Proficiency Testing (PT)
ALME – OR - 06 Method: Determination of particulate matter (TSP) mass flow in flowing air mass.

Instructions for the Dust Testing Train Measurements Participants

Introduction

Český institut pro akreditaci (ČIA, www.cai.cz) – the Czech Accreditation Institute (CAI) - in connection with laboratory Proficiency Testing (PT) by means of proficiency testing (PT) program in conformity with EN ISO/IEC 17043 and in conformity with MPA 30-03-12 par. 4 has established the Association of Laboratories for Emission Measuring (Asociace laboratoří pro měření emisí - ALME, www.alme.cz) as a provider of proficiency testing also for method: ALME – OR - 06: Determination of particulate matter (TSP) mass flow in flowing air mass.

This document gives instructions to participants of PT (proficiency testing) ALME - OR – 06 method: "Determination of particulate matter (TSP) mass flow in flowing air mass" on conceptual and technical part of their participation and performance of measurements on the "Dust Testing Train" facility situated at VŠB – Technical University Ostrava in the Energy Research Center (ERC).
ERC is not an organizer of PT. ERC is a subsupplier of ALME for ALME – OR - 06 method: Determination of particulate matter (TSP) mass flow in flowing air mass.

"Dust Testing Train" Facility Description

Preparation of a concentrated aerodispersive mixture is ensured by a vibration batcher, which spills a known amount of dust into a funnel from which the air and dust mixture is transported to an ejector. The ejector sucks-in the batched dust with air and mixing of this mixture with ejector jet air occurs in a diffuser. Follow-up, this mixture is transported by way of ϕ20 mm pipeline through a conical mixing piece (perforated sheet) to an inlet into the testing train sampling section which is formed by ϕ313 mm vertical pipeline of c. 7 m length. On the vertical sampling section, there are two locations enabling to realize a representative air mass sample take-off for determination of the mean concentration of particulate matter and their mass flow. Further, the air mass is lead into a filtration device where a substantial part of batched dust is captured. The filtration device is subsequently connected with an exhausting fan which represents a source of suction for the dust testing train. The particulate matter mass flow reference value is determined on the basis of the batched dust weighed amount and batching time. The particulate matter mean concentration reference value is determined from the particulate matter mass flow and air mass volume flow in the dust testing train. Air mass volume flow is determined by the Venturi tube which is positioned before the filtration device. Flow rate is controlled with the help of a frequency converter which alters the exhausting fan rotational speed.

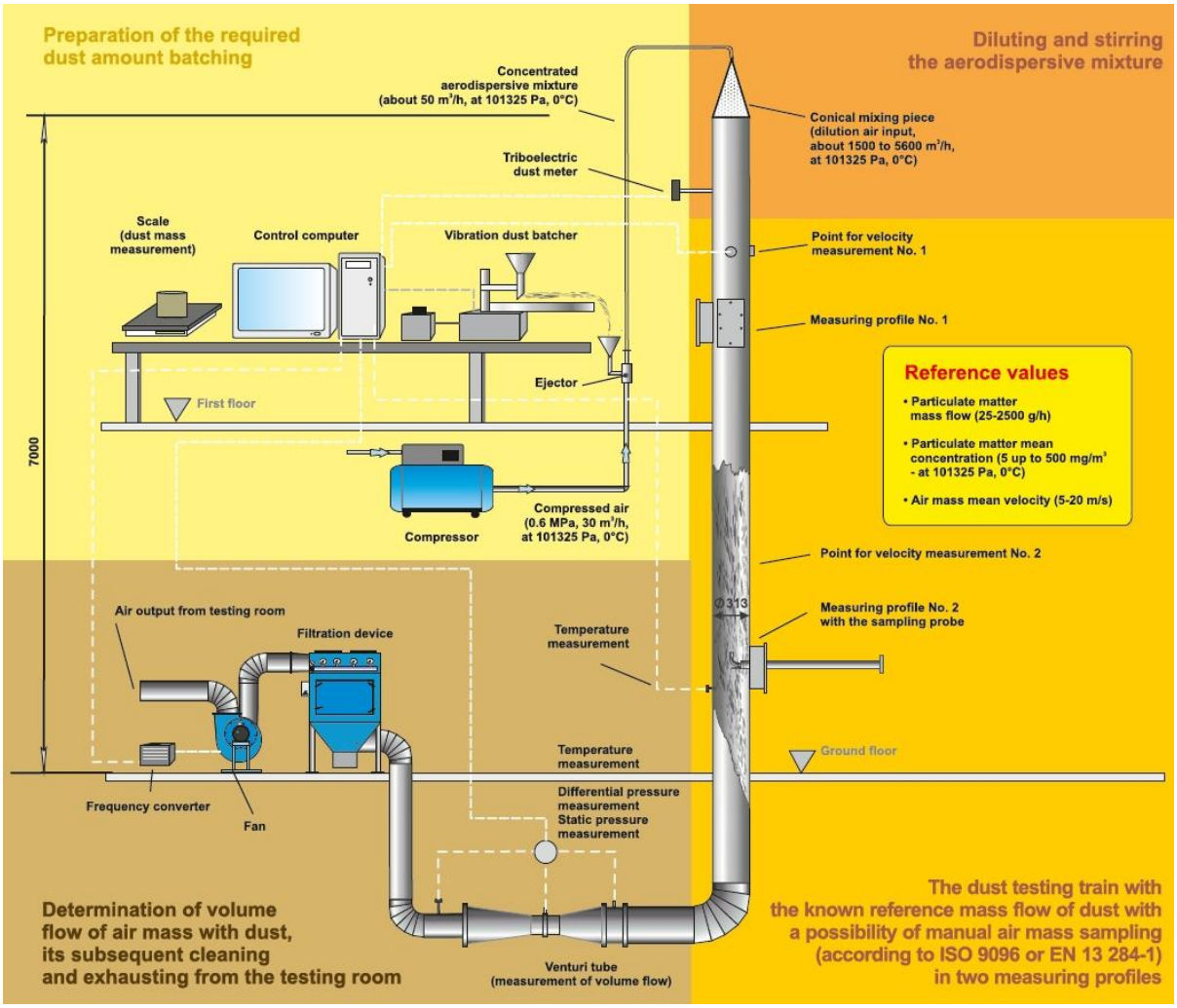

Fig. 1 Dust testing train scheme

Determined Parameters

Within the Proficiency Testing (PT) framework, participants perform the following determinations:

- Determination of particulate matter (TSP) concentration ranging from 5 up to 50 [mg/m^3 at 0°C and 101.325kPa]
- Determination of gas flow mean velocity ranging from 5 up to 15 [m/s]
- Determination of testing medium mass flow with regard to declared concentration and velocity [g/h]

Measuring subjects under verification determine particulate matter mass flow in measuring profiles three times (3 take-offs) and their measured values are compared with reference values of particulate matter mass flow which has been prepared on the dust testing train by ERC (Energy Research Center) workers.

Application for PT

Binding aplication - purchase order for proficiency testing programs ALME 2014 is available on: https://vec.vsb.cz/en/workplace/testing-laboratory-of-boilers/proficiency-testing/

PT application shall be submitted electronic to email alme@alme.cz and simultaneously to email bulisova@empla.cz (both is necessary), contact person: Ing. Alena Bulisová, +420 732 489 813, alme@alme.cz.

The filled-in application form has to be sent to the above mentioned address and a PT participation fee has to be paid.
A participant will obtain information on PT date and venue. A PT participant is obliged to come to the PT place on the specified day. The PT place of performance is fixed, the PT date can be arranged with the PT organizer.

Place of Performance of PT ALME - OR – 06 Method

PT ALME - OR - 06 method is organized at VŠB – Technical University Ostrava, the Energy Research Center. In this workplace, the "dust testing train" facility is located.
The workplace is situated on this address: VŠB – Technical University Ostrava, Energy Research Center, 17. listopadu 15 /2172, Ostrava-Poruba, 708 33.
GPS coordinates - Loc: 49°49'56.878"N, 18°9'34.263"E, active reference link.

Contact persons:

Ing. Jiří Horák, Ph.D.	+420 603 565 926	jirka.horak@vsb.cz
Ing. František Hopan, Ph.D.	+420 608 347 930	frantisek.hopan@vsb.cz
Zdeněk Kysučan	+420 608 122 502	

PT ALME - OR – 06 Method Process Orientation Schedule

For your information, here is the PT time schedule. Usually this schedule is being maintained, however, the schedule adaptation can be arranged. The schedule change has to be agreed by all PT participants on the given day (the dust testing train operators, the PT second participant).

- 8:00 Arrival into the laboratory
- 8:05 Organizational and safety training
- 8:15 Measurement preparations
- 9:30 1st sampling start
- 10:30 2nd sampling start
- 11:30 3rd sampling start
- 12:30 Tidying-up the equipment – handing-over the workplace, submitting the filled-in measurement form
- 13:30 Departure

2 measuring groups perform PT on the given day. Each measuring group is assigned with one measurement location.

Participant's Preparation before his/her Arrival to the PT ALME - OR – 06 Method Place

Participants get their measuring equipment for TSP determination in a pipeline ready. The dust testing train pipeline is of 313 mm inner diameter and is made of stainless sheet of 1 mm thickness. The measurement location is fitted with two flanges perpendicular to one another (see Fig. 2 and Fig. 3). There are 6 holes located in the flanges on which M6 nuts are welded from behind. Participants have minimally one plate cover for this flange adapted for their measuring equipment.

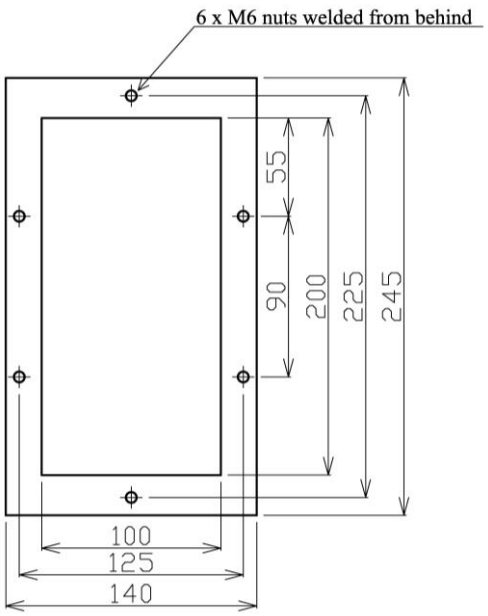

Fig. 2 Dust testing train flange dimensions drawing

Fig. 3 Dust testing train flanges view

When asked for, the dust testing train operator can lend a plate cover with a hole with a welded M36x3 nut in its geometrical centre (see Fig. 4) to a participant.

Fig. 4 Flange plate cover photo (to lend)

The Very Process of PT ALME - OR – 06 Method Determination

- Before measuring, participants are introduced into the test process and briefly trained on safety, more essential instructions are given to participants on-site and in a printed form.
- Before beginning measurements, participants countersign their approval with videorecording which serves to the PT organizer eventually when solving possible participants' complaints.
- Participants are assigned a measurement location (up or down). Participants can make an agreement or locations are assigned by lots.
- Participants have adequate time for preparation of apparatuses and for performing orientational measurements of air mass velocity profile in the dust testing train and other values needed. At that time, demanded parameters of air mass flow are being set in the dust testing train.

- As soon as all PT participants are ready, the very sampling can begin.
- Follow-up the dust testing train operator checks the required air mass flow in the dust testing train with the help of the control software, opens compressed air supply into the ejector and starts-up the vibration batcher in the first entire minute. Then, after one minute, he/she gives the instruction to begin measurements to operators of devices under verification on no.1 and no.2 locations.

TSP Sampling Schedule

At the dust testing train, there are two measurement locations one above another. In order to ensure minimal mutual influence of these two measurement locations, a schedule for inserting the sampling isokinetic probes into the dust testing train and the interference avoidance principles list has been drawn-up. The time schedule of one sampling is shown in Tab. 1.

	Time
1. Dust batcher and compressed air feeder switch-on	t + (-1) min
2. Sampling start in the first point	t + 0 min
3. Probe moving to the second point	t + 15 min
4. Sampling interruption	t + 30 min
5. Probe moving to the second line	x min
6. Sampling continuation in the third point	t + 30 + x min
7. Probe moving to the fourth point	t + 45 + x min
8. Sampling finished	t + 60 + x min
9. Dust batcher switch-off	t + 60 + x + 1 min

Note: x is a time in minutes which is needed by operators of devices under verification for moving the sampling probes from one sampling line to the second sampling line.

Tab. 1 Time schedule of one TSP sampling

Operators of devices under verification are obliged to adhere to following principles:

- It is forbidden to open measurement flanges during sampling!
- During sampling, measurements are performed in four measurement points
- Sampling in each point lasts 15 minutes
- Sequence of measured points is determined by the dust testing train operator so that interference of measurement location no. 2 by measurement location no. 1 cannot occur during measuring (see Tab. 2 and Tab. 3).

Sampling point sequence number	**Point code**	**Point residence time**
1	A1	15 min
2	A2	15 min
Probe moving	-	2-5 min
3	B1	15 min
4	B2	15 min

Point code - see Fig. 5.

Tab. 2 Measurement points sequence schedule on location no. 1 (up)

Sampling point sequence number	Point code	Point residence time
1	B1	15 min
2	B2	15 min
Probe moving	-	2-5 min
3	A1	15 min
4	A2	15 min

Point code - see Fig. 5.

Tab. 3 Measurement points sequence schedule on location no. 2 (down)

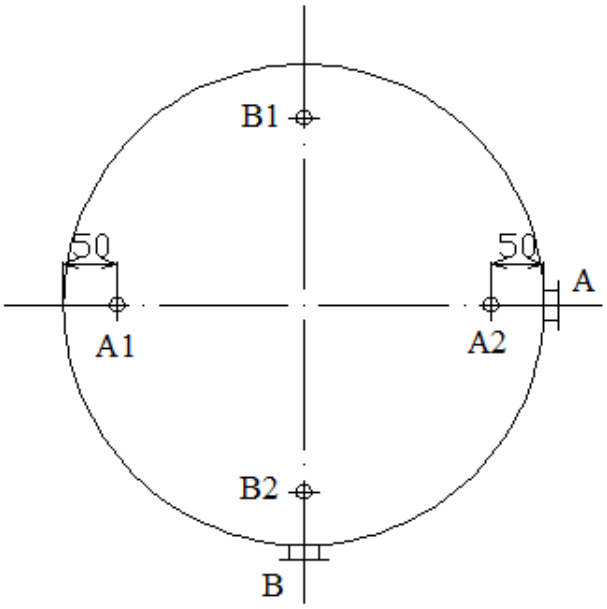

Fig. 5 Dust testing train measuring profile scheme

Additional information:

- Dry air of 1.293 kg/m^3_N density at normal-state conditions is considered as a flowing medium
- Normal-state conditions are 0°C and 101,325 Pa; TSP concentration shall be recomputated to these conditions

PT Participant's Measurement Results Delivery to PT ALME - OR – 06 Method Organizer

Immediately after PT has been finished, a participant fills-in the first page of the form (see Tab. 4) and delivers to the dust testing train operator. The dust testing train operator enters data of this first part of the form into PC, prints it, gives to the participant for a check and subsequently this form will be made in two signed and stamped copies. One copy will remain at the dust testing train operator, the second copy will remain kept by the PT participant. The electronic version will be sent to the participant in a form of a locked document (MS Excel, .xls) to his/her email address.

The participant shall evaluate the measurements on the dust testing train (weighing the filters from all samplings) within one month of the PT. He/she will fill the resulting values on the second page of the printed form and add company stamp. This completed stamped form is signed and stamped and converted into pdf format. The pdf form and the filled electronic form (MS Excel, .xls) must be sent to the both e-mail address alme@alme.cz and and bulisova@empla.cz, contact person: Ing. Alena Bulisová, +420 732 489 813.

PT Participant Output Form -
Determination of Particulate Matter (TSP) Mass Flow in Flowing Air Mass

!!! Page 1 of this form shall be filled-in completely before a participant's departure from PT !!!

Measurement participant name	
Address	
MŽP ČR (MŽP SR) authorization number and validity	
ČIA (SNAS) accreditation number and validity	
Entitled person name	
Entitled person contact (tel./email)	
Apparatus type (brief description)	
Probe type (simple/combined)	
Velocity probe type (L/S/other)	
Number of value measurements in one sampling point	
Retainer type (internal/external)	
Filtration material diameter	
Filtration material sort	
Filtration material certificate (yes/no)	
Probe and retainer washing (yes/no)	
Leakage test (yes/no)	
Leakage test (criteria description for a positive result)	

Measurement location	VŠB – Technical University Ostrava, Energy Research Center			
ALME code				
Sampling marking (assigned by ERC)				
Measurement date	dd.mm.yyyy			
Measuring profile - sampling location (up/down)				
Nose-piece diameter	mm			
Sampling start time	hh:mm			
Sampling finish time	hh:mm			
Which measurement line was measured as the first one (A/B)				
Atmospheric pressure	kPa abs.			
Static pressure in the pipeline (with regard to atmospheric pressure)	Pa			
Air mass temperature in the pipeline	°C			
Profile diameter in line A	mm			
Profile diameter in line B	mm			
Velocity probe constant	-			
Differential pressure in point A1	Pa			
Differential pressure in point A2	Pa			
Differential pressure in point B1	Pa			
Differential pressure in point B2	Pa			

In Ostrava, on _____

Signature of an entitled person of PT participant: _____

ERC representative signature: _____

Tab. 4 The first page of the output form (to be filled-in on-site)

ALME code				
Sampling marking (assigned by ERC)				
Measurement date	dd.mm.yyyy			
Taken-off sample volume (at normal conditions)	m^3/take-off			
Total weight of captured TSP (filter + washing)	mg			
Weight of TSP captured in washing (if carried out)	mg			
Isokinetic ratio	-			
Air mass mean velocity in the measuring profile	**m/s**			
Extended uncertainty of determination of air mass mean velocity in the measuring profile	**m/s**			
Air mass volume flow (normal conditions)	**m^3/h**			
Extended uncertainty of determination of air mass volume flow (normal conditions)	**m^3/h**			
TSP concentration in the measuring profile (normal conditions)	**mg/m^3**			
Extended uncertainty of determination of TSP concentration in the measuring profile (normal conditions)	**mg/m^3**			
TSP mass flow	**g/h**			
Extended uncertainty of determination of TSP mass flow	**g/h**			

Place and date: _____

Signature of an entitled person of PT participant: _____

Tab. 5 The second page of the output form (to be filled-in after scaling the filters)

Disclosing PT Reference Values and PT Complex Evaluation

After PT has been finished and the measured values have been delivered from all participants to the head coordinator, the relating reference values will be disclosed on ALME web (www.alme.cz), i.e. one month after the PT ALME – OR - 06 method. A final report with a participation certificate will be sent to a participant by the end of the September.

Safety and Fire-fighting Training

Wording of the safety training which shall be signed by each PT participant before the works begins:

OCCUPATIONAL SAFETY AND HEALTH PROTECTION INFORMATION REPORT and FIRE PROTECTION INFORMATION REPORT on providing information to outside employees.

Pursuant to the provision § 101, art. 3) of Act no. 262/2006 Coll. (Labour Code), your obligation is to make yourselves familiar to possible dangers when getting around and staying in our institution. The given information are delivered to each employee of another employer or to a self-employer who will perform an activity. If there is a group of workers of another employer, information on risks will be delivered to the group manager and that one will be liable for regular delivery of all obtained information.

- For entering and exiting, you are obliged to use only an appointed place (usually a front door).

- When performing modifications, adaptations and other activities, you are obliged to adhere to all safety procedures relating to your activity, and that including providing written information on risks which might endanger workers or students. In a case of performing works which menace surroundings with noise, dust etc., such a time schedule needs to be agreed which disturbs schoolwork as little as possible.
- When performing an inspection, checkup, or more precisely when getting around the premises, you are obliged to give notice and you will be assigned with an accompaniment employee, otherwise you are obliged to stay on the place determined for performing your activities.
- When entering specific areas (boiler-room, work-room etc.), you are obliged to use prescribed PPE (personal protective equipment), if allotted to you.
- It is forbidden to bring-in and use private electrical appliances (cookers, heating spirals etc.), excepting those necessary for your activity performance.
- Do not use without an agreement technical devices and electrical appliances the owner, or the entrepreneur, of which is VŠB – Technical University Ostrava.
- Do not let any devices, machines, chemical matters or tools without oversight or supervision.
- When using appliances which you are allowed to use, you are obliged to follow the operating instructions.
- If finding-out any malfunction of any equipment owned by the institution (e.g. damage of an extension cord, supply cable, apparatus, appliance), you are obliged to inform a chief worker.
- Do not consume alcoholic beverages and do not abuse other addictive drugs in the institution premises and keep to imperative smoking ban in the area and in the VŠB – Technical University Ostrava premises (§§ 8,9 of Act 379/2005 Coll.).
- You may only put your personal items on designated places, in a case of a long-time activity, arrangement of a key-lockable room may be possible.
- Report an accident or injury which happened in the VŠB – Technical University Ostrava premises to an entrusted worker, first-aid treatment will be provided to you (the worker who makes an introduction shows the places with first-aid kit to the introduced person physically).
- In a case of fire, persons who move around the VŠB – Technical University Ostrava premises are obliged to contribute to fire fighting according to their own abilities, and that exclusively using portable extinguishing means (fire extinguishers) which are placed available throughout corridors.
- If evacuation of the premises was sounded, you are obliged to fall into line and follow instructions of your accompaniment or marked escape ways.
- As to the most essential hazards (except from the mentioned ones), they will always be added for an actual activity, if needed.
- Possibility of slipping or fall on stairs, corridors etc.
- Possibility of collision with another person.
- Possibility of an accident while using an apparatus, appliance etc.; however, introduction to the safe use shall be performed before using.

Videorecording Prior Approval

During PT, the measurement locations are being monitored by a recording camera system. These recordings will be used in a case of suspicion on nonstandard events in the dust testing

train or if participants complain about the measurement location having been interfered by the other measurement location.
Videorecording prior approval wording which shall be signed by each participant before beginning the work:
This is to certify that I was familiarized and agree with making video records of measurement locations of the testing facility for TSP determination. These locations are visibly marked with a plate.