Pressure and Temperature Measurement

# Gas Management Emission Calculating

## How to calculate tank emissions using Gas Density Monitors

# Reactive Gas Monitoring Today

**Gas Density Monitors are currently the industry standard for $SF_6$ monitoring and are installed all over the world in even the harshest climates. They are, however, reactive in nature because readings have to be obtained manually and then react to the indication or alarm.**

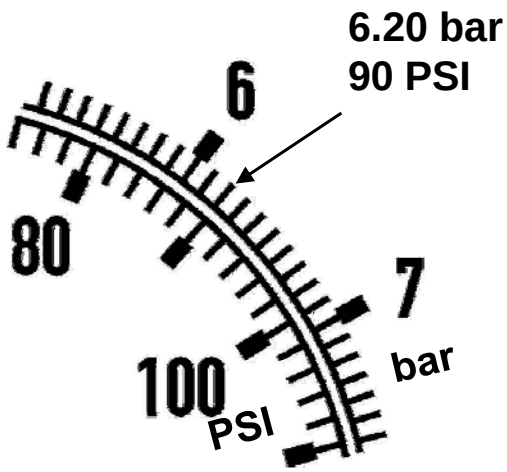
**This tutorial outlines the process of using Gas Density Monitors to calculate $SF_6$ emissions from switchgear tanks.**

# Reactive Gas Monitoring Today – Manual Calculations

Pressure and Temperature Measurement

**Step 1: Determine the temperature-compensated pressure from the Gas Density Monitor**

**Go to the monitor in the substation and read off the exact value on the dial. If the pointer is not at an exact value, an interpolated value may be used.**




**Note, there may be a long delay here. Typically, emission readings are not taken more than once a month and some are not read at all for several years after installation. So, a large emission may have already occurred before an emission rate is known.**

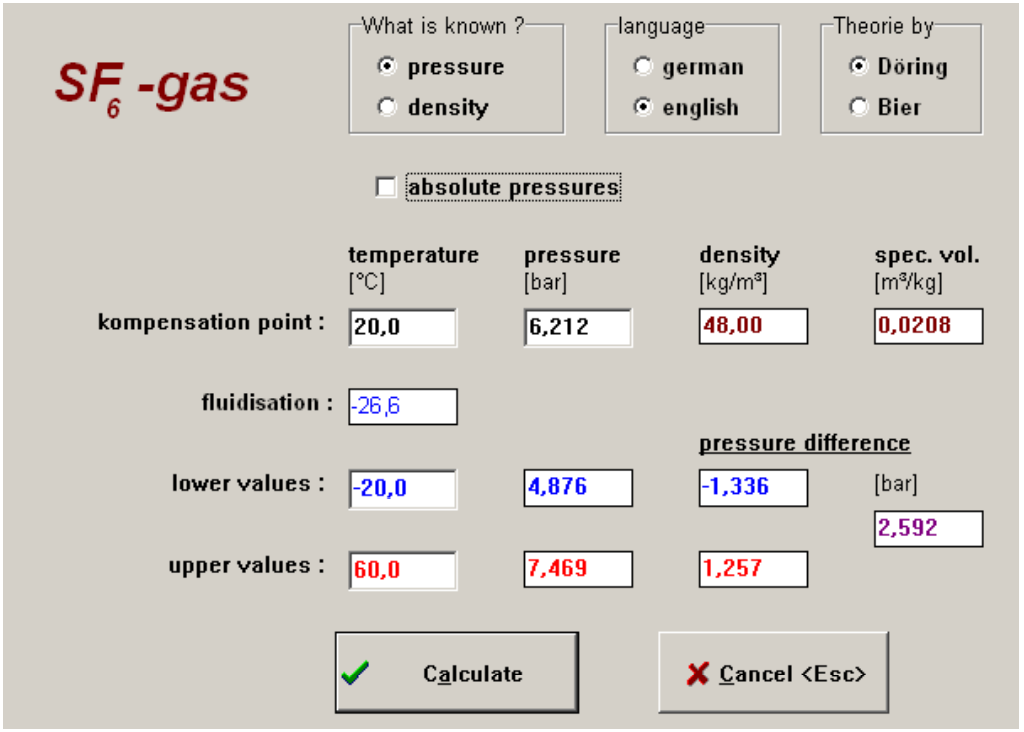
**For this example, 6.200 bar is read off of the dial and the initial fill pressure is 6.212 bar. The time is exactly 3 years after the initial fill.**

# Reactive Gas Monitoring Today – Manual Calculations

Pressure and Temperature Measurement

## Step 2: Calculate the density of $SF_6$ gas in the tank (both initial and current)

Plug in the pressure value (6.2 bar) in this example) into the WIKA SF6-gas program. The program assumes 20°C, so the following values are then obtained:




**Initial Pressure Compensated : 6.212 bar = 90.1 PSI**
**Actual Pressure Compensated : 6.112 bar = 88.6 PSI**
**Initial Gas Mass 100 % : 11.520 kg**
**Tank Volume : 0.240 m³**

# Reactive Gas Monitoring Today – Manual Calculations

Pressure and Temperature Measurement

## Step 3: Calculate the loss of $SF_6$ gas over the time period

**Density @ 6.212 bar**
**Subtract Density @ 6.112 bar**

**Difference** : 0.75 kg/m³ lost $SF_6$ density

**Percentage lost** : 0.75/48.00 = 1.6% total $SF_6$ loss

Lost mass calculation

| | |
|---|---|
| Lost SF6 density | : 0.75 kg/m³ |
| Multiply by tank volume | : x 0.240 m³ |
| Mass lost | : 0.180 kg or 180 g |

# Reactive Gas Monitoring Today – Manual Calculations

WIKA

Pressure and Temperature Measurement

## Step 4: Determine the emission rate

**Percentage lost** : 1.6% total $SF_6$ loss

**Emission rate** : 1.6% / 3 years = .53% / year

**After 3 Years, the conclusion is:**

**1.6 % in 3 Years is a loss of 0.53 % of the gas mass per year**

**Wouldn't it be nice to know this information sooner?**

# Proactive Monitoring of $SF_6$ Gas as the Next Step

WIKA

Pressure and Temperature Measurement

## Gas Density Monitors …

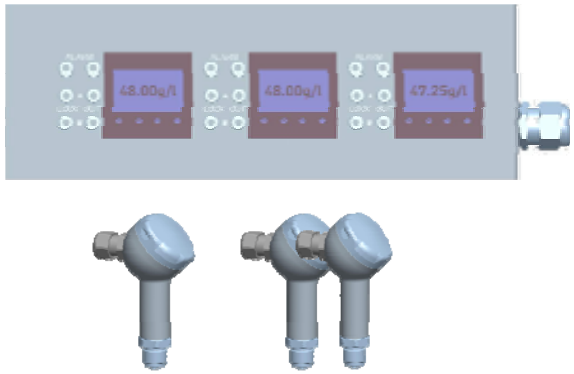
- Ensure the safe operation of switchgear
- Control the filling of switchgear
- Show the current density situation

REACTIVE

## Gas Management Systems …

- Measure low emission rates
- Acquire data into a database
- Analyze data
- Calculate trends in real-time

➢ **RESULT: informed decision-making**




PROACTIVE

**Visit [www.wika.com/sf6](http://www.wika.com/sf6) for more information**