



PM CEMS – MAINTENANCE & CALIBRATION

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SICK
Sensor Intelligence.

CALIBRATION

PARTICULATE MEASUREMENT DEVICES

WHY CALIBRATION IS REQUIRED



Optical, electro-dynamic and tribo-electric monitors are indirect measuring methods. They detect an optical effect – not the dust concentration.



Because of the big variety of dust characteristics, for optical dust monitors it is not possible to measure the dust concentration directly.



To get a mass concentration output signal in mg/m^3 every single dust monitors has to be calibrated by gravimetric measurement equipment.



Different dust characteristics in terms of:

- Colour
- Size
- Surface structure
- Reflexion ability
- Density ...

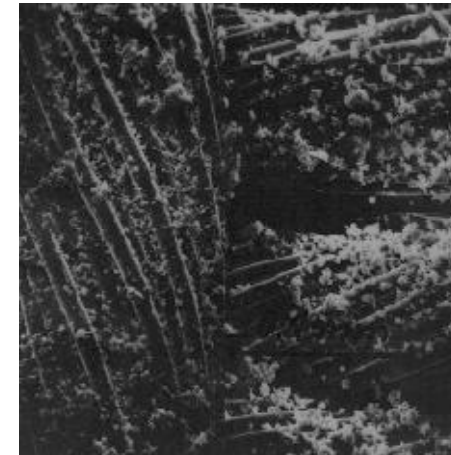
Examples of dust structures



Asbest dust

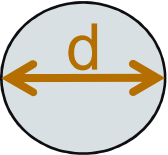
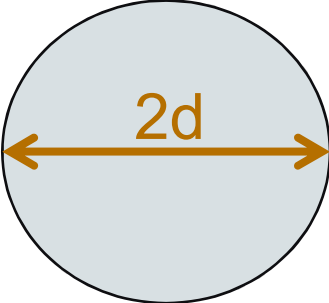


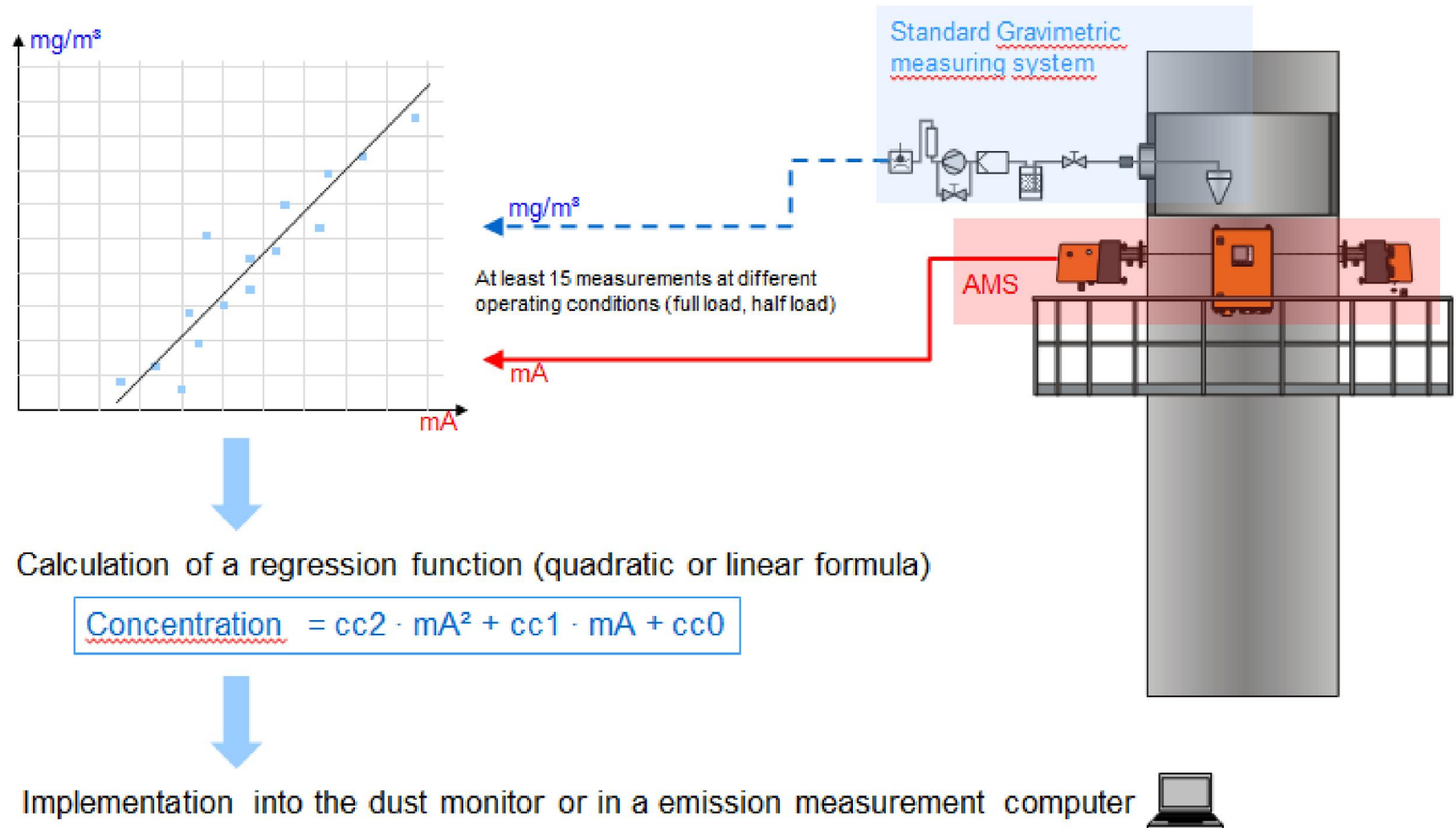
Coal dust



Domestic dust

The relation between particle size and an mass :

Particle size	Diameter	Area	Mass	Relation Mass / Area:
	1	1	1	1
	2	4	8	2



Requirements:

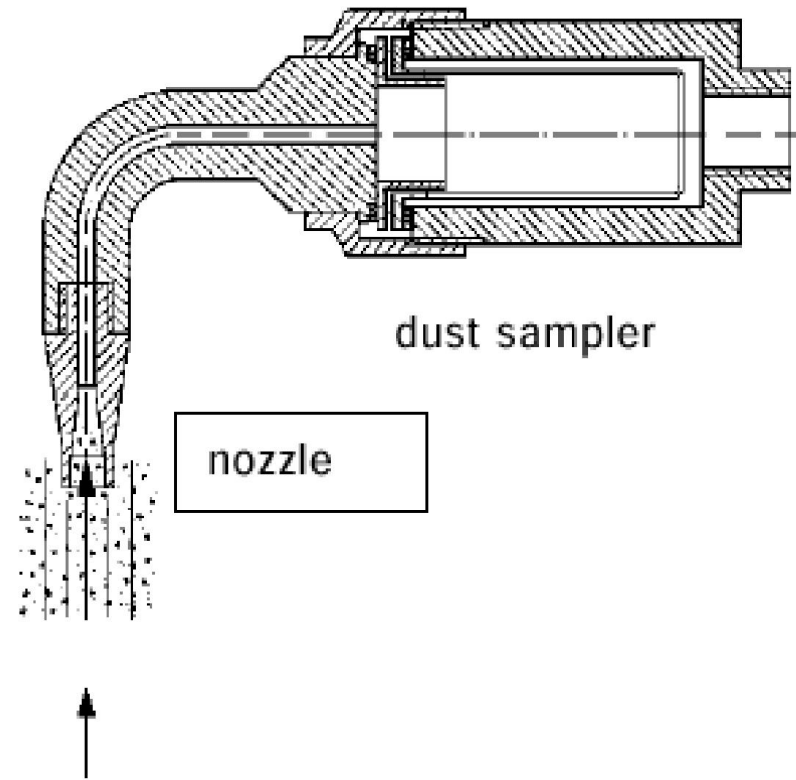
- Distance to the dust monitoring level at least 500 mm in flow direction
- No mutual influencing of dust meter and calibrating device.



PM CEMS CALIBRATION

ISOKINETIC SAMPLING

Homogeneous infiltration.
Big and little particles follow
the gas stream.



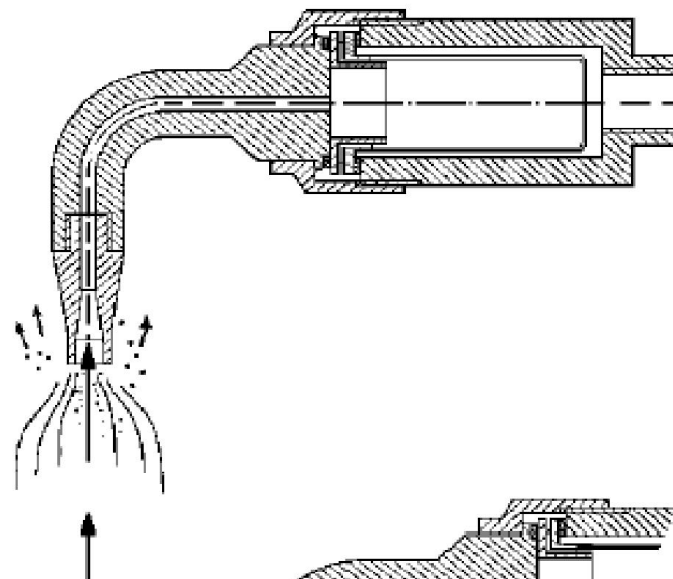
For dust gravimetric comparison according VDI 2066 the gas must be extracted in such way that the gas velocity in the extraction tube and the gas velocity in the stack are the same.

PM CEMS CALIBRATION

NON – ISO KINETIC SAMPLING

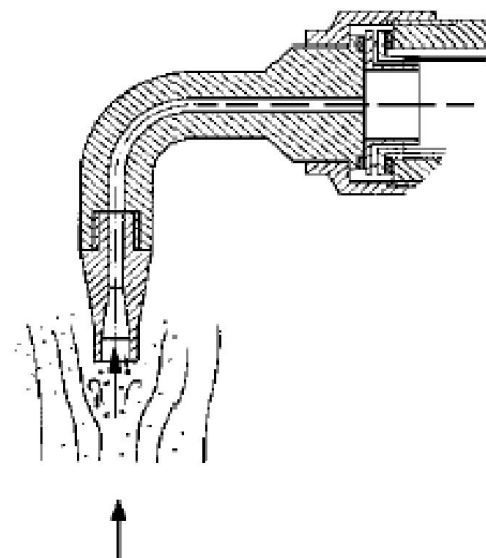
Gas flow too high.

Big particles cannot follow
the gas stream =
Concentration to low.

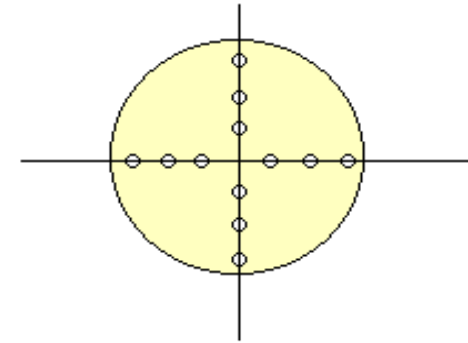


Air flow too low

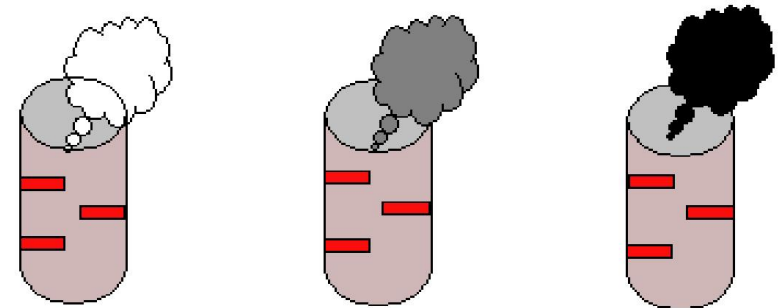
In relation to much big
particles are sucked off =
Concentration to high.



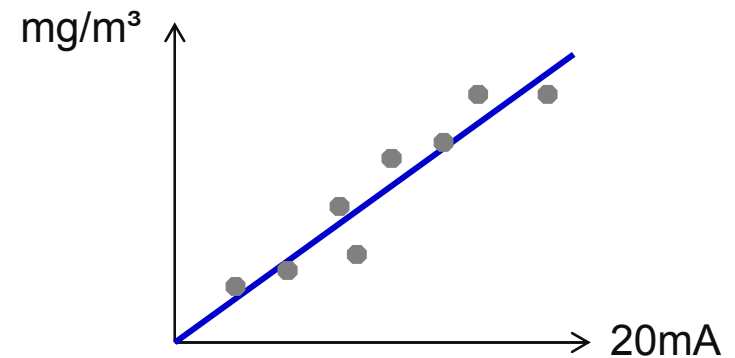
Profile measurements has to be considered.



Calibration is performed under different plant operation and conditions to achieve different dust load.



Relationship between dust concentration in mg/m^3 and monitor output in mA

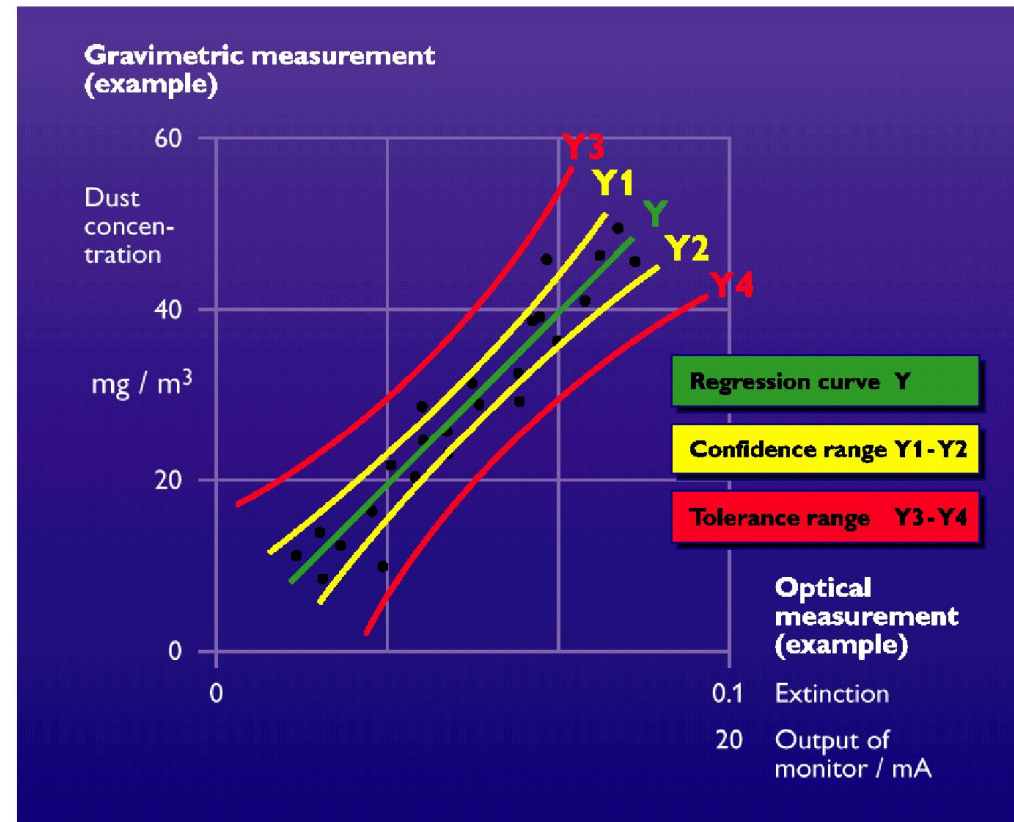


PM CEMS CALIBRATION

REGRESSION CURVE

When evaluating a series of gravimetric dust measurements in accordance to VDI 2066, 95% of the measured extinction values have to be within the tolerance range Y3 and Y4 of the actual dust concentration Y.

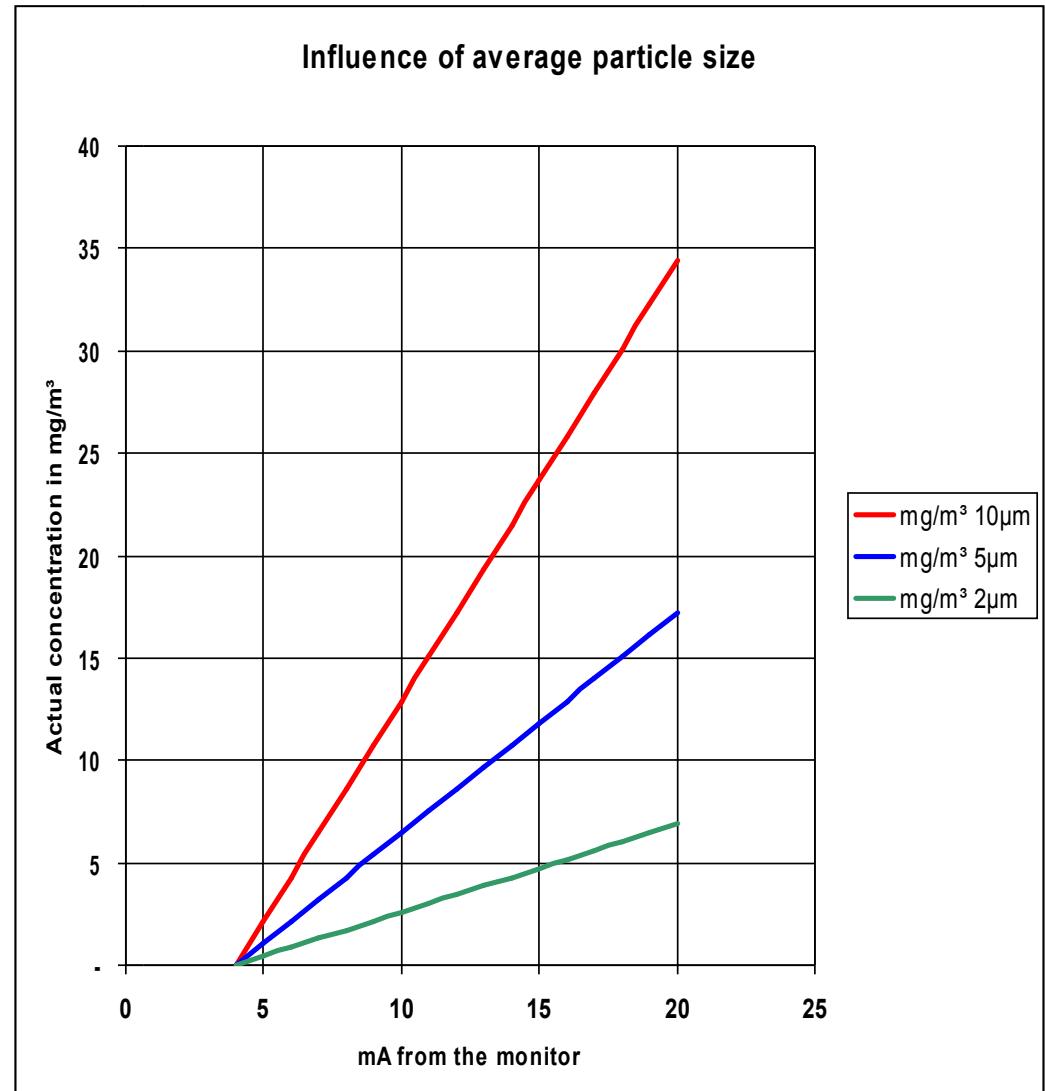
The extinction value established over a long period of time has a 95% probability of falling inside the confidence range which is defined by Y1 and Y2.



The relation between:

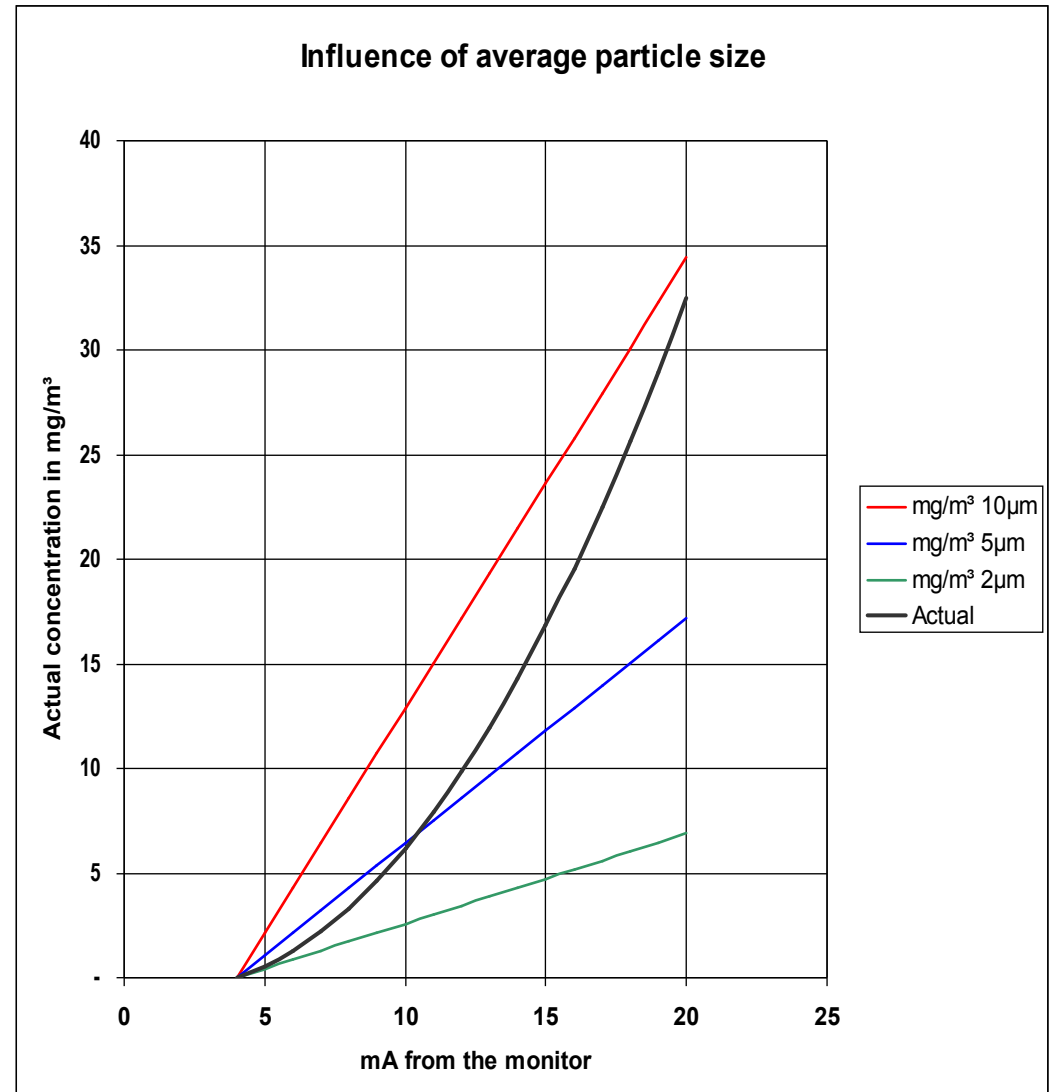
- concentration in mg/m^3
- and monitor output in mA

changes **proportional** with the changes in the average particle size.



Because the average particle size often increases with the concentration (sometimes with the plant load), a non-linear upward rising calibration curve is normal (the black curve).

This has to be respected in the data processing system – means: quadratic curves have to be used. (Requirement of [EN14181](#))

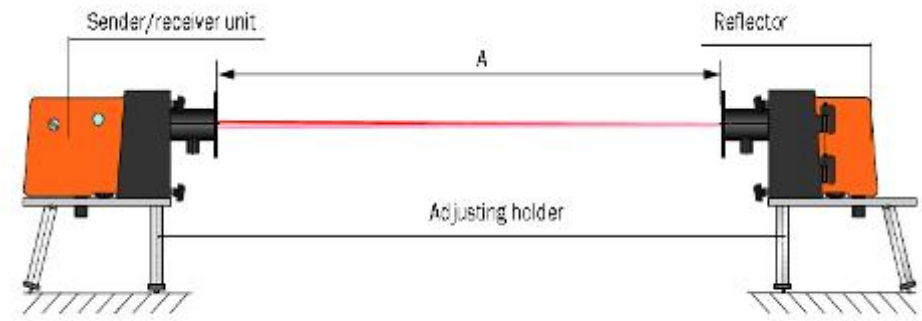


ACCESSORIES LINEARITY FILTER SET

- Filterholder
- Device Filter



- Commissioning
- Maintenance



A = distance flange - flange



MAINTENANCE



MODEL : SB100

Scattered light (dry gas)

Where

Cement Plant after E-filter (Germany)

Dust Meas. Range

0 ... 50mg/m³

CASE 1 : CEMENT PLANT



CASE 1 : CEMENT PLANT



CASE 1 : CEMENT PLANT



CASE 1 : CEMENT PLANT





DUSTHUNTER C200

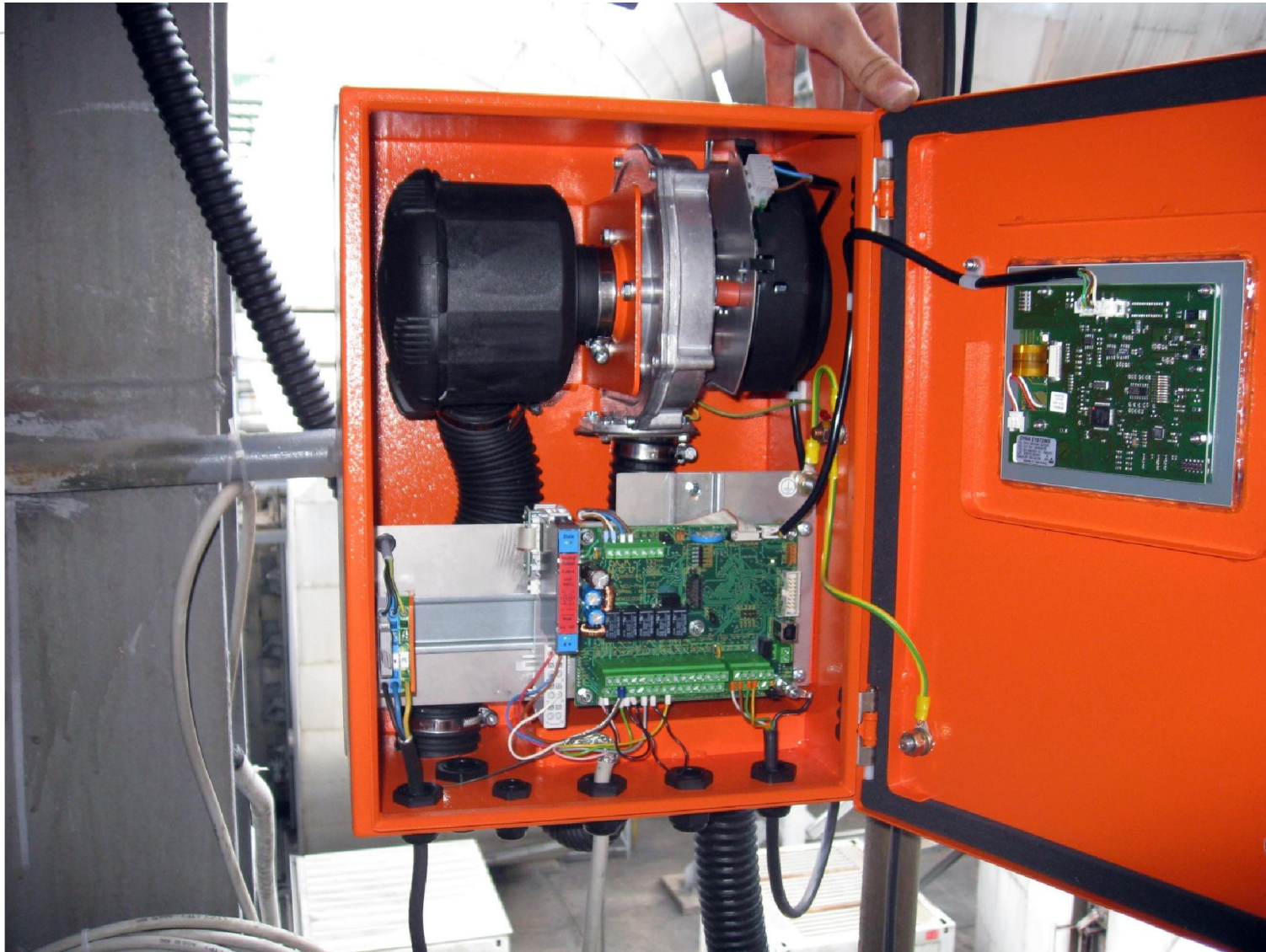
Transmission + Scattered Light

Where	Coal Power Plant in Prunerov after E-filter (Ceska Republika)
Meas. Range Transmission	0 ... 200mg/m ³
Meas. Range Scatt.Light	> 200 mg
Task	Control the E-filter work for a higher efficiency

CASE 2 : AT COAL POWER



CASE 2 : AT COAL POWER



CASE 2 : AT COAL POWER

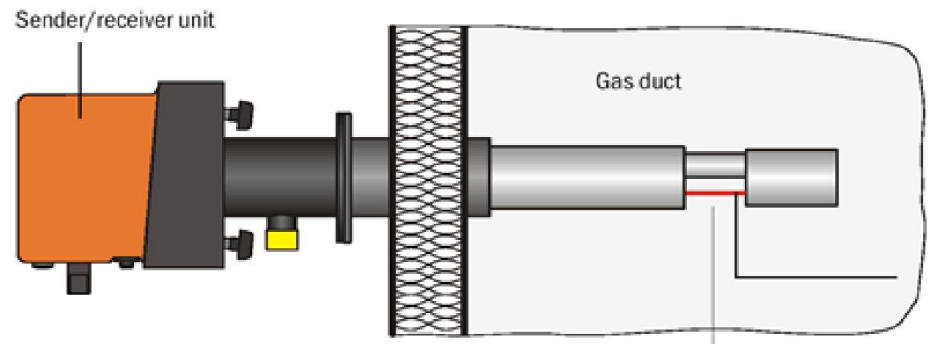


CASE 2 : AT COAL POWER





DUSTHUNTER SP100
Scattered light forward



CASE 3 : STEEL INDUSTRY



CASE 3 : STEEL INDUSTRY



CASE 3 : STEEL INDUSTRY



EN 15267 - Performance criteria and test procedures

Maintenance intervals

- ▶ The maintenance interval shall be derived from the shortest interval between the requisite maintenance work operations. This also includes **manual** zero and span point checks.
- ▶ The maintenance interval is important for QAL3 according to EN 14181:
 - **It defines the time span between QAL3 readings**

Maximum allowable maintenance intervals

Field test duration	Maximum allowable maintenance interval
3 months	1 month
6 months	3 months
12 months	6 months
24 months	12 months



Ensure support resources for the CEMS

- ▶ Training for maintenance staff
- ▶ Training on different Level



Ensure support resources for the CEMS

Target: System availability > 95%

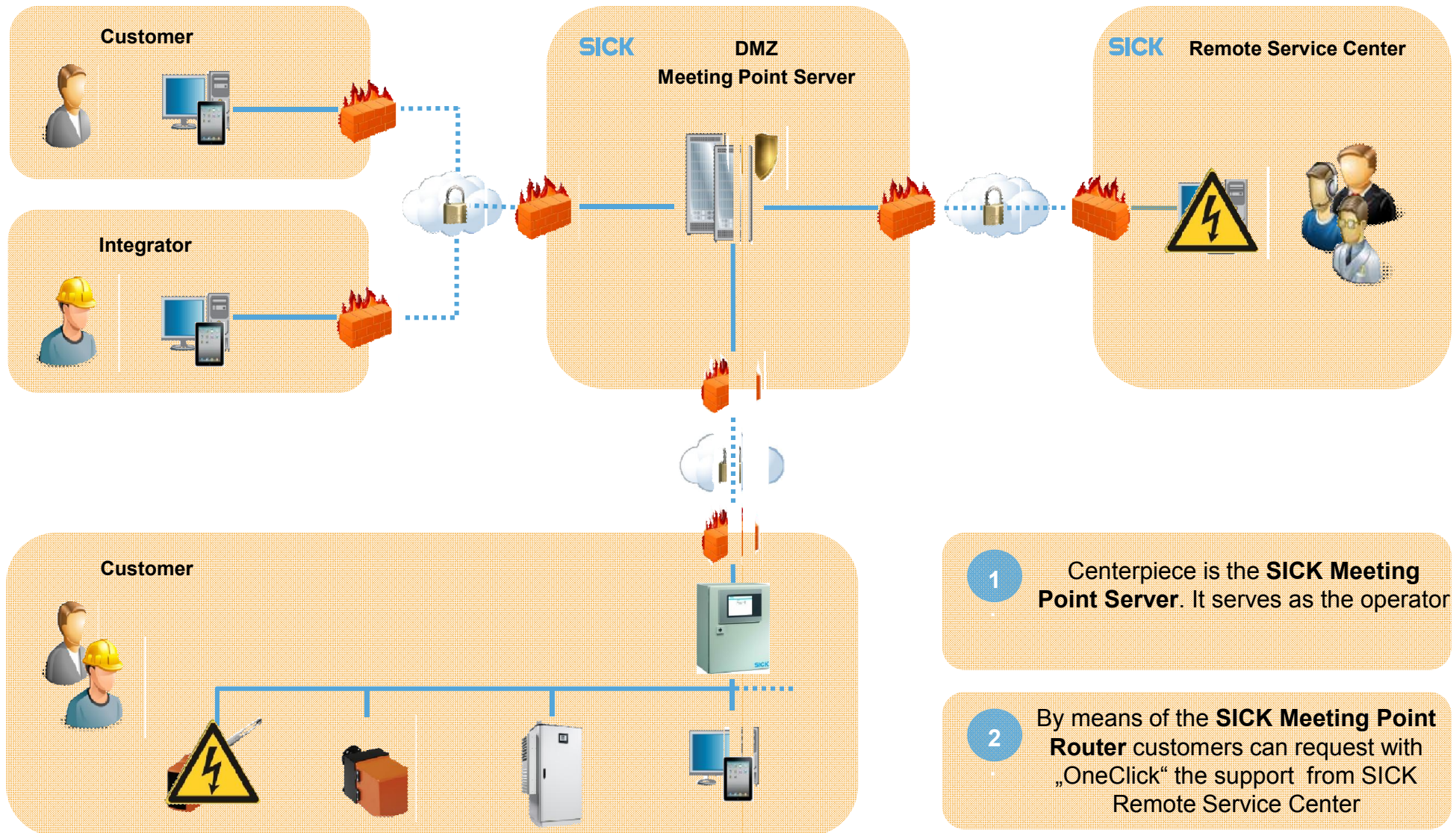
Support requirements:

- ▶ full support (engineering, installation, commissioning and start -up)
- ▶ availability of consumables on-site
- ▶ availability of critical spare parts from stock (local supplier organization)
- ▶ QAL3 zero and span without test gases
- ▶ training
- ▶ maintenance concept (e.g. Remote access)

SICK REMOTE SERVICE PLATFORM INFRASTRUCTURE



Sensor Intelligence.



Ensure support resources for the CEMS

Maintenance Manual



Preventive Maintenance



Ensure support resources for the CEMS

Maintenance Intervals

Maintenance items	refer to	w ¹	q ¹
Visual inspection			
Check if measured values are plausible in the control room		x	x
Check if control cycle is (zero/span) valid (control room or recorder)		x	x
Check if there is any error message (control room)		x	x
Check mechanical damage			x
Check attachments and conditions			x
Connection unit with integrated purge air supply			
Cleaning or replace the filter insert and housing of the purge air supply, part no. 5306091	→ S. 14, §3.2.1		x
External purge air unit (option)			
Check the hoses and ring nozzles	→ S. 17, §3.2.4		x
Replace the filter insert and check housing of the purge air supply, part no. 5306091	→ S. 16, §3.2.3		x

MANY THANKS FOR THE
ATTENTION

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