

### What is TA-Luft?

The Technical Instructions on Air Quality Control (TA-Luft), which have been revised in 2021, are a comprehensive instrument for German authorities to control air pollution.

They contain provisions to protect people and environment from unacceptably high pollution originating from installations as well as requirements according to Best Available Techniques (BAT) to prevent adverse effects on the environment. They set emission limits for all relevant air pollutants from most industrial installations. Existing installations must be upgraded to reflect the best available technology.



### Pipeotech's insights on stricter air emission limits and the wider remit in Germany

TA-Luft is one of Germany's most important environmental legislations aside from the "Federal Pollution Control Act" (Bundes-Immissionsschutzgesetz). TA-Luft governs the licensing requirements for industrial plants and is aimed at reducing emissions of pollutants to improve air quality.

The previous iteration of TA-Luft dates from 2002, meaning that this overhaul has been long overdue. The revisions came into force in December 2021 and are intended to consider the latest air pollution treatment technology and most recent information on pollutants.

For example, TA-Luft 2021 are now including regulations for such variety of processes as biogas, wood pellet production and shredder systems for the first time, as well as new nationwide regulations to protect local residents from odour nuisance.

At Pipeotech, we have analysed the new regulations, and, in this article, we are summarising our insights for our customers. From our perspective, the largest impact related to the amendment of TA-Luft 2021 will be the impact on the gasket and sealing industries in terms of increased challenges to prove product tightness-over-time and under operating conditions in actual bolted flange joints (BFJ) in real piping/pipeline systems.

## So, what are the main changes?

From Pipeotech's perspective, key changes can be found in the section 5.2.6.3 Flange connections.

As a rule, flange connections should only be used if they are necessary for process engineering, safety, or maintenance purposes. In this case, technically tight flange connections are to be used. For selection of seals and design of technically tight flange connections, the tightness class L 0.01 with the corresponding specific leakage rate  $\leq 0.01$  mg/m/s for the test medium helium or other suitable test media, e.g., methane shall be applied.

Proof of tightness regarding compliance with the tightness class must be provided for all flange connections with the gasket located in the main force transfer location of the connection (German: Kraftauptschluss, KHS) within the scope of the guideline VDI 2290 (June 2012 edition) in accordance with the calculation regulations it is based on or proven equivalent methods.

For flange connections with metal seals, e.g., ring joint or lens seals, the procedure of guideline VDI 2290 (June 2012 edition) is to be applied accordingly, provided suitable seal parameters are available.

If no gasket parameters are available for metal gaskets and other flange connections, guideline VDI 2290 (June 2012 edition) is still to be applied except for the calculation specifications contained therein, for example about assembly and quality assurance.

For these cases, from 1st December 2025 at the latest, only flange connections may be used for which there is proof of tightness through type-based component tests of the flange connections or proven equivalent methods. Tightness class L 0.01 applies to the component tests with the corresponding specific leakage rate  $\leq 0.01$  mg/m/s for the test medium helium or other suitable test media such as methane. The test should be based as far as possible on the component test according to the VDI 2200 guideline (June 2007 edition) or other proven equivalent test or measurement methods, such as the helium leak test or the flushing gas method.

According to the amended regulation, the assembly occurs:

- in the customer's specific flange
- at the effective maximum temperature present in operation
- under the effective operating pressure present and in combination with the connection components used.

Furthermore, the amended TA-Luft now requires that the operator ensures that the assembly personnel for the assembly of the flange connections have access to assembly instructions and quality control specifications in accordance with the VDI 2290 guideline (June 2012 edition) and that the assembly personnel have qualifications in accordance with DIN EN 1591-4 (December 2013 edition) or the VDI 2290 guideline (June 2012 edition). The requirements for the assembly, testing and maintenance of the sealing systems are to be specified in management instructions and the employment of EN 1591-4-certified assemblers is a requirement in the amended TA-Luft regulations.

Pipeotech fully supports these requirements for implementation of processes for training and competency assessment of personnel in the assembly of BFJ's with the main drivers being:

- Design codes increasingly require controlled bolt tightening
- Ensure personnel are competent to assemble and tighten bolted joints for a leak-free status throughout its service life
- Training, experience, and assessment of knowledge are required to achieve competency

Through the new VDI 2290 requirement, flange connections that:

- are metallic
- are operated below 400°C and
- contain a medium listed in TA-Luft

require approval and now must have calculational proof of technical leak-tightness according to DIN EN 1591-1.

At Pipeotech we support our customers with complete EN 1591-1 flange joint strength and tightness verification reports based on certified software calculations in full compliance with the code and the amended TA-Luft requirements.

## Especially important to know

The new version of the TA-Luft also changes the requirements from a component-based to a system-based consideration and evaluation of the plants.

Previously, the leak-tightness requirements of TA-Luft only related to individual components, i.e. the gaskets. In future - due to the new version of the requirements for the approval process - now not only must the gasket, but also the entire design of all components, i.e. flange joints, valves and adjoining pipework building up a system - as a complete system - must meet the requirements and be included in the system certificate.

DeltaV-Seal will fully support such a flange joint system certification.

## TA-Luft amendment - the consequences

A distinction is made between non-metallic and metallic flange materials. For non-metallic flange materials, a component test is necessary, depending on the system because there is no such established calculation method available. For metallic flange materials, a calculation (EN 1591/FEM) can be performed as an alternative to the component test (VDI 2200, Annex B). The characteristic values as per EN 13555 are required for the calculation.

Proof is required for every system. If one of the following parameters changes, new proof is required:

- Nominal diameter
- Pipe class
- Gasket
- Operating pressure
- Operating temperature

If a component test (VDI 2200, Annex B) is performed for the proof, the leak-tightness criterion of  $1e-4$  mbar\*dm<sup>3</sup>/m/s (1 bar helium) must be met under real conditions. Under real pressure, however, this is still a difficult undertaking based on available gasket/sealing technology especially at high temperatures and cyclic conditions.

If this limit value is maintained, only this connection is certified as TA-Luft-compliant. For all other flange systems, a new component test (VDI 2200, Annex B) or calculation must be performed as an approval procedure.

With Pipeotech's DeltaV-Seal technology implemented in the design, these tightness requirements will be fully supported both by EN 1591-1 calculations as well as by the component test where the 316L DeltaV-Seal achieves a leak rate of  $1e-8$  mbar\*dm<sup>3</sup>/m/s (1 bar helium).

## How are new types of plants affected compared to the old TA-Luft?

The new paragraph 2.14 of the 2021 amended TA-Luft regulation has a detailed list of all plant types affected by the changes.

It reads:

*“Plants for the production of basic organic chemicals within the meaning of this administrative regulation are plants for the production of the following substances or groups of substances by chemical, biochemical or biological conversion with a total production capacity of more than 20,000 tons per year related to these substances in continuous processes:*

- *hydrocarbons (linear or cyclic, saturated, or unsaturated, aliphatic, or aromatic)*
- *oxygenated hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters, acetates, ethers, peroxides, epoxides*
- *sulfurous hydrocarbons*
- *nitrogenous hydrocarbons such as amines, amides, nitroso, nitro or nitrate compounds, nitriles, cyanates, isocyanates*
- *phosphorus hydrocarbons*
- *halogenated hydrocarbons*
- *organometallic compounds*
- *surfactants*
- *hydrogen peroxide.”*

In summary, all companies and organisations in industries working with hydrocarbons must now deal with the leak-tightness requirements of TA-Luft.

## TA-Luft-compliance – DeltaV-Seal offers the solution

In comparison with most other gasket solutions commonly applied to these industries, DeltaV-Seal offers:

- immunity to cold flow
- very good chemical and corrosion resistance
- very good temperature-specific resistance against creep and relaxation

All Pipeotech's DeltaV-Seal products already have or are in the process of getting DIN EN 13555 characteristic values which are needed for calculations according to DIN EN 1591-1 and therefore to meet the future TA-Luft requirements. Proof of technical leak-tightness can be provided through the required calculational proof for any EN- and ASME flange design.

EN 1591-1-compliant calculations for different projects, applications, and evidence of leak-tightness compliant with VDI 2290 have already been performed at Pipeotech in cooperation with international R&D institutes with unprecedented low leak rate achievements at both low (-196°C, 1.2e-8 mbar\*dm<sup>3</sup>/s/m) and high (400°C, no leakage could be detected) temperatures. In this way, TA-Luft-compliant gasket samples have therefore already been tested.

This proves that Pipeotech's customers have been on the safe side by selecting DeltaV-Seal even when VDI 2290 entered into force during 2012.

## Future goal: A system-related certification

At Pipeotech we support the new strive for system-related certification as stated in the amended TA-Luft and further clarified in the FH Münster project. That is why a close cooperation between plant owners on one side and component (flange/gasket/bolt) manufacturers on the other side is crucial and hence Pipeotech as a gasket manufacturer is planning for such component cooperation's in the near future. The amended regulations support any of the component manufacturer to drive the system development and certification.

As part of this development, future standardization on system level ('*coherent system*'), i.e., bolted flange joint classification (flange+gasket+bolting) may be envisaged much like the concept of piping classes.

The advantage of this is that, above all, manufacturers of high-quality and standardized components will prevail since there will probably be a market consolidation as a result. These sealing systems could then form the basis for sealing system classes (comparable to pipe classes) that will certainly lead to a simplified handling of the problem of "tight connecting elements".

## Final remarks

FH Münster has already dealt with implementation of the new requirements of TA-Luft in cooperation with the German Federal Environmental Agency and made a publication about it: '*Harmonisation of requirements for tight joints such as flanged connections, to limit diffuse light volatile organic emissions. (VOC)*'. This publication can be downloaded for free as a PDF: <http://www.umweltbundesamt.de/publikationen>. In this publication, information, suggestions, and concepts regarding compliance with the new TA-Luft requirements can be found.

As Germany is one of the industry leaders in Europe, Pipeotech believes that these changes will also inspire and influence the air pollution and emission legislation in other European countries.