Andersen
Low-pressure Cascade Impact Sampler

Model: MAIS-10

Summary / Feature

Compared with the conventional impact type samplers, the Andersen Low-pressure Cascade Impact Sampler (MAIS-10) collects and concentrates the particles in extremely small area, so it is possible to increase the collection amount for the analysis.

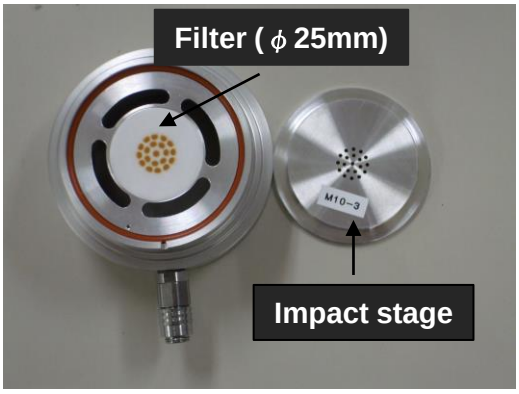
MAIS-10 has a structure with 10 corrosion-resistant aluminum alloy stages, and each stage has multi-jet nozzles. It can classify and collect aerosols from 0.03 μm to 8.6 μm. The collection plate can be used with Quartz filter, Teflon filter, as well as stainless filter. Aerosol of 0.03 μm or smaller sizes are filtered and collected by a backup filter.

MAIS-10 Body

Application

- ✓ Combustion process studies and emission measurements
- ✓ Air pollution research
- ✓ Engine emission measurements
- ✓ Classification and collection for fine particles of high-tech materials, tobacco particles, photochemical aerosols, diesel exhaust particles, etc.

Specifications



After collection

Flow rate:	9 L / min ± 10%
Suction pressure:	-91.3 kPa (upstream point of backup filter)
Pump:	Oil pump
Collection plate diameter:	ϕ 25 mm (Quartz, Teflon, Stainless filter, etc.)
Weight:	2.0 kg (without pump)
Dimensions:	W120 x D120 x H370 mm
Material:	Aluminum

The particulate matters in the air are sampled on each collection plate in such a manner that air stream drawn from top of the sampler head is accelerated in flow in each jet nozzle toward to down stages and impact on each collection plates. Thus each size of particles are aerodynamically classified and collected in each stage.

Generally, the inertial parameter of the impactor - Stokes number (Stk) is defined by the aerosol particle size, the nozzle cross-sectional area, and the aerosol flow velocity. According to the aerodynamic impact research by Dr. Ranz and Dr. Wong, the following formula is given:

$$Stk = \frac{\rho_p D_p^{\,2} V C_c}{9\mu W} \quad \cdots ①$$

$$C_c = \frac{2\lambda}{D_p}\left(1.257 + 0.4\exp\frac{-0.55 D_p}{\lambda}\right) \quad \cdots ②$$

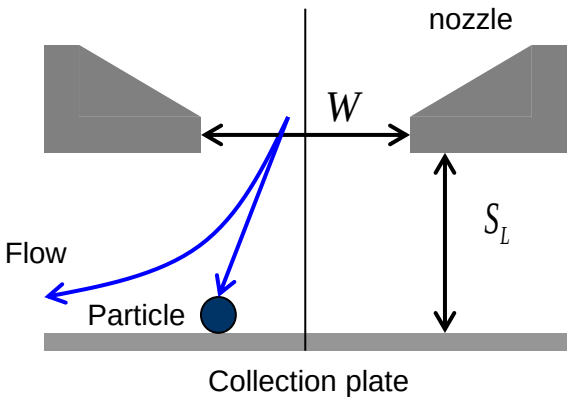
- V : Velocity of gas (m/s)
- D_p: Size of particle (m)
- ρ_p: Particle density (kg/m^3)
- μ : Gas viscosity (kg/m-s)
- Cc: Slip correction factor

The particle size (D_p) at which the collection efficiency reaches 50% is called the cutoff diameter and is expressed as D_{p50}. The stokes diameter (Stk) at that time is expressed as Stk_{50}.

When S_L / D_p and S_L / W is ≧ 1, Stk_{50} takes an almost constant value (see the figure on the lower right), and Stk_{50} has been obtained as an experimental value in the range of √ Stk_{50} = 0.4 to 0.5.
Using the following formula ③ obtained by transforming the above formulas ① and ②, the classification table (lower left) of MAIS-10 is obtained.

$$D_{p50} = \sqrt{\frac{9\mu W Stk_{50}}{C_c \rho_p V}} \quad \cdots ③$$

Stage	$D_{p\,50}$(μm)
1	8.8
2	4.1
3	2.3
4	0.88
5	0.49
6	0.24
7	0.15
8	0.095
9	0.06
10	0.03



Classification characteristics: 0.03 to 8.6 μm in 10 steps

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