PERFORMANCE MONITORING SKPU

1

OBJEKTIF PEMBELAJARAN

- Mengenalpasti Keperluan Perundangan Kepada Performance Monitoring (Pemantauan Prestasi);
- Mengenalpasti Lokasi - Lokasi Performance Monitoring;
- Mengenalpasti Alat - Alat Performance Monitoring;
- Mengenalpasti Parameter - Parameter Performance Monitoring;
- Rekod Performance Monitoring, Penyelenggaraan & Corrective Action.

Legal Requirement of Performance Monitoring

Mengenalpasti Keperluan Perundangan Kepada Performance Monitoring (Pemantauan Prestasi)

WHAT IS PERFORMANCE MONITORING ?

Proactive & preventive monitoring of certain parameters to provide a diagnostic **indication** to ensure that each component of air pollution control equipment are operating optimally

Objectives of Performance Monitoring :

- **As a Health check of APCS**
  Sebagai indikator prestasi SKPU
- **Ensure smooth operation of APCS**
  Memastikan kelancaran operasi SKPU
- **Ensure uninterrupted production**
  Memastikan pengeluaran tidak terganggu
- **Avoid unnecessary plant shutdown**
  Mengelakkan penutupan kilang yang tidak perlu
- **Form an integral part of Preventive maintenance**
  Membentuk bahagian penting dalam pencegahan penyelenggaraan
- **Detect early onset of deteriorating performance of APCS**
  Mengesan permulaan awal kemerosotan prestasi SKPU
- **Specify action level at which corrective actions is required to be initiated**
  Menentukan tahap tindakan di mana tindakan pembetulan perlu dimulakan
- **Compliance to DOE Legal Requirement**
  Pematuhan kepada keperluan undang-undang JAS
- **Avoid costly enforcement penalty**
  Mengelakkan kos penalti bagi penguatkuasaan

Is Performance Monitoring of Air Pollution Control System (APCS) Required under the Law ?

Adakah Pemantauan Prestasi Sistem Kawalan Pencemaran Udara (SKPU) diperlukan di bawah undang-undang ?

DOE Peraturan Udara Bersih (PUB) 2014

Regulation 7 : Air Pollution Control System APCS

(Peraturan 7 : Sistem kawalan pencemaran udara)

- Every premise shall be equipped with **Air Pollution Control System (APCS)**
  (Tiap-tiap premis hendaklah dilengkapkan dengan SKPU)
- APCS shall be designed and constructed by a **professional engineer**
  *(SKPU hendaklah direka dan dibina oleh **jurutera professional**)*
- APCS should be supervised by a **competent person** who shall be on duty **at all times** during operation hours
  *(SKPU hendaklah diselia oleh **orang yang berwibawa** yang perlu bertugas di **sepanjang masa ketika SKPU beroperasi**.)*

DOE Peraturan Udara Bersih (PUB) 2014

Regulation 9 : Performance monitoring of APCS

(Peraturan 9 : Pemantauan prestasi SKPU

An owner or occupier of a premises shall –

Pemunya atau penduduk premis hendaklah—

a) *equip the premises with **relevant facilities, equipment or instruments** to **conduct performance monitoring** of the air pollution control system;*

melengkapkan premis dengan **kemudahan**, **kelengkapan** atau **peralatan** yang berkaitan bagi menjalankan pemantauan prestasi SKPU; dan

DOE Peraturan Udara Bersih (PUB) 2014

Regulation 9 : Performance monitoring of APCS

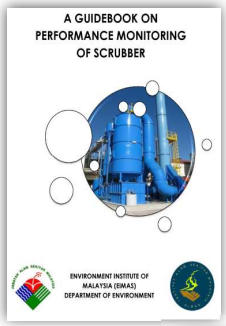
(Peraturan 9 : Pemantauan prestasi SKPU

An owner or occupier of a premises shall –

Pemunya atau penduduk premis hendaklah—

b) **conduct performance monitoring** of the components of the APCS **as determined by the Director General.**

menjalankan pemantauan prestasi bagi komponen SKPU sebagaimana yang ditentukan oleh Ketua Pengarah.

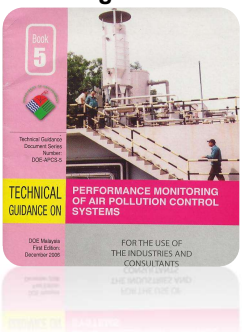


Supervised by competent operator

Stage III (Operation stage) -Proper operation, preventive, performance monitoring)

Maintenance of record

Emission monitoring



DOE Clean Air Regulations 2014

Regulation 10 : Maintenance of Records

1)An owner or occupier of a premises shall **maintain records of manufacturing processes**, and of **maintenance and performance monitoring** of the air pollution control system as determined by the Director General.

2)The records shall kept for at least **three years** and shall be made available for inspection by the Director General or any officer duly authorizes in writing by him.

Competency Course conducted by EiMAS :

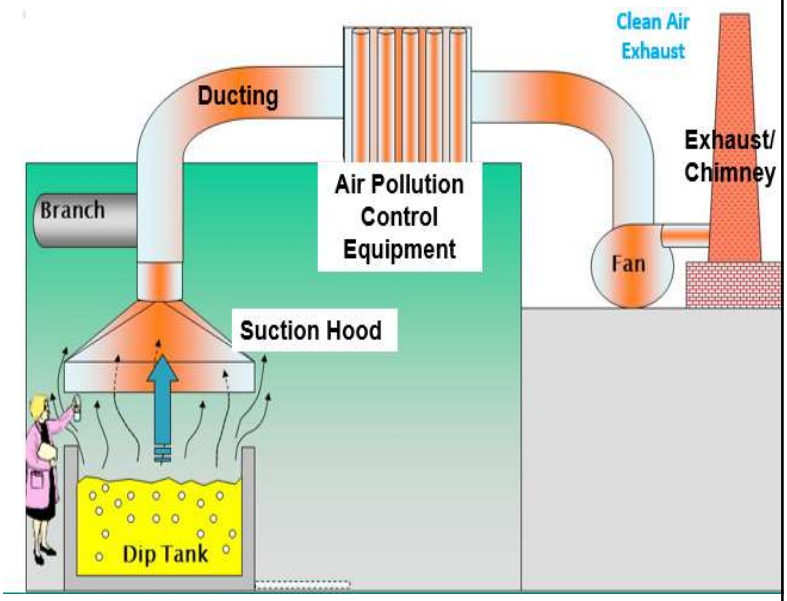
(i) Course on Certified Environmental Professional In Bag Filter Inspection (CePBFI)

(ii) Course on Certified Environmental Professional In Scrubber Inspection (CePSI)

Task :

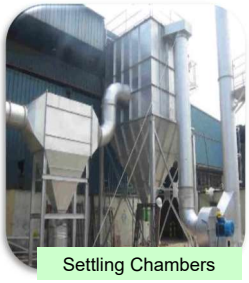
- ❑To ensure the APCS such as bag filter/ scrubber is function appropriately and efficiently according to the original design
- ❑To conduct/ supervise Performance Monitoring activity of APCS in order to get an early detection of any possible failures that may happen

What is Air Pollution Control System (APCS)?



Types of Industrial Air Pollution Control System (APCS) ?

Types of APCS


Settling Chambers


Cyclone


Bag Filter


Electrostatic Precipitator


Regenerative / Recuperative Thermal Oxidizer (RTO)


Wet scrubber

Types of APCS


Venturi Scrubber


Activated Carbon

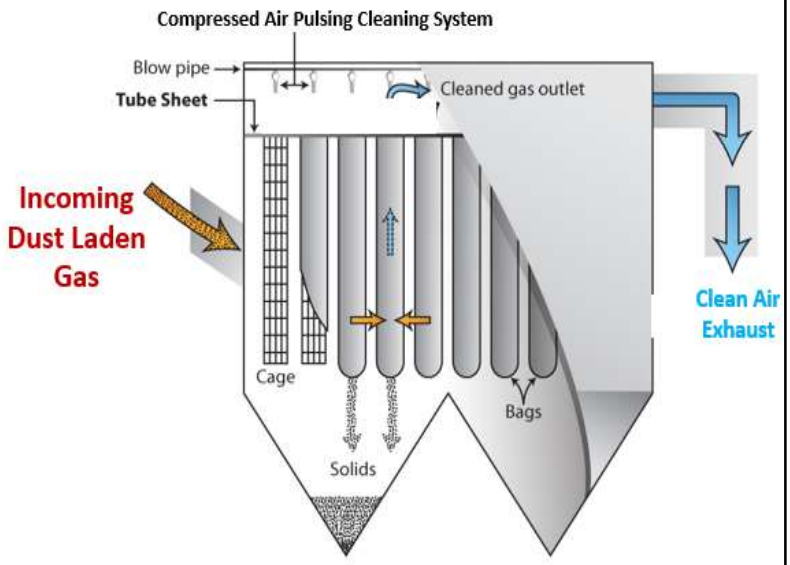

Paint Spray Booth


Oil mist filter

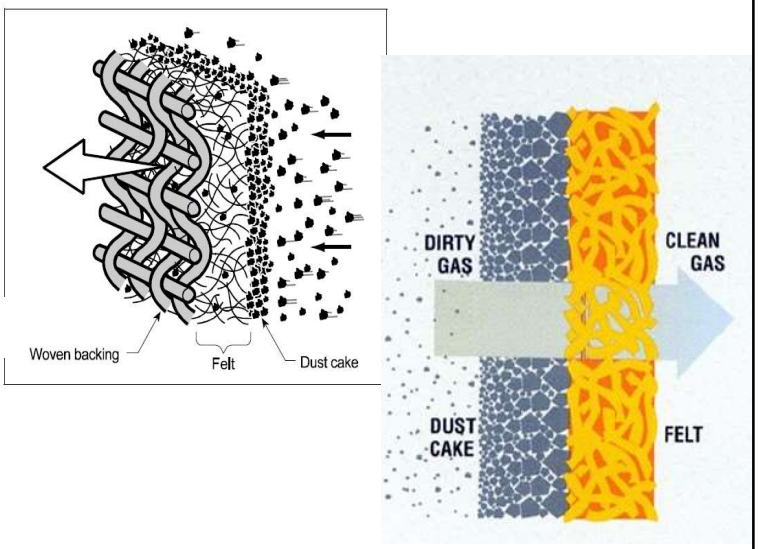
Performance Monitoring of Bag Filter Dust Collector

What is Bag Filter Dust Collector ?

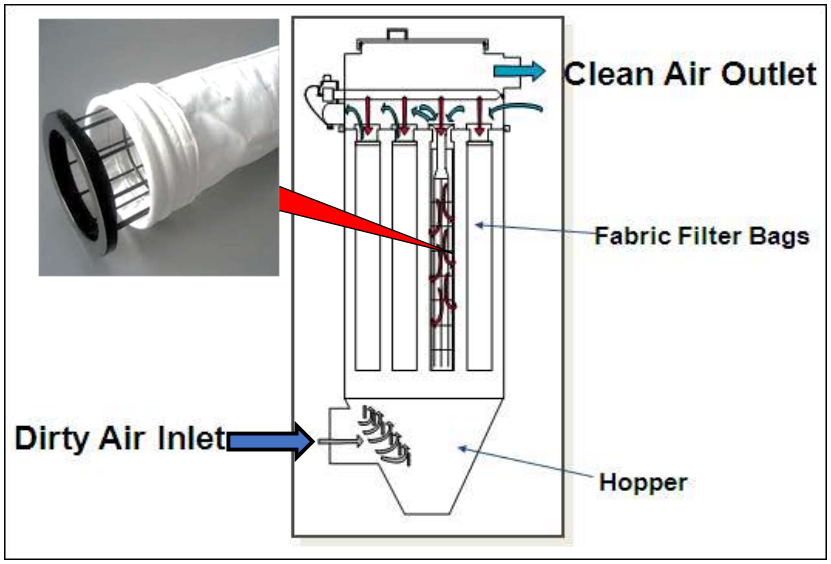
What is Bag Filter Dust Collector ?



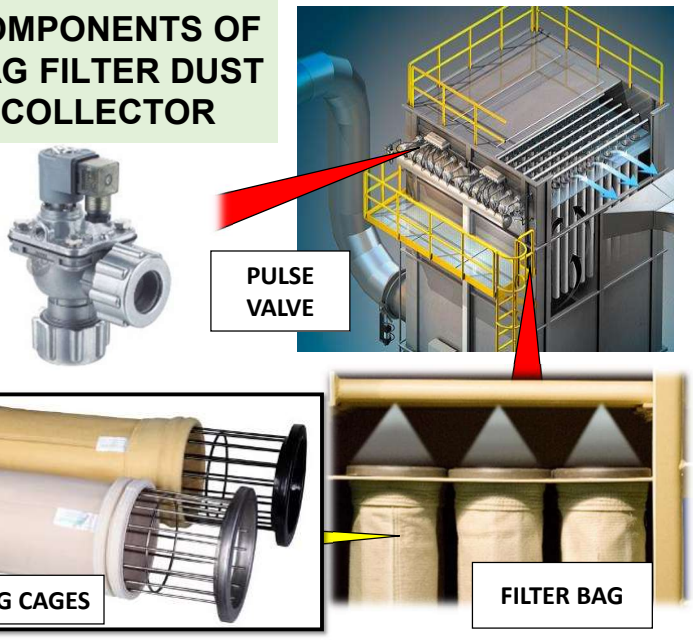
What is Bag Filter Dust Collector ?



What is Bag Filter Dust Collector ?



COMPONENTS OF BAG FILTER DUST COLLECTOR



What is Bag Filter Dust Collector ?

Loading

What is Bag Filter Dust Collector ?

What is Bag Filter Dust Collector ?

What is Bag Filter Dust Collector ?

PERFORMANCE MONITORING DATA OF BAG FILTER DUST COLLECTOR

Daily → Weekly → Monthly → Quarterly → Half Year → Annually

Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(A) DAILY Month:_____Year:_____

Date	Pressure Drop of Filter	Opacity or Stack Emission Condition	Discharge Hopper Condition / Quantity	Compressed Air Pressure	Temperature	Air Flow Rate	Entries by Operator			Checked by Supervisor		
	mm Wg			Bar	Deg °C	m^3/hr	Name	Sign	Date	Name	Sign	Date
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(B) DAILY Month:_____Year:_____

Date	Procedure	Note	Entries by Operator			Checked by Supervisor		
			Name	Sign	Date	Name	Sign	Date
	• Walk through system, listening for proper operation • Check for unusual occurrences in process • Observe control panel indicators • Ensure that dust is being removed from system • Fan motor running ampere							

Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(C) WEEKLY Month:_____Year:_____

Date	Procedure	Notes	Entries by Operator			Checked by Supervisor		
			Name	Sign	Date	Name	Sign	Date
	• Inspect screw conveyor bearings for lubrication • Check packing glands • Check damper/ valves for proper setting • Check compressed air lines, including line filters and dryers • Check that valves are opening and closing properly in bag cleaning sequence • Check temperature-indicating equipment • Check pressure drop indicating equipment for plugged lines							

Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(D) MONTHLY Month:_____Year:_____

Date	Procedure	Note	Entries by Operator			Checked by Supervisor		
			Name	Sign	Date	Name	Sign	Date
	• Inspect fan for material build up and corrosion • Check drive belts for wear and tension • Inspect and lubricate appropriate items • Spot check for bag leaks • Check hoses and clamps • Check accuracy of indicating equipment • Inspect housing for corrosion							

Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(E) QUARTERLY Month:_____Year:_____

Date	Procedure	Note	Entries by Operator			Checked by Supervisor		
			Name	Sign	Date	Name	Sign	Date
	• Inspect baffle plate for wear • Inspect bags thoroughly • Check duct for dust buildup • Check damper valves for proper seating • Check gaskets on doors • Inspect paint, insulation, etc • Check screw conveyor for wear or abrasion • Check fan belts							

Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(F) ANNUALLY Month:_____Year:_____

Date	Procedure	Note	Entries by Operator			Checked by Supervisor		
			Name	Sign	Date	Name	Sign	Date
	• Check welds • Inspect hopper for wear							

Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(A) DAILY Month:_____Year:_____

Dat	Pressure Drop of Filter	Opacity or Stack Emission Condition	Discharge Hopper Condition / Quantity	Compressed Air Pressure	Temperature	Air Flow Rate	Entries by Operator			Checked by Supervisor		
	mm Wg			Bar	Deg °C	m^3/hr	Name	Sign	Date	Name	Sign	Date
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

Pressure Drop of Filter

PARAMETER	Pressure Drop of Filter
WHY MEASURE?	• As indication of resistance to flow • To know actual condition of bag filter • To know pulsing effectiveness
WHAT INSTRUMENT ?	• Magnehelic Gauge • U-tube manometer
WHERE ?	Two points between clean & dirty air side

Why is Pressure Drop important?

Filter Bag Condition :

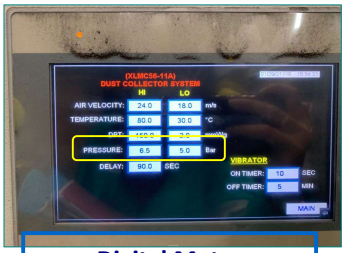
❖**High DP :** is a sign that the **filters are dirty/blocked/choked**.

Why is Pressure Drop important?

Filter Bag Condition :

- **Abnormally low DP or sudden drop of DP** : can indicate the presence of **holes, tears or loose seams** in the bags, or **improperly installed** filters

What instruments to measure Pressure Drop

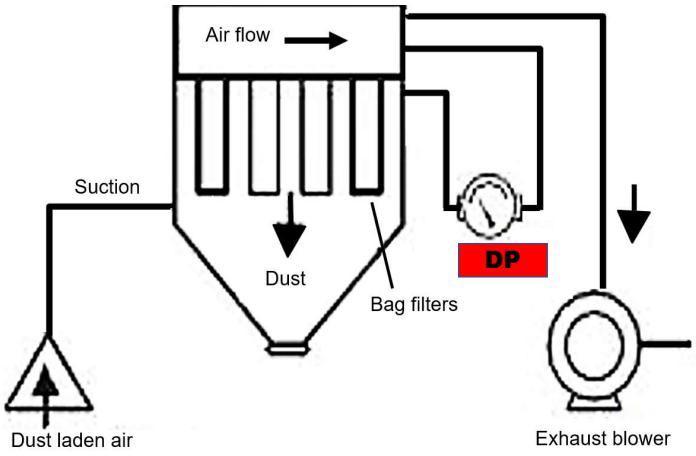


Digital Meter

Magnehelic Differential Pressure Gauge (DP Gauge)

U-Tube Manometer

Where to install dP gauge?



Why is Pressure Drop important?

Scenario A:

Date	Filter DP reading
27/2/2021	50 mm Wg
28/2/2021	50 mm Wg
1/3/2021	50 mm Wg
2/3/2021	50 mm Wg
3/3/2021	50 mm Wg
4/3/2021	**50 mm Wg**

Why is Pressure Drop important?

Scenario B:

Date	Filter DP reading
27/2/2021	4.0 inch Wg
28/2/2021	4.0 inch Wg
1/3/2021	4.5 inch Wg
2/3/2021	4.5 inch Wg
3/3/2021	5.0 inch Wg
4/3/2021	5.5 inch Wg

Why is Pressure Drop important?

Scenario C1:

Date	Filter DP reading
27/2/2021	1.0 inch Wg
28/2/2021	1.0 inch Wg
1/3/2021	1.5 inch Wg
2/3/2021	1.5 inch Wg
3/3/2021	2.0 inch Wg
4/3/2021	**6.0 inch Wg**

Why is Pressure Drop important?

Scenario C2:

Design spec (given by supplier): 6 inch Wg

Date	Filter DP reading
27/2/2021	1.0 inch Wg
28/2/2021	1.0 inch Wg
1/3/2021	1.5 inch Wg
2/3/2021	1.5 inch Wg
3/3/2021	2.0 inch Wg
4/3/2021	**6.0 inch Wg**

Why is Pressure Drop important?

Scenario D:

Design spec (given by supplier): 6 inch Wg

Date	Filter DP reading
27/2/2021	3.0 inch Wg
28/2/2021	3.0 inch Wg
1/3/2021	3.5 inch Wg
2/3/2021	3.5 inch Wg
3/3/2021	4.0 inch Wg
4/3/2021	**0.5 inch Wg**

Why is Pressure Drop important?

Scenario E:

Design spec (given by supplier): 6 inch Wg

Date	Filter DP reading
27/2/2021	2.0 inch Wg
28/2/2021	2.5 inch Wg
1/3/2021	3.5 inch Wg
2/3/2021	4.5 inch Wg
3/3/2021	5.5 inch Wg
4/3/2021	**6.5 inch Wg**

Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(A) DAILY Month:_____ Year:_____

Date	Pressure Drop of Filt	Opacity or Stack Emission Condition	Discharge Hopper Condition / Quantity	Compressed Air Pressure	Temperature	Air Flow Rate	Entries by Operator			Checked by Supervisor		
	mm Wg			Bar	Deg °C	m^3/hr	Name	Sign	Date	Name	Sign	Date
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

Opacity or Stack Emission Condition

PARAMETER	Stack/ Chimney Emission
WHY MEASURE?	To ensure clean emission at all time
WHAT INSTRUMENT ?	• Visual Inspection • Continuous Emission Monitoring System (CEMS) • Opacity meter
WHERE ?	Chimney exit point

What instruments to measure Stack Emission?

Check **VISUALLY**

Opacity Monitor

Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

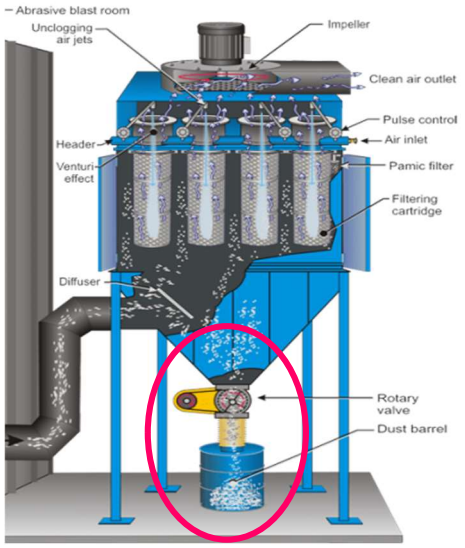
(A) DAILY Month:_____Year:_____

Date	Pressure Drop of Filter	Opacity or Stack Emission Condition	Discharge Hopper Condition / Quantity	Compressed Air Pressure	Temperature	Air Flow Rate	Entries by Operator			Checked by Supervisor		
	mm Wg			Bar	Deg °C	m^3/hr	Name	Sign	Date	Name	Sign	Date
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

Discharge Hopper Condition/ Quantity

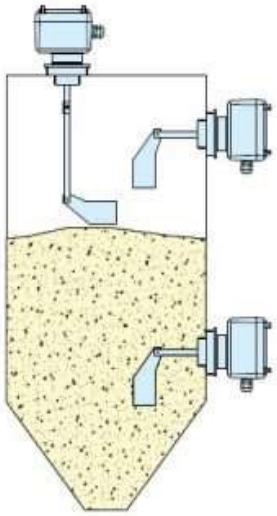
PARAMETER	Discharge Hopper
WHY MEASURE?	To ensure dust is discharge continuously, no dust accumulation inside the hopper
WHAT INSTRUMENT ?	• Visual Inspection at dust bin/ hopper • Dust Level Sensor
WHERE ?	Hopper/ Dust Bin

Discharge Hopper Condition/ Quantity



Discharge Hopper Condition/ Quantity

Dust Level Sensor



Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(A) DAILY Month:_____ Year:_____

Date	Pressure Drop of Filter	Opacity or Stack Emission Condition	Discharge Hopper Condition / Quantity	Compressed Air Pressure	Temperature	Air Flow Rate	Entries by Operator			Checked by Supervisor		
	mm Wg			Bar	Deg °C	m^3/hr	Name	Sign	Date	Name	Sign	Date
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

Compressed Air Pressure

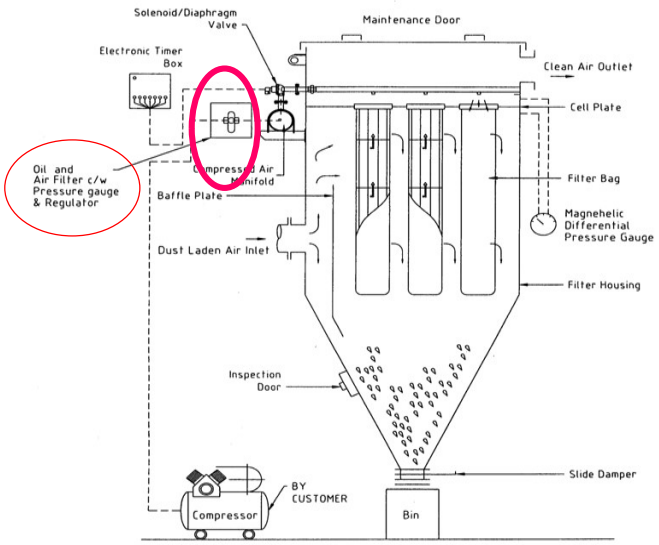
PARAMETER	Compressed Air Pressure
WHY MEASURE?	• To ensure effective cleaning operation • if too high, bag filter will be tear & • if too low, bag filter will not be able to clean properly.
WHAT INSTRUMENT ?	Filter Regulator & Pressure Gauge
WHERE ?	At Compressed Air Tank

What instruments to measure Compressed Air Pressure

Compressed Air Gauge

Filter Regulator Gauge

Compressed Air Pressure



Why is Compressed Air Pressure important?

Scenario A (Design Spec : 5 to 6 bar)

Date	Comp Air Pressure reading
27/2/2021	5 bar
28/2/2021	5.2 bar
1/3/2021	5.4 bar
2/3/2021	6 bar
3/3/2021	5.1 bar
4/3/2021	**6 bar**

Why is Compressed Air Pressure important?

Scenario B (Design Spec : 2 to 4 bar)

Date	Comp Air Pressure reading
27/2/2021	2.5 bar
28/2/2021	3 bar
1/3/2021	4 bar
2/3/2021	3.5 bar
3/3/2021	2 bar
4/3/2021	**6 bar**

Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(A) DAILY Month:_____ Year:_____

Date	Pressure Drop of Filter	Opacity or Stack Emission Condition	Discharge Hopper Condition / Quantity	Compressed Air Pressure	Temperature	Air Flow Rate	Entries by Operator			Checked by Supervisor		
	mm Wg			Bar	Deg °C	m^3/hr	Name	Sign	Date	Name	Sign	Date
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

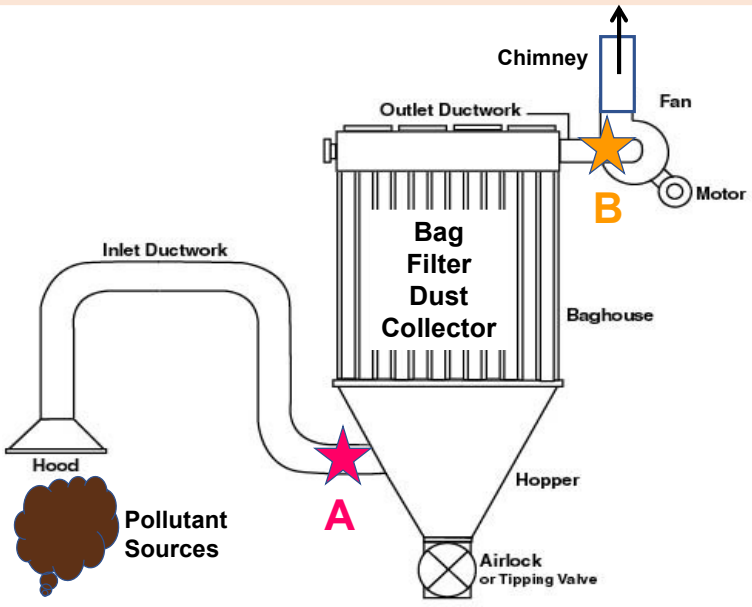
Air Temperature

PARAMETER	Gas Temperature
WHY MEASURE?	• Ensure incoming gas temperature is not exceeding the bag filter limitation to avoid the bag filter from damage. • Ensure the incoming gas temperature is not too low that can cause condensation of the air (this will make filter bag wet & plugged).
WHAT INSTRUMENT ?	Thermometer
WHERE ?	Inlet of / inside Dust Collector

What instruments to measure Air Temperature

Thermometer

Where to install Thermometer ?



Typical Form to Record Performance Monitoring & Preventive Maintenance Data of Bag Filters

(A) DAILY Month:_____ Year:_____

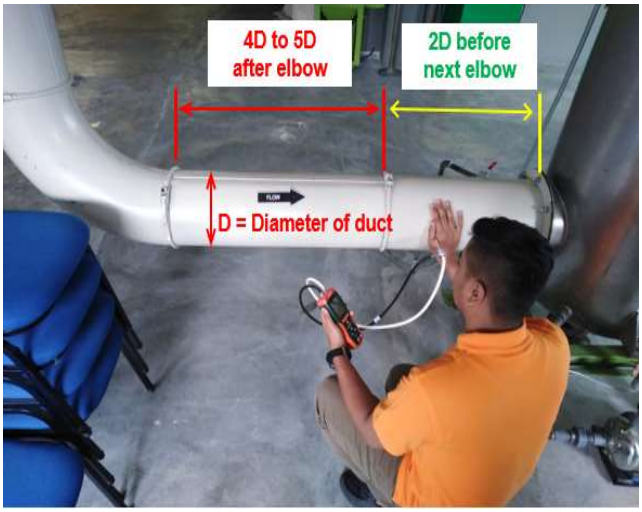
Date	Pressure Drop of Filter	Opacity or Stack Emission Condition	Discharge Hopper Condition / Quantity	Compressed Air Pressure	Temperature	Air Flow Rate	Entries by Operator			Checked by Supervisor		
	mm Wg			Bar	Deg °C	m^3/hr	Name	Sign	Date	Name	Sign	Date
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

Air Flow Rate

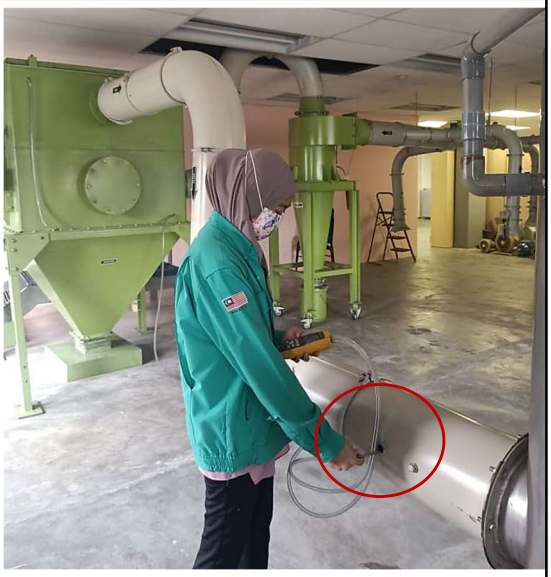
PARAMETER	Air Flow Rate
WHY MEASURE?	• To ensure air flow rate is enough for suction. • A developing leak in the ducting or in the dust collector itself can be identified by examining flowrate record.
WHAT INSTRUMENT ?	• Air Flow Meter with Pitot Tube • Anemometer
WHERE ?	Straight duct (4D away from any elbow/branch/disturbance).

Fan

Where to measure Air Flow Rate?

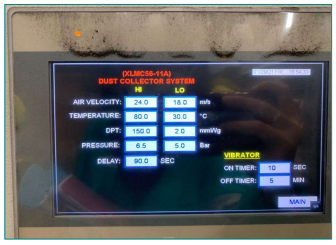


Where to measure Air Flow Rate?



What instruments to measure Air Flow Rate

Air Flow Meter



Why is Air flow rate important?

Scenario A:

Design Spec : 9,000 m^3/Hr (refer to design or fan spec)

Date	Q reading
27/2/2021	9,000 m^3/Hr
28/2/2021	8,800 m^3/Hr
1/3/2021	8,900 m^3/Hr
2/3/2021	8,500 m^3/Hr
3/3/2021	9,050 m^3/Hr
4/3/2021	**9,000 m^3/Hr**

Why is Air flow rate important?

Scenario B:

Design Spec : 9,000 m^3/Hr (refer to design or fan spec)

Date	Q reading
27/2/2021	9,000 m^3/Hr
28/2/2021	8,800 m^3/Hr
1/3/2021	8,900 m^3/Hr
2/3/2021	8,500 m^3/Hr
3/3/2021	9,050 m^3/Hr
4/3/2021	**4,500 m^3/Hr**

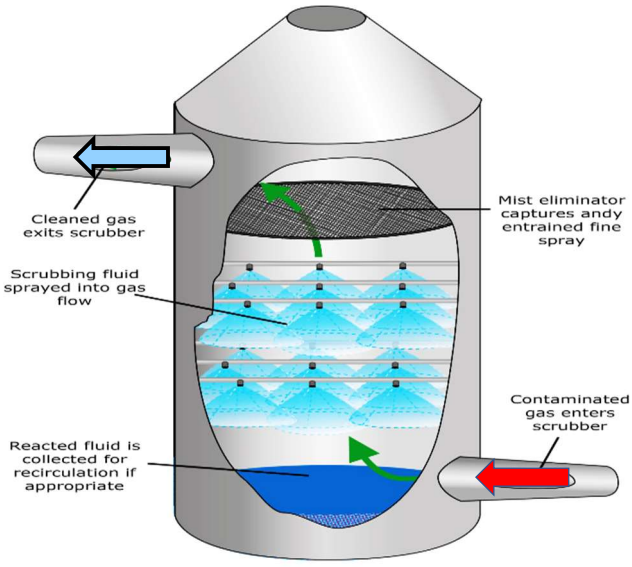
SEKIAN,
TERIMA KASIH

71

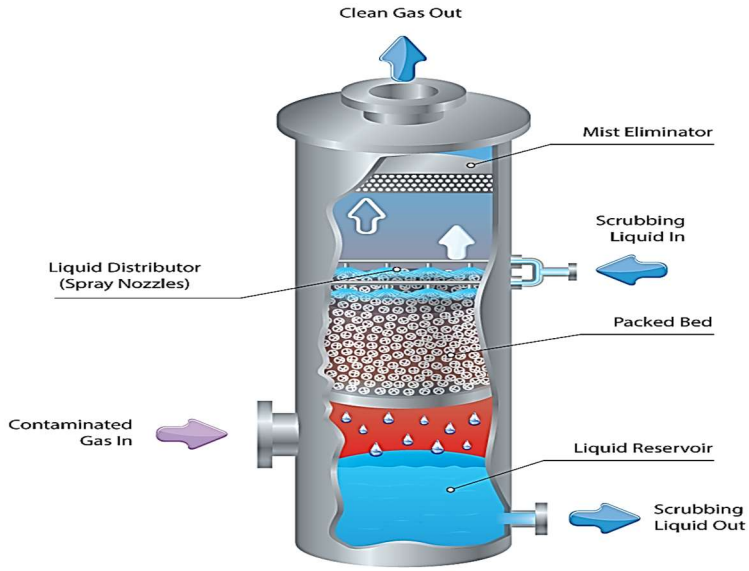
Performance Monitoring of Wet Scrubber

What is Wet Scrubber ?

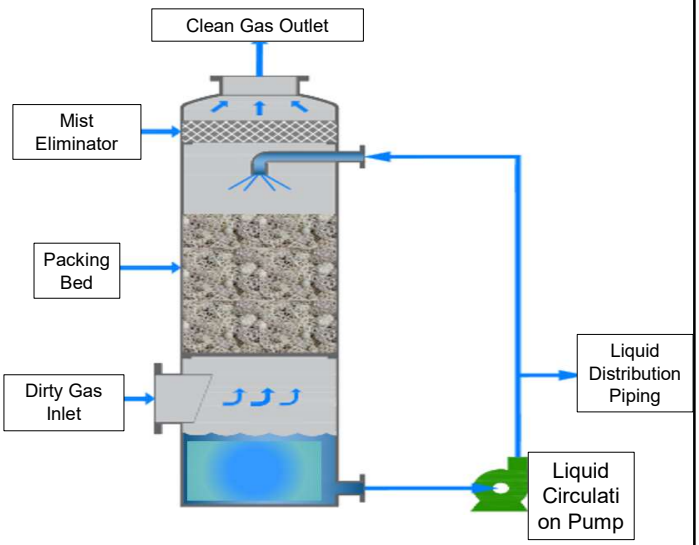
What is Wet Scrubber ?



WET SCRUBBER



PACKED TOWER SCRUBBER



SCRUBBER PACKING

Different types of packing

MIST ELIMINATOR/ DEMISTER

What is Wet Scrubber ?

VAPOUR ENGINEERS

SCRUBBER

PERFORMANCE MONITORING DATA OF SCRUBBER

Daily → Weekly → Monthly → Quarterly → Half Year → Annually

Typical Form to Record Performance Monitoring Data of Packed Tower Scrubber

(A) DAILY Month :_____ Year :_ _____

Date	Pressure Drop of Packing	Pressure Drop of Mist Eliminator	Pressure Drop of Scrubber Body	Gas Temperature (°C)		pH of liquid	Liquid Flow Rate	Chimney emission	Gas Flow Rate	Entries by Operator			Checked by Supervisor		
				In	Out	pH		Visual		Name	Sign	Date	Name	Sign	Date
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															

Since 1983 www.masterjaya.com.my Your One-Stop Centre for Industrial Air Pollution Master Jaya Greentech

Typical Form to Record Performance Data of Packed Tower Scrubber

(B) WEEKLY Month:_____ Year:_____

Date	Procedure	Note	Entries by Operator			Checked by Supervisor		
			Name	Sign	Date	Name	Sign	Date
	Check recirculation pump discharge pressure. Check fan motor operating current. Check circulation pump motor operating current.							

Since 1983 www.masterjaya.com.my Your One-Stop Centre for Industrial Air Pollution Master Jaya Greentech

Typical Form to Record Performance Data of Packed Tower Scrubber

(C) MONTHLY Month:_____ Year:_____

Date	Procedure	Note	Entries by Operator			Checked by Supervisor		
			Name	Sign	Date	Name	Sign	Date
	Check fan vibration. Check pump vibration. Check pump/ piping leakages. Check fan motor temperature. Check pump motor temperature. Check spray nozzles							

Typical Form to Record Performance Data of Packed Tower Scrubber

(E) HALF YEARLY Month:_____ Year:_____

Date	Procedure	Note	Entries by Operator			Checked by Supervisor		
			Name	Sign	Date	Name	Sign	Date
	Inspect fan drive mechanisms, i.e. bearings, belt tensioning, grease level, etc. Inspect mist eliminator for any solid build-up. Inspect packing for any fouling. Pump servicing- replace bearing, grease& mechanical seal (for end suction centrifugal pump).							

Typical Form to Record Performance Data of Packed Tower Scrubber

(D) QUARTERLY Month:_____ Year:_____

Date	Procedure	Note	Entries by Operator			Checked by Supervisor		
			Name	Sign	Date	Name	Sign	Date
	Inspect fan on material build up.							

Typical Form to Record Performance Data of Packed Tower Scrubber

(F) ANNUALLY Month:_____ Year:_____

Date	Procedure	Note	Entries by Operator			Checked by Supervisor		
			Name	Sign	Date	Name	Sign	Date
	Verify accuracy of monitoring instruments and calibrate Inspect physical conditions of the scrubber, i.e. Housing, ductwork, etc Overall system cleaning							

Typical Form to Record Performance Monitoring Data of Packed Tower Scrubber

(A) DAILY Month :_____ Year :_____

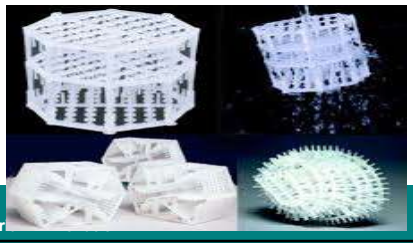
Dat	Pressure Drop of Packing	Pressure Drop of Mist Eliminator	Pressure Drop of Scrubber Body	Gas Temperature (°C)		pH of liquid	Liquid Flow Rate	Chimney emission	Gas Flow Rate	Entries by Operator			Checked by Supervisor		
				In	Out	pH		Visual		Name	Sign	Date	Name	Sign	Date
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															

Pressure Drop of Scrubber Body

PARAMETER	Pressure Drop of Scrubber body
WHY MEASURE?	• As indication of resistance to flow • To know actual condition of the running scrubber
WHAT INSTRUMENT ?	• Magnehelic Gauge • U-tube manometer
WHERE ?	Two points between inlet & outlet of Scrubber Body

Pressure Drop of Packing

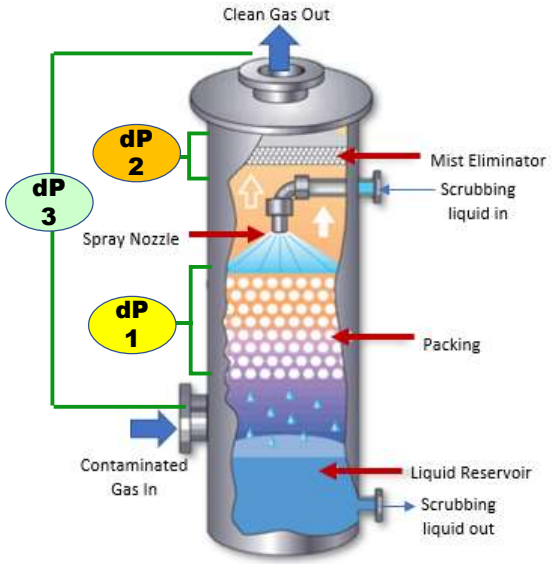
PARAMETER	Pressure Drop of Packing
WHY MEASURE?	To know actual condition of packing.
WHAT INSTRUMENT ?	• Magnehelic Gauge • U-tube manometer
WHERE ?	Two points between inlet & outlet of Packing



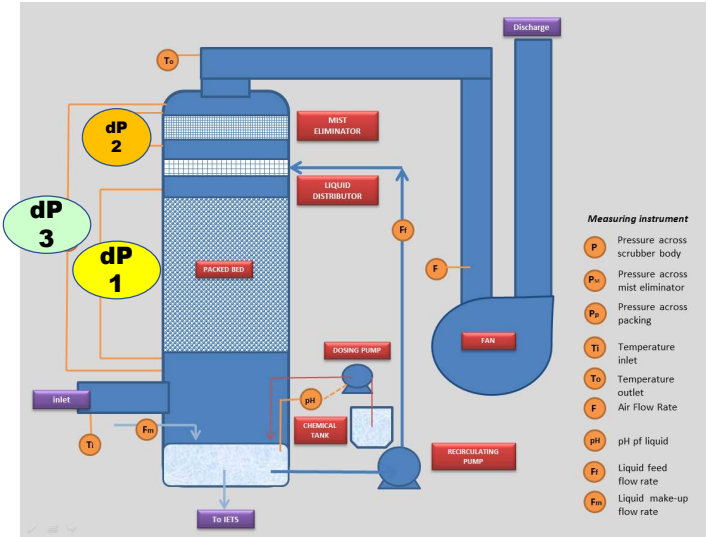
Pressure Drop of Mist Eliminator

PARAMETER	Pressure Drop of Mist Eliminator
WHY MEASURE?	To know actual condition of mist eliminator.
WHAT INSTRUMENT ?	• Magnehelic Gauge • U-tube manometer
WHERE ?	Two points between inlet & outlet of Mist Eliminator

Pressure Drop



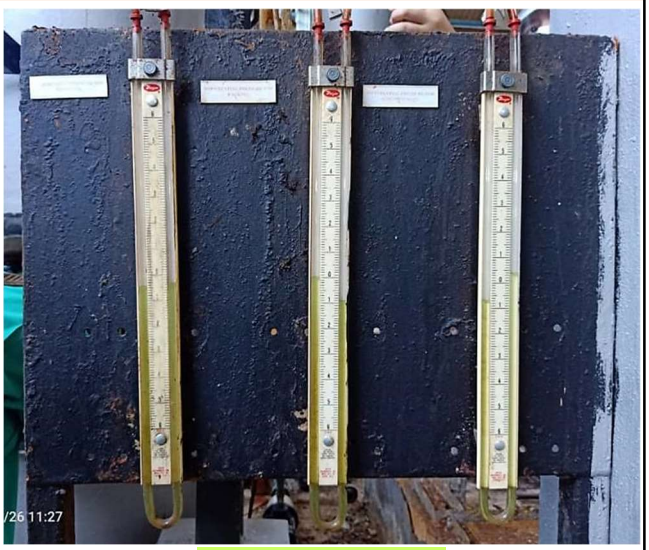
Example : Instruments for Scrubber Performance Monitoring



What instruments to measure Pressure Drop

Magnehelic Gauge

What instruments to measure Pressure Drop



U-tube manometer

Typical Form to Record Performance Monitoring Data of Packed Tower Scrubber

(A) DAILY Month :_____ Year :_ _____

Date	Pressure Drop of Packing	Pressure Drop of Mist Eliminator	Pressure Drop of Scrubber Body	Gas Temperature (°C)		pH of liquid	Liquid Flow Rate	Chimney emission	Gas Flow Rate	Entries by Operator			Checked by Supervisor		
				In	Out	pH		Visual		Name	Sign	Date	Name	Sign	Date
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															

Air Temperature

PARAMETER (Unit)	MEASUREMENT LOCATION	WHY MEASURE
Inlet Gas Temperature (°C)	Inlet of scrubber	• To prevent high inlet gas temperature. • Inlet gas temperature higher than the design value could lead to excessive liquid evaporation resulting in damage to scrubber components.
Outlet Gas Temperature (°C)	Outlet of scrubber	• To evaluate scrubber operation • To protect downstream equipment from excessive temperature. • High outlet temperature may be indicative of poor liquid distribution or plugging of liquid inlet.

What instruments to measure Air Temperature

Portable Type Thermometer

What instruments to measure Air Temperature

Fixed type Thermometer

Typical Form to Record Performance Monitoring Data of Packed Tower Scrubber

(A) DAILY Month :_____ Year :_____

Date	Pressure Drop of Packing	Pressure Drop of Mist Eliminator	Pressure Drop of Scrubber Body	Gas Temperature (°C)		pH of liquid	Liquid Flow Rate	Chimney emission	Gas Flow Rate	Entries by Operator			Checked by Supervisor		
				In	Out	pH		Visual		Name	Sign	Date	Name	Sign	Date
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															

pH of Liquid

PARAMETER	pH of liquid
WHY MEASURE?	• To know the pH of liquid • To ensure effective scrubbing.
WHAT INSTRUMENT ?	pH meter/ sensor
WHERE ?	• At the water tank (scrubber liquid) • At circulation pipe

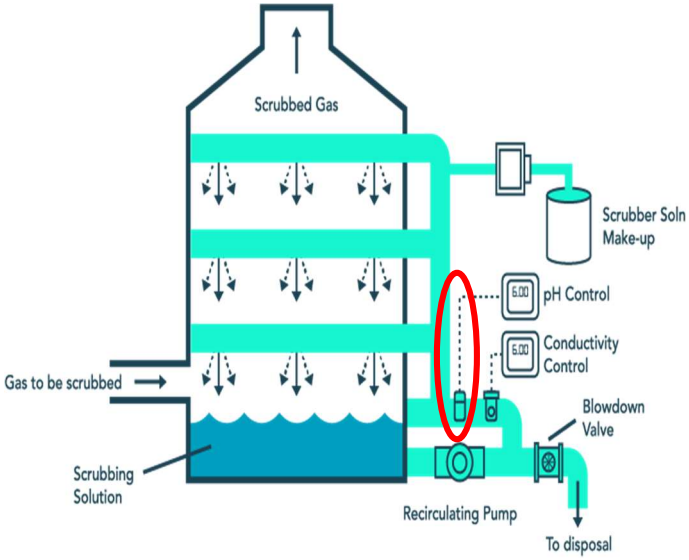
What instruments to measure pH of Liquid

pH Controller

pH Sensor

pH Dosing Pump

pH of Liquid



Typical Form to Record Performance Monitoring Data of Packed Tower Scrubber

(A) DAILY Month :_____ Year :_____

Date	Pressure Drop of Packing	Pressure Drop of Mist Eliminator	Pressure Drop of Scrubber Body	Gas Temperature (°C)		pH of liquid	Liquid Flow Rate	Chimney emission	Gas Flow Rate	Entries by Operator			Checked by Supervisor		
				In	Out	pH		Visual		Name	Sign	Date	Name	Sign	Date
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															

Liquid Flow Rate

PARAMETER	Liquid Flow Meter
WHY MEASURE?	• To ensure effective scrubbing/ absorption. • If too high liquid flow rate will cause flooding • If too low will reduce the efficiency of absorption
WHAT INSTRUMENT ?	Rotameter/ Water Flow Meter
WHERE ?	At circulation pump discharge / outlet piping

What instruments to measure Liquid Flow Rate

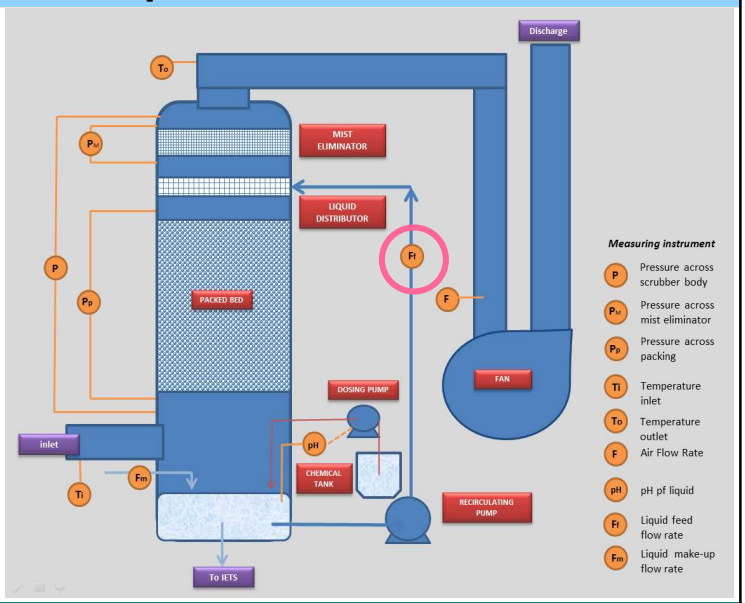
Rotameter

What instruments to measure Liquid Flow Rate

Liquid Flow Meter

Rotameter

Liquid Flow Rate



Why is Liquid flow rate important?

Scenario A:

Design Spec : 250 LPM (refer to design spec)

Date	Q reading
27/2/2021	250 LPM
28/2/2021	250 LPM
1/3/2021	250 LPM
2/3/2021	250 LPM
3/3/2021	250 LPM
4/3/2021	**60 LPM**

Why is Liquid flow rate important?

Scenario A:

Design Spec : 250 LPM (refer to design spec)

Date	Q reading
27/2/2021	250 LPM
28/2/2021	250 LPM
1/3/2021	250 LPM
2/3/2021	250 LPM
3/3/2021	250 LPM
4/3/2021	**0 LPM**

Typical Form to Record Performance Monitoring Data of Packed Tower Scrubber

(A) DAILY Month :_____ Year :_____

Date	Pressure Drop of Packing	Pressure Drop of Mist Eliminator	Pressure Drop of Scrubber Body	Gas Temperature (°C)		pH of liquid	Liquid Flow Rate	Chimney emission	Gas Flow Rate	Entries by Operator			Checked by Supervisor		
				In	Out	pH		Visual		Name	Sign	Date	Name	Sign	Date
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															

Chimney Emission

PARAMETER	Stack/ Chimney Emission
WHY MEASURE?	To ensure clean emission at all time
WHAT INSTRUMENT ?	• Visual Inspection • Continuous Emission Monitoring System (CEMS) • Opacity meter
WHERE ?	Chimney exit point

What instruments to measure Chimney Emission?

Check **VISUALLY**

Opacity Monitor

Typical Form to Record Performance Monitoring Data of Packed Tower Scrubber

(A) DAILY Month :_____ Year :_____

Date	Pressure Drop of Packing	Pressure Drop of Mist Eliminator	Pressure Drop of Scrubber Body	Gas Temperature (°C)		pH of liquid	Liquid Flow Rate	Chimney emission	Gas Flow Rate	Entries by Operator			Checked by Supervisor		
				In	Out	pH		Visual		Name	Sign	Date	Name	Sign	Date
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															
31															

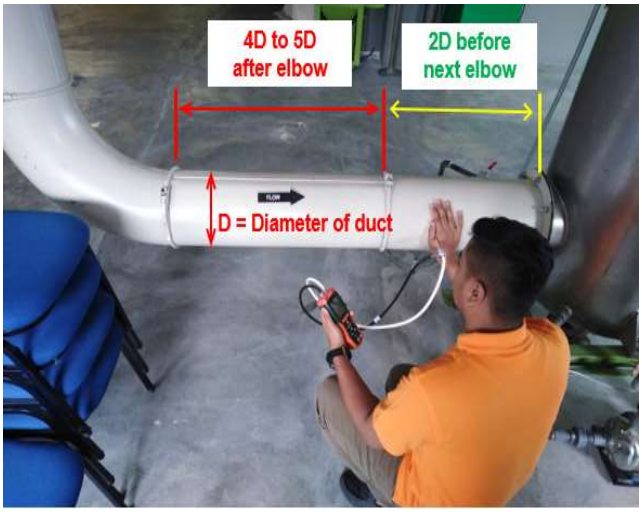
Air Flow Rate

PARAMETER	Air Flow Rate
WHY MEASURE?	• To ensure air flow rate is enough for suction. • A developing leak in the ducting or in the dust collector itself can be identified by examining flowrate record.
WHAT INSTRUMENT ?	• Air Flow Meter with Pitot Tube • Anemometer
WHERE ?	Straight duct (4D away from any elbow/branch/disturbance).

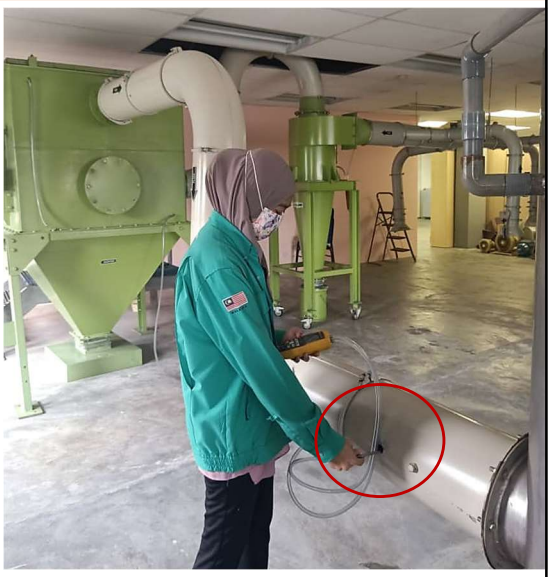
Fan




Where to measure Air Flow Rate?



Where to measure Air Flow Rate?



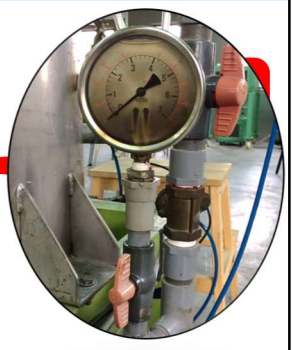
Since 1983 www.masterjaya.com.my
Your One-Stop Centre for Industrial Air Pollution
Master Jaya Greentech

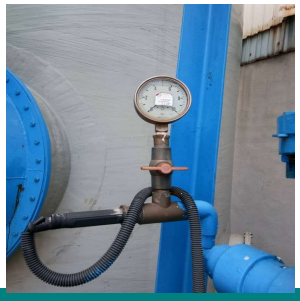
What instruments to measure Air Flow Rate

Air Flow Meter

Since 1983 www.masterjaya.com.my
Your One-Stop Centre for Industrial Air Pollution
Master Jaya Greentech

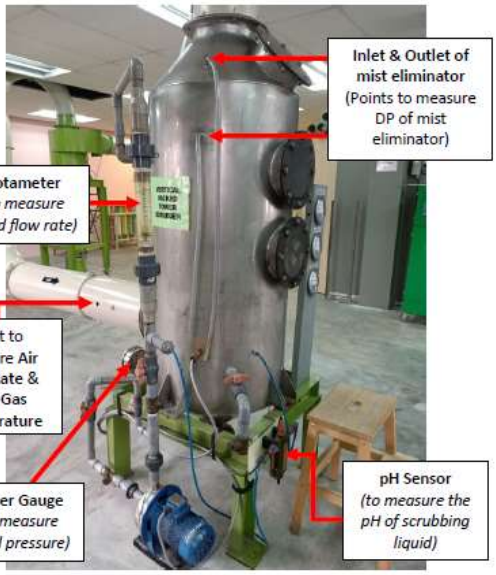
Check Circulation Pump Discharge Pressure

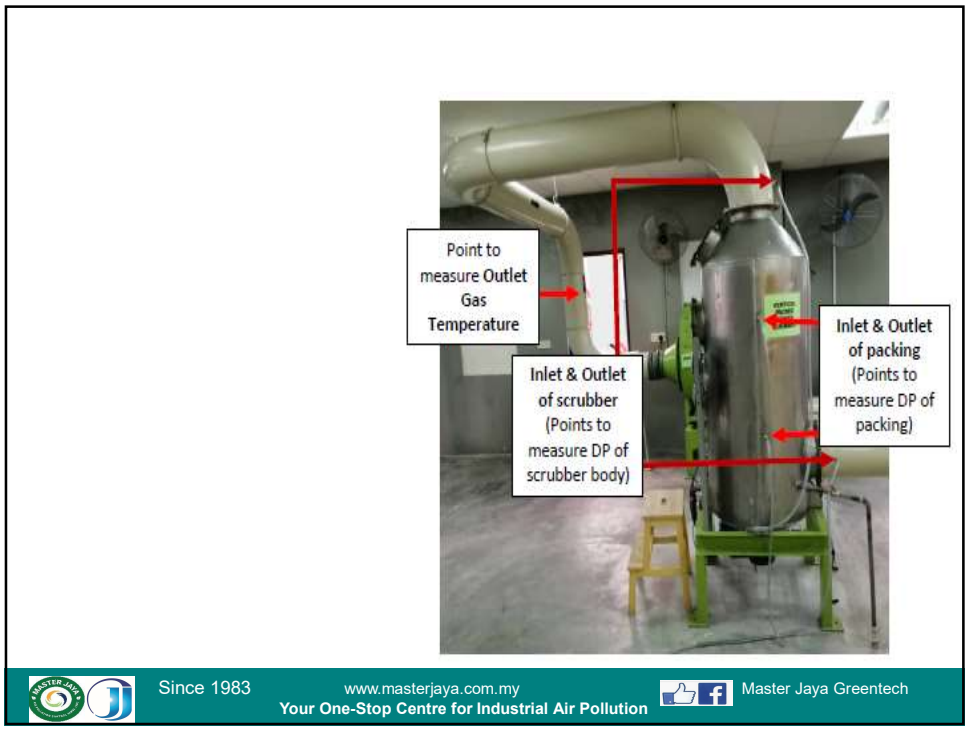


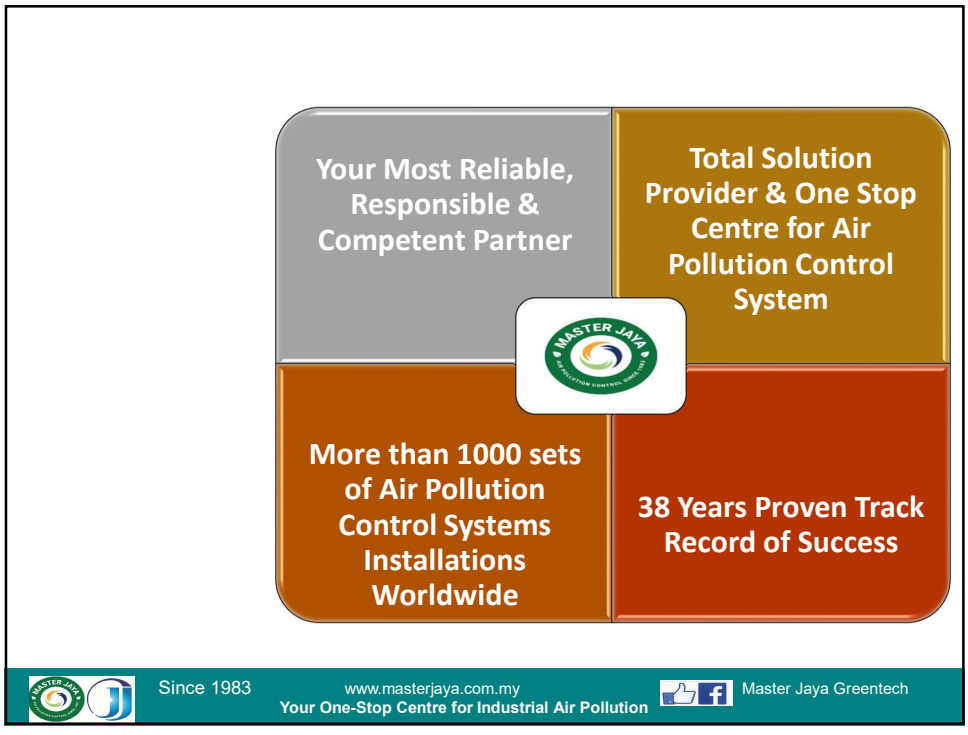


Scrubber Packing Inspection

Check Spray Nozzles Plugging or Leaks




Point to measure Outlet Gas Temperature
Inlet & Outlet of scrubber (Points to measure DP of scrubber body)
Inlet & Outlet of packing (Points to measure DP of packing)
Since 1983
www.masterjaya.com.my
Your One-Stop Centre for Industrial Air Pollution
Master Jaya Greentech


Your Most Reliable, Responsible & Competent Partner
Total Solution Provider & One Stop Centre for Air Pollution Control System
More than 1000 sets of Air Pollution Control Systems Installations Worldwide
38 Years Proven Track Record of Success
Since 1983
www.masterjaya.com.my
Your One-Stop Centre for Industrial Air Pollution
Master Jaya Greentech

Company HQ, Branches & Factory Locations

HQ office :
20, Jalan Taming 3, Taming Jaya Industrial Park,
43300 Seri Kembangan, Selangor

Steel Fabrication Factory :
Lot 8320, Jalan Permata 1, Arab Malaysian
Industrial Park, 71800 Nilai, Negeri Sembilan

Since 1983 www.masterjaya.com.my Master Jaya Greentech
Your One-Stop Centre for Industrial Air Pollution

Company HQ, Branches & Factory Locations

Penang Branch Office
No. 2744, Jln Chain Ferry,
Tmn Inderawasih, 13600 Perai, Pulau Pinang

Johor Branch Office
No. 40, Jalan Pertama, Pusat Perdagangan
Danga Utama, 81300 Skudai, Johor.

Since 1983 www.masterjaya.com.my Master Jaya Greentech
Your One-Stop Centre for Industrial Air Pollution

Company Profile & Core Competencies

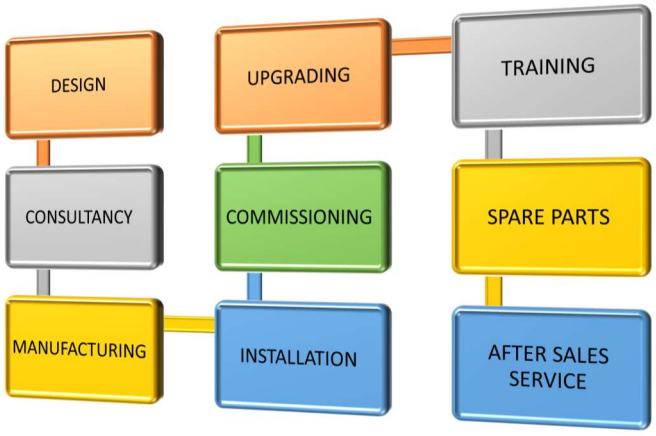
- ✓ Proven practical experience, technical know how and successful track records in Industrial Air Pollution Control & Industrial Ventilation in almost all process & manufacturing industries.
- ✓ Designed, Manufactured, Supplied & Installed more than **1,000 SETS** of air pollution control equipment & systems in Malaysia & foreign countries.

Our List of Clients :

Since 1983 www.masterjaya.com.my Your One-Stop Centre for Industrial Air Pollution Master Jaya Greentech

Company Profile & Core Competencies

SCOPE OF BUSINESS



Company Profile & Core Competencies

TYPE OF INDUSTRIES SERVED

CEMENT
RUBBER
WOODWORKING
STEEL
INCINERATION PLANT
LEAD
FOOD
NON-FEROUS METAL
PHARMACEUTICAL
SUGAR
CHEMICAL
ELECTRONICS
TIN SMELTING
POWDER
PALM OIL
BATTERY
LIME
ALUMINIUM
FURNITURE

Company Profile & Core Competencies

BUSINESS TERRITORIES

- MALAYSIA
- THAILAND
- VIETNAM
- SINGAPORE
- SRI LANKA
- INDONESIA
- PHILIPPINES
- AFRICA
- JAPAN
- BRAZIL
- BANGLADESH

Company Profile & Core Competencies

ISO
ACHIEVEMENT

(Since 5th March 2004)

Certificate of Registration

MOODY INTERNATIONAL

This is to certify that the Quality Management Systems of

MASTER JAYA ENGINEERING SDN BHD
MASTER JAYA ENVIRONMENTAL SDN BHD

Wisma Master Jaya, 20, Jalan Taming 3,
Taming Jaya Industrial Park, 43300 Seri Kembangan,
Selangor Darul Ehsan, Malaysia

have been assessed and found compliant with the requirements of

ISO 9001:2008
BS EN ISO 9001:2008

Approval is hereby granted for registration on the proviso that the certification rules and conditions are observed at all times.

Certification Scope:
Design, Manufacture, Install & Commission, Modify, Upgrade & Service, Industrial Ventilation & Air Pollution Control Equipment and Systems and Related Accessories

Certificate No. Q150988

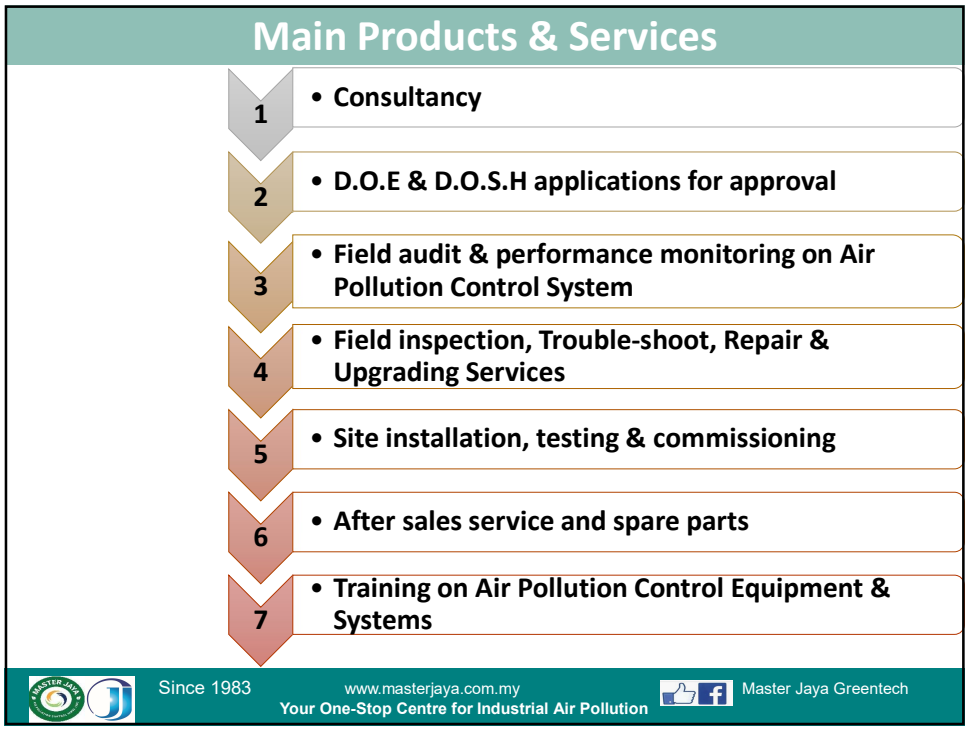
Issue Date: 2 November 2009

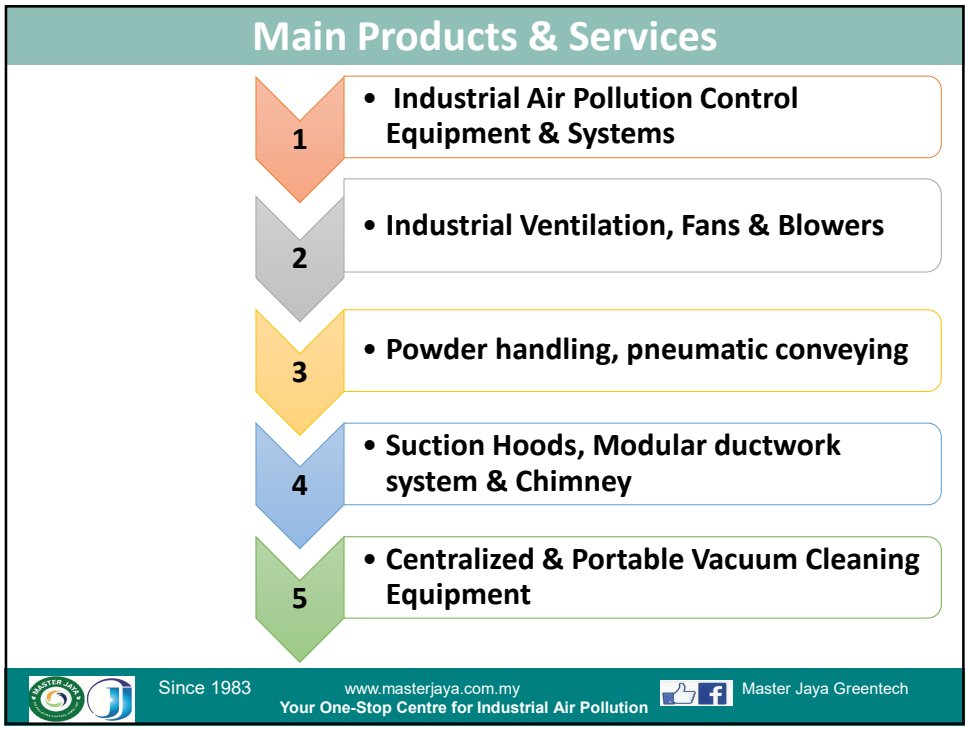
Original Issue Date: 5 March 2004

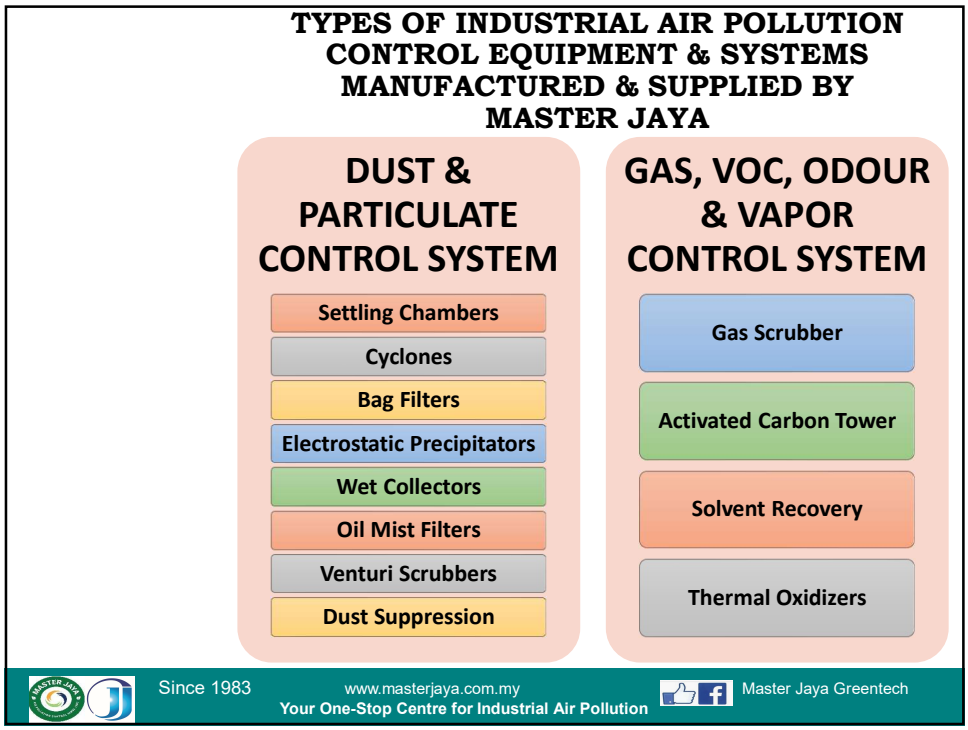
Expiry Date: 1 November 2012

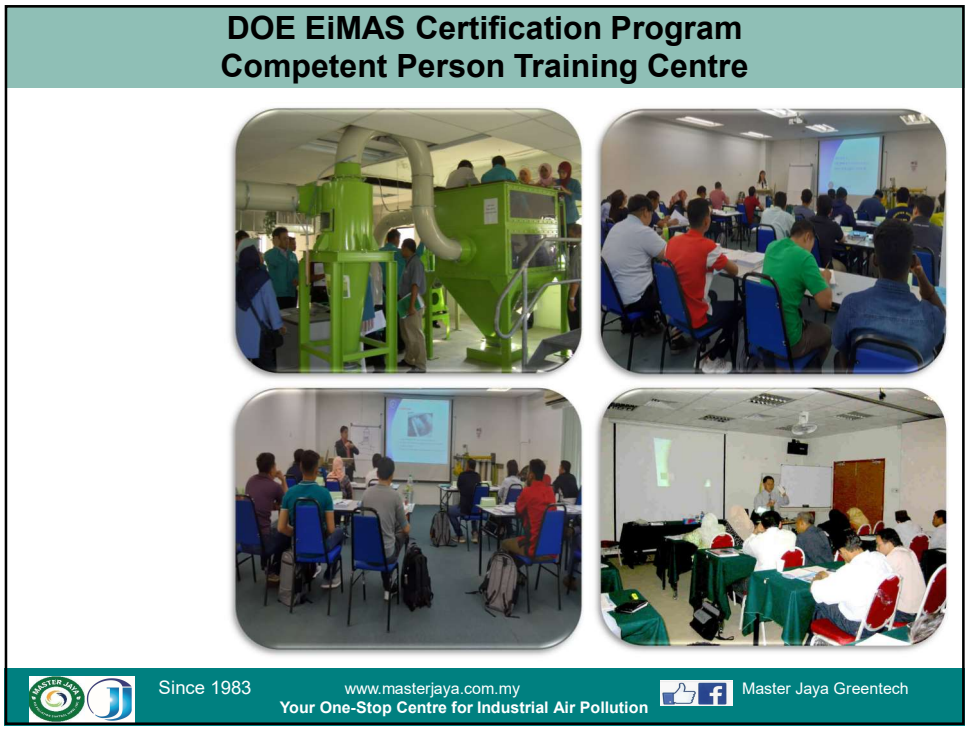
Authorised Signature

Moody International Certification Ltd.


Main Products & Services
1
• Consultancy
2
• D.O.E & D.O.S.H applications for approval
3
• Field audit & performance monitoring on Air Pollution Control System
4
• Field inspection, Trouble-shoot, Repair & Upgrading Services
5
• Site installation, testing & commissioning
6
• After sales service and spare parts
7
• Training on Air Pollution Control Equipment & Systems
Since 1983
www.masterjaya.com.my
Your One-Stop Centre for Industrial Air Pollution
Master Jaya Greentech


Main Products & Services
1
• Industrial Air Pollution Control Equipment & Systems
2
• Industrial Ventilation, Fans & Blowers
3
• Powder handling, pneumatic conveying
4
• Suction Hoods, Modular ductwork system & Chimney
5
• Centralized & Portable Vacuum Cleaning Equipment
Since 1983
www.masterjaya.com.my
Your One-Stop Centre for Industrial Air Pollution
Master Jaya Greentech


TYPES OF INDUSTRIAL AIR POLLUTION CONTROL EQUIPMENT & SYSTEMS MANUFACTURED & SUPPLIED BY MASTER JAYA
DUST & PARTICULATE CONTROL SYSTEM
Settling Chambers
Cyclones
Bag Filters
Electrostatic Precipitators
Wet Collectors
Oil Mist Filters
Venturi Scrubbers
Dust Suppression
GAS, VOC, ODOUR & VAPOR CONTROL SYSTEM
Gas Scrubber
Activated Carbon Tower
Solvent Recovery
Thermal Oxidizers
Since 1983
www.masterjaya.com.my
Your One-Stop Centre for Industrial Air Pollution
Master Jaya Greentech


DOE EiMAS Certification Program
Competent Person Training Centre
Since 1983
www.masterjaya.com.my
Your One-Stop Centre for Industrial Air Pollution
Master Jaya Greentech

TRAINING CENTRE FACILITIES

CePBFO and CePSO Training Center

TRAINING CENTRE FACILITIES

Hands-on Practical Air Pollution Control System

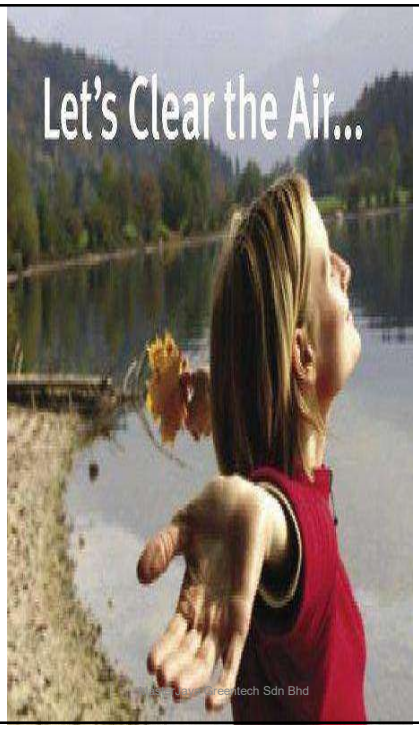
DATO' SERAFIN WOO

MASTER JAYA GREENTECH SDN BHD

*Mobile : **012-3210069*** *Tel : 03-8966-2422*

Email : serafin@masterjaya.com.my

Website : http://www.masterjaya.com.my



MASTER JAYA
AIR POLLUTION CONTROL SINCE 1983

Thank You!!!