Kursus Intensif Pemantapan Prosedur Penguatkuasaan Jabatan Alam Sekitar Mengikut Diskripsi Tugas Semasa Bagi Penolong Jurutera (PJ) Dan Penolong Pegawai Kawalan Alam Sekitar (PPK) 2015

Penilaian Had Pelepasan Cerobong

Objektif

- Peserta boleh normalised had pengeluaran cerobong mengikut rujukan oksigen atau karbon dioksida
- Peserta memahami konsep persampelan cerobong
- Peserta dapat memahami keperluan CEMS dan bagaimana menilai pematuhan

Topik

1. Nilai Batas dan Standard Teknikal PUB 2014
2. Garispanduan Kualiti Udara Ambient
3. Pemantauan Berkala – Secara Percontohan Cerobong
4. Pemantauan Secara Berterusan (CEMS)

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JADUAL KEDUA

(I) Kawalan terhadap peralatan pembakaran bahanapi, pembakar dan krematorium

1. Kawalan kualiti bahanapi untuk peralatan pembakaran bahanapi dan pembakar yang tidak diliputi oleh Jadual Pertama:

Jenis bahanapi	Bahanapi	Parameter kualiti bahanapi
Cecair	Semua	Kandungan sulfur < 500 ppm (per berat)
Pepejal	Batu arang	Kandungan sulfur < 1% (per berat)
	Biojisim	Kayu, bahan buangan pertanian, dsb.: yang dikeringudarakan dan dalam komposisi semulajadinya (contoh, kayu tidak bersalut, bercat atau perawatan lain)
		Sisa daripada industri berasaskan kayu: tanpa pengawet kayu

PERATURAN 13
NILAI BATAS DAN STANDARD TEKNIKAL

2. Pengeluaran pembakaran daripada peralatan pembakaran bahanapi dan pembakar yang tidak diliputi oleh Jadual Pertama:

Kandungan rujukan karbon dioksida ialah 12%

Jenis bahanapi	Pencemar	Nilai batas	Pemantauan
Cecair	Jumlah jirim zarahan (PM) Di mana beban habuk dikeluarkan: a)> 0.33 < 1.0 kg/jam b) ≥ 1.0 kg/jam	50 mg/m^3	 Sekali/tahun 2 kali/tahun
Pepejal	Jumlah jirim zarahan (PM) Di mana beban habuk dikeluarkan: a)> 0.44 < 1.0 kg/jam b)≥ 1.0 < 1.5 kg/jam c)≥ 1.5 < 2.0 kg/jam d)≥ 2.0 < 2.5 kg/jam e)≥ 2.5 kg/jam	150 mg/m^3	 Sekali/tahun 2 kali/tahun 3 kali/tahun 4 kali/tahun Berterusan*
	Karbon monoksida (CO)	1000 mg/m^3	Berkala

BACAAN PENGELUARAN PERLU DINORMALKAN

Bacaan normalized pada STP (273K, 101.3 kPa)

Tentukan rujukan CO_2 adalah 12%

Contoh :

Bagi pelepasan daripada peralatan pembakaran bahanapi yang menggunakan bahanapi pepejal, rujukan karbon dioksida adalah 12% dan nilai had pengeluaran Jumlah Partikulat Terampai adalah 150 mg/m³. Jika bacaan yang diukur adalah 140 mg/m³ pada rujukan karbon dioksida 8%, maka:

$$G_N = [G] \times \frac{CO_{2,ref}}{CO_{2,measured}}$$

$CO_{2,\ measured}$ = CO_2 measured, % vol

$CO_{2,\ ref}$ = reference carbon dioxide content, % vol

[G] = measured gas concentration

$[G_N]$ = normalized gas concentration

$$G_N = [140\ ] \times \frac{(12\ )}{(8\ )}$$

$$= 210\ \ mg/m^3$$

BACAAN PENGELUARAN PERLU DINORMALKAN

Bacaan normalized pada STP (273K, 101.3 kPa)

Tentukan rujukan O_2 yang ditetapkan

Contoh :

Bagi loji janakuasa menggunakan bahanapi pepejal, rujukan oksigen adalah 6% dan nilai had pengeluaran NO_2 adalah 500 mg/m³. Jika bacaan yang diukur adalah 490 mg/m³ pada rujukan oksigen 8%, maka bacaan yang diukur perlu *normalized* dengan menggunakan formula berikut:

$$G_N = [G] \times \frac{(20.9 - O_{2,ref})}{(20.9 - O_{2,measured})}$$

$O_{2,\ measured}$ = O_2 measured, % vol

$O_{2,\ ref}$ = reference oxygen content, % vol

[G] = measured gas concentration

[G_N] = normalized gas concentration

20.9 = percentage of oxygen in ambient air

$$G_N = [490\ ] \times \frac{(20\ .9 - 6)}{(20\ .9 - 8)}$$

$$= 566\ \ mg/m^3$$

PERATURAN 13
NILAI BATAS DAN STANDARD TEKNIKAL

A PENJANAAN HABA DAN KUASA

MW_e = electrical power

1. Dandang

Kandungan rujukan O_2 ialah 6% untuk bahanapi pepejal dan 3% untuk lain-lain.

Jenis bahanapi	Pencemar	Kapasiti	Nilai batas	Pemantauan
Bahanapi pepejal dan cecair	Jumlah SO_2 dan SO_3 dinyatakan sebagai SO_2	>10 MW_e	500 mg/m^3	Berterusan*
	Jumlah NO dan NO_2 dinyatakan sebagai NO_2	>10 MW_e	500 mg/m^3	Berterusan*
	Hidrogen klorida (HCl)	>10 - <100 MW_e	200 mg/m^3	Berkala
	Hidrogen klorida (HCl)	≥100 MW_e	100 mg/m^3	Berkala
	Hidrogen fluorida (HF)	>10 - <100 MW_e	30 mg/m^3	Berkala
	Hidrogen fluorida (HF)	≥100 MW_e	15 mg/m^3	Berkala
	Karbon monoksida (CO)	>10 MW_e	200 mg/m^3	Berterusan*
	Jumlah jirim zarahan (PM)	>10 MW_e	50 mg/m^3	Berterusan*
	Merkuri (Hg)	>10 MW_e	0.03 mg/m^3	Berkala
	PCDD/PCDF	>10 MW_e	0.1 ng TEQ/m^3	Berkala
Bahanapi gas	Jumlah NO dan NO_2 dinyatakan sebagai NO_2	>10 MW_e	350 mg/m^3	Berterusan*
	Karbon monoksida (CO)	>10 MW_e	50 mg/m^3	Berterusan*
	Jumlah jirim zarahan (PM)	> 10 MW_e	5 mg/m^3	Berkala

PERATURAN 13
NILAI BATAS DAN STANDARD TEKNIKAL

2. Turbin pembakaran

Kandungan rujukan O_2 ialah 15%.

Jenis bahanapi	Pencemar	Kapasiti pada keadaan ISO	Nilai batas	Pemantauan
Bahanapi gas	Jumlah NO dan NO_2 dinyatakan sebagai NO_2	>10 MW_e	150mg/m^3	Berterusan*
	Karbon monoksida (CO)	>10 MW_e	100 mg/m^3	Berterusan*
Bahanapi cecair	Jumlah NO dan NO_2 dinyatakan sebagai NO_2	>10 MW_e	200 mg/m^3	Berterusan*
	Karbon monoksida (CO)	>10 MW_e	100 mg/m^3	Berterusan*

* Purata masa bagi pemantauan secara berterusan ialah 30 minit

PERATURAN 13
NILAI BATAS DAN STANDARD TEKNIKAL

3. Set penjana untuk gabungan pengeluaran haba dan kuasa dengan jumlah keluaran terma ≥ 3 MW_e:

Kandungan rujukan O_2 ialah 5%.

Jenis bahanapi	Pencemar	Kapasiti	Nilai batas	Pemantauan
Bahanapi cecair atau gas	Jumlah NO dan NO_2 dinyatakan sebagai NO_2	≥ 3 MW_e	600 mg/m^3	Berkala
	Karbon monoksida (CO)	≥ 3 MW_e	650 mg/m^3	Berkala
	Jumlah jirim zarahan (PM)	≥ 3 MW_e	80 mg/m^3	Berkala

PERATURAN 13
NILAI BATAS DAN STANDARD TEKNIKAL

B PENGELUARAN DAN PEMPROSESAN LOGAM FERUS (KILANG BESI DAN KELULI)

Punca	Pencemar	Nilai batas	Pemantauan
Loji sinter (gas buangan daripada kawasan sinter) (*sinter plants*)	Jumlah SO_2 dan SO_3 dinyatakan sebagai SO_2	500mg/m^3	Berterusan*
	Jumlah NO dan NO_2 dinyatakan sebagai NO_2	400 mg/m^3	Berterusan*
	Jumlah jirim zarahan(PM)	50 mg/m^3	Berterusan*
	Jumlah plumbum sebagai Pb	1 mg/m^3	Berkala
	NMVOC	75 mg/m^3	Berkala
	PCDD/PCDF	0.1 ng TEQ/m^3	Berkala
Ketuhar arang kok (@ 5% O_2) (*coke ovens*)	Jumlah jirim zarahan(PM)	10 mg/m^3	Berterusan*
	Jumlah NO dan NO_2 dinyatakan sebagai NO_2	500 mg/m^3	Berkala
	Sebatian sulfur sebagai S	800 mg/m^3	Berkala
Relau bagas (Penjana semula; @ 3% O_2) (*blast furnace*)	Jumlah jirim zarahan(PM)	50 mg/m^3	Berterusan*
Relau oksigen asas (gas penukar)	Jumlah jirim zarahan(PM)	50 mg/m^3	Berterusan*
Relau arka elektrik (*Electric arc furnace*)	Jumlah jirim zarahan(PM)	50 mg/m^3	Berterusan*
Mesin penggelek: Relau rawatan terma (@ 5% O_2)	Jumlah NO dan NO_2 dinyatakan sebagai NO_2	500 mg/m^3	Berkala

PERATURAN 13
NILAI BATAS DAN STANDARD TEKNIKAL

K *PEMBAKAR BAHAN BUANGAN BAGI SEMUA SAIZ*

Kandungan rujukan O_2 ialah 11%.

Pencemar	Nilai batas	Pemantauan
Jumlah jirim zarahan(PM)	100 mg/m^3	Berterusan*
NMVOC sebagai jumlah karbon organik	10 mg/m^3	Berterusan*
Hidrogen klorida (HCl)	40 mg/m^3	Berterusan*
Hidrogen fluarbon organikjumlah CMUA SAIZ):eh DIcapai h ditunjukkan sebagai jumlah karbon organik.orida (HF)	1 mg/m^3	Berterusan*
Jumlah SO_2 dan SO_3 dinyatakan sebagai SO_2	50 mg/m^3	Berterusan*
Jumlah NO dan NO_2dinyatakan sebagai NO_2	200 mg/m^3	Berterusan*
Karbon monoksida (CO)	50 mg/m^3	Berterusan*
Kadmium dan sebatiannya, dinyatakan sebagai kadmium (Cd) Talium dan sebatiannya, dinyatakan sebagai talium (Tl)	Jumlah 0.05 mg/m^3	Berkala
Merkuri dan sebatiannya, dinyatakan sebagai merkuri (Hg)	0.05 mg/m^3	Berkala
Antimoni (Sb), Arsenik (As), Plumbum (Pb), Kromium (Cr), Kobalt (Co), Kuprum (Cu), Mangan (Mn), Nikel (Ni), Vanadium (V), dan sebatiannya dinyatakan sebagai unsurnya	Jumlah 0.5 mg/m^3	Berkala
PCDD/PCDF	0.1 ng TEQ/m^3	Berkala

Had Kepekatan Standard Kualiti Udara Ambien

- Digunakan bermula1989
- Dikemaskini 2013

  (Arahan Pejabat Bil 12/2014 Bertarikh 14 Okt 2014)

AMBIENT AIR QUALITY GUIDELINE VS API

Pollutants	Averaging time	ppm	µg/m^3	API (100)
Ozone	I hour 8 hours	0.10 0.06	200 120	100
Carbon monoxide	I hour 8 hours	30 9	35 mg/m^3 10 mg/m^3	 100
Nitrogen Dioxide	I hour	0.17	320	100
Sulfur Dioxide	10 minutes 1 hour 24 hours	0.19 0.13 0.04	500 350 105	 100
TSP	24 hour 1year		260 90	
PM10	24 hour 1 year		150 50	100
Lead	3 months		1.5	

P= 101.3 Kpa, T = 25^o C

HAD KEPEKATAN STANDARD KUALITI UDARA AMBIEN 2013

Jadual 1: Had kepekatan parameter zarahan terampai bersaiz 10 mikrometer atau kurang (PM_{10})

MASA PURATA	UNIT	GARIS PANDUAN SEDIA ADA	IT-1 (2015)	IT-2 (2018)	STANDARD (2020)
1 TAHUN	$\mu g/m^3$	50	50	45	**40**
24 JAM	$\mu g/m^3$	150	150	120	**100**

Jadual 2: Had kepekatan parameter zarahan terampai bersaiz 2.5 mikrometer atau kurang ($PM_{2.5}$)

MASA PURATA	UNIT	GARIS PANDUAN SEDIA ADA	IT-1 (2015)	IT-2 (2018)	STANDARD (2020)
1 TAHUN	$\mu g/m^3$	-	35	25	**15**
24 JAM	$\mu g/m^3$	-	75	50	**35**

Jadual 3: Had kepekatan parameter sulfur dioksida (SO_2)

MASA PURATA	UNIT	GARIS PANDUAN SEDIA ADA	IT-1 (2015)	IT-2 (2018)	STANDARD (2020)
1 JAM	$\mu g/m^3$	350	350	300	**250**
24 JAM	$\mu g/m^3$	105	105	90	**80**

Nota : IT – Interim Target

Jadual 4: Had kepekatan parameter nitrogen dioksida (NO_2)

MASA PURATA	UNIT	GARIS PANDUAN SEDIA ADA	IT-1 (2015)	IT-2 (2018)	STANDARD (2020)
1 JAM	$\mu g/m^3$	320	320	300	**280**
24 JAM	$\mu g/m^3$	75	75	75	**70**

Jadual 5: Had kepekatan parameter *Ground-Level Ozone* (O_3)

MASA PURATA	UNIT	GARIS PANDUAN SEDIA ADA	IT-1 (2015)	IT-2 (2018)	STANDARD (2020)
1 JAM	$\mu g/m^3$	200	200	200	**180**
8 JAM	$\mu g/m^3$	120	120	120	**100**

Jadual 6: Had kepekatan parameter karbon monoksida (CO)

MASA PURATA	UNIT	GARIS PANDUAN SEDIA ADA	IT-1 (2015)	IT-2 (2018)	STANDARD (2020)
1 JAM	mg/m^3	35	35	35	**30**
8 JAM	mg/m^3	10	10	10	**10**

Nota : IT – Interim Target

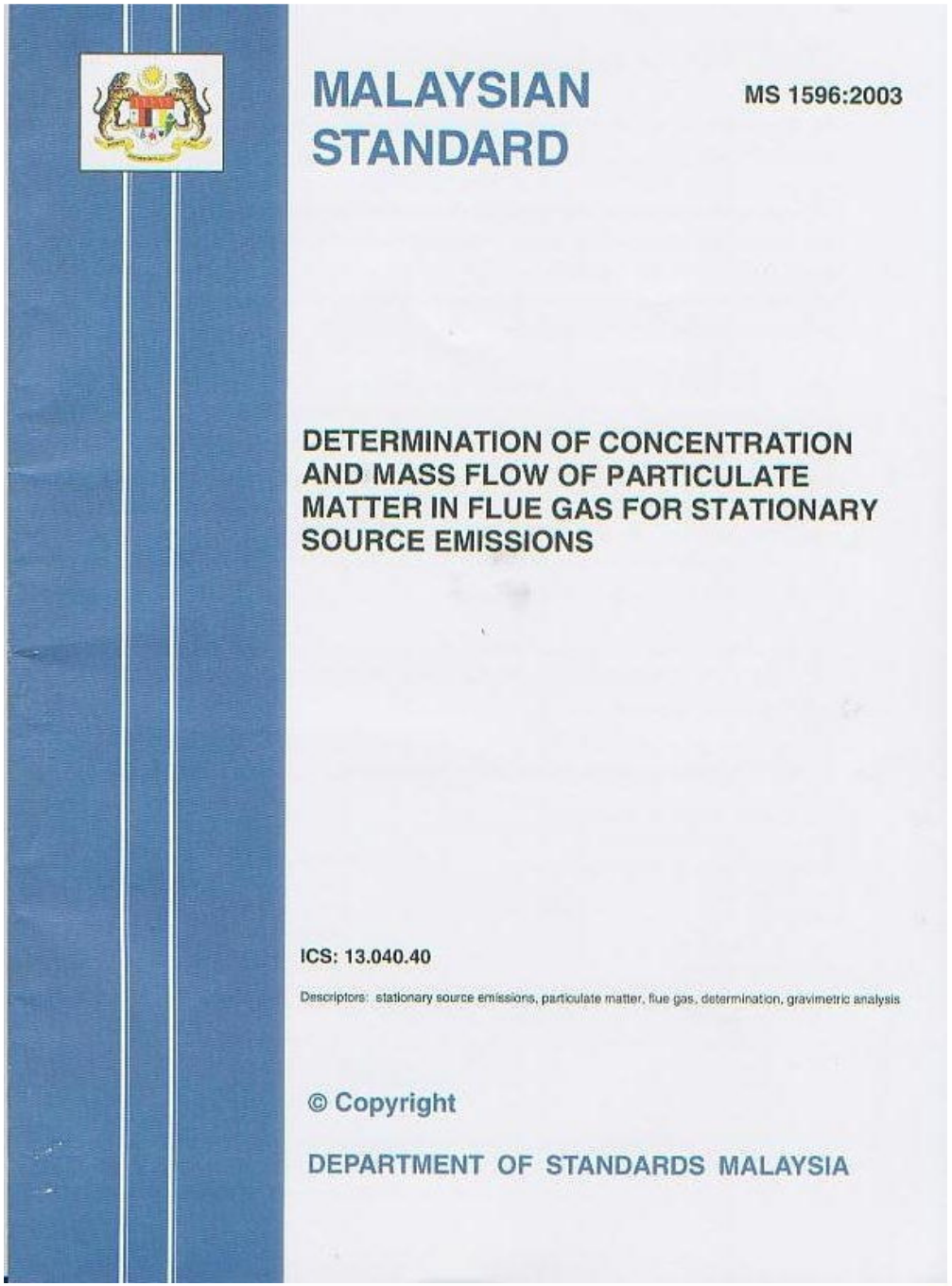
Pemantauan Berkala

Percontohan Cerobong Isokinetik

Malaysian Standard

- MS1596:2003 - Determination of concentration and mass flow of particulate matter in flue gas for stationary source emissions

- MS1723:2003 – Performance evaluation of air pollution control and treatment system : Mechanical dust collectors



MALAYSIAN STANDARD

MS 1596:2003

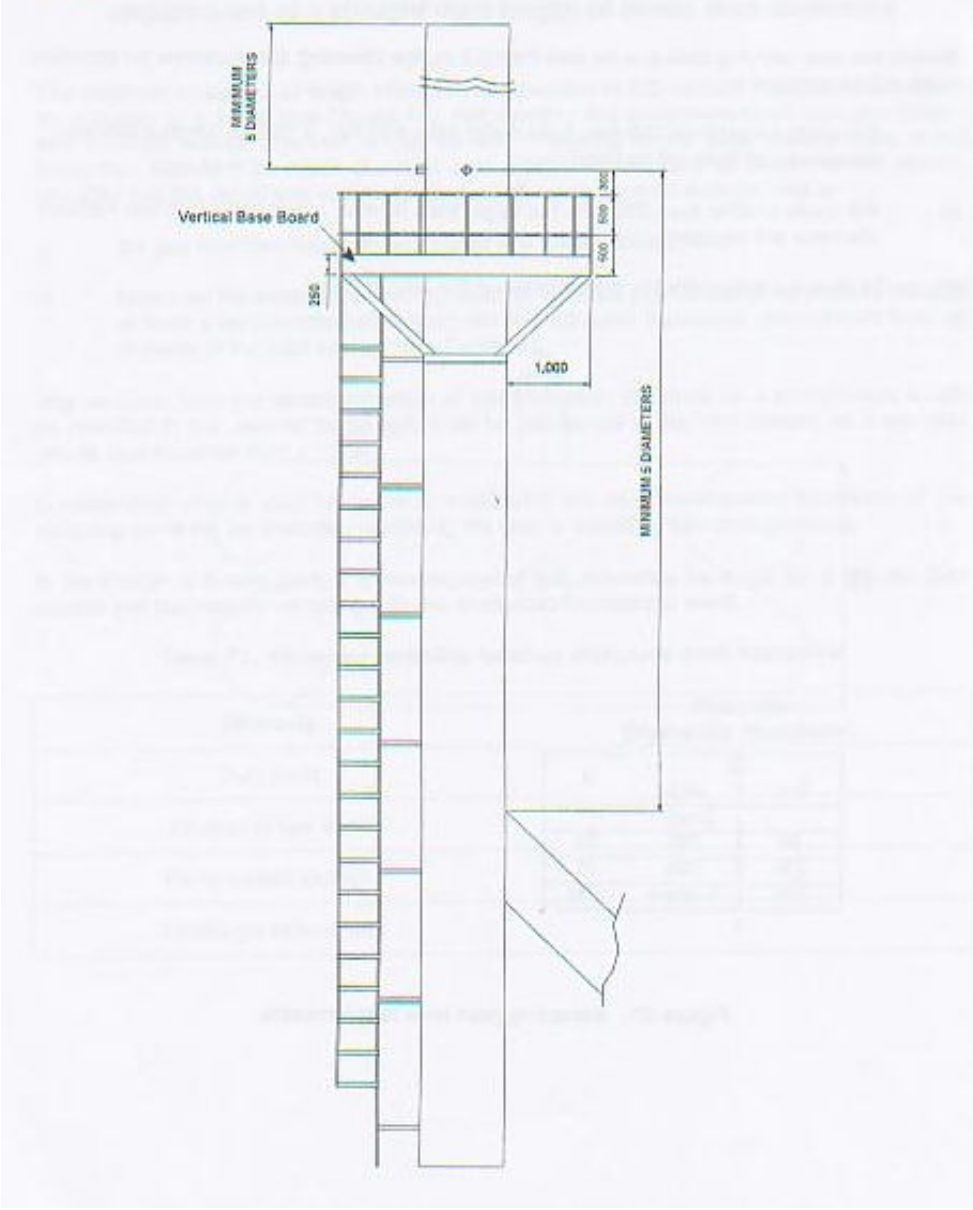
DETERMINATION OF CONCENTRATION AND MASS FLOW OF PARTICULATE MATTER IN FLUE GAS FOR STATIONARY SOURCE EMISSIONS

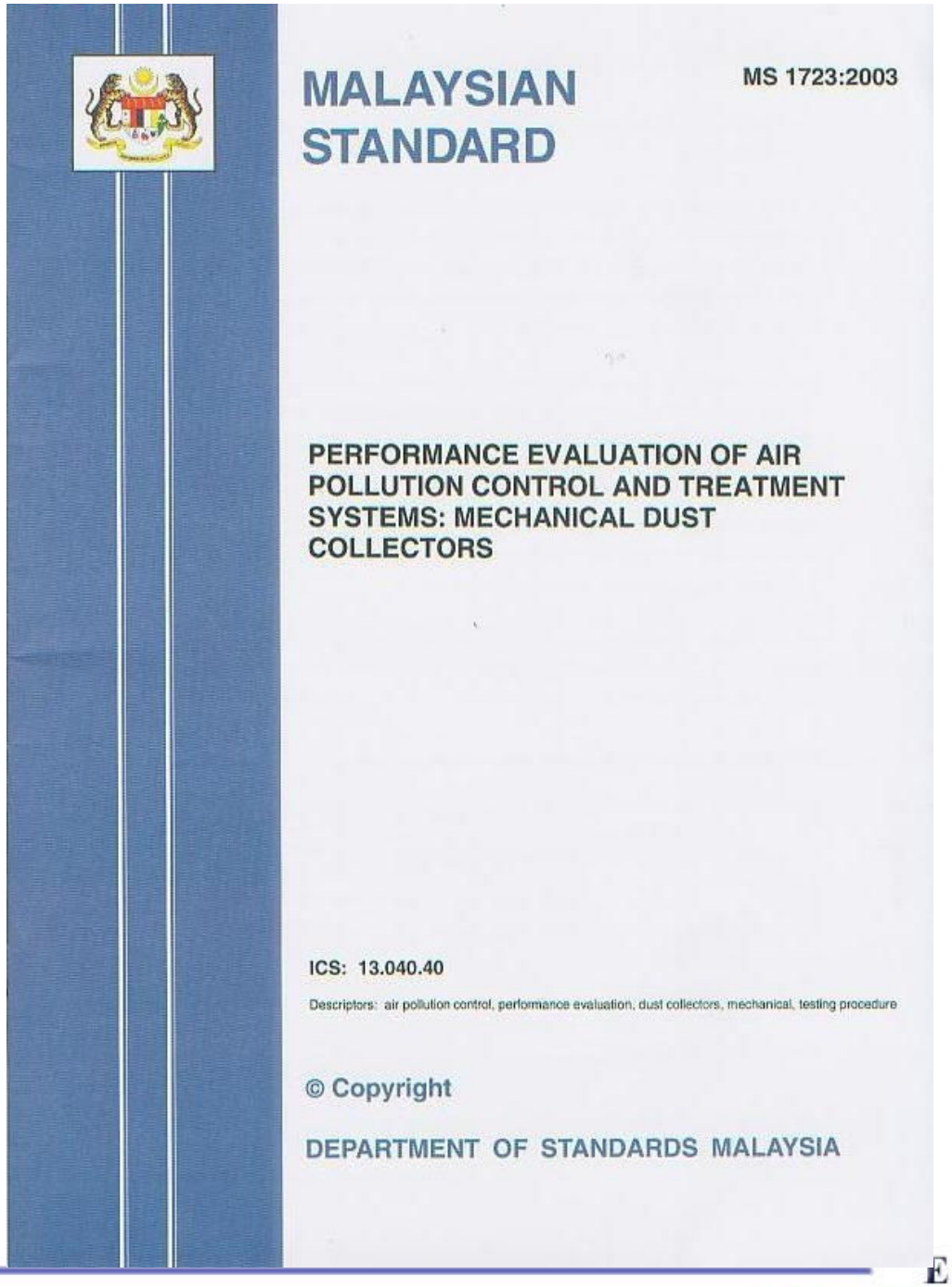
ICS: 13.040.40

Descriptors: stationary source emissions, particulate matter, flue gas, determination, gravimetric analysis

Untuk rujukan JAS sahaja

Rakabentuk takat percontohan





Untuk rujukan JAS sahaja

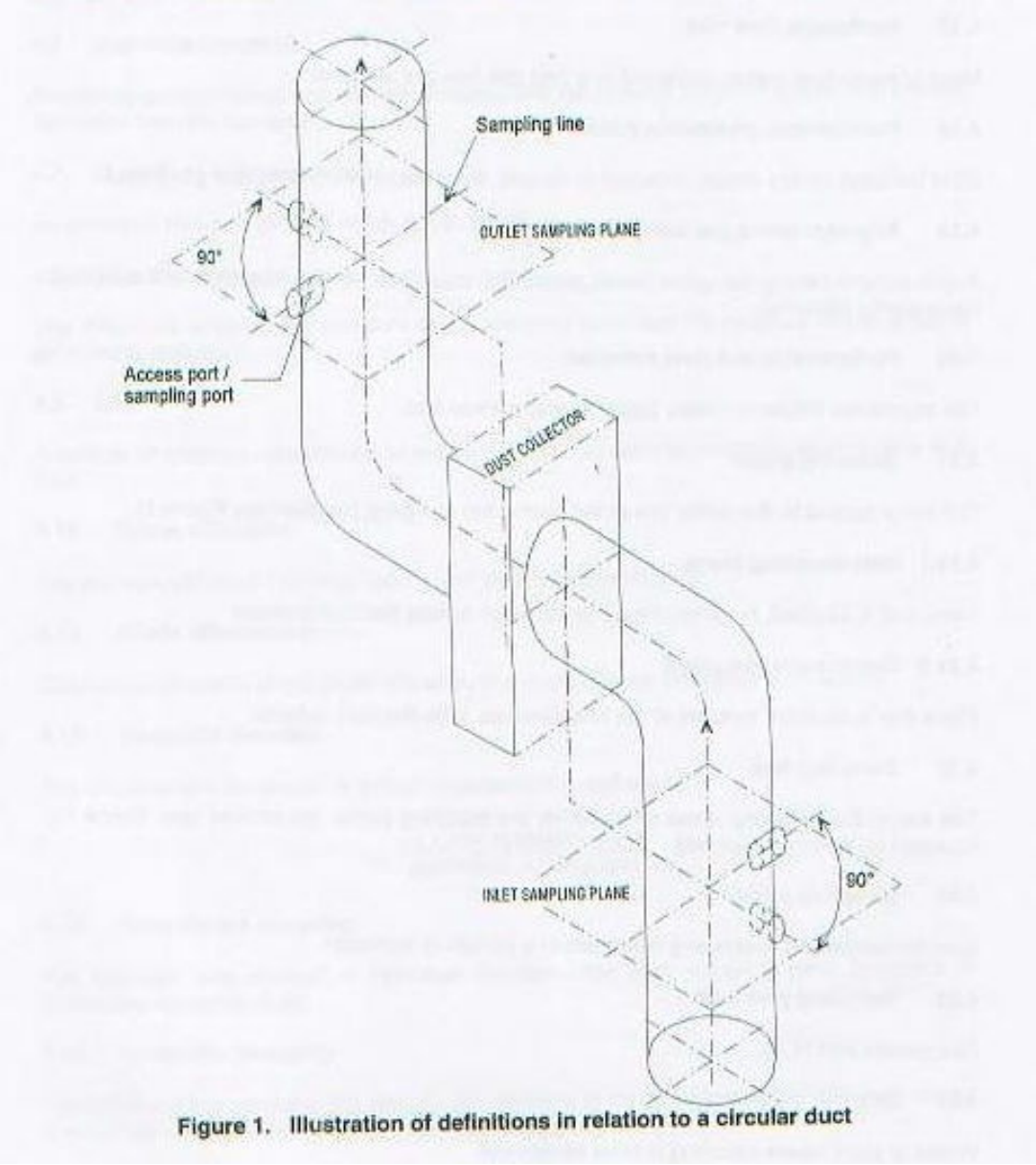


Figure 1. Illustration of definitions in relation to a circular duct

MS 1723:2003

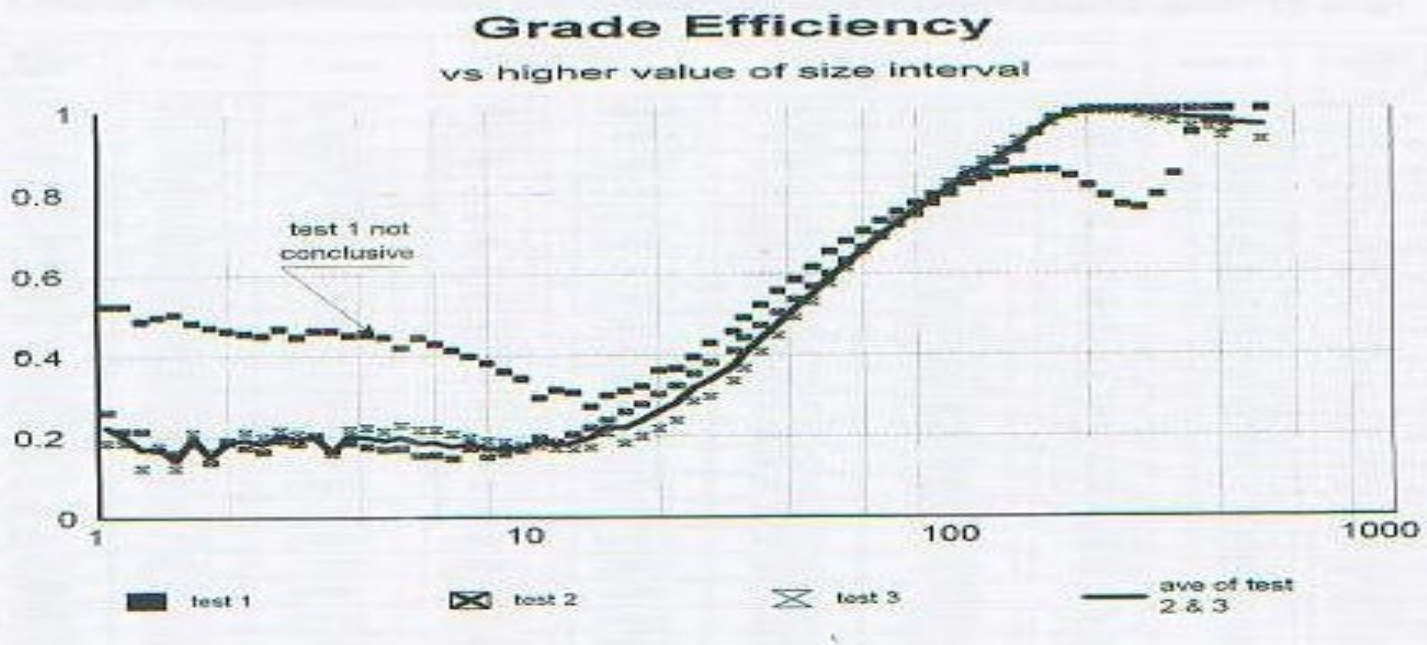
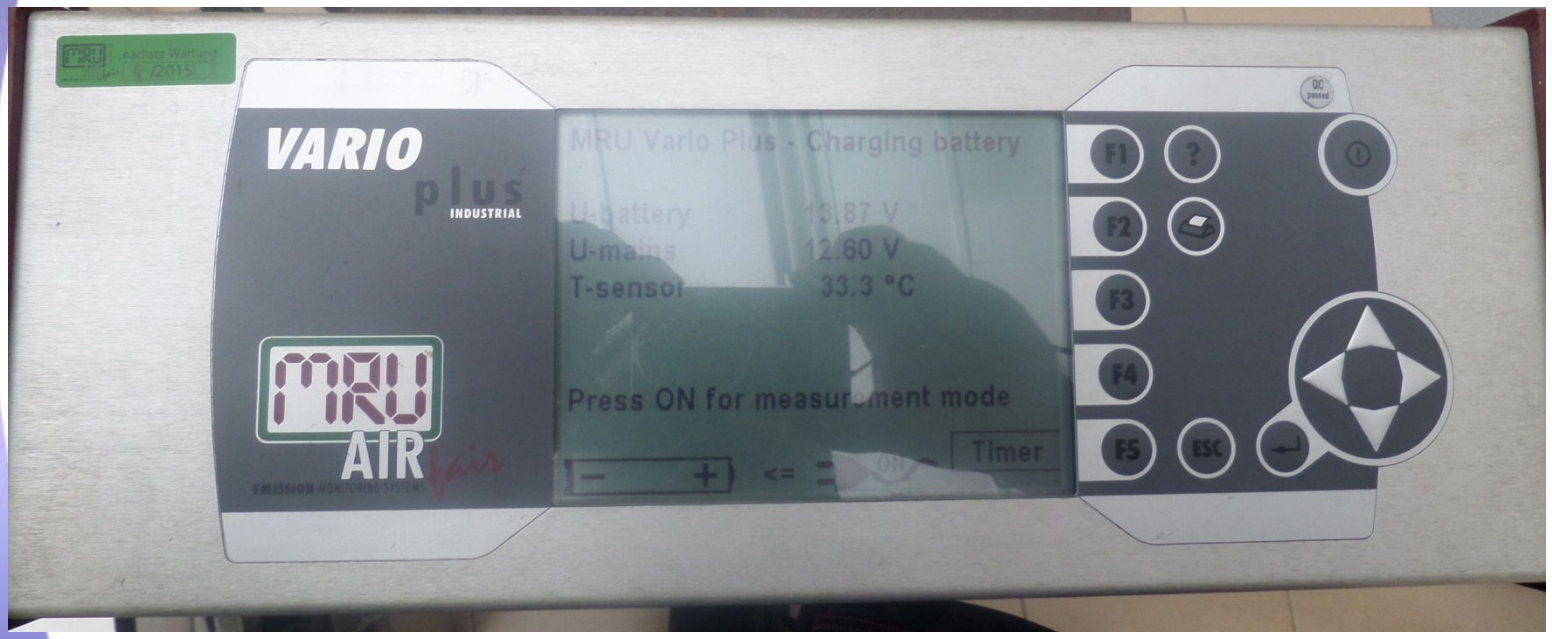


Figure A1. Graph of efficiency per particle size interval using the higher value of the particle size interval

Tests 2 and 3 show similar curves, with only mild differences in the ranges from 10 µm to 50 µm and above 300 µm. Test 1, however, shows a clear difference in the performance of the dust collector. It may indicated some difference in the condition of the dust collector between this and the other two tests. A third test is therefore necessary to conform with the required three representative tests (Clause 12).


07/05/2014


ELAPSED TIME
TEMPERATURE
JENCO THERMOMETER
MODEL 765
DRYER
FILTER
AUX
PROBE
DGM IN
STACK
DGM OUT
PROBE
FILTER
TIMER ON
PUMP ON
POWER ON
NULL ON
ORSAT ON
DURHAM, NC
800-STACKS-5 (782-2575)
C-5000
SOURCE SAMPLER
OPEN
CLOSED
LOOSEN
LEVEL
ORSAT
PUMP
07/05/2014


VARIO
plus
INDUSTRIAL
MRU Vario Plus - Charging battery
U-battery 13.87 V
U-mains 12.60 V
T-sensor 33.3 °C
Press ON for measurement mode
Timer
F1
F2
F3
F4
F5
ESC


07/05/2014


07/05/2014

SOURCE EMMISSION MONITORING

Why Monitoring?

- Process control
- Regulatory compliance
- Air quality modeling
- Develop emission factors
- Performance of pollution control devices

Fundamentals of Gas Laws:

- **Boyle's Law:**

  PV = Constant (at fixed mass and temperature)

- **Charles's Law:**

  V/T = Constant (at constant mass and pressure)

- **Perfect Gas Law:**

$$PV/T = \text{Constant}$$

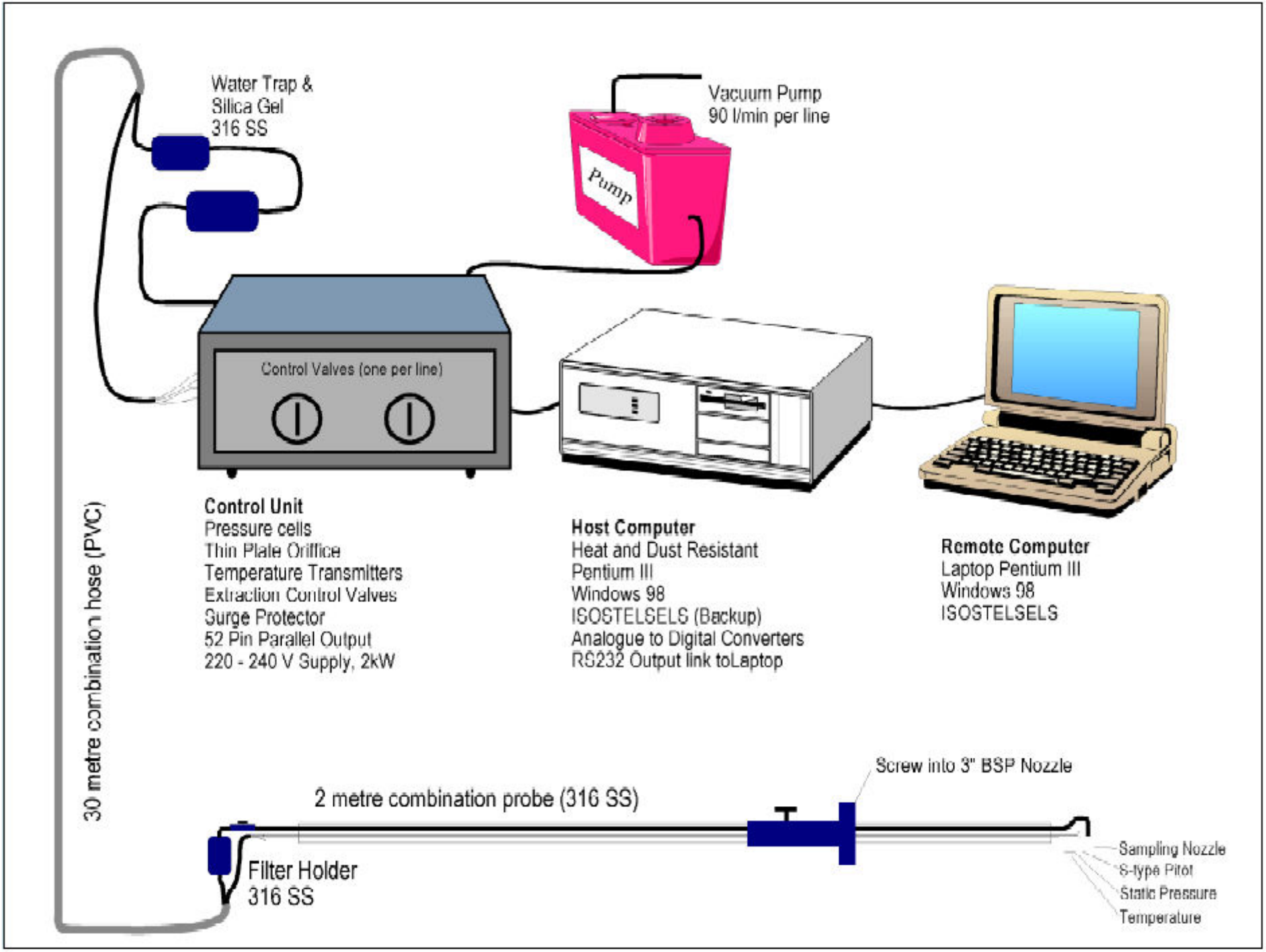
$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

- **Particulate Sampling: Isokinetic Sampling**

WHY?

Units: ppm, mg/Nm^3, µg/m^3

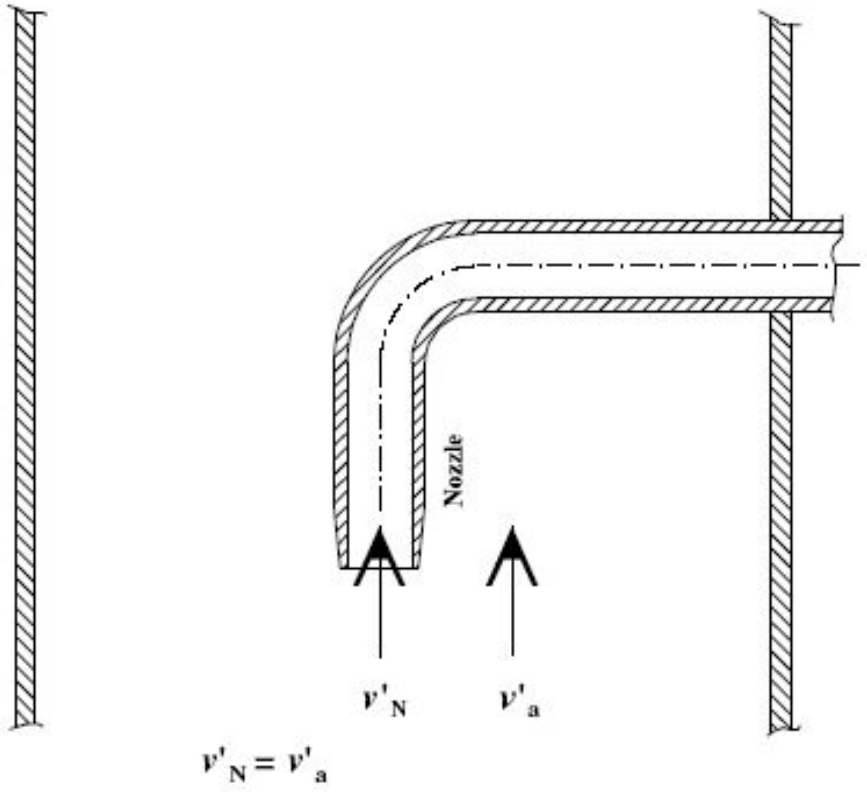
Isokinetic Sampling Equipment


Water Trap &
Silica Gel
316 SS
Vacuum Pump
90 l/min per line
Pump
Control Valves (one per line)
30 metre combination hose (PVC)
Control Unit
Pressure cells
Thin Plate Orifice
Temperature Transmitters
Extraction Control Valves
Surge Protector
52 Pin Parallel Output
220 - 240 V Supply, 2kW
Host Computer
Heat and Dust Resistant
Pentium III
Windows 98
ISOSTELSELS (Backup)
Analogue to Digital Converters
RS232 Output link toLaptop
Remote Computer
Laptop Pentium III
Windows 98
ISOSTELSELS
Screw into 3" BSP Nozzle
2 metre combination probe (316 SS)
Filter Holder
316 SS
Sampling Nozzle
S-type Pitot
Static Pressure
Temperature

Introduction to Isokinetic Sampling

- *'Iso"* means *"equal"*
- *"Kinetic"* means *"movement"*
- Therefore *IsokineticSampling* means sampling at *equalvelocities* ***prevailing*** in the **duct** carrying the gasses

What is Isokinetic Sampling:



Taking a gas sample at prevailing duct velocity

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FUNDAMENTALS OF THE MS1596:2003

- Issued in 2004
- Reference in Malaysia
- Based on ISO9096:1992
- Incorporates ISO10780:1994

Basic Procedure

- Preparation
- LocationIdentification
- Planning
- Set-up
- Test
- ThimbleHandling

Preparation

- Arrival
- Meeting with Plant Representatives
- Discuss the Test
  - Safety considerations
  - Possible influence on operations
  - Plant parameters to be taken
- Plan the operating conditions
  - Measurements should not span over different conditions
  - Synchronize the Test with the operating conditions

Location Identification

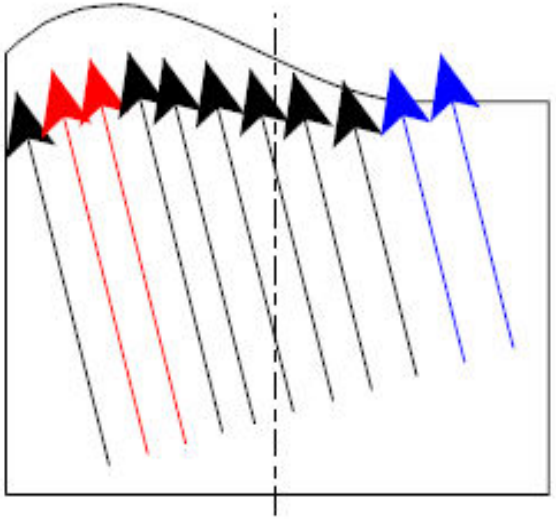
- Stack usually best suited
- 5 d's before, 2 after, except stacks: 5, 5
- Do preliminary velocity profile

LocationIdentification

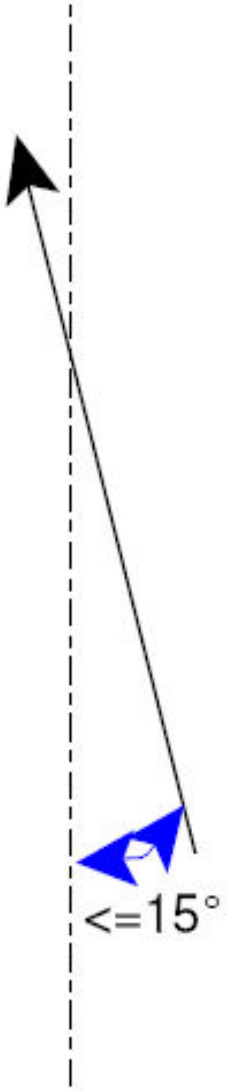
Preliminary Velocity Profile

- angle of gas flow <= 15° to normal,
- no local negative gas flow;
- minimum velocity ≈ 5 Pa
- highest to lowest velocity = 3:1;
- temperature, ±5% from mean, Kelvin

Flow Angle

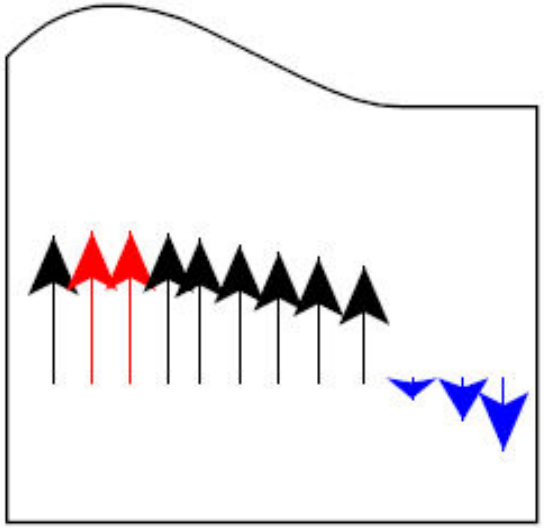


Velocity Profile



Velocity Profile

NoNegativeFlow



Velocity Profile

Minimum Velocity

Representing5Pa

$$v = \sqrt{\frac{dP}{\rho}}, for\ L-type$$

$$v = 0.84\sqrt{\frac{dP}{\rho}}, for\ S-type$$

Example:

For air at 150 °C, 100 kPa

$$v = \sqrt{\frac{5}{0.824}} = 2.46\ m/s$$

$$v = 0.84\sqrt{\frac{5}{0.824}} = 2.07\ m/s$$

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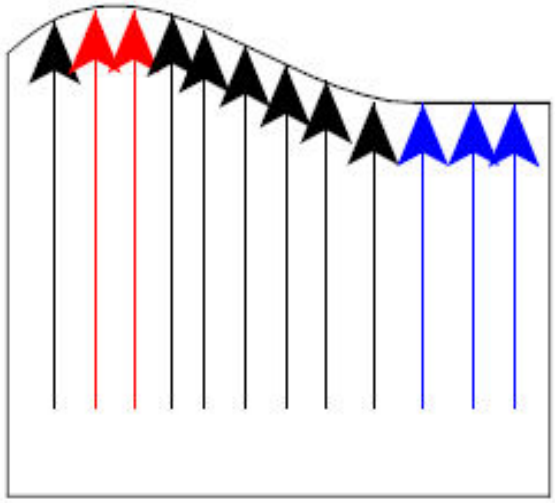
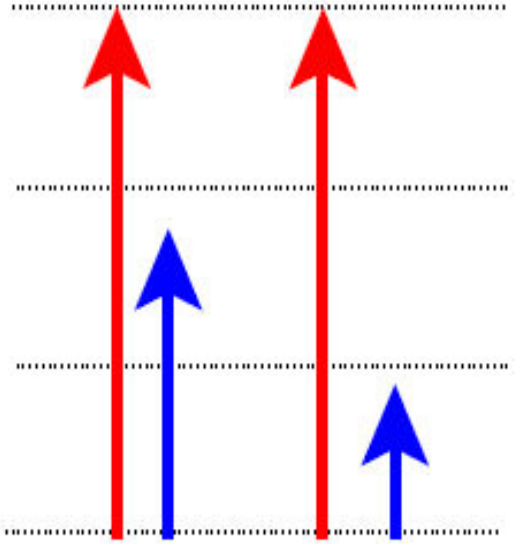
Location Identification

PreliminaryVelocityProfile

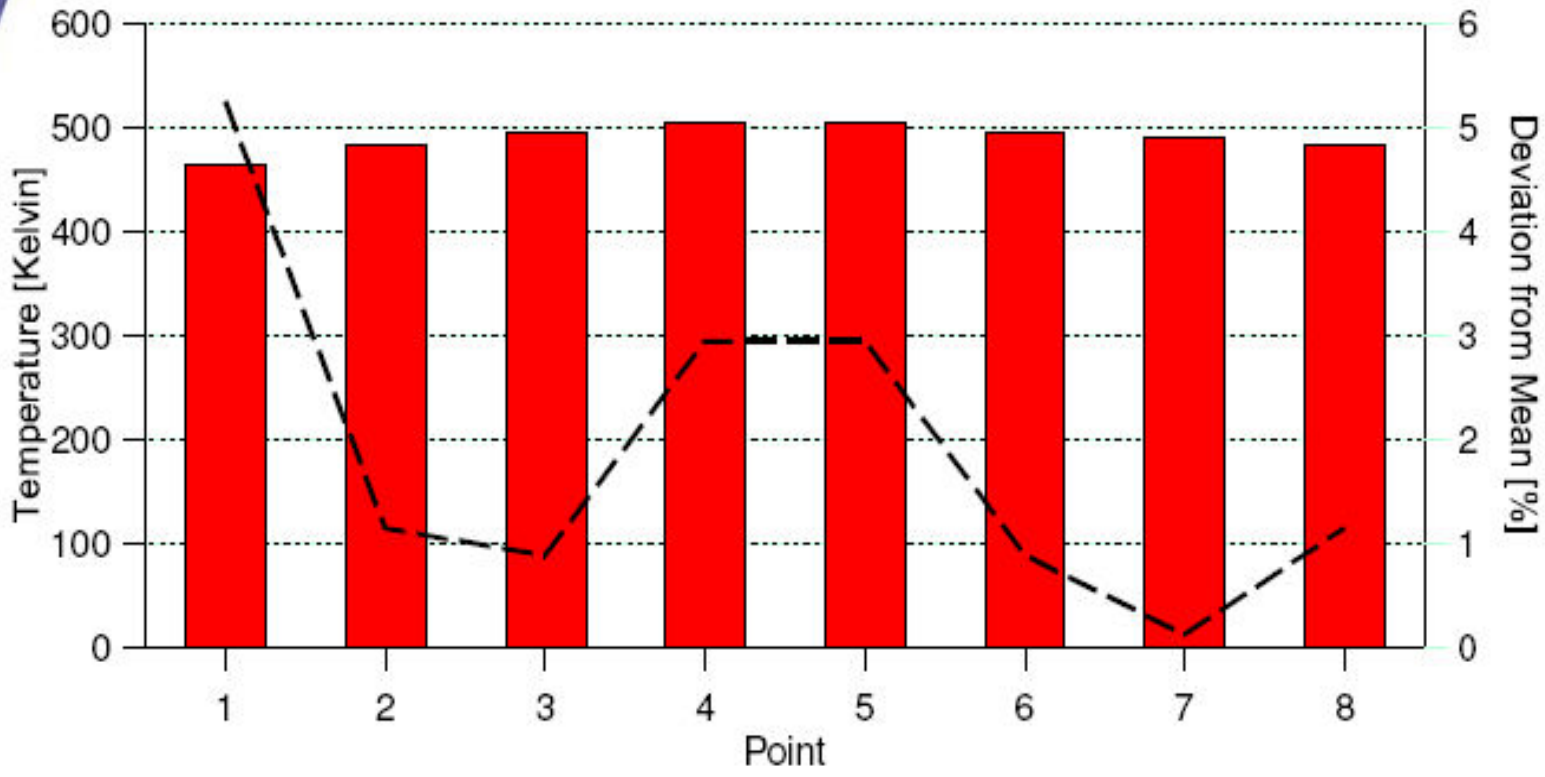


Velocity Profile



Temperature Variation

Not more than 5% [kelvin] from mean value



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Planning

- Based on the preliminary profile, plan the nominal extraction rate, use of heated probes etc.
- Organize manpower based on requirements, such as high temperatures etc.

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Set-Up

- Set up equipment
- Do a leak test

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Test

- Extract the planned sampling volume
- Take the plant parameters
- Monitor the filter, water content etc.
- Finish the test

Thimble Handling

- Take great care with the filter
- Put it in an air-tight container
- Heat up and dessicate in a lab
- Measure the end-weight of the filter and reference

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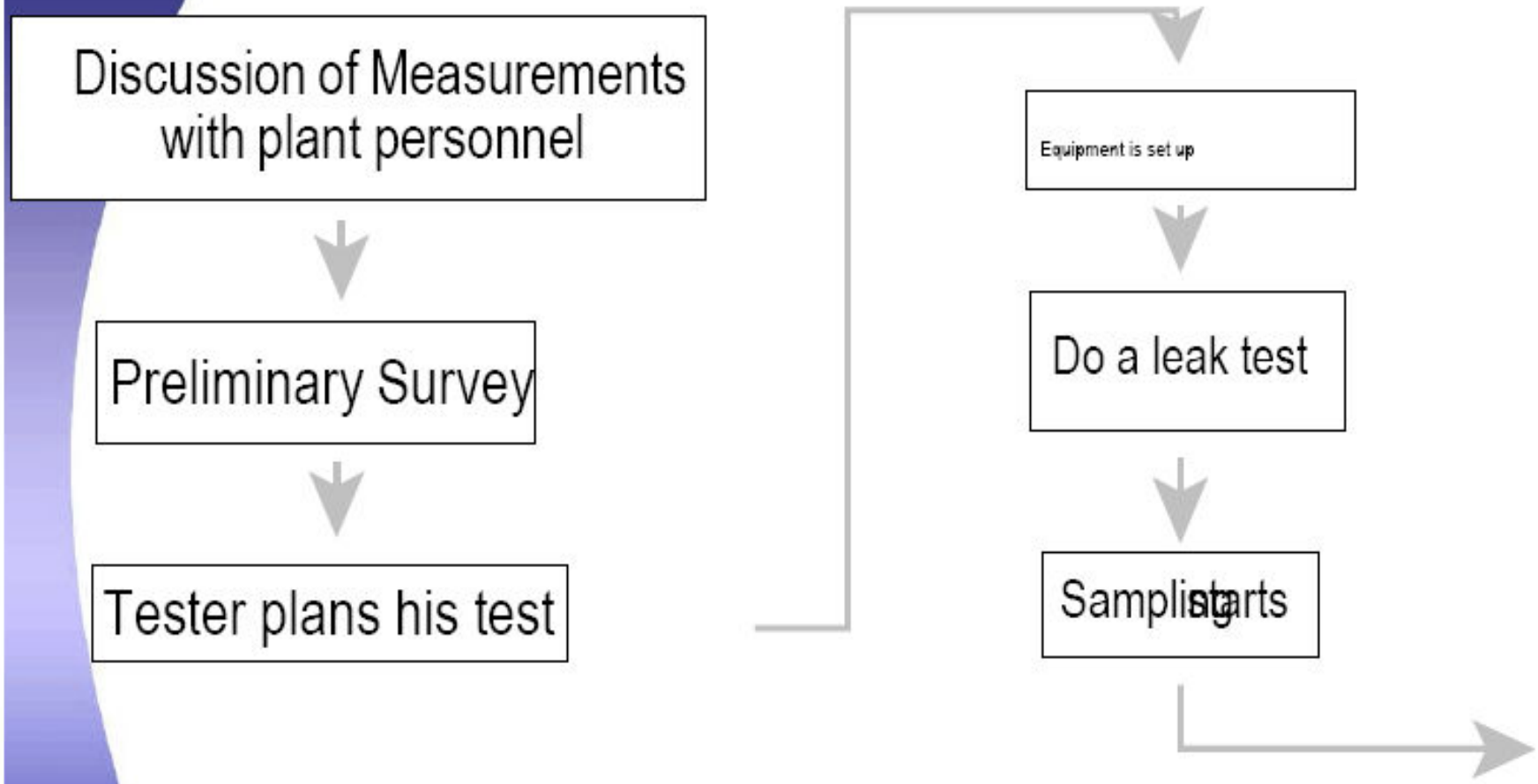
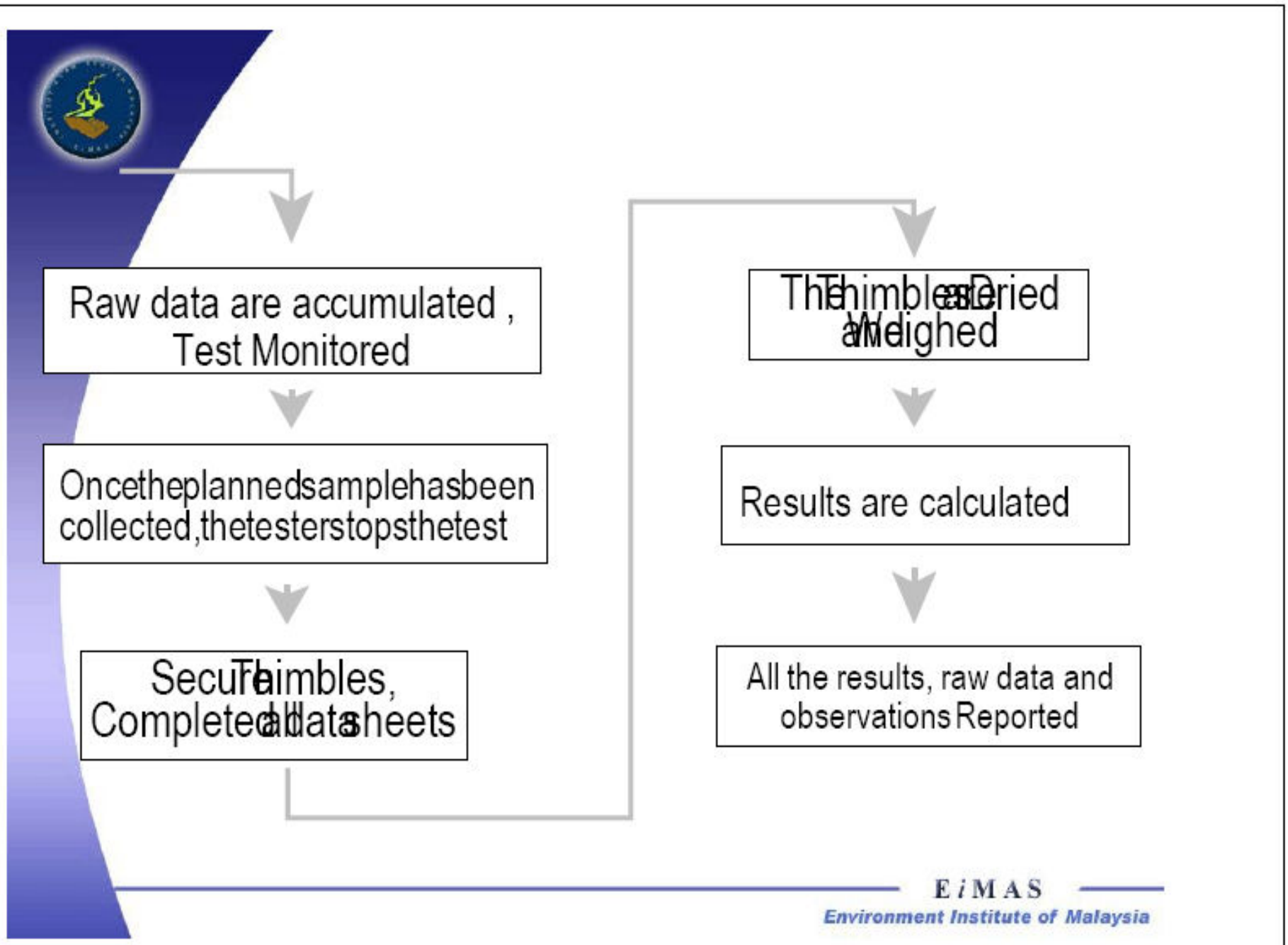
Equipment Requirements

- MS1596:2003 very specific on accuracies
- Various equipment is allowable, including USEPA Method 5 Sampling Trains
- User manual for equipment may not be used as a standard

Summary


Discussion of Measurements with plant personnel
Preliminary Survey
Tester plans his test
Equipment is set up
Do a leak test
Sampling starts


Raw data are accumulated , Test Monitored
Once the planned sample has been collected, the tester stops the test
Secure Thimbles, Completed all data sheets
The thimbles are Dried and Weighed
Results are calculated
All the results, raw data and observations Reported
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Environment Institute of Malaysia

Dust Concentration

$$c = \frac{m}{q_n}$$

Corrected Dust Concentration

$$c_{corrected} = c_{measured} \times \frac{CO_{2\ reference}}{CO_{2\ test\ average}}$$

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Thimble Correction

After baking, conditioning and weighing of thimble

Correct the empty weight of the thimble:

$$\text{thimbleweight}_{(new)} = \frac{\text{referenceweight}_{(new)}}{\text{referenceweight}_{(initial)}} \times \text{thimbleweight}_{(initial)}$$

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Reporting Requirements

- All that is necessary
- Only what is necessary

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Sample Report

- Palm Oil Boiler
- Note that the report will have different parameters for other emission sources

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Environment Institute of Malaysia

Front Page

- Title
  - Source Description
  - Date

EiMAS
Environment Institute of Malaysia

Title Page

- Source
  - Identification (type, chimney number)
  - Company Name
  - Address
  - Witness
- Tester
  - Company
  - Personnel
- Date
- Report Reference
  - Reference Number
  - Authorization

Executive Summary

Optional

- Contain all relevant source information, results and conclusion

Contents

- Very important for longer reports

Purpose

- The purpose of the test needs to be stated clearly and precise
  - Better to think a bit more and write a bit less

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Methodology

- General Description
- State the reference standard that was followed
- Equipment Specification
  - Equipment Model
  - Brief description
  - Standard it complies to (Must be compatible with MS1596:2003)

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Sample Calculation

- May be put in Appendix / Annexure
- Must use actual values from report
- Show all calculations, but only one of each

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Data of Stationary Source

- Brief Description of Source
- Identify Fixed Parameters
- Identify Variable Parameters
- Show sampling platform and points positions

Results

- Process Conditions
- Sampling Gas Conditions
- Dust Sample (Thimble before and after weights)
- Summary

Environment Institute of Malaysia

Discussions of Results

- Only discuss actual results that is shown in the report
- No opinions, focus on the results itself (high, low, plant parameters)

Conclusions

- Conclusions must follow from the discussion of results

Raw Data, Signatures

- Raw data is required for auditing processes
- Raw data only valid if plant representative and tester have signed for it

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Gravimetrical Analysis Report

- A laboratory report showing the before and after weights of the thimbles and reference thimble is required for auditing purposes

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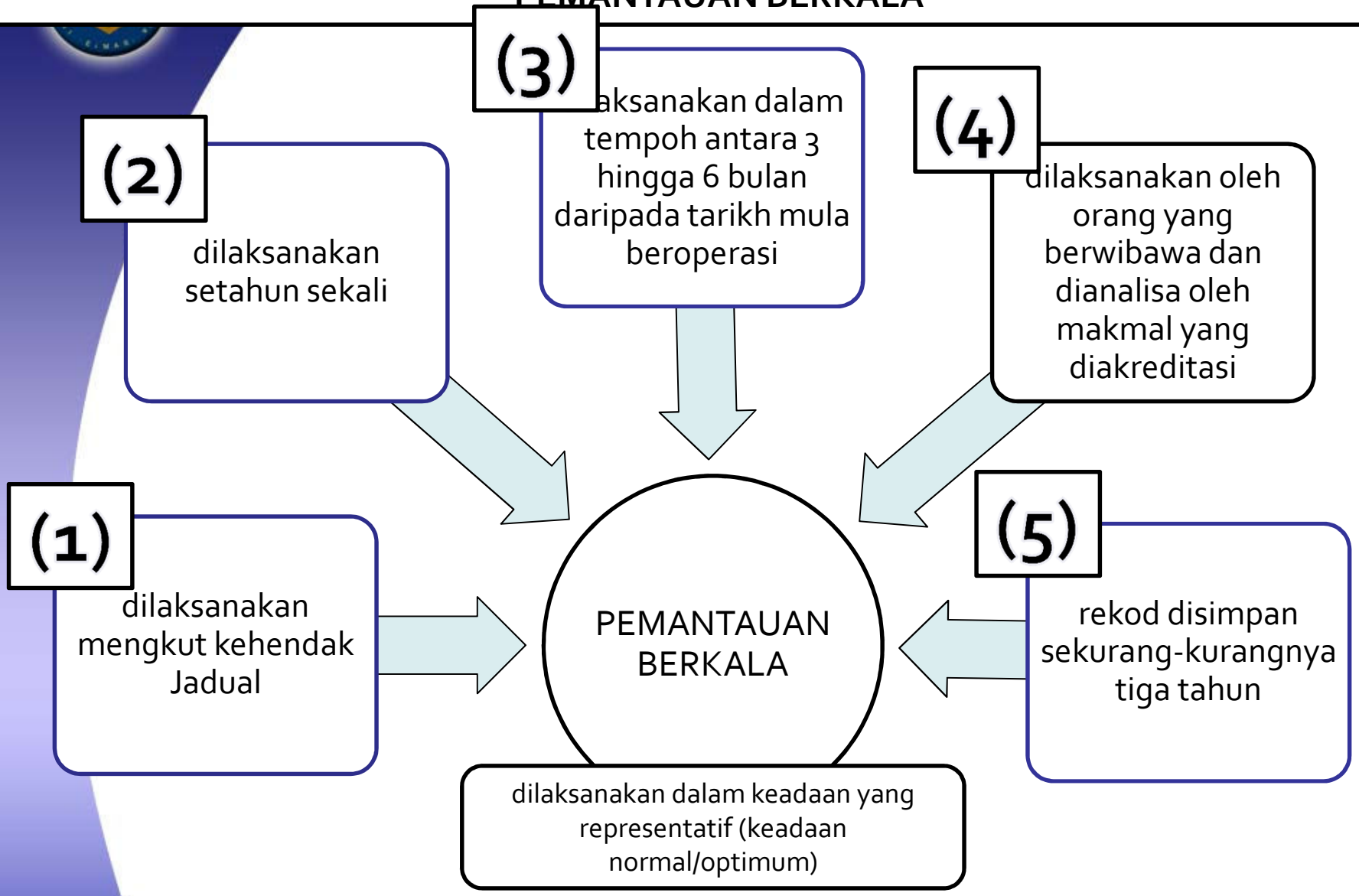
PERATURAN 16
PEMANTAUAN BERKALA



CEMS

PERATURAN 17
PEMANTAUAN PENGELUARAN SECARA BERTERUSAN

(3) Bagi pemantauan pengeluaran secara berterusan, nilai batas adalah dipatuhi jika penilaian keputusan bagi tempoh pengendalian dalam satu tahun mana-mana kalendar menunjukkan bahawa tiada purata harian yang melebihi standard pengeluaran, dan tiada purata bagi setengah jam yang melebihi standard pengeluaran lebih daripada dua kali

PATUH - tiada purata harian melebihi standard pengeluaran, dan
- tiada purata setengah jam melebihi dua kali ganda standard pengeluaran

PEMATUHAN PELEPASAN PENGUKURAN BERTERUSAN

Premis perlu patuh : 50 mg/m^3

KES	KEPUTUSAN		PEMATUHAN
	PURATA HARIAN (mg/m^3)	PURATA SETENGAH JAM (mg/m^3)	
PERTAMA	40	40	PATUH
KEDUA	40	70	PATUH
KETIGA	40	130	TIDAK PATUH
KEEMPAT	65	80	TIDAK PATUH
KELIMA	65	130	TIDAK PATUH

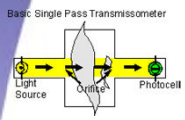
PERATURAN 17
PEMANTAUAN PENGELUARAN SECARA BERTERUSAN

(4) nilai min harian yang berkaitan dengan waktu operasi harian hendaklah diperoleh daripada nilai min bagi setengah jam

TEMPOH	JUMLAH BACAAN	JUMLAH BACAAN YANG BOLEH DITERIMA
1 minit	60	≥ 45 (75%)
30 minit	30	≥ 22 (75%)
24 jam	48	48

Semua industri termasuk KKS yang memasang alat pembakaran bahanapi yang menggunakan bahanapi pepejal dan melepaskan jumlah partikulat terampai melebihi 2.5 kg/jam perlu menjalankan **pengawasan secara berterusan**

Surat Arahan Pejabat Berkaitan PUB 2014



Arahan Pejabat Bil 20/2014 bertarikh 5 Dis 2014
Pelaksanaan Penguatkuasaan PUB 2014

SOP

Jawatankuasa Khas Untuk Kelulusan CEMS dan PEMS (Predictive emission monitoring system)

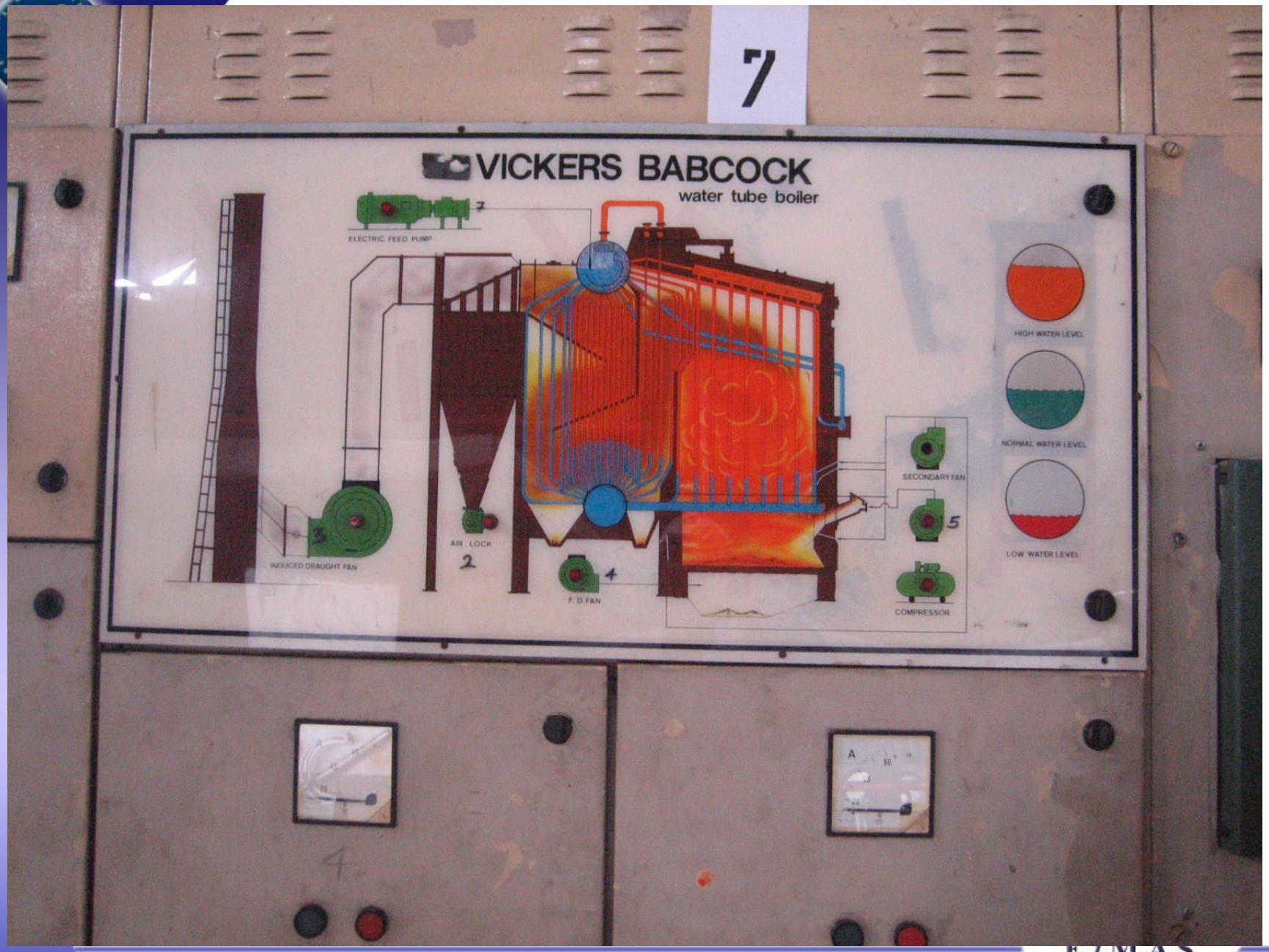
- Pengerusi TKPP
- Ahli dari Bahagian Udara, Penguatkuasaan, Bahagian Teknologi Maklumat, Bahagian Penilaian
- EiMAS – input teknikal

Peranan Jawatankuasa

- Menilai kelulusan CEMS dan PEMS yang dicadangkan oleh pihak vendor
- Menilai cadangan vendor yang menyediakan perkhidmatan data interface system (DIS)
- Menyedia dokumen panduan menilai kesesuaian CEMS
- Menyedia dokumen panduan menilai PEMS
- Bagi kes diteliti melebihi had PUB 2014, perlu memasang APCS

Sambungan ..

- Bagi kelulusan PEMS, RATA (Relative accuracy test audit), RAA (Relative accuracy audit) memerlukan prosedur dijalankan seperti 40CFR Part 60, 40 CFR Part 75, Sub Part E, Part 75, PS 16 dimana yand berkenaan
- Bagi pemasangan CEMS perlu menilai kesesuaian alat, software dan kepeluan untuk dikalibrasi mengkut keperluan PS16, Annual survaillance test (AST)
- Garispanduan CEMS dikemaskini mengikut kehendak PUB 2014

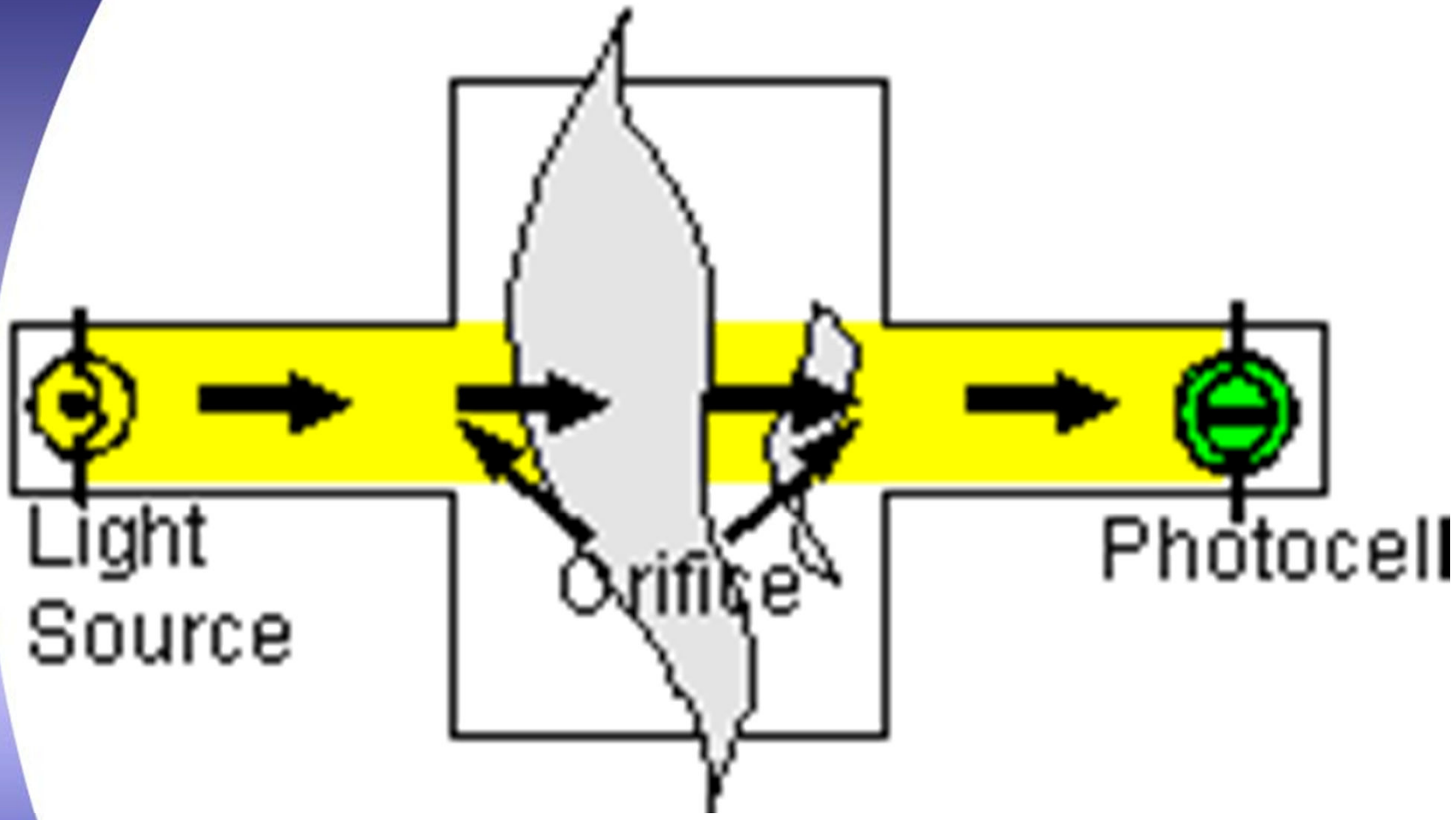

7
VICKERS BABCOCK
water tube boiler
ELECTRIC FEED PUMP
INDUCED DRAUGHT FAN
AIR LOCK
F.D.FAN
SECONDARY FAN
COMPRESSOR
HIGH WATER LEVEL
NORMAL WATER LEVEL
LOW WATER LEVEL


NORMAL MUTE ALARM
NORMAL MUTE ALARM
Honeywell
Honeywell

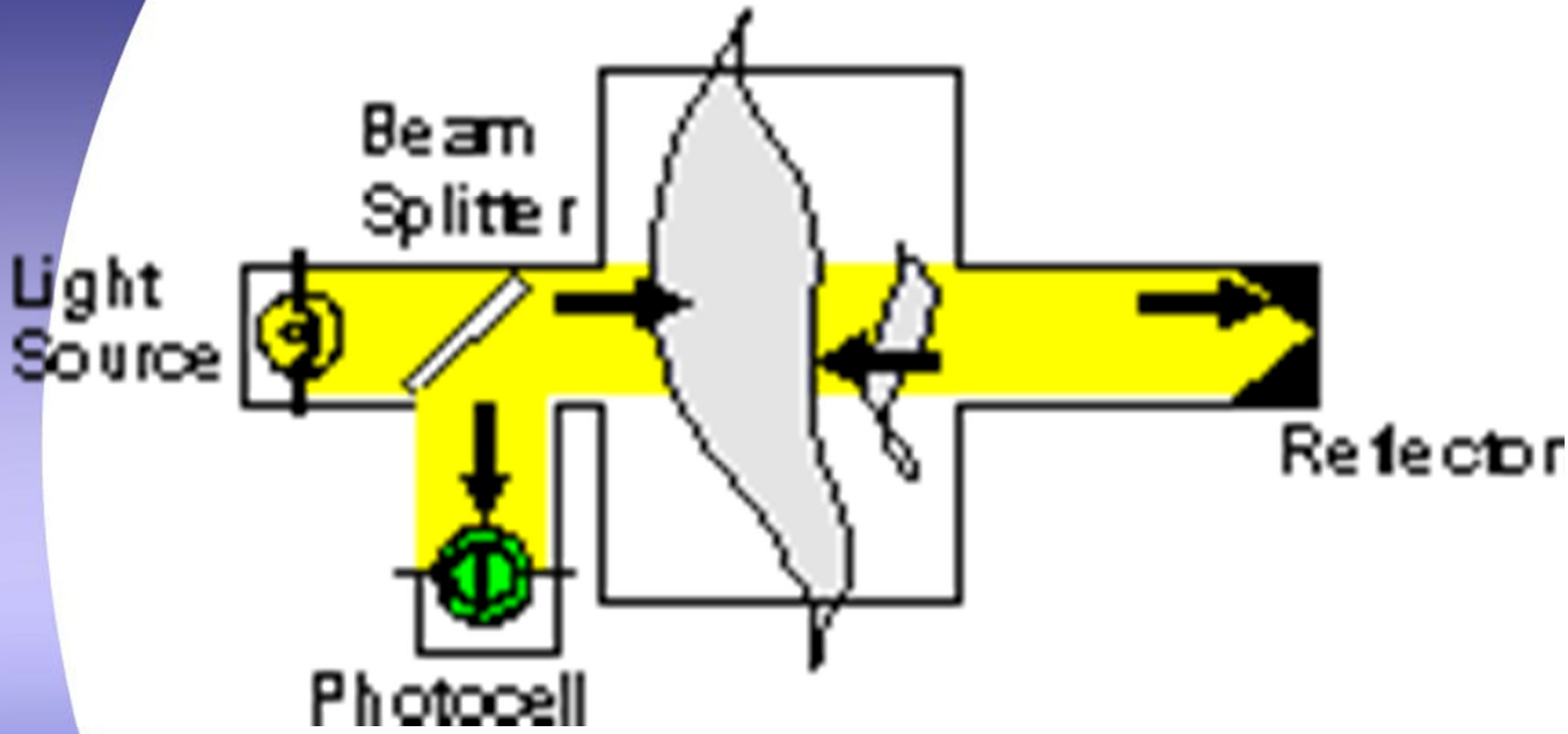

Honeywell


NORMAL MUTE ALARM

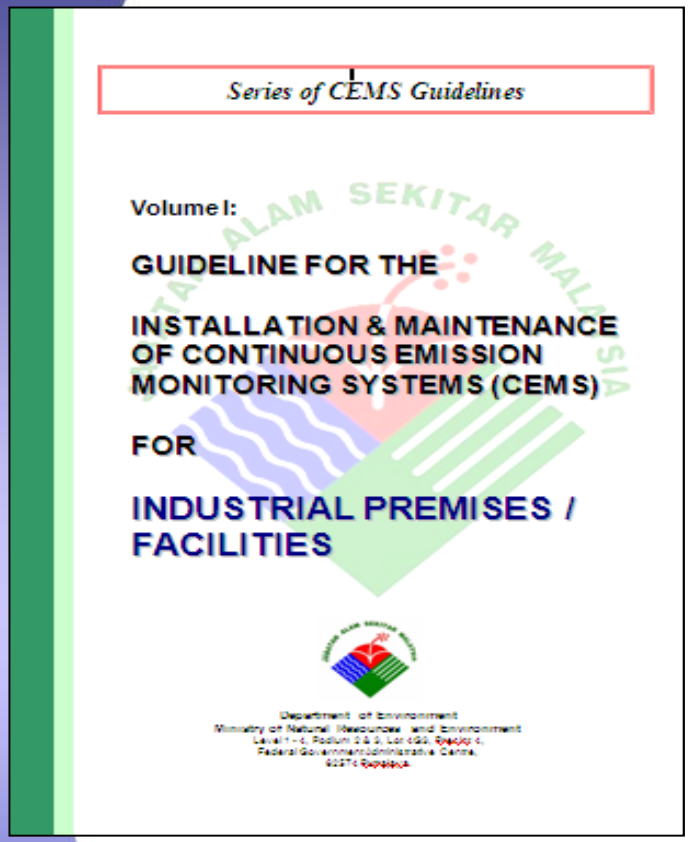
Basic Single Pass Transmissometer

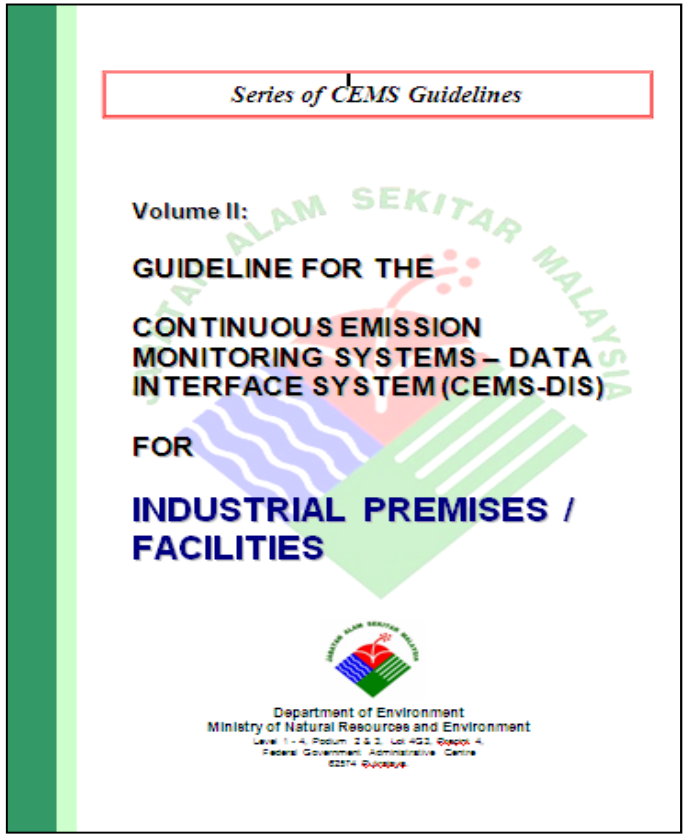


Basic Double Pass Transmissometer

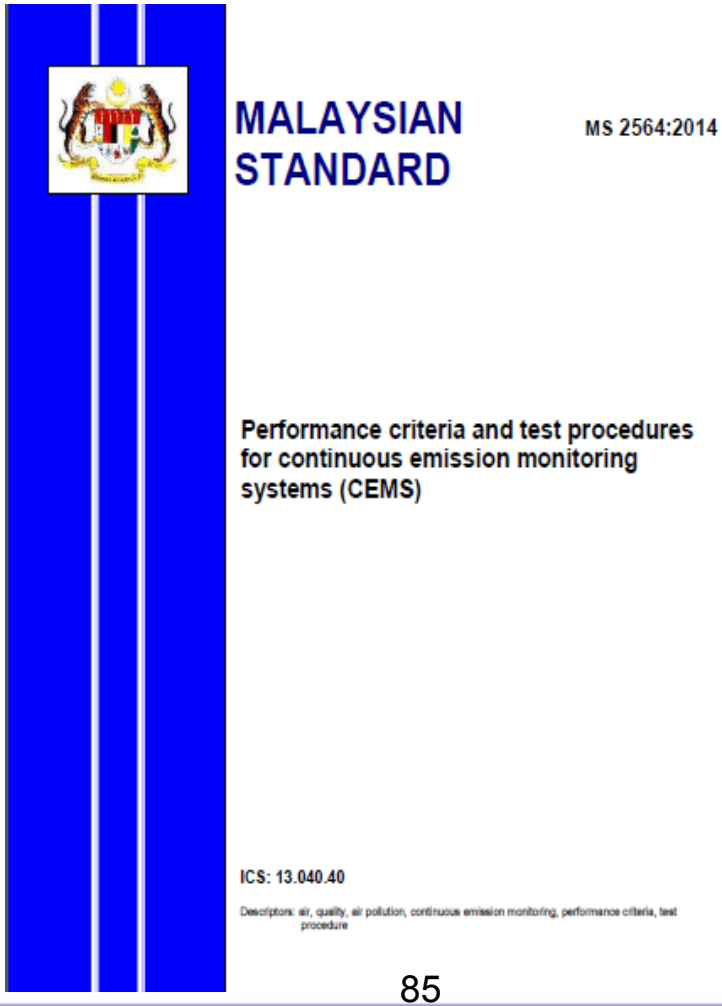


TWO GUIDELINES FOR INDUSTRIES ISSUED BY DOE





Malaysian Standard Issued by Department of Standards Malaysia



MALAYSIAN STANDARD

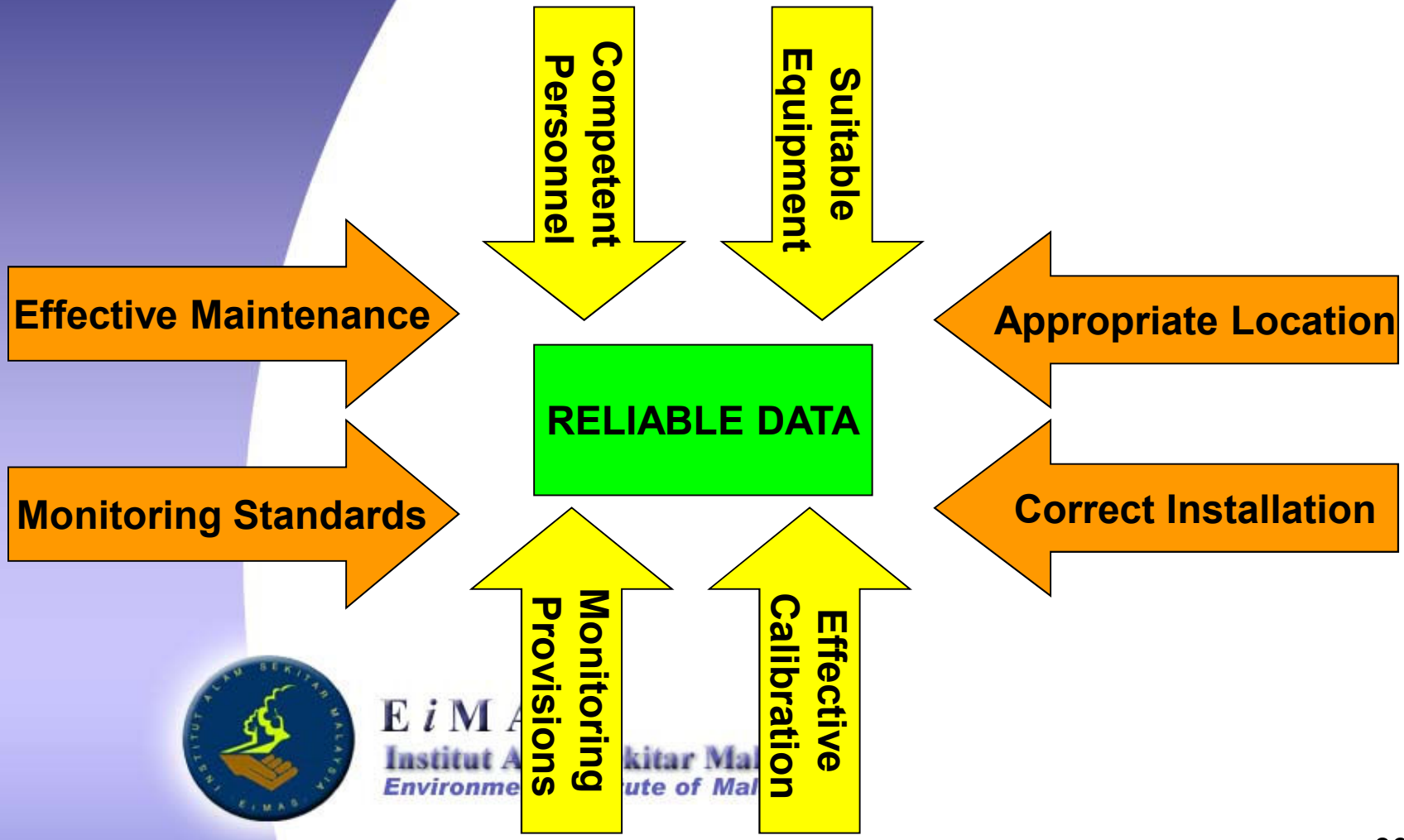
MS 2564:2014

Performance criteria and test procedures for continuous emission monitoring systems (CEMS)

ICS: 13.040.40

Descriptors: air, quality, air pollution, continuous emission monitoring, performance criteria, test procedure

How to get reliable emissions data ?



Typical problems found with CEMs on site

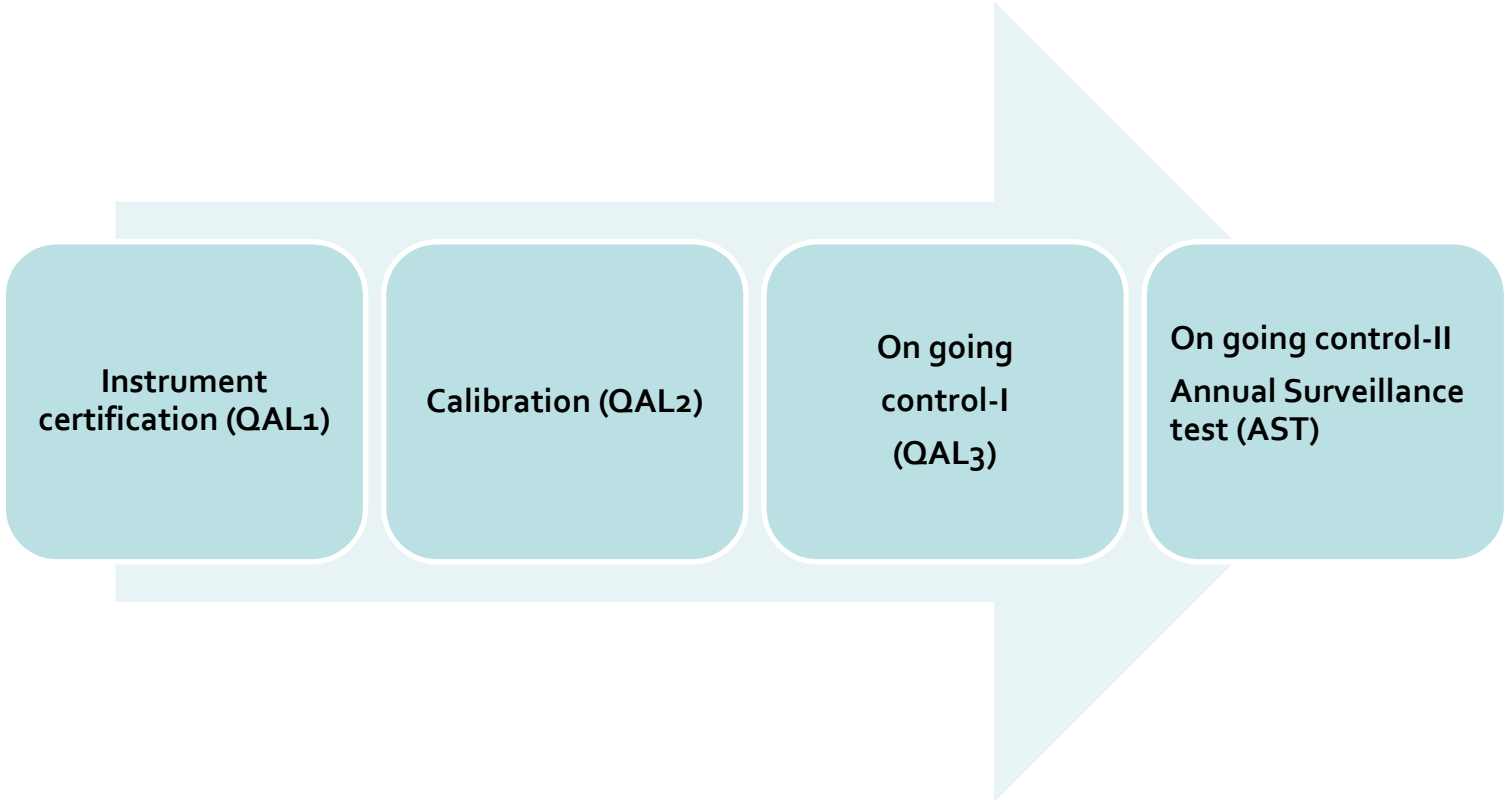
- Wrong CEM for the application
- No CEM maintenance
- Contamination of optics/ misalignment
- Sample system not working (blocked, moisture)
- Operator not aware of zero and span alarms
- Outdated or invalid calibrations
- Inappropriate reference materials (out of date gas)
- No record keeping

OUR NEW FOCUS

To ensure:

1. Only approved CEMS is installed
2. CEMS is installed and calibrated according to specifications
3. CEMS is maintained (QA/QC) according to specifications
4. CEMS is audited (AST)
5. Constantly review CEMS data sent to DOE and take appropriate enforcement action

3 LEVELS TO ENSURE QUALITY
(Quality Assurance Level-QAL)



QAL1-
QA & QC at manufacturing stage

Type approval Scheme

- MCERTS
- TUV
- USEPA
- Other approved certification scheme

Minimum suitability criteria

- Instrument field trials on a similar process (e.g. boiler, incinerator)
- Instrument field trials on a similar gas sampling and conditioning system
- Certified range must be less than 2.5 (combustion process), 1.5 (incinerator) times the daily average ELV
- Physical measurement range sufficient to include the highest concentration that may occur during operation
- Certificate includes uncertainty information required for QAL3

QA & QC at Installation stage

- **Check for Functionality and verify Performance**

Typical functionality and performance Checks

- Leak test
- Response time
- Linearity
- Interference
- Zero and span drift
- Comparison with a standard reference method (SRM)

After installation, QAL2 is required if:

- CEMS undergoes repair that invalidates the calibration
- Major change in processes or fuel change
- QAL3 or AST shows a new calibration is required

QAL2- establishing calibration curve

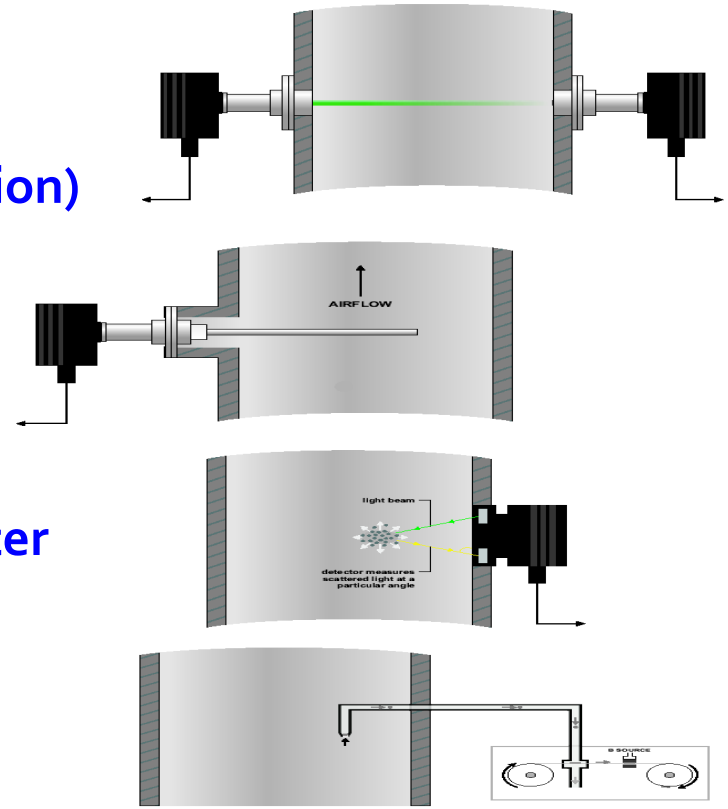
- Procedure described in EN 14181
- Need to have a good spread of data to provide a reliable calibration function
- Reference materials to be used; may not be available for particulate monitoring (use optical filters or attenuators)
- Generally $R^2 > 0.9$ accepted

QA & QC during operational stage- QAL 3

- Zero and span Check carried out periodically (e.g. once in 24 hr)
- If drift out of control, QAL2 required
- AST: yearly check that calibration still valid

Continuous Dust (Particulate) CEMs for monitoring in mg/m^3

- In-situ measurement (in the stack)
  - Optical
    - Extinction
    - Dynamic Opacity (Scintillation)
  - Probe electrification
    - Triboelectric (DC)
    - Electrodynamic
  - Light scatter
    - Back/side/forward scatter
- Extractive for wet stacks
  - BETA absorption
  - Light scatter



A range of particulate monitors

Industries/ applications	Process conditions	Typical solution	Comments
Incinerators	0-10mg/m^3 (bagfilters after dry scrubbing)	Light scatter Electrodynamic	Cost effective solution for highly abated processes (below 1mg/m^3)
Cremators	0 –100mg/m^3	Extinction Electrodynamic	Probe can operate at up to 1000'C BImSchV 27 available
Cement kilns	0-10mg/m^3 (for incin). 0-50mg/m^3 (other)	Opacity/ dynamic Opacity Light scatter	Plant networked solution extends to mill applications
Coal fired power plant	0- 50mg/m3 0- 150mg/m3 (developing world)	Extinction Dynamic Opacity	Real alternative to Opacity where contamination and maintenance are issues US EPA compliant Opacity to be introduced in 2005
Pulp and Paper	0- 50mg/m^3 High humidity	Electrodynamic	Insulated electrodynamic probe allows instrument to discriminate between water vapour and particulate
Refineries	0- 50mg/m^3 (EX gas zone)	Extinction Electrodynamic	Category 1 device approved according to ATEX

Gas CEMs : physical configuration

- Extractive- Cold (rarely used)
  - Hot/Wet (heated lines)
  - Dilution
  - Drying system - Chillers
  - Permeation
- In-Situ
  - Folded Beam
  - Cross Duct

Issues related to Extractive Measurement

- In specifying a sampling system it is critical to understand
  - Water vapour content of flue gas
  - Dew Point
  - Stack Temperature
  - Gases to be measured which are absorbed by water (e.g. SO_2)
  - Gases which require special sampling materials (e.g. HCL, NH_3, Hg)
- Sampling system must be designed to keep sample gas above dew point at all times and not to become blocked with particulate

Suitability for application

Technique	Type	Gases Measured	Comments
Chemiluminescence	Extractive	NO, NO_X, NO_2 *	*NO2 calculated (NO_X – NO)
UV Fluorescence	Extractive	SO_2 (H_2S, TRS)	Gases in brackets can also be measured but not simultaneously
IR Gas Filter Correlation	Extractive Insitu envelope folded beam	CO, CO_2, NO_X, SO_2, N_2O	Multiple gases can be monitored, Typically 2 to 5
Fourier Transform Infra-red (FTIR)	Extractive / Path	CO, CO_2, SO_2, NO_X, HCL, HF etc.	Multiple gases can be monitored, typically 5+
Differential optical absorption spectroscopy (DOAS)	Path	CO, CO_2, SO_2, HCL, HF, NO, NO_2, NH_3, VOCs, H_2O	Multiple gases can be monitored, typically 5+ NO2 measured directly. Additional gases can be added at relatively low cost.
Flame Ionization Detector (FID)	Extractive	Total HC	Requires hydrogen carrier gas.
Tunable Laser Diode (TLD)	Path	HCL, HF, NH_3, CH_4, CO, CO_2, H_2O	Cost effective for single component applications.
Zirconia oxide cell	In-situ	O_2	Widely used, max temp generally 500oC
Paramagnetic	Extractive	O_2	
Photo acoustic spectroscopy (PAS)	Extractive	CO, CO_2, SO_2, HCL, HF, NO, NO_2, NH_3, VOCs, H_2O	Can measure virtually any gas that absorbs IR. Detailed analysis of other compounds that may be present other than target gases required.

CONCLUSION

- New approach of managing air pollutant from stationary sources by utilizing performance monitoring and applying CEMS
- CEMS need proper maintenance and QA/QC
- MS 2564:2014 on performance criteria and test procedure for CEMS as a tool for industries in meeting requirements as set by the department