# GERMAN DWA Rules and Standards

## **Advisory Leaflet DWA-M 376E**

# Safety Regulations for Biogas Holders with Membrane Seals

October 2006

Sicherheitsregeln für Biogasbehälter mit Membrandichtung



German Association for Water, Wastewater and Waste Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e. V. The German Association for Water, Wastewater and Waste (DWA) is intensively involved with the development of reliable and sustainable water management. Being a politically and economically independent organisation it operates specifically in the areas of water management, wastewater, waste and soil protection.

In Europe the DWA is the association in this field with the greatest number of members and, due to its specialist competence it holds a special position with regard to standardisation, professional training and information of the public. The members, approximately 14,000 represent specialists and managers from municipalities, universities, consulting engineers, authorities and businesses.

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## Foreword

The following standards concerning the storage of biogas in low pressure gasholders were published up to now by the German Technical and Scientific Association for Gas and Water (DVGW):

- DVGW Standard G 430 Guidelines for the erection and operation of low pressure gas containers
- DVGW Standard G 431 Guidelines for the manufacture of low pressure gas containers with hints for delivery agreements

The standards date from 1964 and 1960 and thus no longer represent the generally recognised rules of technology. In the field of public gas supply, low pressure gas holders are barely used anymore. However low pressure biogas holders are an intrinsic part of many wastewater treatment plants. Hence the DVGW encouraged the German Association for Water, Wastewater and Waste (DWA) to review these safety regulations and to produce a revised standard. The DWA-Main Committee "Waste and Sewage Sludge" instructed the Sub-Committee AK-8 "Biogas", to formulate these regulations. For this purpose the DWA-Working Group AK 8-2 "Biogas Storage" was formed and given this task.

The members of the DWA-Working Group agreed on formulating minimal requirements, both for technical safety equipment as well as for the operation of biogas holders. The starting point was to consider possible dangers arising from the operation of biogas holders particularly with regard to the operating personnel and the local environment.

This Advisory Leaflet at hand comprises minimum requirements for biogas holders with membrane seals, which represent the required standard to ensure sufficient safety. Safety measures can be further improved by the operator, the economic efficiency of the investment shall be decided by the operator.

Deviations from the safety regulations that result from future technical developments must offer at least an equivalent safety factor. In such cases it is the responsibility of the operator to ensure that any hidden dangers are recognised and relevant safety measures are implemented.

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## **User Notes**

This Advisory Leaflet has been produced by a group of technical, scientific and economic experts, working in an honorary capacity and applying the rules and procedures of the ATV-DVWK and the Standard ATV-DVWK-A 400. Based on judicial precedent, there exists an actual presumption that this document is textually and technically correct.

Any party is free to make use of this Advisory Leaflet. However, the application of its contents may also be made an obligation under the terms of legal or administrative regulations, or of a contract, or for some other legal reason.

This Advisory Leaflet is an important, but not the sole, source of information for solutions to technical problems. Applying information given here does not relieve the user of responsibility for his own actions or for correctly applying this information in specific cases. This holds true in particular when it comes to respecting the margins laid down in this Advisory Leaflet.

## 1 Scope

The objective of this Advisory Leaflet is to establish basic principles, according to existing legal regulations and current state of knowledge, for preventing fire and explosion dangers.

The area of application applies to aboveground gasholders with membrane seals used for the storage of biogas with a maximum pressure not exceeding 100 hPa. The Advisory Leaflet applies only to biogas holders that are free standing external constructions in the agricultural sector or in water management and waste management systems. Gasholders that store gasses using a membrane tensioned above the degrading substrate are not included in the area of application of this Advisory Leaflet. Information applying to the toxic effects of biogas is available in the Advisory Leaflet ATV-DVWK-M 363 "Herkunft, Aufbereitung und Verwertung von Biogasen" [Origin, preparation and utilisation of biogasses].

Information about technical, electrical and safety equipment for digester gas systems is available in the Advisory Leaflet DWA-M 212 (in preparation).

For agricultural biogas plants a special procedure documentation No. 69 exists: "Safety Regulations for Agricultural Biogas Plants" (German Association of Accident Prevention and Insurance in Agriculture, 2002).

## 2 Terms and Definitions

#### Biogas

Biogas is formed by the anaerobic degradation of organic material. The gas composition consists almost entirely of methane ( $CH_4$ ) and carbon dioxide ( $CO_2$ ). See also: Advisory Leaflet ATV-DVWK-M 363 [Origin, preparation and utilisation of biogasses].

#### Biogas holders with membrane seals

Biogas holders with membrane seals use a flexible membrane, which completely or partly encloses the gas chamber volume and which provides a technically gastight storage room. The membrane can be constructed with or without fibre-reinforcement. The stored volume is varied by movement of the membrane.

#### Excess pressure safety system

An excess pressure safety system is a safety system that is activated by gas pressure and protects the biogas holder against destructive excess pressure that may result from overfilling or other malfunctions.

#### Anti-suction safety system

An anti-suction safety system prevents further extraction by suction, if the biogas holder is already empty and thus protects the biogas holder from the formation of destructive negative pressure.

#### Negative pressure safety system

A negative pressure safety system protects the biogas holder from destructive negative pressure by feeding air into the gasholder.

#### Dead storage volume

Dead storage volume describes that portion of the biogas holder volume from which gas or air cannot be extracted under normal operating conditions.