



**Holcim EMR  
List of  
EN Standards and VDI Guidelines  
usable for  
Discontinuous Measurements in  
Cement Plants**

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(HGRS-JW-04-25s)

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## **SUMMARY**

( ...) shall not be used

<b>Pollutant</b>	<b>VDI Guideline</b>		<b>DIN/EN Standard</b>	
	<b>Number</b>	<b>Edition</b>	<b>Number</b>	<b>Edition</b>
<b>Dust</b> - High concentrations - Low concentrations - Particle Size Selective	2066 - 2	08.93		
	2066 - 7	08.93	EN 13284 - 1	11.01
	2066 - 5 2066-10	11.94 07.03		
<b>Heavy Metals</b> - Sampling - Analytic  - Mercury	3868 - 1	12.94		
	2268 - 1	04.87		
	2268 - 2	02.90		
	2268 - 3	12.88		
	2268 - 4	05.90		
			EN 13211	06.01
<b>Sulfur Dioxide</b> (SO <sub>2</sub> )	2462 - 8	03.85		
<b>Sulfur Trioxide</b> (SO <sub>3</sub> )	2462 - 7	03.85		
<b>Nitrogen Oxides</b> (NO <sub>x</sub> )	(2456 - 8)	01.86		
<b>Basic Nitrogen Compounds</b>	3496 - 1	04.82		
<b>Hydrogen Chloride</b> (HCl)			EN 1911-1 EN 1911-2 EN 1911-3	07.98 07.98 07.98
<b>Chlorine</b> (Cl <sub>2</sub> )	(3488 - 1)	12.79		
	(3488 - 2)	11.80		
<b>Fluorine Chloride</b> (HF)	2470 - 1	10.75		
<b>Volatile Organic Compounds</b> (VOC)	(3481 - 2)	09.98		
	(3481 - 1)	08.75		
	3481 - 3	10.95	EN 12619	09.99
<b>Polycyclic Aromatic Hydrocarbons</b> (PAH) - Sampling - Analytic			EN 1948-1	02.04
	3873 - 1	11.92		
<b>Benzene</b>	NIOSH 1501			
<b>Dioxins and Furans</b>			EN 1948 - 1	02.04
			EN 1948 - 2	02.04
			EN 1948 - 3	02.04

1. **DUST**

		VDI Guideline		DIN/EN Standard	
		Number	Edition	Number	Edition
For high concentrations	1	2066 - 2	08.93		
For low concentrations	2	2066 - 7	08.93	EN 13284 - 1	11.01
Particle Size Selective	3	2066 - 5	11.94		
	4	2066-10	07.03		

- 1) VDI 2066 -2: Measurement of particulate matter; manual dust measurement in flowing gases; gravimetric determination of dust load; tubular filter devices
- 2) VDI 2066 - 7: Measurement of particulate matter; manual dust measurement in flowing gases; gravimetric determination of dust load; plane filter devices  
EN 13284 - 1: Stationary source emissions - Determination of low range mass concentration of dust - Part 1: Manual gravimetric method
- 3) VDI 2066 - 5: Measurement of particulate matter; manual dust measurement in flowing gases; Particle Size Selective Measurement by Impaction Method
- 4) VDI 2066-10: Technical rule (draft): Measurement of particulate matter - Dust measurement in flowing gases - Measurement of PM<sub>10</sub> and PM<sub>2,5</sub> emissions

## 2. INORGANIC SUBSTANCES MAINLY AS DUST PARTICLES

(Heavy Metals)

		VDI Guideline		DIN/EN Standard	
		Number	Edition	Number	Edition
Sampling	5	3868 - 1	12.94		
Analytic	6	2268 - 1	04.87		
	7	2268 - 2	02.90		
	8	2268 - 3	12.88		
	9	2268 - 4	05.90		
Mercury	10			EN 13211	06.01

- 5) VDI 3868 - 1: Determination of total emission of metals, metalloids, and their compounds - Manual measurement in flowing, emitted gases - Sampling system for particulate and filter-passing matter
- 6) VDI 2268 - 1: Chemical analysis of particulate matter; determination of Ba, Be, Cd, Co, Cr, Cu, Ni, Pb, Sr, V, Zn in particulate emissions by atomic spectrometric methods
- 7) VDI 2268 - 2: Chemical analysis of particulate matter; determination of arsenic, antimony and selenium in dust emissions by atomic absorption spectrometry after separation of their volatile hydrides
- 8) VDI 2268 - 3: Chemical analysis of particulate matter; determination of thallium in particulate emissions by atomic absorption spectrometry
- 9) VDI 2268 - 4: Chemical analysis of particulate matter; determination of arsenic, antimony and selenium in dust emissions by graphite-furnace atomic absorption spectrometry
- 10) EN 13211: Air quality - Stationary source emissions - Manual method of determination of the concentration of total mercury;

### 3. INORGANIC GASEOUS COMPOUNDS

		VDI Guideline		DIN/EN Standard	
		Number	Edition	Number	Edition
Sulfur Dioxide (SO <sub>2</sub> )	11	2462 - 8	03.85		
Sulfur Trioxide (SO <sub>3</sub> )	12	2462 - 7	03.85		
Nitrogen Oxides (NO <sub>x</sub> )	13	(2456 - 8)	01.86		
Basic Nitrogen Compounds	14	3496 -1	04.82		
Hydrogen Chloride (HCl)	15			EN 1911-1	07.98
	16			EN 1911-2	07.98
	17			EN 1911-3	07.98
Chlorine (Cl <sub>2</sub> )	18	(3488 - 1)	12.79		
		(3488 - 2)	11.80		
Fluorine Chloride (HF)	19	2470 - 1	10.75		

- 11) VDI 2462 - 8: Measurement of gaseous emissions; measurement of the sulfur-dioxide concentration; H<sub>2</sub>O<sub>2</sub>-thorin method
- 12) VDI 2462 - 7: Measurement of gaseous emissions; measurement of the sulfur-trioxide concentration; 2-propanol method
- 13) No guideline for discontinuous measurements available; measurement with validated analyzing systems (e.g. chemiluminescence, IR) recommended.
- The guideline VDI 2456 - 8 (Gaseous emission measurement; analytical determination of the sum of nitrogen monoxide and nitrogen dioxide; sodium salicylate method) shall not be used.
  - The nitrates, nitrites and certain organic nitrogenous compounds entrained in the form of vapors or suspended matter may substantially and systematically impair the result in the direction of higher values. In high concentrations, sulfur dioxide and other oxidizable substances greatly impede complete oxidation of the nitrogen monoxide.
- 14) VDI 3496 - 1: Gaseous emission measurement; determination of basic nitrogen compounds seizable by absorption in sulphuric acid
- Determination of ammonia emission in cement plants
  - Available only in German

- 15) EN 1911 - 1: Stationary source emissions - Manual method of determination of HCl - Part 1: Sampling of gases
- 16) EN 1911 - 2: Stationary source emissions - Manual method of determination of HCl - Part 2: Gaseous compounds absorption
- 17) EN 1911 - 3: Stationary source emissions - Manual method of determination of HCl - Part 3: Absorption solutions analysis and calculation
- 18) No guideline for discontinuous measurements available
- The guideline VDI 3488 - 1 (Gaseous emission measurement; measurement of chlorine and oxides of chlorine; methyl orange method) and the guideline 3488 - 2 (Gaseous emission measurement; measurement of chlorine concentration; bromide iodide method) should not be used
  - Reaction of chlorine with sulfur dioxide in wet exhaust gases.
- 19) VDI 2470 - 1: Gaseous emission measurement; measurement of gaseous fluorine compounds; absorption method
- Available only in German

#### 4. ORGANIC COMPOUNDS

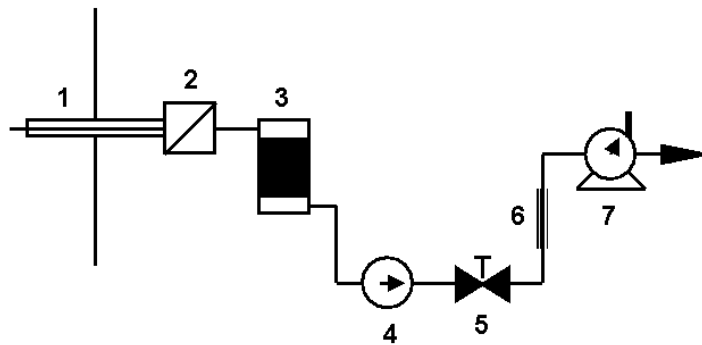
		VDI Guideline		DIN/EN Standard	
		Number	Edition	Number	Edition
Volatile Organic Compounds (VOC)	20	(3481 - 2)	09.98	EN 12619	09.99
	21	(3481 - 1)	08.75		
	22	3481 - 3	10.95		
Polycyclic Aromatic Hydrocarbons (PAH) Sampling	23	3873 - 1	11.92	EN 1948-1	02.04
Benzene	24	NIOSH 1501			
Dioxins and Furans	25			EN 1948 - 1	02.04
	26			EN 1948 - 2	02.04
	27			EN 1948 - 3	02.04

- 20) VDI 3481 - 2: (Gaseous emission measurement - Determination of gaseous organic carbon in waste gases - Adsorption on silica gel) shall not be used
- The method shall not be used for measurements of combustion plants due to interfering effect of CO<sub>2</sub> and H<sub>2</sub>O
- 21) VDI 3481 -1: Gaseous emission measurement; determination of hydrocarbon concentration; flame-ionization-detector (FID) is withdrawn
- Withdrawn and replaced by VDI 3481-3
  - Available only in German
- 22) VDI 3481 - 3: Gaseous emission measurement - Determination of volatile organic compounds, especially solvents, flame ionization detector (FID)  
EN 12619: Stationary source emissions - Determination of the mass concentration of total gaseous organic carbon at low concentrations in flue gases - Continuous flame ionisation detector method
- 23) VDI 3878 - 1: Emission measurement; measurement of Polycyclic Aromatic Hydrocarbons (PAH) in stationary industrial plants; dilution method (RWTÜV method); gas-chromatographic determination

- 24) NIOSH method 1501<sup>1</sup> can be used for non-continuous benzene measurement in cement-plant exhaust gases. This method is based on adsorptive enrichment in activated carbon followed by liquid desorption and analysis by gas chromatography. The method is also suitable for the following compounds: cumene, a-methyl-styrene, styrene, vinyl-toluene, p-tert-butyl-toluene, ethyl-benzene, naphthalene, toluene, and xylene.

- Sampling

The water must be removed prior to absorption by activated carbon. The following Figure shows the scheme of an example sampling system.



- 1 Heated gas-extraction tube (>120 [°C])
- 2 Heated filter (>120 [°C])
- 3 Condensate collector (measuring-gas cooler, ...)
- 4 Gas-sample pump
- 5 Regulator and shut-off valve
- 6 Activated carbon tube
- 7 Gas volume meter

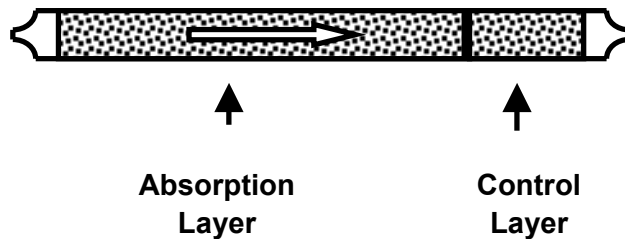
Adsorption in activated carbon at a flow of 0.5 to 1.5 [l/min] up to a maximum volume of 50 - 100 [l]. Breakthrough is not expected at these flows and volumes.

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<sup>1</sup>

NIOSH Manual of Analytical Methods, 3rd Ed., US Department of Health and Human Services, National Institute for Occupational Safety and Health, Cincinnati, USA, (1994)  
<http://www.cdc.gov/niosh/nmam/nmammenu.html>

- Analysis  
 The absorption tubes: Dräger activated charcoal tube Type G, 6728831 or a similar product  
 The activated carbon tube consists of an absorption layer (0.7 [g] activated coal) and a control layer (0.3 [g] activated coal).  
 Both layers are analyzed separately



- Storage  
 The analysis of the tube must be made latest 14 days after the absorption test.  
 In the time between the test and the analysis the activated coal tubes must be stored in a refrigerator.
- Preparation / Analysis  
 Scratch of the tubes with a glasscutter, and then break  
 Put the absorption layer and the control layer in a separate glass vessel (Type G --> 20 [ml])  
 Put (pipette) 10.00 [ml] CS<sub>2</sub> to it and close the vessel immediately  
 Shake the vessel during 30 minutes  
 After deposit of the coal take approximately 1 [ml] of the solution with a syringe and put it in the sample glass vessel of the Gas chromatograph (GC). Close it immediately

- 25) Stationary source emissions - Determination of the mass concentration of PCDDs/PCDFs and dioxin-like PCBs - Part 1: Sampling
- 26) Stationary source emissions - Determination of the mass concentration of PCDDs/PCDFs and dioxin-like PCBs - Part 2: Extraction and clean-up of PCDDs/PCDFs
- 27) Stationary source emissions - Determination of the mass concentration of PCDDs/PCDFs and dioxin-like PCBs - Part 3: Identification and quantification of PCDDs/PCDFs