

From planning to operations

# How to design your plant for the safe transport of chemicals

Maximum protection for employees, the environment, and operations: Case study ams-OSRAM International GmbH.

# Table of contents

|   |           |
|---|-----------|
| <b>Legal principles</b>   | <b>4</b>  |
| • Directives of the Wastewater Protection Act (AwSV) and Water Management Act (WHG) |           |
| <b>Maximum protection</b>   | <b>6</b>  |
| • One solution, triple protection   |           |
| <b>From planning to installation</b>  | <b>8</b>  |
| • Material selection and planning support   |           |
| • Joining technologies and Leak detection solutions                                 |           |
| <b>Double Containment solution<br/>CONTAIN-IT Plus</b>                              | <b>12</b> |
| • Case study amsOSRAM International GmbH  |           |



## Legal principles

# Directives of the Wastewater Protection Act (AwSV) and Water Management Act (WHG)

Handling aggressive fluids and gases is a daily routine in many industries, but fortunately, incidents rarely occur. Companies must ensure that no one is harmed by their activities.

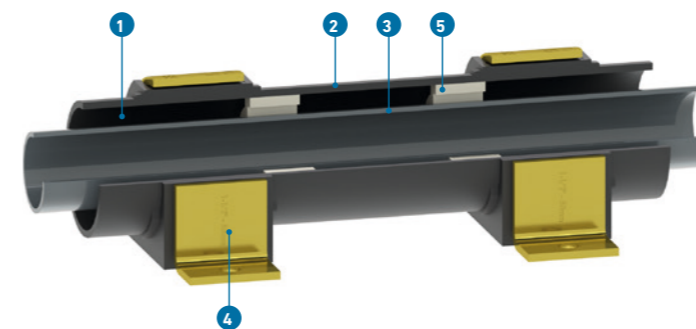
This responsibility has a legal basis; essential guidelines in this regard are the Ordinance on Installations for Handling Substances Hazardous to Water (Verordnung über Anlagen zum Umgang mit wassergefährdenden Stoffen, AwSV) and the Water Resources Act (Wasserhaushaltsgesetz, WHG) in Germany. For example, the AwSV specifies which pipelines must be double-walled, while the WHG stipulates that operators must avoid causing harm to local waters at all costs. Therefore, planners and plant operators depend on suitable technical solutions that adhere to increasingly strict standards and laws to ensure the highest level of protection for people and the environment.

Image: Consisting of a carrier pipe, spacers, and an outer pipe, double containment systems such as the CONTAIN-IT Plus solution provide additional safety for plants, employees, and the environment.  
Source: GF Piping Systems



### Important guidelines

- The Water Resources Act (WHG) demands that companies using water-hazardous materials safeguard their installations during installation, use, and potentially even after shutdown, in order to prevent water pollution at all costs.
- The Ordinance on Installations for the Handling of Substances Hazardous to Water (AwSV) stipulates that every operator must classify transported substances according to water hazard classes. The responsible authority must be informed accordingly. The Rigoletto database helps with the classification.
- The AwSV requires above-ground pipelines to be fitted with retention systems when transporting substances that are particularly hazardous to water.
- In the case of water hazard classes 2 and 3, double-walled pipelines are generally prescribed for the transport of substances hazardous to water.
- According to AwSV, 1. substances hazardous to water must not leak, 2. it must be possible to quickly and reliably detect leaks, 3. leaking substances must be detected and retained and 4. properly disposed of.



### CONTAIN-IT Plus – design

- 1 Monitoring room
- 2 Containment pipe
- 3 Inner pipe
- 4 Pipe clamp
- 5 Spacers

### Transport of aggressive media

According to the AwSV, the facilities for transporting water-polluting substances must therefore be particularly leak-proof, stable, and sufficiently resistant to the expected chemical influences. When it comes to transporting aggressive media, double containment systems have proven their worth over many years. They consist of a carrier pipe as well as an outer pipe that provides additional protection in the event of a leakage from the inner pipe. The carrier pipe is centered within the outer pipe using spacers. In order for operators to detect unexpected leaks and begin countermeasures after a maximum of 72 hours, leakage detection systems must be connected to the interstitial space. These systems are used in water and wastewater treatment, microelectronics, the chemical process industry, or the pharmaceutical industry, for example.



Maximum protection

# One solution, triple protection



## Employee protection

Safety in a company is a priority, and personal injury must be avoided at all costs (Workplace Ordinance).



## Environmental protection

Depending on national regulations, double containment systems are required and are proven solutions for safely transporting hazardous media. The systems can be used for fluid transportation in- and outdoors, as well as below ground.



## Company protection

Leakages of aggressive media can cause enormous costs: In addition to protecting employees and the environment, the quality of the end product, the image of the company and plant availability must also be ensured, depending on the application.

Image: Thanks to its modular design, the CONTAIN-IT Plus double containment system can be configured entirely according to customer requirements: The carrier pipe, outer pipe, valves and actuators as well as leakage sensors can be individually adapted to the medium to be transported.  
Source: GF Piping Systems



From planning to installation

# Material selection and planning support

To ensure a safe and efficient operation, companies need a holistic approach to their double containment projects. From system design to installation and regular maintenance, flow solution providers should offer their customers both engineering and consulting services. This includes access to all planning-relevant data such as CAD libraries, a diverse product portfolio combined with the corresponding machines and tools, system-specific engineering services and training, as well as custom solutions. At the same time, companies should ensure that they source their piping systems from one manufacturer wherever possible in order to maximize compatibility between components and interfaces. This way, modern, customized solutions ensure the complete integrity of double containment systems – and production continues safely and reliably.

## It all comes down to the material

What does a modern double containment system need to be capable of? Above all, companies must already consider the necessary material properties during the planning phase. Depending on the intended use, they are adapted to the media that will be transported. The material of the carrier pipe must be selected at a very early stage of the project based on the material safety data sheet as well as the existing process & environmental conditions. Plastic pipes are an ideal solution thanks to their corrosion-free properties, especially when transporting acids or alkalis. Depending on the operating conditions and the chemicals being transported, materials such as PVC-U, PVC-C, PP, PE, PVDF or ECTFE are particularly suitable for this purpose.

For outer pipes, polyethylene solutions have now established themselves as all-rounders, as the outer pipe only comes into contact with the medium for a short period of time. This material is characterized by its good chemical resistance to acids, alkalis and salts, as well as a variety of organic and inorganic solvents. In addition, thanks to its high UV resistance, resistance against denting, flexibility, and impact strength, the material is used particularly in harsh environmental conditions. Last but not least, plastic piping systems excel thanks to their low weight and easy handling, allowing for straightforward installation even in spaces that are difficult to access.

## Structural analysis and stress calculation

DVS Guideline DVS 2210-2 must be taken into account when planning, designing and installing a double containment system. The structural analysis and the stress calculation are a key element for safe operation. Using the data from the structural analysis and stress calculation questionnaire (DVS 2210-2), the manufacturer guarantees that the calculated pipeline is stable under the specified loads (material, dimension, flow medium, pressure, and temperature) throughout the projected service life. Due to the different operating conditions of the inner and outer pipe as well as the use of various materials with different expansion coefficients, some applications may experience high stress related to inhibited thermal expansion, which also has to be calculated. In addition to these stresses, planners and installers receive further project-specific and fundamental key figures – such as fixed point & guide bearing forces, the distances between spacers, etc. Spacer distances are particularly important for ensuring the stability of a double containment system, as they prevent the inner pipe from buckling in the outer pipe due to thermal influences.

Bild: Regensburg (DE): Das auf optische Halbleiter und LED-Technik spezialisierte Unternehmen ams-OSRAM International GmbH setzt bei der Produktion von Beleuchtung, Visualisierung und Sensorentechnik auf modernste Anlagen mit größtmöglichem Schutz für Mitarbeitende und Umwelt.  
Quelle: GF Piping Systems

# Joining technologies and Leak detection solutions

## Installation

In addition to the material properties, the lightweight design of double containment systems plays a very important role. The successive jointing technology between the inner & outer pipe allows a double containment pipe to be connected in the same way as a single pipe using the familiar and proven jointing technology in accordance with DVS guidelines. Using this jointing technology, a mandatory visual inspection of the carrier pipe connection can be ensured and a pressure test can be carried out before closing the outer pipe. During visual inspection, the parameters to be considered for

quality assurance - welding bead height, K-value, wall offset, bonding - should be applied appropriately for quality assurance, depending on the jointing technology of the carrier pipe. This eliminates so-called 'blind' connections, which occur in many systems with every change of direction, and then usually have to be executed 'blindly'.

## Sensors enable fast leakage detection

The design of the leakage detection system already represents a key component in the planning phase to ensure safe operation. Especially in long pipelines, it is recommended to divide the interstitial space into smaller sections (20-50m) using system subdivision fittings in accordance with the recommendations of DVS 2210-2. Capacitive, non-contact low-point sensors installed in the sections can quickly and reliably detect unexpected leaks and ensure that appropriate measures are initiated.



# Case study amsOSRAM International GmbH

How can designers and plant operators make the handling of hazardous media safer, more environmentally friendly, and more cost-effective? The company ams-OSRAM International GmbH requires piping systems for the transport of various production-specific chemicals. Bilfinger Life Science, a company specializing in plant and piping system design, is contracted to replace the existing pipes. The new double containment piping systems are supplied by GF Piping Systems.



A part of the ams-Osram Group, ams-OSRAM International GmbH specializes in optical semiconductors and LED technology, and its products are used in the fields of lighting, visualization as well as sensor technology. To produce these various products, ams-OSRAM International GmbH relies on modern double containment systems. This is because the supply and treatment of ultrapure water and chemicals plays an important role in the production of semiconductors and LED technologies. On the one hand, these substances are needed for the complex production process, but at the same time the resulting wastewater has to be neutralized, filtered and disposed of.

In order to meet the highest quality standards even after the production expansion and to ensure the protection of the environment and people, ams-OSRAM International GmbH relies on the CONTAIN-IT Plus double containment system. The media to be transported include various production-specific chemicals that play an important role in the semiconductor industry. The company has two goals for the project: Modern double containment systems made of plastic, which are equally suitable for the many different media used in the production process, are to be installed. In addition, two buildings need to be connected with a new double containment system that will have different control systems. Bilfinger Life Science, a company specializing in plant and piping system construction, is commissioned to carry out the project.

Image: Regensburg (DE): The company ams-OSRAM International GmbH, which specializes in optical semiconductors and LED technology, relies on state-of-the-art plants with the greatest possible protection for employees and the environment in the production of lighting, visualization and sensor technology.  
Source: GF Piping Systems

First, an external engineering firm conducts the basic planning and creates a so-called facility utility matrix (FUM). This matrix documents the requirements of the production facilities at ams-OSRAM International GmbH as well as the exact quantities and types of media they need. "The FUM is enormously important for the planning phase, as it forms the basis for determining the materials, capacities and design of the pipes. Since production facilities are continuously modified and developed, the FUM is a living document that is regularly adapted," explains Michael Kiefer, Product Manager at Bilfinger Life Science GmbH. During the planning phase, which lasts about one year, the sections requiring a double containment system are also determined in this way. Here, Bilfinger Life Science opts for the proven CONTAIN-IT Plus double containment system by GF Piping Systems. With its system that has been developed according to the leading guideline DVS 2210-2 for double containment systems, the company offers a broad portfolio of products (including fittings, pipes, valves, mechanical separation, leakage detection solutions, actuators) that can be adapted to specific project needs. GF Piping Systems also offers numerous machines and tools for jointing technologies (bonding, butt welding, electrofusion) to find the ideal long-term solution for any operating conditions. In addition, the company's Engineering Services department provides support during stress calculations of the pipeline isometrics, which must be particularly taken into account both when designing the steel structure and during installation. Furthermore, GF Piping Systems has a customizing department in which special components are also manufactured on request.

The installation of the components runs smoothly in spite of tight spaces and a strict timeline, so as not to restrict production. "This is where the properties of the plastic piping systems came into their own. They are lighter and more compact than systems made of metal and are therefore quick and safe to install," adds Michael Kiefer. But he is also impressed by the performance of the components: "For one thing, they are very durable due to their non-corrosive properties and ensure smooth operation. The flexibility of the outer pipe materials is particularly noteworthy in the CONTAIN-IT Plus system. The polyethylene (PE100) protective pipe was installed in harsh environmental conditions while the transparent PVC-U outer piping system was used in easily accessible areas, making visual inspection very easy during routine checks." Cyrus Ardjomandi is Business Development Manager at GF Piping Systems and knows what customers are looking for: "The big advantage of the GF solution is that the important connection of the carrier pipe can be tested for tightness before the outer pipe is connected. In the case of simultaneously welded double pipes, the weld bead of the inner pipe cannot be inspected from the outside after the welding process."

The final step after almost four months of construction is putting the system into operation. For this purpose, an initial test run is carried out in which the carrier pipes are tested for leaks with water. The same is done for the outer pipes with gas. Next, the required media can be gradually introduced into the new system. Now that safe and reliable operation has been assured, Michael Kiefer is very satisfied with the cooperation between Bilfinger Life Science and GF Piping Systems. "Good technical support was very important to us from the outset. GF Piping Systems supported the project right from the start during the planning phase, supplied additional equipment for the installation, and provided training at short notice."





Learn more about the double containment system  
**CONTAIN-IT Plus**

[www.gfps.com/containitplus](http://www.gfps.com/containitplus)



Image: Consisting of a carrier pipe, spacers, and an outer pipe, double containment systems such as the CONTAIN-IT Plus solution provide additional safety for plants, employees, and the environment.  
Source: GF Piping Systems



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