DURAG GROUP

GUIDANCE BOOK

on the European Directive 2010/75/EU IED Industrial Emissions Directive
under the influence of the new European standards

ON THE EUROPEAN DIRECTIVE 2010/75/EU IED INDUSTRIAL EMISSIONS DIRECTIVE UNDER THE INFLUENCE OF THE NEW EUROPEAN STANDARDS

- DIRECTIVE 2010/75/EU OF 24TH NOVEMBER 2010 ON INDUSTRIAL EMISSIONS (INTEGRATED POLLUTION PREVENTION AND CONTROL) (IED)
- EUROPEAN STANDARD EN 14181 STATIONARY SOURCE EMISSIONS – QUALITY ASSURANCE OF AUTOMATED MEASURING SYSTEMS
- EUROPEAN STANDARD EN 15267 AIR QUALITY – CERTIFICATION OF AUTOMATED MEASURING SYSTEMS
- EUROPEAN STANDARD EN 17255 STATIONARY SOURCE EMISSIONS – DATA ACQUISITION AND HANDLING SYSTEMS

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PREFACE

This Guidance book contains legal obligations for plants according to directive 2010/75/EU of 24th November 2010 (IED) and directive 2015/2193/EU of 25th of November 2015 (MCP) – as well as requirements for continuous emission – and evaluation systems.

- Read the guidance book if you have any questions to the European Directives for large or medium combustion plants
- When you search for information to EN 14181 – quality assurance for automated measuring systems (AMS)
- If you like to research minimum requirements
- Look up abbreviations within the glossary
- Use links and source references for your own research and detailed information
- Additionally, you will find applications and a DURAG product overview at the end of this guidance book

Since years, the DURAG GROUP is committed to optimize your day-to-day business with this guidance book. We are delighted about your interest.

1 THE EUROPEAN DIRECTIVES + STANDARDIZATION

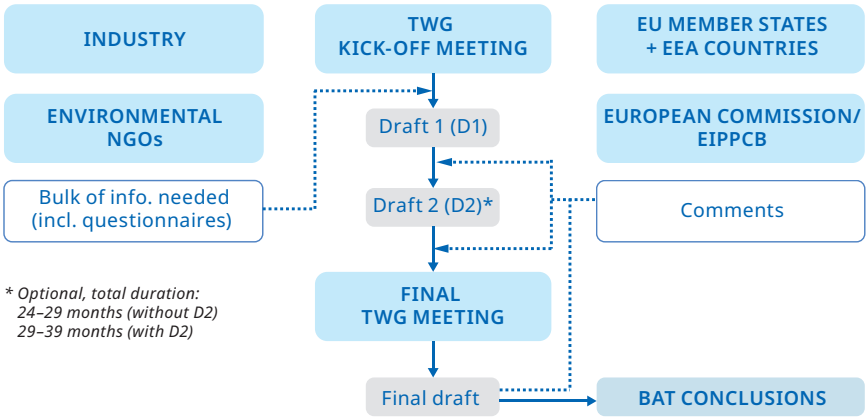
THE EUROPEAN DIRECTIVES + STANDARDIZATION

DIRECTIVE 2010/75/EU – THE INDUSTRIAL EMISSIONS DIRECTIVE OR IED

Directive 2010/75/EU of the European Parliament and the Council on industrial emissions – the Industrial Emissions Directive or IED – is the main EU instrument regulating pollutant emissions from industrial installations. The IED was adopted on 24th of November 2010. It is based on a Commission proposal recasting 7 previously existing directives (including in particular the IPPC Directive). The IED entered into force on 6th of January 2011 and had to be transposed by Member States by 7th of January 2013.

More than 52,000 agro-industrial installations undertaking the industrial activities listed in Annex I of the IED are required to operate in accordance with a permit (granted by the authorities in the Member States).

The permit conditions including emission limit values must be based on the Best Available Techniques (BAT). The European Union's Industrial Emissions Directive defines Best Available Techniques (BAT) as "the most effective and advanced stage in the development of activities and their methods of operation, indicating the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where this is not practicable, to reduce emissions and the impact on the environment as a whole". In order to define BAT and the BAT-associated environmental performance at EU level, the Commission organizes an exchange of information with experts from Member States, industry, and environmental organizations. This work is coordinated by the European IPPC Bureau at the EU Joint Research Centre in Seville (Spain) and is called the "Sevilla Process". This process results in BAT Reference Documents (BREFs); the BAT conclusions contained are adopted by the Commission as Implementing Decisions. To achieve this, experts from Member States, industry, environmental NGOs, and services of the Commission discuss together every detail of these norms.



Source: Roudier, S. (2019), The 'Sevilla' Process.

A BREF is a comprehensive report that determines best available techniques (BAT) and emerging techniques based on empirical data and sound techno-economic information. The key element of a BREF is the section on 'BAT Conclusions' that is adopted as a stand-alone document through a committee procedure. BAT Conclusions lay down the main findings of an EU BREF and include the scope and definition of each BAT and their applicability, the BATAELs and BAT-AEPLs and associated monitoring requirements (OECD). The IED requires that these BAT conclusions be the reference for setting permit conditions. They are published in the Official Journal of the European Union as standalone Commission Implementing Decisions and translated into all official EU languages (OECD, 2018[27]).

As of 2021, the European IPPC Bureau has issued 33 BREFs, most of them have been already reviewed and updated. One can retrieve and download the current versions of the existing BREFs from BAT reference documents | Eippcb (europa.eu). This website also informs about the status of each BREF.

In many countries, BAT are used to derive BAT-associated environmental performance levels (BAT-AEPLs). These encompass BAT-associated emission levels (BAT-AELs) as well as other environmental performance levels. BAT-AELs are – according to the European Union's Industrial Emissions Directive (IED) – "the range of emission levels obtained under normal operating conditions using a best available technique or a combination of best available techniques expressed as an average over a given period of time, under specified reference conditions". The BAT-AELs are technologically driven; i. e. they reflect the environmental performance levels that can be achieved by implementing BAT or a combination of BAT, rather than being based on e. g. national emission targets and/or on the whole operating range of current performance of all installations. It is the obligation of the EU member states to determine related specific limit values. A specific BREF was developed for the monitoring of emissions to air and water from installations under the Industrial Emissions Directive, which is referred to as the 'ROM'. For certain activities, i. e. large combustion plants or waste incineration and co-incineration plants, the IED also sets EU wide emission limit values for selected pollutants.
The Commission will propose a revision of EU measures addressing pollution from large industrial installations, as announced in the European Green Deal. The Commission is undertaking an impact assessment with a view to tabling a proposal for its revision in 2022.

The EU is the only region in the world with a climate neutrality target enshrined into law. To reach climate neutrality by 2050 All 27 EU Member States committed to turning the EU into the first climate neutral continent by 2050. To get there, they pledged to reduce emissions by at least 55 % by 2030, compared to 1990 levels: "Fit for 55 Package". The European Green Deal set the blueprint for this transformational change.

In the following a brief description of two BREFs under the IED that are of particular significance for emissions monitoring in Europe:

BEST AVAILABLE TECHNIQUES (BAT) REFERENCE DOCUMENT FOR LARGE COMBUSTION PLANTS

The BAT Reference Document (BREF) for Large Combustion Plants is published by the European Commission pursuant to Article 13(6) of the Directive. This BREF for Large Combustion Plants concerns the following activities specified in Annex I to Directive 2010/75/EU:

1. Combustion of fuels in installations with a total rated thermal input of 50 MW or more, only when this activity takes place in combustion plants with a total rated thermal input of 50 MW or more.
2. Gasification of coal or other fuels in installations with a total rated thermal input of 20 MW or more, only when this activity is directly associated to a combustion plant.
3. Disposal or recovery of waste in waste co-incineration plants for non-hazardous waste with a capacity exceeding 3 tons per hour or for hazardous waste with a capacity exceeding 10 tons per day, only when this activity takes place in combustion plants covered under 1. above.

In particular, this document covers upstream, and downstream activities directly associated with the aforementioned activities including the emission prevention and control techniques applied. The fuels considered in this document are any solid, liquid and/or gaseous combustible material including:

- Solid fuels (e.g. coal, lignite, peat);
- Biomass (as defined in Article 3(31) of Directive 2010/75/EU);
- Liquid fuels (e. g. heavy fuel oil and gas oil);
- Gaseous fuels (e. g. natural gas, hydrogen-containing gas, and syngas);
- Industry-specific fuels (e. g. by-products from the chemical and iron and steel industries);
- Waste except mixed municipal waste as defined in Article 3(39) and except other waste listed in Article 42(2)(a)(ii) and (iii) of Directive 2010/75/EU.

Critical issues for the implementation of Directive 2010/75/EU in the Large Combustion Plants sector are the emissions to air of nitrogen oxides, sulfur dioxide, hydrogen chloride and fluoride, organic compounds, dust, and metals including mercury; emissions to water resulting especially from the use of wet abatement techniques for the removal of sulfur dioxide from the flue-gases; resource efficiency and especially energy efficiency. This BREF contains 12 chapters.

Source: Best Available Techniques (BAT) reference document for large combustion plants – Publications Office of the EU (europa.eu)

DETAILS OF LARGE COMBUSTION PLANTS (LCPS)

- According to IED, a combustion plant in which any fuel is oxidized to produce useful heat (excluding directly fired processes);
- Existing plants permitted before 7th of January 2013;
- Large Combustion Plants (Chapter III and Annex V of the IED):
  - > 50 MWth single unit with one stack;
  - > 50 MWth multiple units with a common stack (containing one or more flue gas streams);
  - > 50 MWth multiple units with single stacks which could have been flued together in the judgement of the competent authority.
- LCP aggregation excludes units <15 MWth;
- Monitoring of air polluting substances must be conducted in accordance with the provisions of Part 3 of IED Annex V. The IED emission limit values to air shall be regarded as being complied with if the conditions set out in Part 4 of Annex V are fulfilled;
- Emission Limit Values (ELVs) defined for NOx, SO_2, dust and CO (gas firing only) for different plant technologies & age: Fueling, operating hours, during normal operation excluding start-up and shut-down (SU-SD). According to the current IED, ELVs apply for loads >70 %;
- Permits for LCPs need to be updated in line with the LCP BAT conclusions by August 2021. These BAT conclusions establish performance levels associated with BAT and include monitoring requirements;
- Compliance began by 17.08.2021 for existing plants;
- BAT-AELs differ enormously with regards to control technologies and monitoring requirements;
- IED harmonized reporting for all combustion plants:
  - Monthly average: 100 %;
  - Daily average: 110 %;
  - Hourly 95 Percentile: 200 %.
- Compliance assessment is based on validated hourly averages (following the subtraction of the confidence interval for each pollutant);
- LCP BREF specifies annual and daily BAT-AELs;
- Full ELV compliance subject to derogation, e. g. limited lifetime;
- Peripherals are required for correction of reference conditions (O_2 etc.) and flow;
- Member states differ in implementation, ongoing IED review.

Source: David Graham and IED – Chapter III – Special provisions for Large Combustion Plants – Environment – European Commission (europa.eu), modified

MONITORING REQUIREMENTS LCP BREF

Wide range of pollutants – more aligned with Energy from Waste (EfW) regulation

Group	Species	Applies to	Frequency	Unless	Then
1. IED pollutants	NO_x	All fuels	Continuous	Plant <100 MWth and <1,500 h/yr operation	Periodic (6 m)
	CO				
	SO_2	Coal, Bio-mass, HFO, Gas Oil			
		Oil fired without SO_2 abatement			Periodic (3 m)
	Dust	Coal, Bio-mass, HFO, Gas Oil	Continuous	Plant <100 MWth and <1,500 h/yr operation	Periodic (6 m)
2. Acid gases	HCI	Coal	Periodic (3 m)	Emissions are 'sufficiently stable'	Periodic (12 m)
				Plant < 100 MWth and < 1,500 h/yr operation	Periodic (6 m)
		Biomass	Continuous	Emissions are 'sufficiently stable'	Periodic (6 m)
				Plant < 100 MWth and < 1,500 h/yr operation	Periodic (6 m)
				Plant < 100 MWth and < 500 h/yr operation	Periodic (12 m)
	HF	Coal	Periodic (3 m)	Emissions are 'sufficiently stable'	Periodic (12 m)
				Plant < 100 MWth and < 1,500 h/yr operation	Periodic (6 m)
		Biomass	Periodic (12 m)		
3. Metals	Hg	Coal (≥ 300 MWth)	Continuous	Emissions are 'sufficiently stable'	Periodic (6 m)
		Biomass	Periodic (12 m)	Emissions are 'sufficiently stable'	No monitoring
	Trace metals	Coal, Bio-mass, HFO, Gas Oil	Periodic (12 m)	Emissions are deemed insignificant	Less frequent
4. Abatement	NH_3	All fuels with SCR/SNCR	Continuous	Plant < 100 MWth and < 1,500 h/yr operation	Periodic (6 m)
				Emissions are 'sufficiently stable' (SCR only)	Periodic (12 m)
	SO_3	All fuels with SCR	Periodic (12 m)	–	–

Source: David Graham

BEST AVAILABLE TECHNIQUES (BAT) REFERENCE DOCUMENT FOR WASTE INCINERATION

The Best Available Techniques (BAT) Reference Document (BREF) for Waste Incineration is also published by the European Commission pursuant to Article 13(6) of the Directive. The BREF for Waste Incineration covers

- The disposal or recovery of waste in waste incineration plants and waste co-incineration plants, and
- the disposal or recovery of waste involving the treatment of slags and/or bottom ashes from the incineration of waste.

Critical issues for the implementation of Directive 2010/75/EU in the waste incineration (WI) sector include emissions to air, emissions to water, and the efficiency of the recovery of energy and of materials from the waste. This BREF contains 7 chapters, which include

- General information on the WI sector;
- Information on the common processes and general techniques for the pre-treatment, storage, and handling of different types of waste; the thermal treatment; energy recovery; flue-gas cleaning; waste-water treatment; and the treatment of solid residues;
- Currently reported ranges of the emission and consumption levels;
- Techniques to consider in the determination of BAT;
- BAT conclusions as defined in Article 3(12) of the Directive;
- Information on 'emerging techniques' as defined in Article 3(14) of the Directive as well as recommendations for future work.

Source: Best Available Techniques (BAT) reference document for waste incineration – Publications Office of the EU (europa.eu)

WI BREF 2019

- WI BREF and BATC documents published in December 2019, coming effective in December 2023;
- Scope: > 3 t/h non hazardous waste or > 10 t/d hazardous waste;
- ELV ranges:

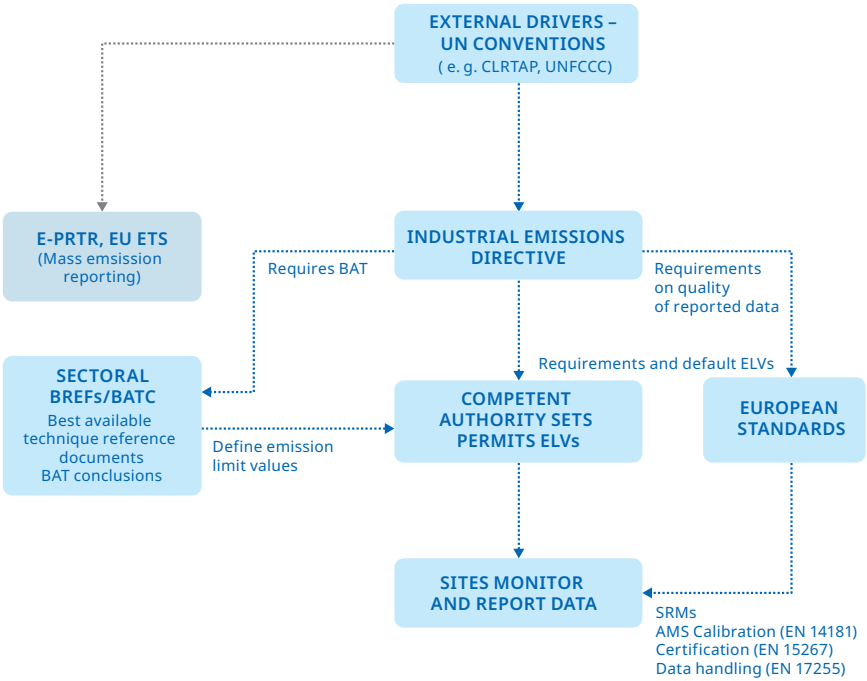
mg/m³*	HF	HCI	SO_2	NH_3	NO_x	CO	TVOC	Hg	Dust
WI BREF 2006 daily average, maximum	1	8	40	10	100	30	10		5
WI BREF 2006 daily average new plant, maximum	1	6	30	10	120	50	10	20	5
WI BREF 2006 daily average existing plant, maximum	1	8	40	10	150	50	10	20	5

** Measure is displayed at 1,013.25 hPa and 0 °C*

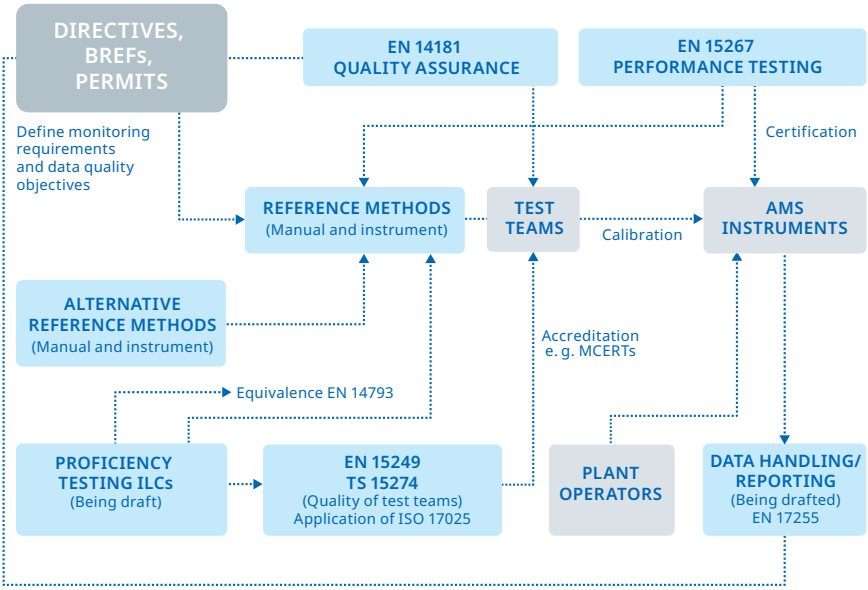
- All environmental permits of existing waste incineration installations in Europe need to be reviewed during the implementation period of 4 years;
- The most notable change is the reqiurement to monitor mercury emissions.

Source: Jyrki Korpela

The following figure illustrates the interdependencies and relationships within the emissions monitoring framework under the IED, while the figure on page 19 explains the structure of main quality assurance standards under associated directives and BREFs. Emissions monitoring quality assurance is covered by EN 14181 with EN 15267 parts 1–4 describing type testing of emissions monitoring and measurement equipment.

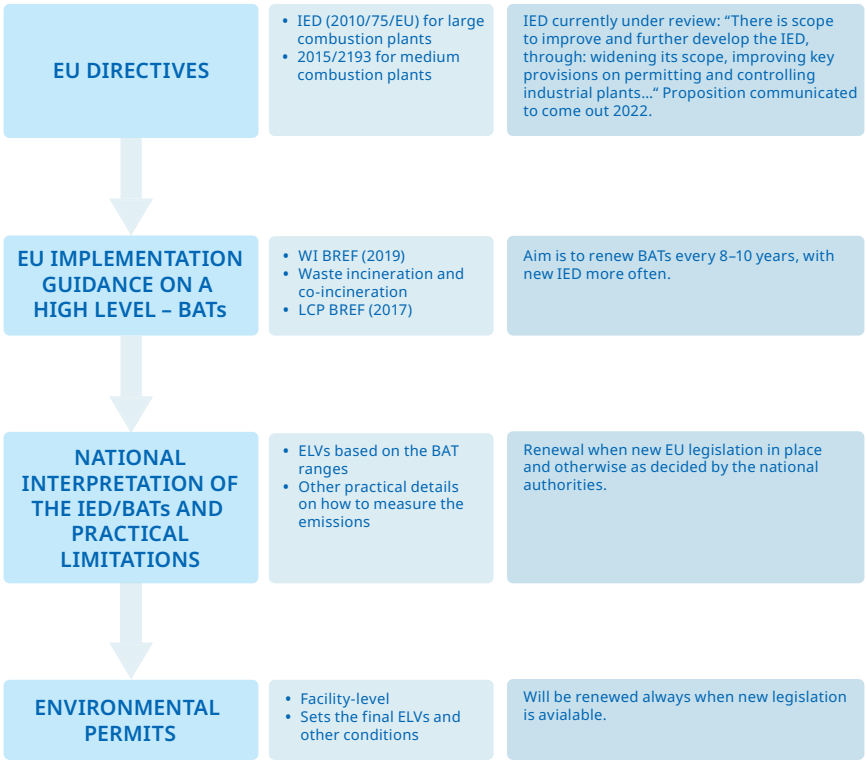


Sources: Rod Robinson



Sources: Rod Robinson

The following figure summarizes the hierarchy of major directives and regulations under the IED from EU to national levels.



Source: Jyrki Korpela

THE MEDIUM COMBUSTION PLANT DIRECTIVE

There are estimated to be around 143,000 medium combustion plants (MCPs) in the EU, which are an important source of emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_x) and dust.

Directive (EU) 2015/2193 on the limitation of emissions of certain pollutants into the air from MCPs known as the Medium Combustion Plant Directive regulates pollutant emissions from the combustion of fuels in plants with a rated thermal input equal to or greater than 1 Megawatt thermal (MWth) and less than 50 MWth.
The MCPD also implements obligations arising from the Gothenburg Protocol under the UNECE Convention on Long-Range Transboundary Air Pollution.
This Directive fills the regulatory gap at EU level between large combustion plants (> 50 MWth), covered by the Industrial Emissions Directive (IED) and smaller appliances (heaters and boilers <1 MWth) covered by the Ecodesign Directive.

The MCPD regulates emissions of SO_2, NO_x and dust to air and also requires monitoring of carbon monoxide (CO) emissions. The emission limit values set in the MCPD apply from 20th of December 2018 for new plants and 2025 or 2030 for existing plants, depending on their size.

Periodic measurements shall be required at least:

- Every three years for MCPs 1–20 MW;
- Every year for MCPs > 20 MW;
- Measurements shall be required only for: (a) pollutants for which an emission limit value is laid down in this Directive for the plant concerned with measurements for CO for all plants;
- Portable AMS must comply with the latest version of EN15267-4. It shall constitute an equivalent method to a SRM accepted.

1 THE EUROPEAN DIRECTIVES – TABLES

Emission limit values for waste incineration plants (continuous measurements, standardised at 11 % O_2, mineral waste oil at 3% O_2), shown in mg/m^3

	Specials	Daily Avg. WID 2000	1/2 h Avg. WID 2000 (100%) <1/2 h-LV A	1/2 h Avg. WID 2000 (97%) <1/2 h-LV B	Daily Avg. IED 2010	1/2 h Avg. WID 2000 (100%) <1/2 h-LV A	1/2 h Avg. WID 2000 (97%) <1/2 h-LV B
Dust		10	30	10	10	30	10
TOC		10	20	10	10	20	10
HCl		10	60	10	10	60	10
HF		1	4	2	1	4	2
SO_2		50	200	50	50	200	50
NO_2	≤6 t/d existing plants [1]	200	not included		400	not included	
	>6 t/d existing and all new plants	200	400	200	200	400	200
CO		50	100 [2]	150 (95% at 10 min) [2]	50 (97%)	100 [2]	150 (95% at 10 min) [2]

Remarks:
1) Existing plant full requested for authorization before 28th of December 2002 and put into operation not later than 28th of December 2004
2) Alternatively

- Emission limit values according to WID up to 40% thermal co-incineration;
- Limit value calculation for solid, liquid and biological waste according to the following formula, if no specific limit value has been defined;
- If waste incineration is the main purpose of a co-incineration plant it shall be treated as a normal incineration plant. If the heat release from the waste incineration is less than 10% of the total heat release it is set to equal 10%.

$$\frac{C_{PROC} * V_{PROC} + C_{WASTE} * V_{WASTE}}{V_{PROC} + V_{WASTE}} = \overline{C}$$

C_{Proc} for combustion plants co-incinerating waste

Pollutant	Plant specification		EC Directive 2000/76 Waste incineration	EC Directive 2010/75 Industrial Emissions		
	Fuel	Thermal input [MW]	C_{Proc} as daily avg. [mg/m³]	C_{Proc} as daily avg. [mg/m³] transitional ruling [1]	C_{Proc} as daily avg. [mg/m³] existing plants as of 01.01.2016 [2]	C_{Proc} as daily avg. [mg/m³] new plants as of 07.01.2013 [3]
Dust	Solid fuels with the exception of biomass (O_2 content 6 %)	<50	50	50	50	50
		50 … 100	50	50	30	20
		100 … 300	30	30	25 (peat: 20)	20
		>300	30	30	20	10 (peat: 20)
	Biomass (O_2 content 6 %)	<50	50	50	50	50
		50 … 100	50	50	30	20
		100 … 300	30	30	20	20
		>300	30	30	20	20
	Liquid fuels (O_2 content 3 %)	<50	50	50	50	50
		50 … 100	50	50	30	20
		100 … 300	30	30	25	20
		>300	30	30	20	10

Pollutant	Plant specification		EC Directive 2000/76 Waste incineration	EC Directive 2010/75 Industrial Emissions		
	Fuel	Thermal input [MW]	C_{Proc} as daily avg. [mg/m³]	C_{Proc} as daily avg. [mg/m³] transitional ruling [1]	C_{Proc} as daily avg. [mg/m³] existing plants as of 01.01.2016 [2]	C_{Proc} as daily avg. [mg/m³] new plants as of 07.01.2013 [3]
SO_2	Solid fuels with the exception of biomass (O_2 content 6%)	<50	not included	not included	not included	not included
		50 ... 100	850 (SAG≥90%) [4]	850	400 (peat: 300)	400 (peat: 300)
		100 ... 300	850 to 200 (linear decrease) (SAG≥92%) [4]	200	200	200 (peat: 300, peat with fluidized bed 250)
		>300	200 (SAG≥95%) [4]	200	200	150 (fluidized bed partial 200)
	Biomass (O_2 content 6%)	<50	not included	not included	not included	not included
		50 ... 100	200	200	200	200
		100 ... 300	200	200	200	200
		>300	200	200	200	150
	Liquid fuels (O_2 content 3%)	<50	not included	not included	not included	not included
		50 ... 100	850	850	350	350
		100 ... 300	850 to 200 (linear)	400 to 200 (linear)	250	200
		>300	200	200	200	150

Continued on next page

Pollutant	Plant specification		EC Directive 2000/76 Waste incineration	EC Directive 2010/75 Industrial emissions		
	Fuel	Thermal input [MW]	C_{Proc} as daily avg. [mg/m³]	C_{Proc} as daily avg. [mg/m³] transitional ruling [1]	C_{Proc} as daily avg. [mg/m³] existing plants as of 01.01.2016 [2]	C_{Proc} as daily avg. [mg/m³] new plants as of 07.01.2013 [3]
NO_2	Solid fuels with the exception of biomass (O_2 content 6%)	<50	not included	not included	not included	not included
		50 … 100	400	400	300 (lignite: 400)	300 (peat: 250)
		100 … 300	300	200	200	200
		>300	200	200	200	150 (pulv. lignite: 200)
	Biomass (O_2 content 6%)	<50	not included	not included	not included	not included
		50 … 100	350	350	300	250
		100 … 300	300	300	250	200
		>300	300	200	200	150
	Liquid fuels (O_2 content 3%)	<50	not included	not included	not included	not included
		50 … 100	400	400	400	300
		100 … 300	300	200	200	150
		>300	200	200	150	100

Remarks:
1) For existing plants before 31st of December 2015 and new plants before 7th of January 2013
(New/existing plant definition see IED Article 30, paragraph 2 and 3)
2) For existing plants as of 1st of January 2016
(New/existing plant definition see IED Article 30, paragraph 2 and 3)
3) For new plants as of 7th of January 2013
(New/existing plant definition see IED Article 30, paragraph 2 and 3)
4) With indigenous fuels alternatively minimum rates of desulphurization (=SAG)

Special cement plant regulation

Pollutant	Daily limit value
Dust	30
NO_x (existing plants)	800
NO_x (new plants)	500
HCl	10
HF	1
TOC	10
SO_2	50
CO	to be defined locally

All values are in mg/m^3 at 10% O_2

LCPD – DIRECTIVE 2001/80/EC ON THE LIMITATION OF EMISSIONS OF CERTAIN POLLUTANTS INTO THE AIR FROM LARGE COMBUSTION PLANTS

The LCPD covered all combustion installations with a rated thermal output exceeding 50 MW irrespective the type of fuel used with the exception of waste. The Directive shall apply only to combustion plants designed for production of energy with the exception of those which make direct use of the products of combustion in manufacturing processes.

Existing plants
Licensed before 1st of July 1987 will have to comply with the emission limit values in annex A of the Directive latest 1st of January 2008 (exception: no more than 20,000 operational hours after 1st of January 2008 ending no later than 31st of December 2015).

New plants
Licensed after 1st of July 1987 but before 27th of November 2002, in operation 27th of November 2003 latest will have to comply with the emission limit values in annex A of the Directive.

New new plants
Licensed after 27th of November 2002 or in operation later than 27th of November 2003 will have to comply with the limit values of part B of the Directive.
National, more stringent time and emission limit values possible.

LCPD 2001/80/EC requirements
Emission standards shall be regarded as having been complied with, if within one calendar year.

Existing plants, starting 1st of January 2008, new plants until 2002/2003:
- None of the calendar monthly mean value exceeds the emission value A;
- 97% of all 48 hourly SO_2 and dust mean values do not exceed 110% of emission limit values A;
- 95% of all 48 hourly NO_X mean values do not exceed 110% of emission values A.

New plants, later than 2002/2003
- No validated daily average value exceeds the relevant limit values B;
- 95% of all the validated hourly averages values do not exceed 200% of the relevant limit values B;
- Continuous measurement for SO_2, NO_X and dust required for plants >100 MW.

IED 2010/75/EU requirements for combustion plants
The Directive on Industrial Emissions IED 2010/75/EC has replaced the LCPD 2001/80/EC with effect from 1st of January 2016.

Existing plants
Permitted before 7th of January 2013 and put into operation not later than 7th of January 2014.

New plants
Permitted after 7th of January 2013 or in operation later than 7th of January 2014.

Emission standards shall be regarded as having been complied with if the evaluation of the measurement results indicates, for operating hours within a calendar year, that all of the following conditions have been met:
- No validated monthly average value exceeds the relevant emission limit values set out in the tables below;
- No validated daily average value exceeds 110% of the relevant emission limit values set out in the tables below;
- 95% of all the validated hourly average values over the year do not exceed 200% of the relevant emission limit values set out in the tables below.

Emission limit values (mg/m³*) for combustion plants using solid fuels with the exception of gas turbines and gas engines, standardized at 6% O_2

	Thermal input and fuel LCPD 2001		Limit values LCPD 2001 existing plants [1])	Limit values LCPD 2001 new plants [2])	Thermal input and fuel IED 2010		Limit values IED existing plants [3])	Limit values IED new plants [4])
SO_2	<50 MW		not included		25 … 50 MW		in preparation	
	50 … 100 MW	in general	2000	850	50 … 100 MW	in general	400	400
		Biomass	2000	200		Biomass	200	200
						Peat	300	300
	100 … 500 MW		2,000 to 400 linear decrease	200	100 … 300 MW	in general	250	200
						Biomass	200	200
						Peat	300	300
	>500 MW		400	200	>300 MW	in general	200	150
						Fluidized bed	200	200
NO_2	<50 MW		not included		25 … 50 MW		in preparation	
	50 … 100 MW		600	400	50 … 100 MW	in general	300	300
						Lignite	450	400
						Biomass, peat	300	250
	100 … 300 MW	in general	600	200	100 … 300 MW	in general	200	200
		Biomass		300		Biomass, peat	250	200
	300 … 500 MW		600	200				
	>500 MW	before 2015	500	200	>300 MW	in general	200	150
		after 2016	200			Lignite	200	200

** Measure is displayed at 1,013.25 hPa and 0 °C*

	Thermal input and fuel LCPD 2001	Limit values LCPD 2001 existing plants [1)]	Limit values LCPD 2001 new plants [2)]	Thermal input and fuel IED 2010		Limit values IED existing plants [3)]	Limit values IED new plants [4)]
Dust	<50 MW	not included		25 ... 50 MW		in preparation	
	50 ... 100 MW	100	50	50 ... 100 MW		30	20
	100 ... 500 MW	100	30	100 ... 300 MW	in general	25	20
					Biomass, peat	20	
	>500 MW	50	30	>300 MW	in general	20	10
					Biomass, peat	20	20

Remarks:
1) *New and existing plants according to LCPD, article 4 paragraph 1 or 3*
2) *New plants according to LCPD, article 4 paragraph 2*
3) *Existing plants according to IED, article 30 paragraph 2: Permitted before 7th of January 2013 and put into operation not later than 7th of January 2014 (derogations up to 2016)*
4) *New plants according to IED, article 30 paragraph 3: All plants except paragraph 2*

Emission limit values (mg/m³*) for combustion plants using liquid fuels with the exception of gas turbines and gas engines, standardized at 3% O_2

	Thermal input and fuel LCPD 2001		Limit values LCPD 2001 existing plants [1]	Limit values LCPD 2001 new plants [2]	Thermal input and fuel IED 2010		Limit values IED existing plants [3]	Limit values IED new plants [4]
SO_2	<50 MW		not included		25 ... 50 MW		in preparation	
	50 ... 100 MW		1,700	850	50 ... 100 MW		350	350
	100 ... 300 MW		1,700	400 to 200 linear decrease	100 ... 300 MW		250	200
	300 ... 500 MW		1,700 to 400 linear decrease	200				
	>500 MW		400	200	>300 MW		200	150
	<50 MW		not included		25 ... 50 MW		in preparation	
NO_2	50 ... 100 MW		450	400	50 ... 100 MW		450	300
	100 ... 300 MW	in general	450	200	100 ... 300 MW	in general	200	150
		Biomass		300		Refineries	450	
					300 ... 500 MW	others	150	100
	300 ... 500 MW		450	200		Refineries	450	
	>500 MW		400	200	>500 MW		150	100
	<50 MW		not included		25 ... 50 MW		in preparation	

** Measure is displayed at 1,013.25 hPa and 0 °C*

	Thermal input and fuel LCPD 2001	Limit values LCPD 2001 existing plants [1)]	Limit values LCPD 2001 new plants [2)]	Thermal input and fuel IED 2010		Limit values IED existing plants [3)]	Limit values IED new plants [4)]
Dust	50 ... 100 MW	50	50	50 ... 100 MW	in general	30	20
					Refineries	50	
	100 ... 500 MW	50	30	100 ... 300 MW	in general	25	20
					Refineries	50	
	>500 MW	50	30	>300 MW	in general	20	10
					Refineries	50	

Remarks:
1) New and existing plants according to LCPD, article 4 paragraph 1 or 3
2) New plants according to LCPD, article 4 paragraph 2
3) Existing plants according to IED, article 30 paragraph 2: Permitted before 7th of January 2013 and put into operation not later than 7th of January 2014 (derogations up to 2016)
4) New plants according to IED, article 30 paragraph 3: All plants except paragraph 2

Emission limit values (mg/m³*) for combustion plants using gaseous fuels with the exception of gas turbines and gas engines, standardized at 3% O_2

	Thermal input and fuel LCPD 2001		Limit values LCPD 2001 existing plants [1]	Limit values LCPD 2001 new plants [2]	Thermal input and fuel IED 2010		Limit values IED existing plants [3]	Limit values IED new plants [4]
SO_2	<50 MW		not included		25 ... 50 MW		in preparation	
	>50 MW	in general	35		>50 MW	in general	35	
		Liquefied gas	5			Liquefied gas	5	
		coke oven gas	800	400		coke oven gas	400	
		blast furnace gas	800	200		blast furnace gas	200	
		gases from the gasification of refinery residues	800					
	<50 MW		not included		25 ... 50 MW		in preparation	

** Measure is displayed at 1,013.25 hPa and 0 °C*

	Thermal input and fuel LCPD 2001		Limit values LCPD 2001 existing plants [1]	Limit values LCPD 2001 new plants [2]	Thermal input and fuel IED 2010		Limit values IED existing plants [3]	Limit values IED new plants [4]
NO_2	50 … 100 MW	Natural gas	not specified	150	50 … 100 MW	Natural gas	100	100
		in general	300	200		Steel industry gas	200	
						Refineries	200	
	100 … 300 MW	Natural gas	not specified	150	100 … 300 MW	Natural gas	100	100
		in general	300	200		Steel industry gas	200	
	300 … 500 MW	Natural gas	not specified	150		Refineries	200	
		in general	300	200				
	>500 MW	Natural gas	not specified	100	>300 MW	Natural gas	100	100
		in general	200	200		Steel industry gas	200	
						Refineries	200	
	<50 MW		not included		25 … 50 MW		in preparation	
Dust	>50 MW	in general	5	5	>50 MW	in general	5	
		blast furnace gas	10	10		blast furnace gas	10	
		Steel industry gas	50	30		Steel industry gas	30	
CO	>50 MW	no defaults			>50 MW	Natural gas	100	

Remarks:
1) *New and existing plants according to LCPD, article 4 paragraph 1 or 3*
2) *New plants according to LCPD, article 4 paragraph 2*
3) *Existing plants according to IED, article 30 paragraph 2: Permitted before 7th of January 2013 and put into operation not later than 7th of January 2014 (derogations up to 2016)*
4) *New plants according to IED, article 30 paragraph 3: All plants except paragraph 2*

Emission limit values (mg/m³*) for combustion plants of gas turbines and gas engines standardized at 15 % O_2

	Thermal input and fuel LCPD 2001		Limit values LCPD 2001 existing plants [1])	Limit values LCPD 2001 new plants [2])	Thermal input and fuel IED 2010		Limit values IED existing plants [3])	Limit values IED new plants [4])
SO_2	<50 MW		not included		25 … 50 MW		in preparation	
	50 … 100 MW		not included		50 … 100 MW		not included	
NO_2	<50 MW		not included		25 … 50 MW		in preparation	
	>50 MW	Gas turbines, liquid fuels (light and medium distillate)		120	>50 MW	Liquid fuels (light and medium distillate)	90	50
		Gas turbines, natural gas		50		Natural gas	50	50
		Gas turbines, other gaseous fuels		120		Other gaseous fuels	120	50
						Gas engine	120	75

** Measure is displayed at 1,013.25 hPa and 0 °C*

	Thermal input and fuel LCPD 2001		Limit values LCPD 2001 existing plants [1)]	Limit values LCPD 2001 new plants [2)]	Thermal input and fuel IED 2010		Limit values IED existing plants [3)]	Limit values IED new plants [4)]
Dust	<50 MW		not included		25 ... 50 MW		in preparation	
	>50 MW		not included		50 ... 100 MW			
CO	> 50 MW	no defaults			>50 MW	Gas turbines, liquid fuels (light and medium distillate)	100	
						Gas turbines, natural gas	100	
						Gas engine	100	

Remarks:
1) *New and existing plants according to LCPD, article 4 paragraph 1 or 3*
2) *New plants according to LCPD, article 4 paragraph 2*
3) *Existing plants according to IED, article 30 paragraph 2: Permitted before 7th of January 2013 and put into operation not later than 7th of January 2014 (derogations up to 2016)*
4) *New plants according to IED, article 30 paragraph 3: All plants except paragraph 2*

2 EN 14181

EN 14181

The stated European Directives stipulate in the annexes on measurement technology that sampling and analysis of all pollutants is to be carried out in accordance with CEN standards. The associated CEN standard was compiled by the technical committee CEN/TC 264 "Air Quality". The European Standard EN 14181 specifies procedures for establishing quality assurance levels (QAL) for automated measuring systems (AMS) installed on industrial plants for the determination of the flue gas components and other flue gas parameters. It was approved by CEN on 3rd of November 2003 and officially released in July 2004; it has been updated by 30th of November 2014. Appendix J of EN 14181: 2014 describes the main technical changes between the first and second edition of the standard.

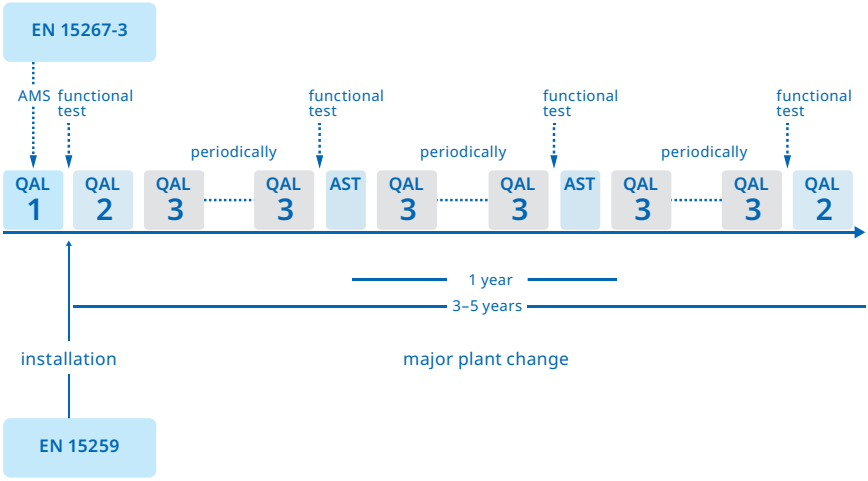
Besides the three quality assurance levels an annual surveillance test (AST) for automated measuring systems is defined in EN 14181.

QAL1 – First quality assurane level
Requirement for use of automatic measuring systems that have been proven suitable for its measurement task. The suitability test is specified in EN 15267-1, EN 15267-2, EN 15267-3 and EN ISO 14956.

QAL2 – Second quality assurance level
Procedure to calibrate the AMS and determine the variability of the measured values obtained by it, so as to demonstrate the suitability of the AMS for its application, following its installation.

QAL3 – Third quality assurance level
Continuous quality assurance by the operator during normal operation of an AMS (drift and precision of the AMS, verification on control card).

AST – Annual surveillance test
Annual surveillance test to evaluate that the AMS functions correctly and its performance remains valid and that its calibration function and variability remain as previously determined.



EN 14181 prescribes which characteristics automated measuring systems AMS must possess, and how they must be calibrated and maintained. In addition to the calibration function, the measuring uncertainty – which plays a decisive role in the validation of the measured values obtained during continuous monitoring – is also determined from the calibration data. In addition, the requirements for the uncertainty of the measured values obtained with the measuring equipment, which are defined in the EU directives relating to fossil power plants, waste incineration plants and waste co-incineration plants, are checked using a method described in the standard.

All new installed automated measuring systems must be certified in accordance with the standards EN 15267-1, EN 15267-2 and EN 15267-3. The AMS shall be able to measure in a range of zero and a value of 1.5 times the emission limit value (ELV) for waste incineration plants. For large combustion plants it shall be able to measure in a range of zero and a value of 2.5 times the ELV.

EN 14181 – QUALITY ASSURANCE FOR AUTOMATIC MEASURING EQUIPMENT

Influenced by:
- VDI 2066/3950;
- ISO 10155;
- North American (RATA) requirements.

Prerequisites:
- Suitable measuring systems;
- Comparable measuring systems;
- Correct installation;
- Permanent quality assurance during plant operation.

QAL1 – Suitibility test
QAL1 specifies the suitability of a measuring instrument by calculating the total measuring uncertainty in accordance with EN ISO 14956 prior to installation. During the suitability test it shall be proven that the total uncertainty obtained from the AMS meets the specification for uncertainty stated in the applicable regulations.
The suitability test is a combination of laboratory and field testing.

During the laboratory test the following performance characteristics are determined:
- Influence of ambient temperature, voltage and vibrations;
- Linearity;
- Response time.

During the field test the following performance characteristics are determined:
- Drift;
- Response time;
- Availability;
- Maintenance interval;
- Reproducability;
- Calibration capability.

QAL1 values of selected DURAG GROUP devices

Device		QAL1 Total Expanded Uncertainty $U=u_c \cdot 1.96$	QAL2 Total Allowed Uncertainty Percentage of Daily Limit Value	Availability (Minimum requirement: >95%, for O_2: >98%)
D-R 290		0.52 mg/m³	30	99.4%
D-R 320		0.35 mg/m³	30	97.5%
D-R 808		0.30 mg/m³	30	99.3%
D-R 820 F		1.23 mg/m³	30	98.2%
LaserCEM	CO	3.12 mg/m³	10	98.5%
	H_2O	1.57 Vol.-%	10	
	HCl	0.66 mg/m³	40	
	NH_3	0.75 mg/m³	40	
	NO	3.83 mg/m³	20	
	O_2	0.61 Vol.-%	10	
	SO_2	3.71 mg/m³	20	

QAL2 – Calibration and validation of the AMS

- Functional test of the AMS including check of correct installation;
- Correct selection of the measuring range;
- Calibration of the device using a standard reference method (SRM);
- Determination of the calibration function of the AMS and its range of validity;
- Calibration function either as linear regression or straight line from the zero point to the center of a point cluster;
- Calculation of the fluctuation range at the 95 % confidence interval;
- Test repeated at least every 5 years and more frequently if required by legislation or authority.

QAL3 – Continuous monitoring

- Permanent quality assurance during plant operation through the operating personnel;
- Assurance of reliable and correct operation of the measuring system (maintenance records);
- Regular checks, at least once per maintenance interval;
- Zero point, measuring range, drift;
- Determination of drift and accuracy using CUSUM cards or with an Excel chart;
- Identification/definition of when manufacturer's maintenance is necessary for the measuring instrument.

AST – Annual Surveillance Test

- Annual confirmation of the QAL2 calibration curve;
- Verification of the validity of the calibration curve;
- Function test;
- Small calibration using 5 parallel measurements;
- QAL2 is to be repeated if AST fails;
- Resetting of the exceedance counter for the invalid calibration range.

3

EN 15267

EN 15267

Tested and certified equipment for continuous emission and ambient air monitoring is the basis of an optimal pollution control. An automated measuring system AMS must comply with performance criteria, maximum permissible measurement uncertainties and testing requirements. The European Standard EN 15267 specifies the general principles, including procedures and requirements, for the product certification of AMS for monitoring ambient air quality and emissions from stationary sources. It comprises four parts:

Part 1 General principles

Part 2 Initial and yearly repeated assessment of the manufacturer's quality system for design and manufacturing

Part 3 Performance criteria and test procedures for monitoring emissions from stationary sources (continuous measuring AMS)

Part 4 Performance criteria and test procedures for periodic measurements of emissions from stationary sources (portable AMS)

The product certification consists of the following sequential stages:

- Performance testing of an AMS;
- Initial assessment of the manufacturer's quality management system;
- Certification;
- Surveillance.

Performance testing consists of a laboratory and field testing. Field testing is carried out for at least three months on an industrial installation representatitve of the intended application. All tests are carried out by an accredited testing laboratory.

The test report of the performance testing will be evaluated in the context of a technical examination moderated by the German Federal Environment Agency. With positive assessment, the certificate is issued by the German Federal Environment Agency for a period of five years and published in addition to the Federal Gazette on the website www.qal1.de.
The quality management system and the production of the manufacturer have to undergo an initial and yearly repeated audit in addition to the standard EN ISO 9001 audit.

During the annual audits, inevitably necessary changes of the hardware and/or software of the measuring systems are reviewed and confirmed by further research, if necessary. The manufacturer has to record all performed modifications in a technical logbook. The modifications are divided into the following categories:

Type 0 No measurable influence on the measuring system

Type 1 No significant influence

Type 2 Significant influence, a partial or total review by the test institute may be necessary

Minimum requirements for automated measuring systems in the laboratory (L) and field test (F)

Performance characteristic	Minimum requirement				Tests
	Dust	Gases except O_2	O_2	Volume Flow	Laboratory Field test
Response time	≤200 s	≤200 s ≤400 s for NH_3, HCl and HF	≤200 s	≤60 s	L + F
Repeatability standard deviation at zero point	≤2.0 % [a]	≤2.0 % [a]	≤0.20 % [d]	≤2.0 % [a]	L
Repeatability standard deviation at span point	≤5.0 % [b]	≤2.0 % [a]	≤0.20 % [d]		L
Lack-of-fit	≤3.0 % [a]	≤2.0 % [a]	≤ 0.20 % [d]	≤3.0 % [a] [c]	L + F
Influence of ambient temperature change from nominal value at 20 °C within specified range at zero point	≤5.0 % [a]	≤5.0 % [a]	≤ 0.50 % [d]	≤5.0 % [a]	L
Influence of ambient temperature change from nominal value at 20 °C within specified range at span point	≤5.0 % [a]	≤5.0 % [a]	≤0.50 % [d]	≤5.0 % [a]	L
Influence of sample gas pressure at span point, for a pressure change Δp of 3 kPa		≤2.0 % [a]	≤0.20 % [d]		L
Influence of sample gas flow on extractive AMS for a given specification by the manufacturer		≤2.0 % [a]	≤0.20 % [d]		L
Influence of voltage, at –15 % below and at +10 % above nominal supply voltage	≤2.0 % [a]	≤2.0 % [a]	≤0.20 % [d]	≤2.0 % [a]	L
Influence of vibration		≤2.0 % [a]	≤0.20 % [d]		L

Performance characteristic	Minimum requirement				Tests
	Dust	Gases except O_2	O_2	Volume Flow	Laboratory Field test
Cross-sensitivity		≤4.0 % [a)]	≤0.40 % [d)]		L
Excursion of the measurement beam of in-situ AMS		≤2.0 % [a)]	–		L
Determination coefficient of calibration function, R^2	≥0.90	≥0.90	≥0.90	≥0.90	F
Minimum maintenance interval	8 days	8 days	8 days	8 days	F
Zero drift within maintenance interval	≤3.0 % [a)]	≤3.0 % [a)]	≤0.20 % [d)]	≤2.0 % [a)]	F
Span drift within maintenance interval	≤3.0 % [a)]	≤3.0 % [a)]	≤0.20 % [d)]	≤4.0 % [a)]	F
Availability	≥95.0 %	≥95.0 %	≥98.0 % [d)]	≥95.0 %	F
Reproducibility, R_{field}	≤2,0 % [a)] (>20mg/m³) ≤3,3 % [a)] (≤20mg/m³)	≤3.3 % [a)]	≤0.20 % [d)]	≤3.3 % [a)]	F

a) Percentage value as percentage of the upper limit of the certification range
b) Percentage value as percentage of the emission limit value
c) Only for laboratory tests
d) Percentage value as oxygen volume concentration (volume fraction)

4 EMISSION DATA EVALUATION + ASSESSMENT

EMISSION DATA EVALUATION + ASSESSMENT

The evaluation of the continuously acquired emission values must comply with the relevant legal requirements, fulfill the requirements of the competent authority and provide the operator with the possibility of having the historical, current and predicted emission values for reporting, conducting evaluations and controlling the operational process of the plant.

Essential evaluation criteria include:

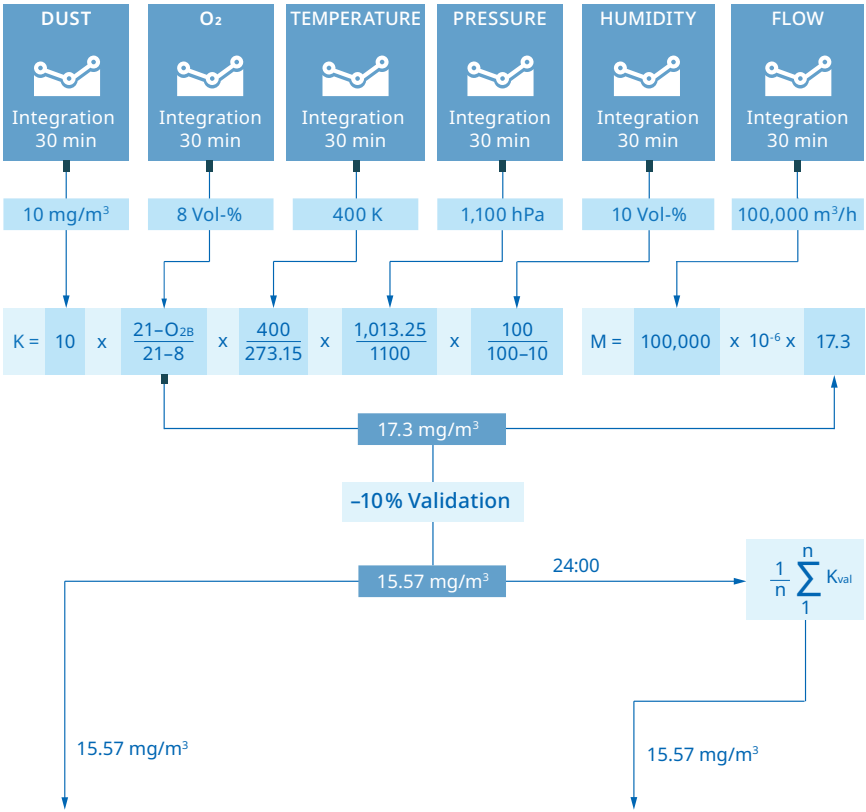
- Continuous acquisition of the parameters and reference values to be measured;
- Generation of standardized, oxygen referenced integral values (10 min, 30 min, 60 min);
- Validation of the integral values (absolute, percentage);
- Generation of daily average values (48 h average values, monthly average values) from the validated integral values;
- Monitoring of the equipment failure (maintenance/fault) and logging in the daily and annual statistics;
- Monitoring of the valid calibration ranges and evaluation/logging in accordance with EN 14181;
- Monitoring of drift and precision of the continuously operating analyzers (control charts) in accordance with EN 14181.

Validation

The (half-) hourly average value is validated at the end of the integration interval from the integral values of the raw measurement data by subtracting the measurement uncertainty as a constant value, derived from the calibration (at 95% confidence interval) after the appropriate standardization (temperature, pressure) and oxygen reference value calculation, from the measurement value. Negatively validated average values will be set to zero.

The daily average values are formed as the arithmetic mean of the validated (half-) hourly average values.

VALIDATION



REPORTS

Concentration
- Minute values;
- Integral values (e. g. 60');
- 24-h average value;
- 48-h average value;
- Weekly average value;
- Monthly average value;
- Yearly average value.

Mass flow (Totals/averages)
- Minute values;
- Integral values;
- 24-h value;
- 48-h value;
- Weekly average value;
- Monthly average value;
- Yearly average value;

Statistic
- Limit values (Percentile);
- Time of operation;
- Time out of operation;
- System Availability (Analyzers, evaluation system).

The integral values will be validated by subtraction of the confidence interval at 95%. The daily averages will be calculated from the validated integral values.

As requirements, IED 2010/75/EU, stipulate maximum values of measurement uncertainty for continuous measuring equipment and the validation of the measurement results. Until now, confidence and tolerance ranges of at least 5 or 10 % were defined for measurement uncertainty. These confidence and tolerance ranges are now inapplicable. The validated (half-) hourly and daily average values are determined on the basis of measured (half-) hourly average values after subtraction of the confidence interval determined by calibration (measurement uncertainty/variability).

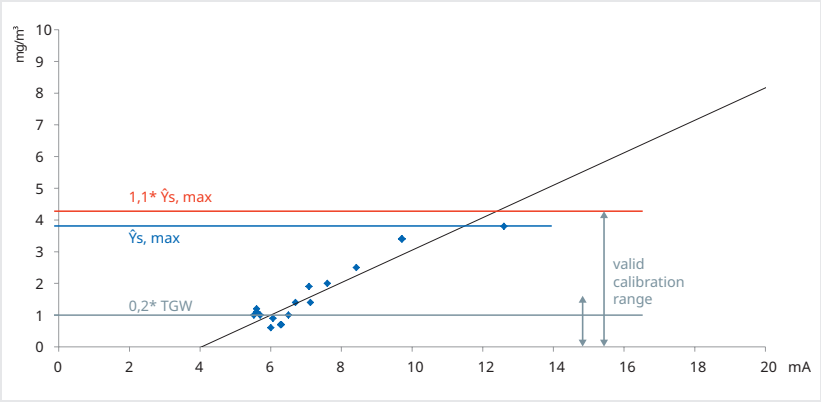
The value of the 95 % confidence interval for an individual measurement result must not exceed the following percentages of this emission limit stipulated for the daily average value:

Carbon monoxide (CO)	10 %
Sulphur dioxide (SO_2)	20 %
Nitrogen oxide (NO_x)	20 %
Total dust	30 %
Total organic carbon (TOC)	30 %
Mercury (Hg)	40 %
Hydrogen chloride (HCl)	40 %
Hydrogen fluoride (HF)	40 %

VALIDITY OF THE CALIBRATION CURVE

Determination of the calibration curve for the measuring instrument using a standard reference method under different operating conditions (fuels, load, etc.) without manipulation of the furnace or filter systems (adjusting the burner, slitting the filter hoses or reducing the capacity of the electrostatic precipitator).

Calibration of the measuring instrument using a minimum of 15 measuring points distributed over 8–10 hours on 3 days. The long period should take all possible aspects of proper operation of the plant into account. The validity range for the calibration is specified in the calibration report.
Validated average values outside the valid calibration range (No. 6.5 EN 14181) are to be stored with the associated time and with their status and are to be logged at the end of the day and year. In the short period class, the percentage exceedance of the valid calibration range in the current week (Mo.–Su.) are registered and the number of weeks with excessive percentages is registered in the long period class.



D-R 320

- Calibration function only valid within the calibration range;
- Valid calibration range between 0 and Ŷs, max plus an extension of 10 % of Ŷs, max or to 20 % of ELV, whichever is greater;
- New calibration QAL2 necessary within six months if >5 % of all values per week lie above the valid calibration range for more than 5 weeks or >40 % of all values lie above the valid calibration range for at least one week;
- Extrapolation of higher values permitted.

LOGGING AND DOCUMENTATION FOR VERIFICATION

- Daily reports with all integral values incl. status information;
- Monthly reports with all daily average values incl. status information;
- Annual reports with all monthly average values incl. status information;
- Statistics reports with information on limit value exceedances, availability of the AMS, failure of waste gas cleaning equipment and the emitted emission quantity;
- Documentation of failure of AMS for the operator's information;
- CUSUM, Shewhart or EWMA card to verify drift and precision of the AMS at the zero point and reference point;
- Complete documentation of the AMS by the operator in accordance with Point 9 Annex C of EN 14181.

Correct and legally conformant evaluation/reporting of continuous measurement and calculation data is no longer possible manually. Modern computer-based evaluation systems are indispensable for fulfilling the specific requirements. These systems are preprogrammed according to the plant type; they acquire, calculate and report all emission-relevant data according to the legal requirements as well as the specifications of the local authorities.

A special form of evaluation is prescribed in Germany and can also be activated to expand the EU standard evaluation.

Classification
(required by authority in Germany)
Although all integral values are stored along with the plant and channel status, the principle of classification is still maintained. Classification documents the class frequency distribution for the whole year on a single page in a clearly identifiable way. Limit value exceedances with reference to pollutants are identifiable at a glance. Classification must be referenced to a time starting at 00:00. As an alternative to issuing classification tables, the integral values determined can also be issued as daily, monthly and annual tables.

The daily average values are to be determined for the interval from 00:00 to 24:00 if there are at least 12 valid half-hourly average values are available.

Every day is declared invalid, in which more than 5 half-hourly average values or 3 hourly average values are unavailable due to faults or maintenance of the continuous measurement system. If more than 10 days a year are declared invalid for such reasons, the competent authority must oblige the operator to introduce suitable measures to improve the reliability of the continuous monitoring system.

EUROPEAN MINIMUM REQUIREMENTS EN 17255

Stationary source emissions –
Quality assurance of AMS data

European Minimum Requirements for Data Acquisition and Handling Systems (DAHS)
This European Standard specifies requirements for the handling of data produced by an AMS. The main items covered by the standard are given by, but not limited to raw data acquisition, raw data validation, data correction, data averaging, data security, data alarms, data archiving, data display, data access, program validation, data reporting and program integrity.

It specifies the minimum requirements for the handling of AMS data, supporting the requirements of EN 14181 and legislation e.g. EU Directives such as IED and MCP. The standard does not preclude the use of additional features and functions provided the minimum requirements of this standard are met and that these features do not adversely affect data quality, clarity or access.
The scope of this standard begins at the final data output terminals of the AMS and covers the entire process leading to and including the presentation of data to the competent authority.

The standard EN 17255 is divided into:

Part 1 Specification of requirements for the handling and reporting of data

Part 2 Specification of requirements on data acquisition and handling systems

Part 3 Specification of requirements for the performance test of data acquisition and handling system

Part 4 Specification of requirements for the installation and on-going quality assurance and quality control

Raw data received in analogue format (4 ... 20 mA) or as digital communication (e. g. Modbus, Profibus, OPC) from any AMS or PEMS output shall be continuously sampled at a rate fast enough to ensure no loss in information.


NO SMOKING
CLOSE IN THE EVENT OF FIRE

The sampling can never be slower than 1 sample per 10 seconds from each individual source (each individual AMS, typically 1 second sampling rate).

FLD: First Level Data
Raw data including status signals or average values calculated from the raw data including status signals. Sampling rate not slower than 1 per 10 seconds. Storage in DAHS for at least 5 year in an auditable manner.

SFLD: Standardized First Level Data
First level emission data calibrated and normalized using first level peripheral data (these values are not for reporting, but for information of the operator)

AFLD: Averaged First Level Data
Calculated for the STA averaging time from all valid FLD values

STA: Short Term Averages
(Typically 10, 30, 60 minutes) are calculated from first level data if 2/3 or more FLD-values are available. Verification, that STA is within the calibration range (EN14181 QAL2). Storage in DAHS at least 5 years in an auditable manner.

SSTA: Standardized Short-Term Average
Short-term average of emission data calibrated and converted to standard conditions using short-term average peripheral data

VSTA: Validated Short-Term Average
Standardized short-term average with the relevant confidence interval subtracted to comply with EU Directive reporting requirements

VLTA: Validated Long Term Average
(Typically daily, 48-hourly, weekly, monthly, yearly). The averages are calculated from validated short-term averages. Valid if ¼ or more VSTA-values are available, storage in DAHS at least 5 years in an auditable manner.

Depending on the regulations, averages can be calculated as block averages and/or rolling averages

First Level Data (FLD)
The FLD values are the first set of data to be stored in permanent storage. Data in the FLD-storage can be identical to the raw data, i. e. unprocessed as they are received from the AMS or PEMS, or they can be scaled to units representing concentration or process parameters.

Standardized First Level Data (SFLD)
The SFLD is determined by applying the calibration function and the conversion to standard conditions directly to the FLD. This provides a short time period data set, which can be used by the operator for process/abatement control or optimization. The DAHS shall make it clear that averaging these SFLD over the STA period could give a different answer to the SSTA and shall not be used for compliance assessment.

Averaged First Level Data (AFLD)
The average first level data shall be calculated for the STA averaging time from all valid FLD values. Negative FLD values shall be included in the calculation of the averaged FLD. If the FLD value is an average of raw data the FLD average has to be calculated from the FLD values weighted by the time coverage of each FLD value.

Short-Term Average (STA)
Short-term averages are the shortest period of averages the plant shall report to the authorities. According to variations in different EU Directives this can be 10 minutes, 30 minutes or 1 hour, depending on the type and application of the plant. The calibration function determined in QAL2 according to EN 14181 shall be used to calculate the short-term averages (STA) on the basis of the averaged FLD.
The STA shall be evaluated if valid FLD is available for at least two-thirds of the STA averaging time. The DAHS shall automatically log and report monthly the amount of time where exceedance of the measurement range has taken place, and the total time where data has been capped may not exceed 2 % of the total operation time in each individual calendar month.

Standardized short term averages (SSTA)
The SSTA is calculated by normalizing the STA emission values with STA peripheral values, such like oxygen, temperature, pressure and moisture.

Validated short-term average (VSTA)
The validated STA (VSTA) shall be calculated by subtracting the uncertainty from the standardized STA in accordance with the procedure laid down in the national legislation.

Note: The EU Directives prescribe that, before reporting the concentration of any pollutant to the authorities, the measurement uncertainties in the form of 95 % confidence intervals shall be subtracted from the measurement value, for compliance reporting only. Different countries have different interpretation of this, and consequently different procedures of doing it. The method of subtracting and the value of the uncertainty shall be stated in the report and stored in the event log.

Validated Long Term Averages (VLTA)
Long-term averages are any longer periods of averages the plant shall report to the authorities. According to variations in different EU Directives the averaging period can be 1 day, 1 week, 1 month, 1 quarter or 1 year, depending on the type and application of the plant.

The long-term average is calculated as the arithmetic mean of sufficient numbers of validated short-term averages (VSTA), to make up the period of the long-term average.

If the plant operator shall report according to legal local time (LLT), the daily average shall be calculated as follows: For the day switching from LST to DST, where one hour is lost, the daily average shall be calculated from the STA values within the 23-h time period; for the day switching from DST to LST, where one hour is gained (duplicated), the daily average shall be calculated from the STA values within the 24-h time period.

QAL3 procedure
The QAL3 procedure should be performed in the DAHS, the necessary input data (measurement at zero and span point) shall either be automatically or manually entered into the DAHS. The DAHS reporting shall include all data related to the entire QAL3 process.

Calibration range check
Verification that the STA-measurement is within the calibration range as specified during the last valid QAL2 according to EN 14181.

Standardization of concentrations and flue gas flow data
Measured concentrations shall be standardized only as SSTA-values (typically 10, 30, 60 minutes) since SSTA values are the only values validated by a calibration according to QAL2 procedure from EN 14181. Standardisation can include:

- Correction to reference oxygen levels;
- Correction for temperature;
- Correction for pressure;
- Correction for water vapor.

The SSTA-value of the pollutant mass flow shall be calculated from SSTA-values of the concentration and the flue gas flow at same conditions. The annual emission is calculated by summation of the SSTA-values of the pollutant mass flow.

Flue gas flows are for instance used for the calculation of the pollutant mass flow for reporting to the authority or calculation of the emission limit value in cases that two or more combustion plants are connected to one stack.

Block averages
Where averages are 'block' type averages, periods will commence as detailed below

Averaging period	Starting time (unless otherwise specified by local legislation or permit)	Calculation basis
≤1 min for FLD	Minute averages start at the first second of the minute. Averages less than 1 min start at the first second of the minute and subsequent intervals, e.g. for a 5 s period at 0 s, 5 s, 10 s, 15 s etc.	Raw data
≤1 h for STA	Hourly averages start at the first minute of the hour. Averages less than 1 h start at the first minute of the hour and subsequent intervals, e.g. for a 10 min period at 0 min, 10 min, 20 min etc.	FLD
1 day	Daily averages start at 00:00:00 LLT of the day.	VSTA
48 h	48-h-averages start at 00:00:00 LLT.	VSTA
1 month	Monthly averages start at 00:00:00 LLT on the first day of the calendar month.	VSTA
1 year	Annual averages start at 00:00:00 LLT on the first day of the calendar year.	VSTA

Rolling averages
Where averages are rolling averages, the average commences N periods prior to the actual moment in time that the period ends and has a resolution indicated in the table below. For example, for 10 min rolling averages, a value is recorded every minute that represents the average of the previous ten 1-min-averages.

Averaging period	Calculation frequency (unless otherwise specified by local legislation or permit)	Calculation basis (unless otherwise specified by local legislation or permit)
Multiples of periods less than 1 h, i.e. 10 min	every FLD period	FLD
1 h	every FLD period	FLD
1 day	every STA period	VSTA
48 h	every STA period	VSTA
1 month	daily	VSTA
1 year	monthly	VSTA

5 SYSTEM D-EMS 2020, DATACEMS

SYSTEM D-EMS 2020, DATACEMS

D-EMS 2020 – A MODULAR SYSTEM APPLICABLE FOR INDUSTRIAL PLANTS OF ANY SIZE

- QAL1 certified according to EN 15267-2 by the TÜV Rheinland;
- Software available in more than 20 MCERTS certified languages.

Emission evaluation in accordance with German requirements, the European Directives (EU) 2015/2193 (MCP) & 2010/75/EU (IED), considering EN 14181:2014 and European Minimum Requirements EN 17255.

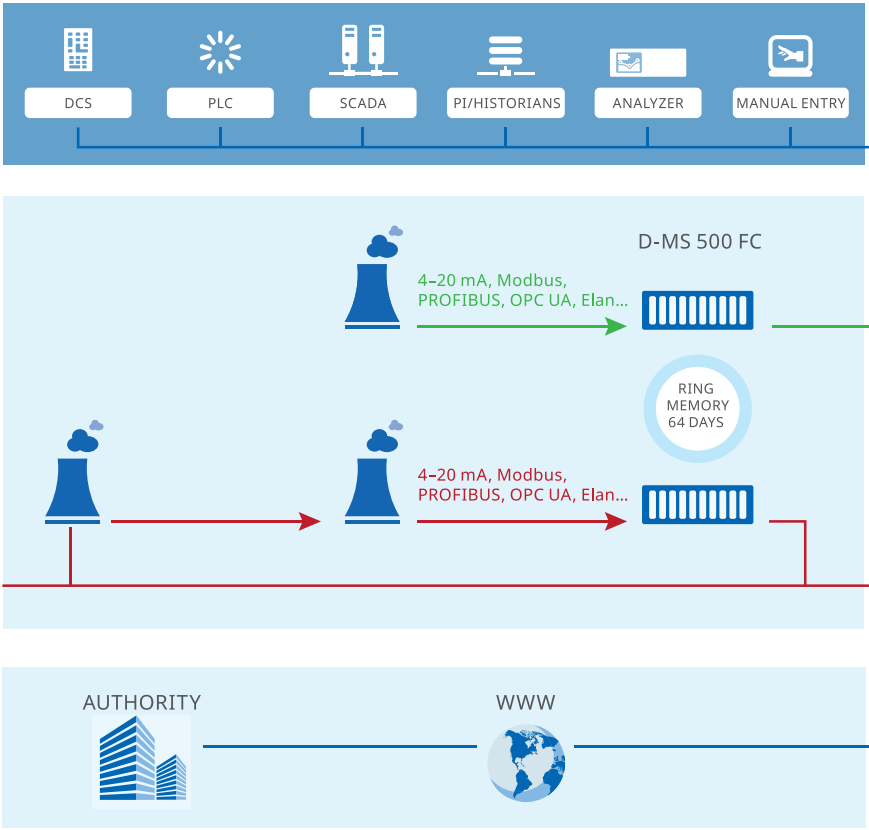
The D-EMS 2020 system can be freely configured according to the needs of the plant and the requirements of the operator. The system is modular structured, fulfills the current requirements, is prepared for future guidelines and can be easily extended after installation by further software modules as well as hardware components.
The heart of the D-EMS 2020 system is the Server PC in an industrial design with the suitability tested D-EMS 2020 software. The use of server hard disks as Raid array network ensure a high level of reliability and, in conjunction with the D-MS 500 FC data logger, enables compliance with the legally required availability of 99 %.

The system can be composed of:
- The D-MS 500 FC data logger;
- The D-MS 500 FC DIN rails;
- A bus connection directly to the PC or via the D-MS 500 FC;
- Or a combination of the above options.

If the D-MS 500 FC data logger is used, there is intermediate data storage for up to 128 days. If the connection to the PC or the PC itself is faulty, after re-establishing communication all data are automatically calculated, stored in the system in the correct chronological order, the official reports created and remote emission monitoring transmission automatically executed without downtime.

Features
- Complies with European and US EPA based regulations;
- Analog and digital data acquisition with long-term data storage in accordance with legal requirements;
- Provision of data to customer systems via analog and digital interface;
- Presentation of current, historical or forecast measurement data as bar or line chart and optionally in customer-specific design;
- Standalone and client-server architecture, installation options to meet the various customer requirements;
- Role-based user management, including LDAP(S);
- Additional modules such as GHG, QAL3, automatic backup.

Benefits
- Scalable and modular system for all plant sizes and types;
- Fully-featured modern system design;
- Intuitive and easy-to-use interface;
- Flexible configuration to meet the various customer requirements;
- Powerful reporting with multiple customization options and e-mail notification.



TECHNICAL DATA

Data acquisition

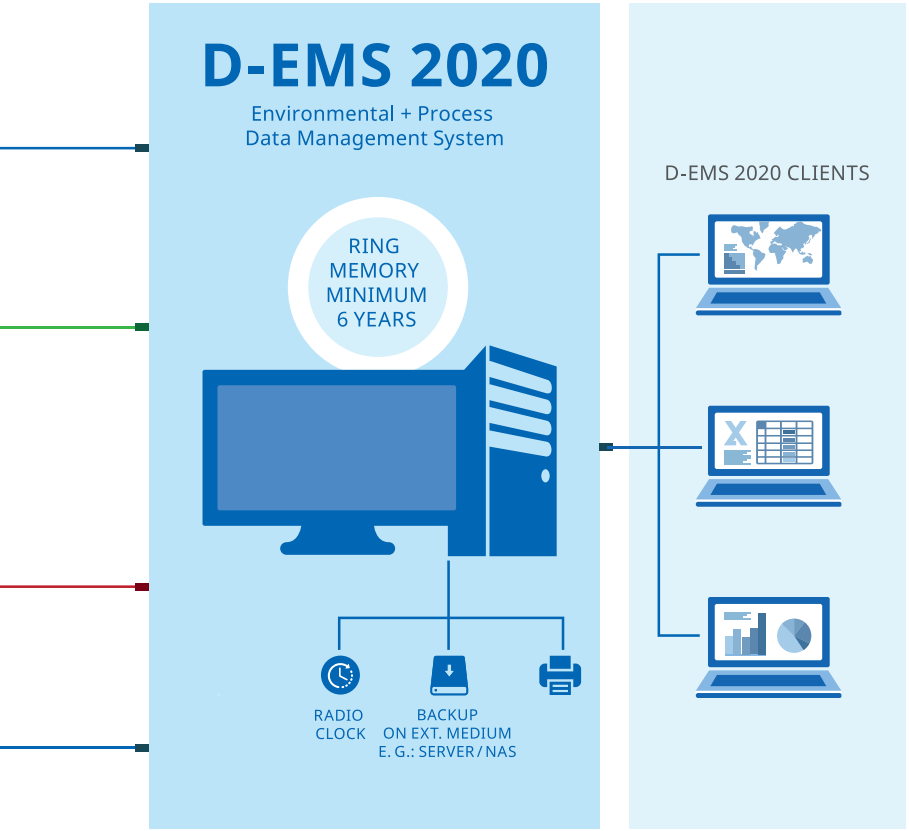
- Per server up to 1,024 analog inputs;
- Per server up to 1,024 analog outputs;
- Per server up to 2,048 analog inputs;
- Per server up to 2,048 analog outputs;
- Data acquisition can be carried out either directly or via data loggers in the D-MS 500 FC family to the server.

Interfaces

- 4 ... 20 mA;
- Modbus RTU/TCP;
- PROFIBUS DP;
- PROFIBUS Master (VDI 4201);
- PROFINET;
- Elan;
- OPC UA;
- Mode 4;
- Ethernet IP;
- And others.

Data export

- PDF, XLS, XML, CSV, ASCII files.



TECHNICAL DATA

Data security

- Data buffer in the D-MS 500 FC data logger family with internal ring memory of up to 128 days;
- Encrypted data communication between server and data loggers;
- Encrypted and password protected SQL database;
- Role-based user management, including LDAP(S);
- External data storage and backup (file server, NAS, etc.);
- Alarm notification on failure of a storage medium;
- Internet/intranet connection Automatic data transfer to any web server on the Internet for visualization via HTML;
- Daily data control.

Vizualization

- Reporting (daily, monthly, quarterly, yearly, and others);
- Bar and line charts with current and historical data;
- Alarm and event management with comment functionality and e-mail notification.

BASIC SYSTEM WITH THE D-MS 500 FC DATA LOGGER

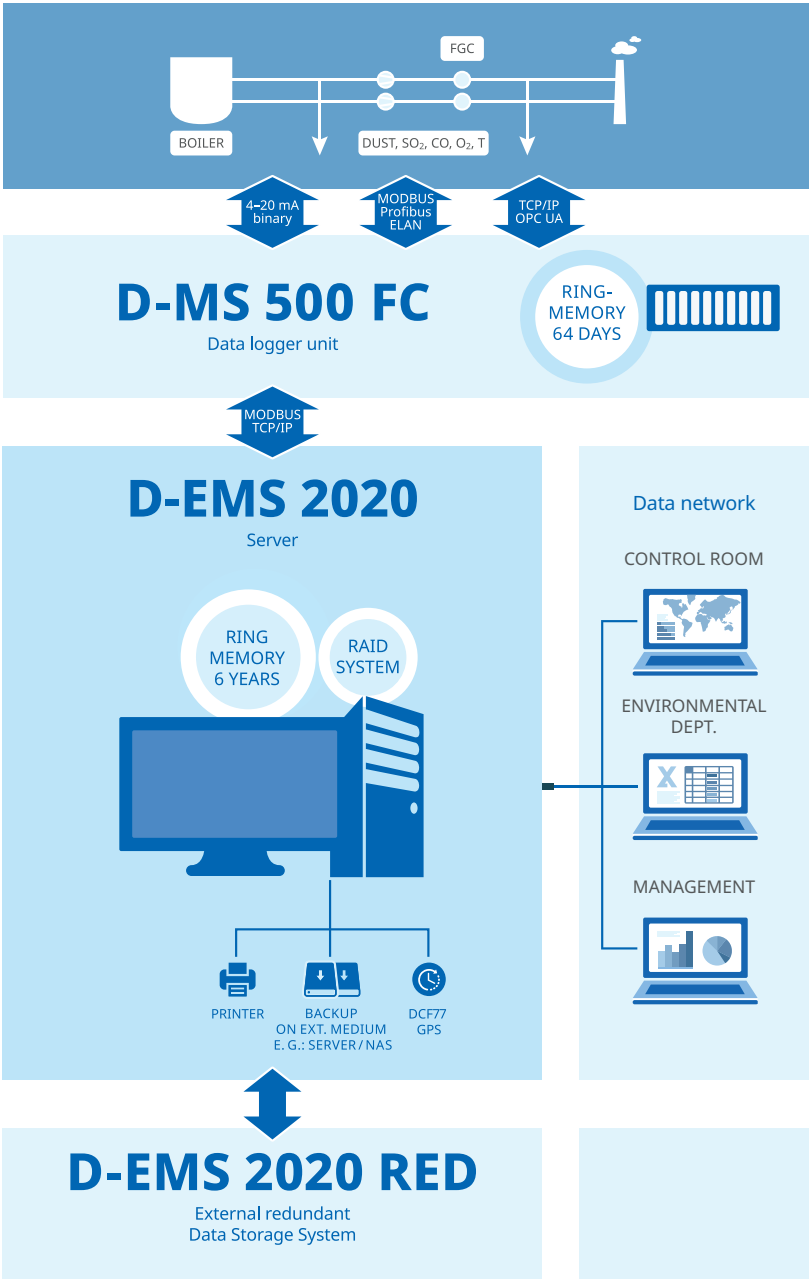
D-EMS 2020 Server

- Windows-based and certified D-EMS 2020 software;
- 19" or Tower PC in industrial design;
- Windows 10/11 Pro or Windows Server 2019/2022.

D-MS 500 FC data logger

- DIN/top hat rail mounting design;
- 1 serial interface RS232/485;
- 2 Ethernet RJ45 interfaces;
- Internal memory 64 days, (optional 96/128 days);
- Operating voltage 24V DC, 100 W (single or redundant).

If the server fails or the communication between the server and the data logger is interrupted, all raw values are temporarily stored in the data logger until the problems are solved and then all data are calculated and stored in the database.


FGC
BOILER
DUST, SO_2, CO, O_2, T
4–20 mA binary
MODBUS Profibus ELAN
TCP/IP OPC UA
D-MS 500 FC
Data logger unit
RING-MEMORY 64 DAYS
MODBUS TCP/IP
D-EMS 2020
Server
RING MEMORY 6 YEARS
RAID SYSTEM
PRINTER
BACKUP ON EXT. MEDIUM E. G.: SERVER / NAS
DCF77 GPS
Data network
CONTROL ROOM
ENVIRONMENTAL DEPT.
MANAGEMENT
D-EMS 2020 RED
External redundant Data Storage System

DATACEMS

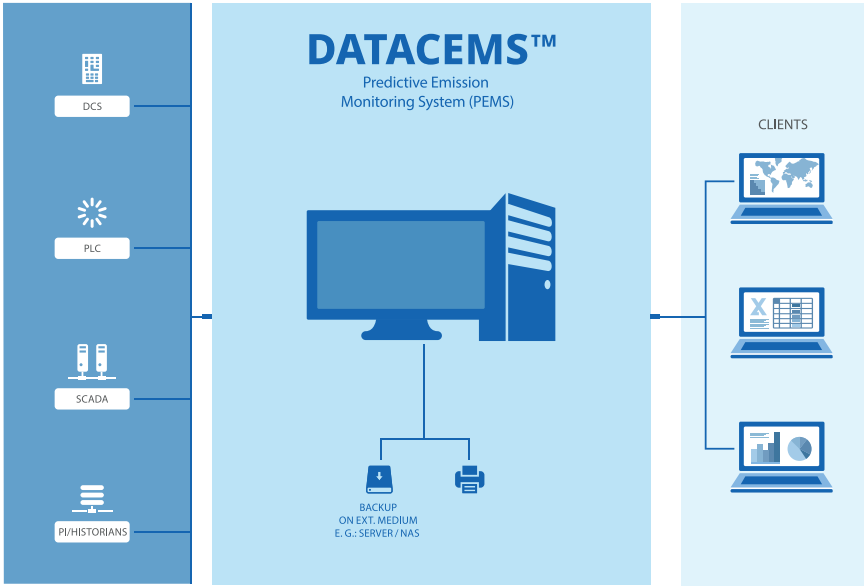
Predictive Emission Monitoring System
Software-based predictive emission monitoring system (PEMS) for continuous real-time monitoring of pollutants such as NO_X, SO_2, CO, HC or reference variables such as O_2.

PEMS are an innovative and cost-effective approach to continuous monitoring of emission sources as an alternative to continuous emissions monitoring systems (CEMS).

The models are built with quality assured emissions training data along with paired, time-synchronized data of process parameters with correlation to emissions.

Functionality: A predictive emission monitoring system cannot measure emissions directly and instead uses an empirical model to predict emissions based on real-time process data.

Features
- Windows based continuous and real-time monitoring of emissions;
- Multiple PEMS engines on one server to cover multiple sources;
- Multidimensional Mathematical Modeling (MdM_2) technology to compute the emissions;
- Sensor Validation System (SVS) to determine status and health of process sensor;
- Performance criteria and reproducibility as per TS 17198;
- Measurement frequency 1 second;
- Response time: 99,9 % less than 1 second;
- Data availability 99 % +;
- All standard interfaces, e. g. OPC UA, PI, Modbus, PROFIBUS etc.;
- Executable on standard server and workstation hardware.


DCS
PLC
SCADA
PI/HISTORIANS
DATACEMS™
Predictive Emission
Monitoring System (PEMS)
BACKUP
ON EXT. MEDIUM
E. G.: SERVER / NAS
CLIENTS

PEMS IN A NUTSHELL

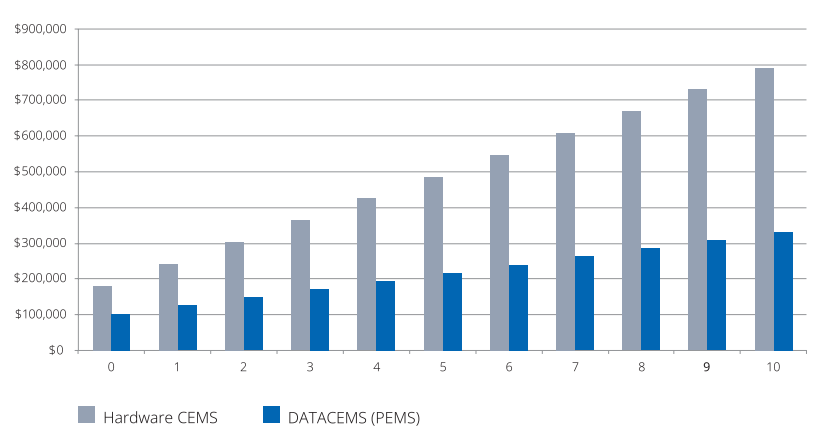
Predictive Emission Monitoring (PEM represents a novel and cost-effective approach for continuous monitoring of source emissions as alternative to Automated Measuring Systems (AMS). In order to be accepted as full compliance solution, PEM needs to be strictly in line with applicable regulations for source monitoring.

PEM Systems (PEMS) are software based. Consequently, they do not need gas analyzers and associated hardware like sample conditioning or shelters. Interfaced with plant control systems, PEMS utilize process inputs to offer continuous, realtime monitoring of pollutants, e. g. NOx, SO_2, CO, HC or diluents like O_2 and CO_2. PEMS are generally suitable for all gas and oil fired emission sources in lieu of Automated Measuring Systems (AMS), providing equal accuracy and data quality.

The models are built with quality assured emissions training data along with paired, time-synchronized data of process parameters with correlation to emissions.

PEMS are frequently packaged with Data Acquisition and Handling Systems (DAHS) to result in self-sufficient compliance solutions. Applications exist for utilities, petrochemical, chemical, steel and other industrial plants or municipal sites. PEMS offer significant cost benefits with lower capital expenditures as well as much lower operational and maintenance cost than a AMS. PEMS and DAHS require for operation very little or no plant manpower.

To become a certifiable, accepted equivalent to a AMS, however, PEMS need to be based on a sound regulatory framework and has to obey the requirements of a de-



monstrable, stringent quality assurance scheme. U.S. Environmental Protection Agency (EPA) has stipulated the Performance Specification (PS) 16 within 40 CFR Part 60 or Subpart E of 40 CFR Part 75 to certify PEMS as alternative monitoring method in lieu of CEMS. In Europe, a PEMS standard – Technical Specification (TS) 17198 has been developed within CEN / Technical Committee TC 264 "Air Quality", which takes into account the relevant European standards EN 14181 and EN 15267.

At present, PEMS is mainly applied in countries following U.S. EPA regulations, because these standards are in place for some years already and demonstration programs have been executed. Consequently, the technology already gained significant interest not only in the U.S. but in the Middle East and Asia. PEMS installations exist as stand-alone compliance solutions or as part of an integrated environmental monitoring approach capable to address multiple sources in one plant. One prerequisite is seamless integration of PEMS and DAHS and integration in plant-wide IT and communication networks. An additional benefit is that a PEMS is a viable diagnostic tool to lower emissions and improve combustion efficiency.

PEMS is used at multiple plant sites, particularly in the U.S., but also in the Middle East and partly in Asia. In Europe PEMS so far is common in selected countries.
A strong motivation to replace a AMS with PEMS results from cost savings due to lower capital expenditures as well as much lower operational and maintenance cost. This motivation is based on the fact that PEMS can accomplish equal accuracy and quality of emissions data compared to a AMS.

As rule of thumb, it can be rated:

- PEMS procurement: 40–80 % cost compared to a AMS;
- PEMS operation and maintenance including energy consumption: Approximately 5–10 % annual cost versus CEMS. Savings can be between 50,000 and 100,000 € p.a. per system;
- AMS / PEMS quality assurance: Annual cost is at the same level for both if the same QA scheme is applied.

Return on investment (ROI) is achieved in usually less than one year.

OVERALL SYSTEM WITH ALL AVAILABLE SOFTWARE MODULES

DATACEMS	Predictive Emissions Monitoring System Module (PEMS) – Determination of current emissions based on historical emission data and current plant/process parameters.
D-EMS 2020 AMS Control	Free configuration tool of flow controls: Zero or test gas supply for automatic AMS calibration, back purging of sample gas pipes/pitot tubes and others. Various valve controls incl. automatically/manual control options.
D-EMS 2020 Auth	Module for transferring data in ASCII, CSV, PDF, XLS, XML and other formats via SFTP to the authority over the Internet.
D-EMS 2020 Cloud	SSL secured access to measured and calculated data and reports on the internet from everywhere.
D-EMS 2020 GHG	Module for collection, evaluation, reporting und visualization of current and historical GHG output of fossil-fired combustion plants according to the European Greenhouse gas emission allowance trading scheme (2003/87/EG).
D-EMS 2020 MDE	Manual data entry module for any pre-set/discontinuous values.
D-EMS 2020 QAL3	Module for complete documentation of the AMS, acquisition and evaluation of drift/precision (QAL3) according to EN 14181:2014, with automatic creation of the CUSUM, Shewhart or EWMA control chart.
D-EMS 2020 RED	External, physically separated, redundant data storage on a NAS.
D-EMS 2020 RWS	Electronic acquisition and display of raw values, sampling rate 1/s, 12-bit accuracy.
D-EMS 2020 Tiles	Module to create your own data visualization dashboard.
D-EMS 2020 Web	Module for HTML-based presentation of selected values and reports on a web server in the Inter-/Intranet.

6 MEASURING DEVICES FOR EMISSIONS + AMBIENT AIR

MEASURING DEVICES FOR EMISSIONS + AMBIENT AIR

LASERCEM | LASER INFRARED SPECTROMETER

- Continuous multigas measurement
- High resolution IR laser technology
- Patented OFCEAS TDL technology with patented Low Pressure Sampling system
- No moving optical parts
- Direct measurement without modifying the sample

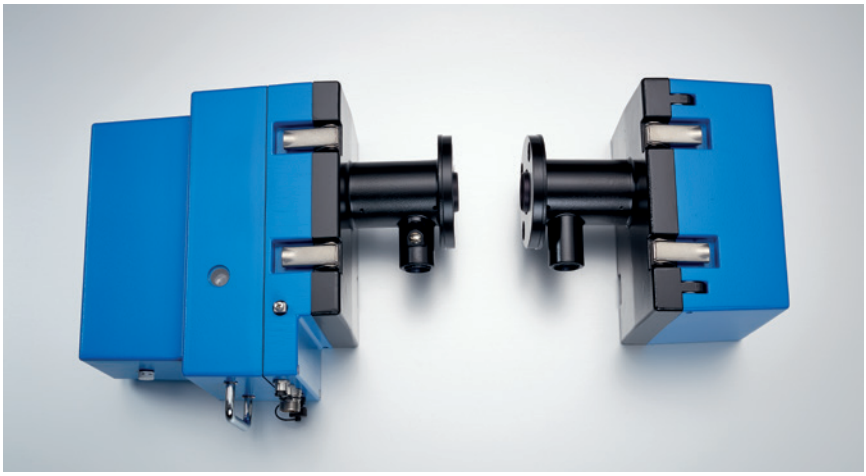
Continued on next page

LASERCEM | LASER INFRARED SPECTROMETER

Component***	Certified measuring range*	Maximum measuring range
CO (mg/m³)	0 ... 75; 0 ... 1,249 0 ... 30**	0 ... 3,000
CO_2 (% vol)		0 ... 20
NO (mg/m³)	0 ... 78; 0 ... 150 0 ... 2,008	0 ... 3,000
NO_2 (mg/m³)	0 ... 40; 0 ... 100**	0 ... 2,000
N_2O (mg/m³)		0 ... 500
HF (mg/m³)	0 ... 1.5; 0 ... 10**	0 ... 100
SO_2 (mg/m³)	0 ... 75; 0 ... 2,858	0 ... 5,000
HCl (mg/m³)	0 ... 15; 0 ... 98	0 ... 150
NH_3 (mg/m³)	0 ... 15; 0 ... 45 0 ... 76	0 ... 500
CH_4 (mg/m³)	0 ... 5; 0 ... 20**	0 ... 500
O_2 (% vol)	0 ... 21	0 ... 25
H_2O (% vol)	0 ... 30; 0 ... 40	0 ... 60
H_2S (mg/m³)		0 ... 7,500 0 ... 100
CHOH (mg/m³)		0 ... 30 0 ... 5

* *QAL1 + MCERTS*
** *Certification ongoing*
*** *Measure is displayed at 1,013.25 hPa and 0 °C*

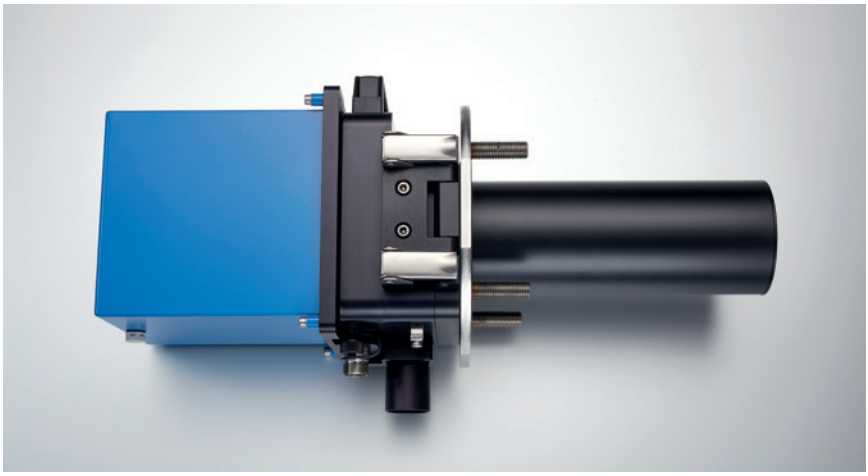
D-R 290 | DUST AND OPACITY MONITOR



- Continuous and contactless measurement of dust concentration
- Ideal for medium to large dust concentrations
- Automatic zero and reference point check
- Automatic contamination check and correction
- QAL1 certified according to EN 15267

Measuring value	Dust concentration, opacity
Measuring range	Opacity: Minimum 0 ... 20 %, maximum 0 ... 100 % Dust: Minimum 0 ... 80 mg/m³, maximum 0 ... 4,000 mg/m³
Smallest certified measuring range	0 ... 15 mg/m³
Operating conditions	In duct: • Temperature: Up to +250 °C standard, others on request • Humidity: 0 ... 95 % RH, non-condensing • Relative pressure: –50 ... +20 hPa
Inner duct diameter	1 ... 18 m
Ambient temperature	–40 ... +60 °C

D-R 320 | DUST MONITOR



- Continuous and contactless measurement of dust concentration
- Ideal for small to medium dust concentrations
- One-sided installation without optical alignment
- Automatic zero and reference point check
- Automatic contamination check and correction
- QAL1 certified according to EN 15267

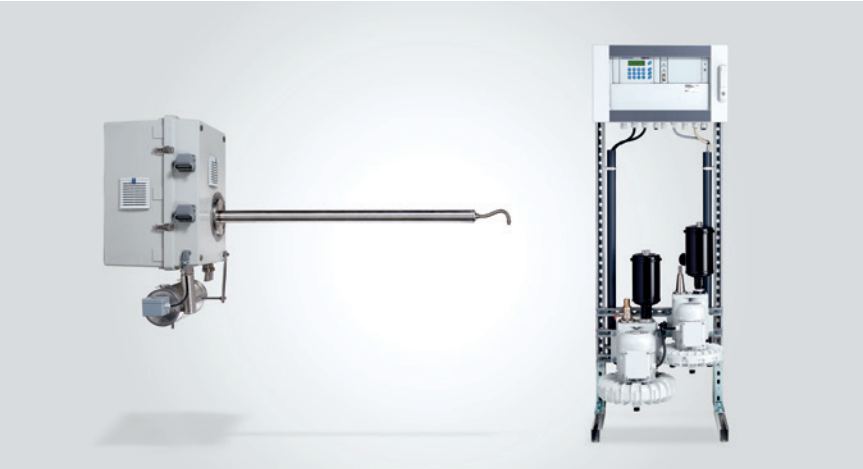
Measuring value	Dust concentration
Measuring range	Minimum 0 ... 5 mg/m³ Maximum 0 ... 200 mg/m³
Smallest certified measuring range	0 ... 7.5 mg/m³
Operating conditions	In duct: • Temperature: Up to +600 °C • Humidity: 0 ... 95 % RH, non-condensing • Relative pressure: –50 ... +50 hPa
Inner duct diameter	>0.7 m
Ambient temperature	–40 ... +60 °C

D-R 808 | DUST MONITOR

- Continuous measurement of dust concentration
- Ideal for small to medium dust concentrations
- One-sided installation without optical alignment
- Automatic zero and reference point check
- Automatic contamination check and correction
- QAL1 certified according to EN 15267

Measuring value	Dust concentration
Measuring range	Minimum 0 ... 5 mg/m³ Maximum 0 ... 200 mg/m³
Smallest certified measuring range	0 ... 7.5 mg/m³
Operating conditions	In duct: • Temperature: Up to +350 °C • Humidity: 0 ... 95 % RH, non-condensing • Relative pressure: –50 ... +50 hPa
Inner duct diameter	>0.3 m
Ambient temperature	–40 ... +60 °C

D-R 820 F | EXTRACTIVE DUST MONITOR FOR WET GASES



- Continuous measurement of dust concentration in wet gases
- Ideal for small to medium dust concentrations
- Extractive measurement, dilution of the sample gas
- Automatic zero and reference point check
- Automatic contamination check and correction
- QAL1 certified according to EN 15267

Measuring value	Dust concentration
Measuring range	Minimum 0 ... 15 mg/m³ Maximum 0 ... 200 mg/m³
Smallest certified measuring range	0 ... 15 mg/m³
Operating conditions	In duct: • Temperature: Up to +220 °C • Humidity: 0 ... >95 % RH, non-condensing, maximum 30 g/m³ H_2O as aerosol • Relative pressure: –30 ... +2 hPa
Inner duct diameter	>0.4 m
Ambient temperature	–20 ... +50 °C

HM-1400 TRX 2 | TOTAL MERCURY ANALYZER

- Continuous mercury analysis
- QAL1 certified according to EN 15267
- Process control of mercury mitigation measures with speciation option
- Low instrument air consumption
- Internal reference gas generator for automatic reference point check
- Maintenance: fast system cooling and heating

Measuring value	Total mercury concentration
Measuring range	0 … 15 µg/m³, 0 … 45 µg/m³, 0 … 75 µg/m³, 0 … 400 µg/m³, 0 … 3,000 µg/m³ (depending on design)
Smallest certified measuring range	0 … 15 µg/m³ *
Operating conditions	In duct: • Temperature: Up to +300 °C • Humidity: 0 … 100 % RH, non-condensing • Relative pressure: –50 … +20 hPa
Inner duct diameter	>0.5 m
Ambient temperature	Analyzer: 0 … +50 °C Probe: –20 … +50 °C

** For large combustion plants and waste incinerators*

D-FL 100 | VOLUME FLOW MEASURING SYSTEM

- Continuous measurement of flow velocity
- Versions for use at extreme high temperatures or in corrosive gases available
- One-sided or installation on both sides possible
- Cost effective measurement system
- Representative measurement even at difficult flow conditions
- QAL1 certified according to EN 15267

Measuring value	Flow velocity, volume flow
Measuring range	Flow velocity: 3 ... 50 m/s
Certified measuring range	3 ... 30 m/s, 3 ... 50 m/s
Operating conditions	In duct: • Temperature: Up to +450 °C, others on request • Humidity: 0 ... 95 % RH, non-condensing • Relative pressure: –50 ... +50 hPa
Inner duct diameter	0.4 ... 9 m
Ambient temperature	–20 ... +50 °C

D-FL 220 | VOLUME FLOW MEASURING SYSTEM

- Continuous and contactless measurement
- Corrosion resistant ultrasonic transducer
- Ideal for saturated or aggressive flue gases
- Automatic zero and reference point check
- Representative measurement even at difficult flow conditions
- QAL1 certified according to EN 15267

Measuring value	Flow velocity, volume flow
Measuring range	Flow velocity: 0 ... 40 m/s
Certified measuring range	0 ... 30 m/s
Operating conditions	In duct: • Temperature: Up to +300 °C • Humidity: 0 ... 100 % RH, condensation allowed • Relative pressure: –50 ... +20 hPa
Inner duct diameter	0.5 ... 14 m, dependant on flue gas and installation conditions
Ambient temperature	–40 ... +60 °C

EDM 280 | PM MONITOR, 19“ RACK VERSION

- Optical measuring cell, 72 logarithmically equidistant size channels
- PSL traceable particle sizing according to ISO 21501-1
- Conformity according to DIN EN 16450, VDI 4202-1
- Low-maintenance sampling design with improved inlet efficiency at high wind speeds and adaptive heating for optimized sample air conditioning
- Output of six dust mass fractions TSP, PM10, PM4, PM2.5, PM1 and PMcoarse
- Total particle concentration, particle number size distribution and meteo sensor data
- Intuitively operation via graphical user interface (touch display)

Measured variable	TSP, PM10, PM4, PM2.5, PM1, PMcoarse
Measuring range	0 … 10,500 µg/m³ for PM10
Sample gas	• Temperature: –40 … 60 °C • Relative humidity: 100 % (–40 °C) … 30 % (60 °C) or absolute humidity maximum 60 g/m³ • Air pressure: 530 … 1,080 hPa
Data protocol (ASCII)	• GRIMM-protocol • Modbus TCP • GESYTEC/Bayern-Hessen-Protocol

F-701-20 | PARTICULATE MATTER MONITORING

- Continuous measurement of particulate matter PM2.5 and PM10 in ambient air
- Up to 1.5 years of operation with only one filter tape through multiple occupancy
- Extended Gesytec protocol for improved remote operation and access to measured data
- Precalibrated measuring system delivers accurate results without specific local calibration
- Easy integration into existing monitoring networks

Measuring value	Particulate matter in ambient air PM2.5, PM10, TSP
Measuring range	0 ... 100 µg/m³, 0 ... 100 mg/m³
Certified measuring range	PM2.5: 0 ... 1,000 µg/m³ PM10: 0 ... 200 µg/m³
Air pressure	800 ... 1,300 hPa
Ambient temperature	Device: 0 ... +40 °C Sample inlet: –20 ... +50 °C

7 GLOSSARY, DOWNLOADS + SOURCE REFERENCES

GLOSSARY

AFLD	Averaged First Level Data
AM	Approval Methodology
AMS	Automated Measuring System
AST	Annual Surveillance Test
BAT	Best Available Techniques
BImSchV	Ordinance for the Implementation of the Federal Emission Control Act German: Verordnung zur Durchführung des Bundes-Immissionsschutz-gesetzes
CEN	European Committee for Standardization French: Comité Européen de Normalisation
CER	Certified Emission Reduction
CLRTAP	Convention on long-range transboundary air pollution
CUSUM	Cumulative Sum control card
DAHS	Data Acquisition and Handling Systems
EEA	European Economic Area
EIPPCB	European Integrated Pollution Prevention and Control Bureau
ELV	Emission Limit Value
EN 14181	Stationary source emissions – Quality assurance of automated measuring systems
EN 14956	Air quality – Evaluation of the suitability of a measurement method by comparison with a stated measurement uncertainty
EN 15267	Air quality – Certification of automated measuring systems, part 1–3
EN 17255	Stationary source emissions – Data acquisition and handling systems, part 1–4
EPA	Environmental Protection Agency
E-PRTR	European Pollutant Release and Transfer Register
EU ETS	EU Emission Trading System

Continued on next page

GLOSSARY

FLD	First Level Data
IED	Industrial Emissions Directive 2010/75/EU of the European Parliament and of the Council of 24th of October 2010 on industrial emissions (integrated pollution prevention and control)
ISO	International Organization for Standardization
ISO 10155	Stationary source emissions – Automated monitoring of mass concentrations of particles – Performance characteristics, test methods and specifications
LCPD	Large Combustion Plant Directive 2001/80/EC of the European Parliament and of the Council of 23rd of October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants
LLT	Legal Local Time
LV	Limit Value
MCERTS	Monitoring Certification Scheme
MCP	Directive (EU) 2015/2193 of the European Parliament and of the Council of 25th of November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants
NGO	Non-governmental organization
PEMS	Predictive Emission Monitoring Systems
QAL	Quality Assurance Level
RATA	Relative Accuracy Test Audit - US EPA
SAG	Desulphurization rate German: Schwefelabscheidegrad
SFLD	Standardized First Level Data
SRM	Standard Reference Method
SSTA	Standardized Short-Term Average
STA	Short-Term Average
TI Air	Technical Instructions on Air Quality Control German: Technische Anleitung zur Reinhaltung der Luft TA Luft
TOC	Total Organic Carbon

TÜV	Technical Inspections Organization German: Technischer Uberwachungsverein
TWG:	Technical Working Group
UNFCCC:	United Nations Framework Convention on Climate Change
VDI	The Association of German Engineers German: Verein Deutscher Ingenieure e. V.
VLTA	Validated Long-Term Average
VSTA	Validated Short-Term Average
WID	Waste Incineration Directive 2000/76/EC of the European Parliament and of the Council of 4th of December 2000 on the incineration of waste

DOWNLOADS + SOURCE REFERENCES

General source references	https://eippcb.jrc.ec.europa.eu/about/sevilla_process https://eippcb.jrc.ec.europa.eu/about/more_information https://ec.europa.eu/environment/industry/stationary/mcp.htm https://ec.europa.eu/environment/industry/stationary/ied/evaluation.htm https://ec.europa.eu/environment/industry/stationary/lcp/chapter3.htm https://eippcb.jrc.ec.europa.eu/reference Neuwahl, F., Brinkmann, T., Lecomte, T., et al., Best Available Techniques (BAT) reference document for large combustion plants: Industrial Emissions Directive 2010/75/EU (integrated pollution prevention and control), Europäische Kommission, Gemeinsame Forschungsstelle, Publications Office, 2017 https://data.europa.eu/doi/10.2760/949 Cusano, G., Roudier, S., Neuwahl, F., et al., Best Available Techniques (BAT) reference document for waste incineration: Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control), Europäische Kommission, Gemeinsame Forschungsstelle, Publications Office, 2020 https://data.europa.eu/doi/10.2760/761437 Enhesa Trend Report on Environment_ Around the world in air emissions_V2 2022_02 David Graham (2022) Regulation of large combustion plant within the European Union. Oral presentation CEM 2022 (virtual conference) Directive 2010/75/EU of the European Parliament and of the council of 24th of November 2010 on industrial emissions (integrated pollution prevention and control) Chapter III – Special provisions for large combustion plants – Environment – European Commission (europa.eu), modified Jyrki Korpela (2022) WI BAT conclusions and changes in emissions monitoring – What should you know? Oral presentation CEM 2022 (virtual conference) Jerome Lapagne (2022) The new MCP Directive and recommendations for suitable gas monitoring solutions. Oral presentation CEM 2022 (virtual conference) OECD (2020) Best Available Techniques (BAT) for Preventing and Controlling Industrial Pollution, Activity 4: Guidance Document on Determining BAT, BAT-Associated Environmental Performance Levels and BAT-Based Permit Conditions, Environment, Health and Safety, Environment Directorate, OECD Rod Robinson (2022) The development of Standards in Europe to meet Regulatory needs. Oral presentation CEM 2022 (virtual conference)

Continued on next page

DOWNLOADS + SOURCE REFERENCES

CEN/TS 17198	https://www.beuth.de/de/technische-regel/din-cen-ts-17198/278090491
EIPPCB	https://eippcb.jrc.ec.europa.eu/about/more_information
EN 15267	https://www.beuth.de/en/standard/din-en-15267-1/112519055
EN 14181	https://www.beuth.de/en/standard/din-en-14181/207503732
EN 14956	https://www.beuth.de/en/standard/din-en-14956/81611061
IED 2010/75/EU	https://ec.europa.eu/environment/industry/stationary/ied/evaluation.htm
ISO 10155	https://www.beuth.de/en/standard/iso-10155/1692306
LCPD 2001/80/EC	https://ec.europa.eu/environment/industry/stationary/lcp/chapter3.htm
MCP (EU) 2015/2193	https://ec.europa.eu/environment/industry/stationary/mcp.htm
Minimum Requirements	http://www.umweltbundesamt.de/sites/default/files/medien/pdfs/Uniform-Practice-Emission-Monitoring.pdf
Sevilla process	https://eippcb.jrc.ec.europa.eu/about/sevilla_process
TI Air	https://www.verwaltungsvorschriften-im-internet.de/bsvwvbund_18082021_IGI25025005.htm
VDI 2066	https://www.vdi.de/richtlinien/details/vdi-2066-blatt-1-messen-von-partikeln-staubmessung-in-stroemenden-gasen-gravimetrische-bestimmung-der-staubbeladung
VDI 3950	https://www.vdi.de/richtlinien/details/vdi-3950-emissionen-aus-stationaeren-quellen-qualitaetssicherung-fuer-automatische-mess-und-elektronische-auswerteeinrichtungen
WID 2000/76/EC	https://ec.europa.eu/environment/archives/air/stationary/wid/legislation.htm

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DURAG GROUP

DURAG GROUP

Kollaustraße 105
22453 Hamburg, Germany
Phone +49 40 554218-0
info@durag.com

DURAG.COM