



Chlorine

Chemical Description: Chlorine
Chemical Formula: Cl₂
CAS-No: 7782-50-5

Commercial form	Chlorine is supplied to the Leverkusen, Dormagen and Uerdingen Chemparks in gas form via pipelines.
Uses	Chlorine is one of the most important raw materials in the chemical industry and is used for the production of chlorine-containing organic and inorganic intermediates and chlorine-free and chlorine-containing end products (e.g. plastics, crop protection agents and pharmaceuticals).
Properties	<p>As one of the most reactive elements, chlorine has a strongly oxidizing action and reacts with numerous elements and inorganic and organic compounds, even at room temperature.</p> <p>Chlorine is a yellow-green gas at 0 °C and 1013 mbar. It is about 2.5 times heavier than air and therefore sinks rapidly to the ground.</p> <p>Chlorine gas is not combustible itself, but can cause combustible substances to ignite. Explosive mixtures can form with hydrogen, ammonia and hydrocarbons, e.g. acetylene.</p> <p>Chlorine gas is moderately soluble in water (6.8 g/l at 20 °C). A crystalline compound, chlorine hydrate, precipitates from chlorine dissolved in water (chlorine water) at below 10 °C. This compound can cause blockage of pipelines. With moist air, chlorine gas forms a highly corrosive mist of hydrochloric acid and hypochlorous acid.</p>
Detection	<p>Chlorine has an extremely intense, pungent odor and is perceptible even in extremely low concentrations.</p> <p>The mass concentration of chlorine in air can be determined using commercially available test tubes, which are suitable even for very small amounts of chlorine.</p> <p>A qualitative test is the decoloration of chlorine by indigo carmine solution (100 mg/l of water). Suitable quantitative tests are the iodometry and Methyl Orange methods.</p> <p>Leaks in lines, containers and valves are evident from the formation of white mist if ammonia-containing vapors (aqueous ammonia solution < 5 %) are brought into the vicinity. Ammonia water should not be sprayed onto leaks or brass valves due to the associated corrosion.</p>



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Materials

The choice of materials depends on the state of the chlorine (moist, dry, liquid) and the pressure and temperature. In particular cases, especially on use of new materials (e.g. plastics), a resistance test is necessary.

Dry chlorine:

For storage containers, pipelines and valves, the main material used is steel (RSt 35) since this is not attacked by dry chlorine gas. Owing to the risk of a reaction between chlorine and iron (chlorine-iron fire from 170 °C), high temperatures should be avoided. If this is impossible for operational reasons, special materials (e.g. nickel or high-alloy steels) must be used.

In the presence of moisture, chlorine attacks virtually all metals. The apparatus parts which come into contact with chlorine must therefore be carefully dried using dry air or nitrogen before use. When not being used, the parts should be blanked off in order to prevent the ingress of moisture.

Moist chlorine:

Moist chlorine reacts with virtually all metals, with the exception of titanium and tantalum. Regarding the use of titanium, it should be noted that dry chlorine gas reacts spontaneously with this metal.

Suitable materials for pipelines are rubber- or PTFE- or PVDF-lined steel or plastics, e.g. PVC, glass-fiber-reinforced, unsaturated polyester resins (GF-UP) or epoxy resins. Glass is also resistant to moist chlorine.

Transport and storage

Extensive regulations should be observed during storage, emptying, filling and transport. German Chemical Industry Employers' Accident Liability Insurance Association Notesheet M 020 on "Chlorine" gives an overview.

Chlorine is assigned to water hazard class 2 (hazardous to water). The corresponding laws and regulations on water protection are applicable.

Health risks

Chlorine is toxic and is rapidly fatal at a mass concentration from about 150 mg/m³ in the respiratory system. Even at a very low volume proportion (1 ml/m³), it irritates eyes and respiratory organs.

The maximum workplace concentration TRGS 900 is 0.5 ml/m³ (ppm) or 1.5 mg/m³ (8 hour average).

Safety measures

German Chemical Industry Employers' Liability Accident Insurance Association Notesheet on "Chlorine" (M 020) gives information both on protective measures when handling chlorine and the action to be taken in the event of escape of chlorine and also on first aid.



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If there is a risk of chlorine being breathed in concentrations above the maximum workplace concentration, suitable respiratory equipment should be used. At higher or indeterminate chlorine contents, only a self-contained breathing apparatus (e.g. compressed-air breathing apparatus) provides protection. Medical assistance must be obtained immediately whenever chlorine gas is breathed in.

The skin can be protected against chlorine gas by means of protective suits made from rubberized fabric, while full protective suits provide protection against liquid chlorine.

Further information is given in the Material Safety Data Sheet "Chlorine" (No. 112000012976).

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