

gasurhe	Technical standard
---------	--------------------

Insulation joints			
TSP-04D03-45	Medium	Revision	3
	 ERDGAS  WASSER-STOFF	Next Revision	01.06.2030
Created		Reviewed	
16.06.2025 Lukas Lübbe (GOI)		16.06.2025 Stefan Nitz (GOI)	
Change note for previous revision			
Fundamental revision of the standard			
Incorporation of the hydrogen medium			
Inclusion of flanges/couplings, etc.			
Replaces the following document(s):			
- the previous standard			

	Insulation joints	GUD-TEC-Standard TSP-04D03-45
---	--------------------------	----------------------------------

Table of content

1	OBJECTIVE AND PURPOSE.....	4
2	RESPONSIBILITIES AND LEGAL FOUNDATIONS.....	4
3	FUNDAMENTALS AND VARIANTS	4
3.1	Insulating flange	5
3.1.1	Scope and characteristics	5
3.1.2	Assembly	6
3.1.3	Spark Gap	6
3.2	Insulating couplings.....	8
3.2.1	Scope and characteristics	8
3.2.2	Assembly	8
3.2.3	Spark Gap	9
3.3	Separation point for Attachments	10
3.3.1	Scope and characteristics	10
4	DESIGN.....	11
4.1	Regulations.....	11
4.2	Manufacturer's certificate and declaration (Herstellerzertifikat und -erklärung) ...	11
5	DOCUMENTATION.....	11
5.1	Structure and content of the documentation.....	11
5.2	Review of the documentation.....	11
6	APPLICABLE DOCUMENTS/NOTES.....	12

	Insulation joints	GUD-TEC-Standard TSP-04D03-45
---	--------------------------	----------------------------------

1 Objective and purpose

This technical specification encompasses the requirements of Gasunie Deutschland (GUD) for the use of insulating joints. Insulating joints can be implemented as insulating flanges or insulating couplings. In addition to the normative specifications of the German regulations (see Section 4.1), the requirements listed here are to be understood as additional requirements.

2 Responsibilities and legal foundations

The applicable regulations, rules, and standards are listed in TSP-04D03-01 “Rohrbau, Leitungsbau”.

3 Fundamentals and variants

Insulating joints are electrotechnical protective measures for the galvanic separation of electrical systems or cathodic protection systems. The purpose of an insulating joint is to separate two electrical systems from each other. This separation makes it possible to control the cathodic protection systems (KKS) areas, allowing the protection current to be managed and faults to be confined to individual KKS areas.

In the GUD network, insulating joints are used in the following locations for the specified purposes:

- At the separation of LKS (local cathodic protection systems) from KKS.
- At property boundaries to prevent uncontrolled discharge of KKS protection current into adjacent networks of other operators.
- To segment pipeline lengths, making high-voltage systems (HSB) manageable.
- To prevent KKS protection current from flowing into grounding systems.

Based on the specific purpose or application case, in conjunction with the location and the intended KKS/LKS protection concept, it must be determined which type of insulating joint can or must be used.

	Insulation joints	GUD-TEC-Standard TSP-04D03-45
---	--------------------------	----------------------------------

3.1 Insulating flange

3.1.1 Scope and characteristics

Insulating flanges are distinguished not only by their insulating properties but also by their mechanical durability. Particularly noteworthy is their strength against torsional and axial forces that occur due to load changes during pipeline operation. Alternative insulating joints, such as insulating couplings (see section 3.2), have lower mechanical durability compared to insulating flanges.

This part of the specification applies to ready-to-install insulating flange connections and insulating sets mounted at the installation site for the electrical separation of cathodically protected pipeline systems from each other and from unprotected plant areas. Insulating flanges are to be used exclusively in the **above-ground** area of the GUD network. Installation can be carried out with or without hot work, depending on the size of the connected pipeline, and can be done either vertically or horizontally.

The insulating flange connection is to be executed as an RTJ flange by default. The insulating element must be adapted to the geometry of the RTJ flange design. Additionally, the flange must be equipped with two stainless steel cable lugs (4 mm thick), each with three connection holes for attaching the Ex-spark gap and for test connections. When mounting the cable lugs, they must be positioned offset to one another by at least one bolt distance.

Insulating flange connections for pipelines up to 10 inches in diameter are to be provided as an insulating set (installation set) at the immediate installation site. It should be noted that this is a strong recommendation that can be bypassed in individual cases with the agreement and approval of the project manager and the KKS department (Dept. GOI). Installation is carried out according to the manufacturer's instructions.

Insulating flange connections for pipelines larger than 10 inches in diameter are to be provided as a "ready-to-install" component from the factory, which is installed in the pipeline at the installation site through hot work (welding). Here too, it should be noted that this is a strong recommendation that can be bypassed in individual cases with the agreement and approval of the project manager and the KKS department (Dept. GOI).

Ready-to-install insulating flange connections must undergo pressure and tightness testing at the factory. Relevant for the pressure and tightness testing are the consideration of necessary attachments such as pressure gauges, weld-on sockets for pressure test connections, and pressure relief. The dimensioning of the assembly is to be defined depending on the nominal diameter and in coordination with GUD as the client.

3.1.2 Assembly

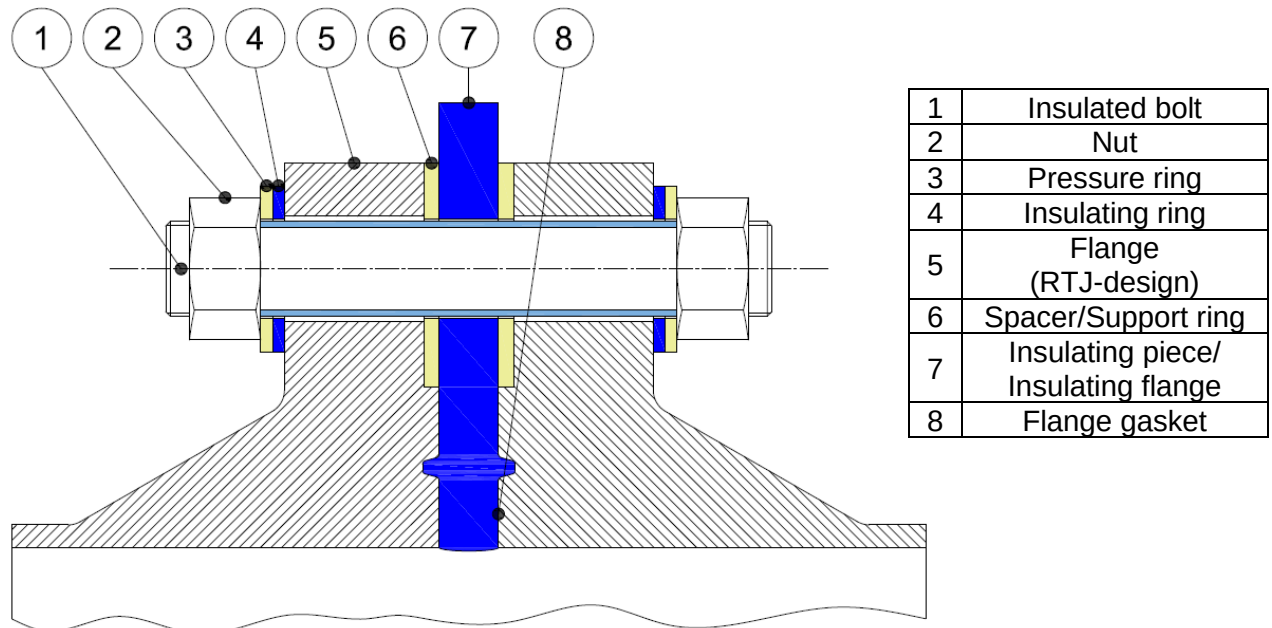


Figure 1: Schematic Structure of Insulating Flange (Assembly)

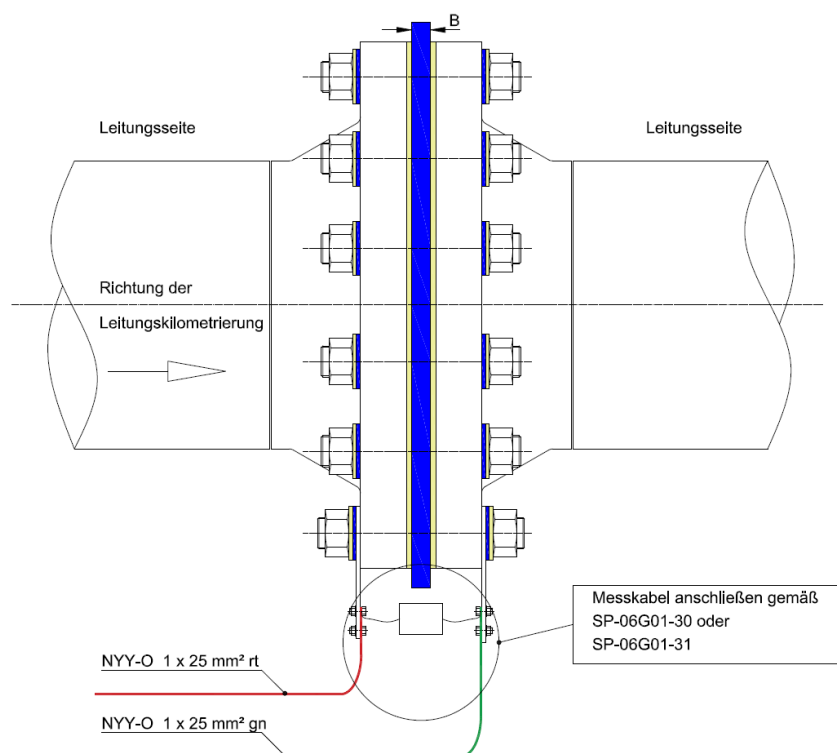
The insulating flange itself is located between two RTJ flanges of the existing system according to the schematic structure in Figure 1. It must be designed so that the RTJ-specific groove is used not for sealing purposes but for the axial securing of the insulating flange. Flat gaskets are to be used for sealing the flange. The thickness of the insulating flange must be at least 19 mm and at most 100 mm. The selection of the thickness is particularly crucial for existing insulating flange connections that need to be adjusted during repairs. The free choice of thickness allows for the use of a suitable flange without extensive modifications and hot work. The standard insulating flange used in the GUD network for new construction or as a replacement (Pos. 7, Figure 1) should have a thickness B of 19 mm (see Figure 2). In addition to the thickness, the insulating flange should have a larger outer diameter than the flange (Pos. 5, Figure 1) to extend beyond it.

Furthermore, so-called spacer or support rings are to be installed between the flange and the insulating flange to ensure a block flange connection during assembly and thus achieve a maximum tightening torque of the bolt screws. Additionally, an insulating flange must be mechanically maintenance-free and permanently technically tight (according to BetrSichV, TRBS 2141, and TRGS 722) in the installed state to be used in the GUD network.

3.1.3 Spark Gap

To protect against overvoltage, insulating flanges must be equipped with so-called Ex-spark gaps. Insulating flanges are to be fitted with stainless steel cable lugs (at least 4 mm thick) to attach an Ex-spark gap. The cable lugs must be mounted offset to one another to prevent bridging. Typically, the cable lugs are mounted in the 3 – 5 o'clock position or the 7 – 9 o'clock position.

During installation, it is crucial to ensure that the cable lugs have sufficiently conductive contact. Therefore, any existing coatings/paints on the flange must be completely removed before installation. In addition to the Ex-spark gap, a KKS measuring point must be established according to the GUD-TEC standard TSP-06G01-20 "KKS Measuring Point Type 'D'".



Klemmbrettbelegung

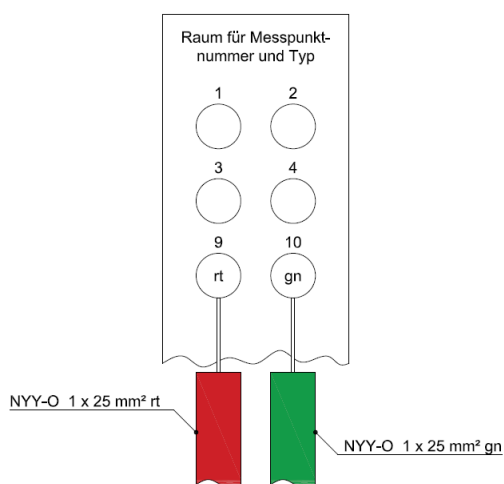


Figure 2: Implementation of the KKS Measuring Point for Insulating Flanges

Regarding the **verification of the functionality** of the separation point, the insulating flange must be tested by a KKS specialist both before and after installation in the pipeline. This measurement test must be documented accordingly and submitted to the KKS department (Dept. GOI).

3.2 Insulating couplings

3.2.1 Scope and characteristics

This part of the specification applies to insulating couplings for the electrical separation of cathodically protected pipeline systems from each other and from unprotected plant areas. Insulating couplings are characterized not only by their insulating properties but also by their fully pre-assembled insulating section. Additionally, the coupling is fully encased, so that after installation, only the weld seam connections need to be re-encased.

Insulating couplings are primarily to be used **underground** in the GUD network. However, the use of an insulating coupling in the above-ground area is fundamentally possible with the agreement and approval of the KKS department (Dept. GOI). Hot work is necessarily required for installation. The installation can be carried out either vertically or horizontally. Ideally, insulating couplings should be installed vertically, as in the horizontal position, contaminants such as dust and natural gas condensates can lead to bridging of the coupling on the internal insulation. Therefore, when installing horizontally, it is important to ensure that the insulating coupling is not connected at a low point.

3.2.2 Assembly

1	Weld-on contact	4	Gasket
2	Insulation	5	Insulation
3	Dielectric/filling		

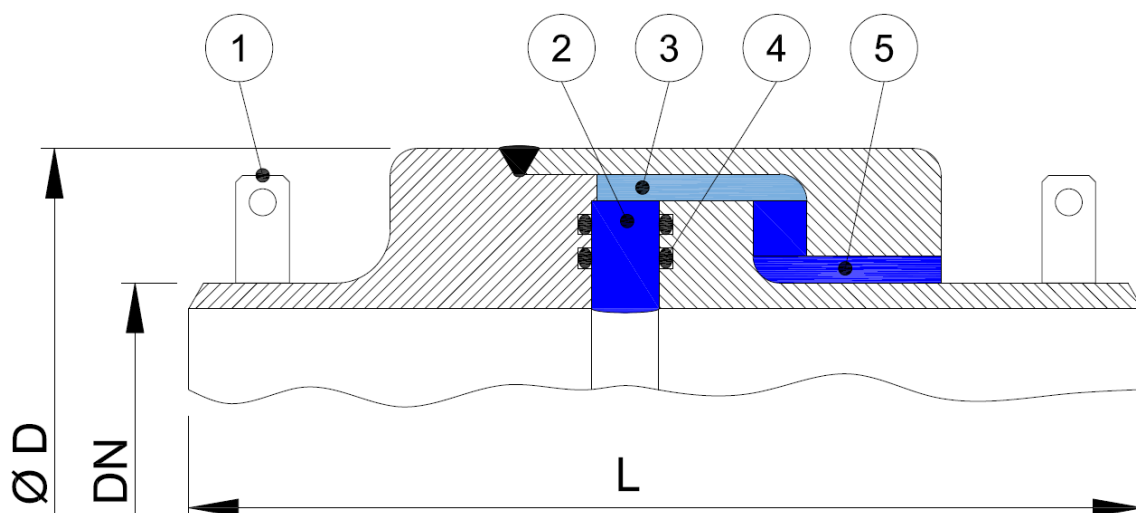


Figure 3: Insulating Coupling – Schematic Cross-Section

An insulating coupling to be used in the GUD network must be supplied from the factory **without** an internal spark gap. The Ex-spark gap is to be connected externally to the coupling via weld-on contacts (see the following section).

Generally, insulating couplings are welded into the pipeline, so that any repair or replacement involves hot work.

3.2.3 Spark Gap



Figure 4: Installation of Ex-Spark Gap for Insulating Coupling

To protect against overvoltage, insulating joints must be equipped with so-called Ex-spark gaps. The Ex-spark gap is to be routed to the above-ground area and connected in a KV cabinet (see Figure 4). The coaxial cable used for the connection must not exceed a **maximum length of 5 meters**. Consequently, it is essential to ensure that the distance between an insulating coupling and a KV cabinet is limited. If it is not possible to connect an Ex-spark gap to the insulating coupling within the permissible length of 5 meters, the spark gap can be omitted in individual cases. In such cases, **coordination with the KKS department** (Dept. GOI) is mandatory.

The spark gap is designed according to the GUD-TEC standard TSP-06G01-20 "KKS Measuring Point Type 'D'". The measuring contacts are to be welded at a **distance "A" of approximately 100 mm** from the butt edge of the insulating piece to allow for proper encapsulation of the contacts (see Figure 5). The welded measuring contacts, with approximate dimensions of 8 x 25 mm, must not exceed a **height 'B' (distance from the pipe) of 30 mm**.

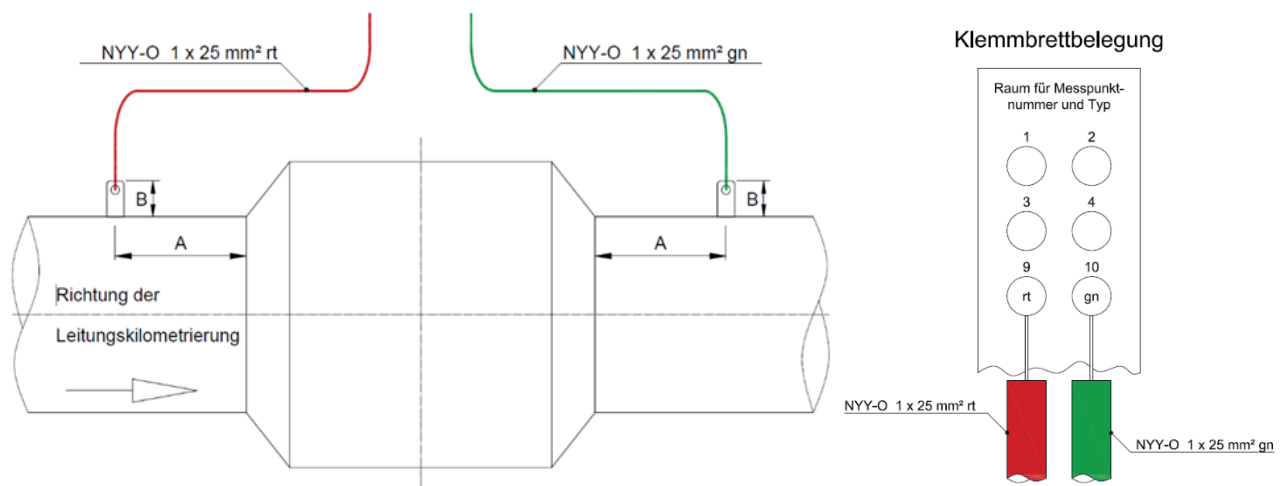


Figure 5: Implementation of the KKS Measuring Point for Insulating Couplings

Regarding the **verification of the functionality** of the separation point, the insulating coupling must be tested by a KKS specialist both before and after installation in the pipeline. This measurement test must be documented accordingly and submitted to the KKS department (Dept. GOI).

	Insulation joints	GUD-TEC-Standard TSP-04D03-45
---	--------------------------	----------------------------------

Separation point for Attachments

3.2.4 Scope and characteristics

For any attachments installed in a KKS-protected section that needs to be electrically isolated or separated, insulating separation points must also be provided. This particularly applies to attachments that have an electrical connection. In these cases, it mainly involves gearboxes and motors on valves. These attachments must be isolated using so-called insulating drives.



Figure 6: Insulating drive (red) on rotary actuator (example)

Connections to measuring and control instruments (functional piping), if they are attached to a pipeline that needs to be isolated, must be executed with an insulating separation fitting.



Figure 7: Insulating separation fitting (example)

Separation points for attachments must always be executed above ground. For LKS-protected systems, the described insulating separation points for attachments are not required.

In case of specific questions or uncertainty about the necessity of insulating separation points, consultation with the KKS department (Dept. GOI) is required.

	Insulation joints	GUD-TEC-Standard TSP-04D03-45
---	--------------------------	----------------------------------

4 Design

4.1 Regulations

For the planning and design of insulating joints, the following regulations and standards must be applied.

DIN EN 1594	Gasinfrastruktur - Rohrleitungen für einen maximal zulässigen Betriebsdruck über 16 bar
DIN 30690-1 (2019)	Bauteile in Anlagen der Gasversorgung
DVGW G 491 (A) (2022)	Gasdruckregelanlagen bis PN100
DVGW G 463 (A) (2022)	Gasrohrleitungen größer PN16
DVGW GW 24 (A) (2014)	KKS in Ex-Bereichen
Gas Info Nr. 19 (2019)	Flanschverbindungen in Gasanlagen
DVGW G 221 (2021)	Leitfaden zur Anwendung des DVGW-Regelwerks auf die leitungsgebundene Versorgung der Allgemeinheit mit wasserstoffhaltigen Gasen und Wasserstoff
BetrSichV	Betriebssicherheitsverordnung
TRBS 2141	Gefährdungen durch Dampf und Druck bei Freisetzung von Medien
TRGS 722	Vermeidung oder Einschränkung gefährlicher explosionsfähiger Gemische

4.2 Manufacturer's certificate and declaration (Herstellerzertifikat und -erklärung)

Insulating joints (couplings or flanges) must be suitable for the use of gases according to the DVGW Worksheet G260. In particular, the suitability for use with hydrogen must be demonstrated by the manufacturer. This includes considering the requirements for the manufacturer's certificate and declaration according to the DVGW Information Sheet G221 (Chapter 6).

5 Documentation

5.1 Structure and content of the documentation

The structure and content of the documentation are specified as follows.

- Table of Contents
- Construction Inspection Report/Factory Number
- Design Data Sheet
- Drawing/Bill of Materials
- Material Certificates
- NDT (Non-Destructive Testing) Protocols (for welds)
- Heat Treatment Protocol for Q1 Welds
- Verification of Functionality

5.2 Review of the documentation

	Insulation joints	GUD-TEC-Standard TSP-04D03-45
---	--------------------------	----------------------------------

The documentation must be reviewed by the responsible expert, and the review must be documented in the construction inspection report.

6 Applicable Documents/Notes

The following documents contain supporting information for this instruction:

TSP-04D03-01 Rohrbau, Leitungsbau Vorschriften, Regeln und Normen

TSP-06G01-20 Technische Spezifikationen für die Ausführung von KKS-Messstellen

The illustrations contained in this document are schematic and exemplary representations that do not claim to be precise reproductions. The colors used are solely for illustration purposes and do not represent binding requirements.