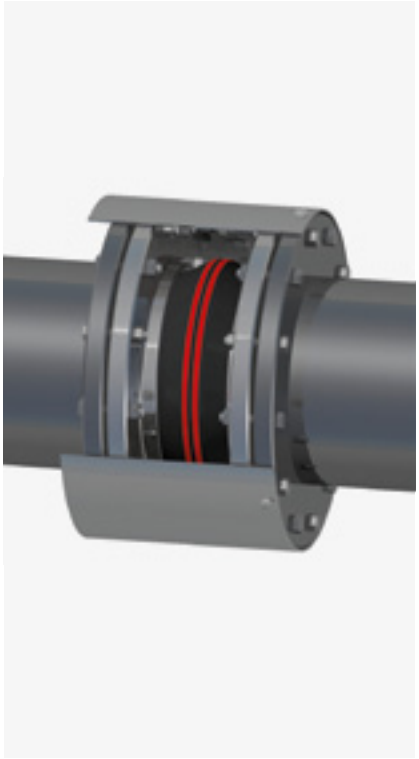
Conical inner sleeve
(lateral and angular movement absorption)

Telescopic inner sleeve (large axial movement absorption and full bellows protection)

External protection systems

Extremely rough operating conditions, weather influence such as strong UV radiation or risk of damage from external mechanical influence require protection of the rubber expansion joint. Suitable products are available, starting with a simple flame protection cover made of a glass fabric with an insulating insert for flame impact up to 800 °C to robust protection for placement in the ground.

Flame protection cover



External tube

Soil protection cover