

MODEL KS-306.60-WI

MICROPROCESSOR CONTROLLED, CONTINUOUS OPERATION, LOW VOLUME
FLOW RATE DUST, AEROSOL, SOLID PARTICLE SAMPLER WITH
PM₁₀ - PM_{2,5} - PM₁ PRESEPARATOR

ISO 12884 AND EN 12341 STANDARD

KÁLMÁN SYSTEM SINCE 1976



FEATURES

- 👍 Volume flow rate meter tested and calibrated by the National Office of Measures.
- 👍 Wide sampling measurement range.
- 👍 High-accuracy, long-life volume flow rate meter, practically insensitive to pollution.
- 👍 Sampling volume flow rate stabilisation, continuous regulation to the set values.
- 👍 Sampling for Ø 60 or 50 [mm] filter, 3x2- double stage PM₁₀ PM_{2,5} and PM₁ impactor.
- 👍 Microprocessor control, PC connection facility for data polling.
- 👍 Protection against intervention. Data protection and storing, restarting in case of power failures.
- 👍 Full-range LCD display for checking of the summated volume and volume flow rate.
- 👍 Portable, lightweight design and easy handling.
- 👍 Operation from 230 [V] mains.

1. Purpose

The type **KS-306.60-WI** sampler instrument is suitable for continuous, 24-hour or longer-duration, one- or three-stage, fractionated sampling of airborne solid particles, aerosols to be found in the air.

/Fig. 1./

Together with a chamber-system, circular gap nozzle type, two-stage dual impactor integrated with the sampler, the instrument facilitates filtering out of approx. 70-100 [m³] airborne dust and solid particles from the air, daily.

Depending on the dust concentration - after 24 - 96 hours of sampling - with decomposition to three fractions - having an adequate analytical background - the heavy metals bound to the dust and other toxic materials causing the genetic mutations and, other materials emitted to dwelling areas by the industrial technologies can be detected.

The sampler is provided with cascade impactors of PM₁₀ - 10 [µm] , PM_{2,5} - 2,5 [µm] and PM₁ - 1 [µm] cut-off size, pre-separator and back-up filter.

The intake device and the volume flow rate meter form a compact unit. To increase the measuring accuracy a temperature-measuring probe has been built-in.

The control electronics stores all measurement data and it can be interconnected with a PC through USB port.

The measurement data can be displayed in file or, using the AR-COM communication software, printed.

The measurement method complies with the specifications of the ISO 12884 and the EN 12341 standards, too.

2. Summarising technical description, volume flow rate measurement

The so-called low volume flow rate sampler shown in **Fig. 1.** consists of the following main sub-units:

- Suction device integrated with the volume flow meter.
- 3x2-double stage cascade impactor and filter housing with connection extension.
- Measuring and control unit with thermometer and pressure signal forwarding cables and electric fittings, with covering providing protection against drip water.

From the air flowing from the outer atmosphere through the sampler intake device /1/, **Fig. 1.**, designed according to the EPA recommendations, provided with guide columns reducing the influence of the wind intensity and wind direction variations, and a volume flow rate reducing space, via a short straight tube section and a Venturi volume flow rate meter /2/, the dust particles of bigger size are separating on the trapping plates of the impactor stages /3/.

The smaller particles are intercepted by a planar filter of 60 [mm] diameter accommodated in the filter housing /4/. The high-purity air is passed through the blow-out opening of the vacuum pump to

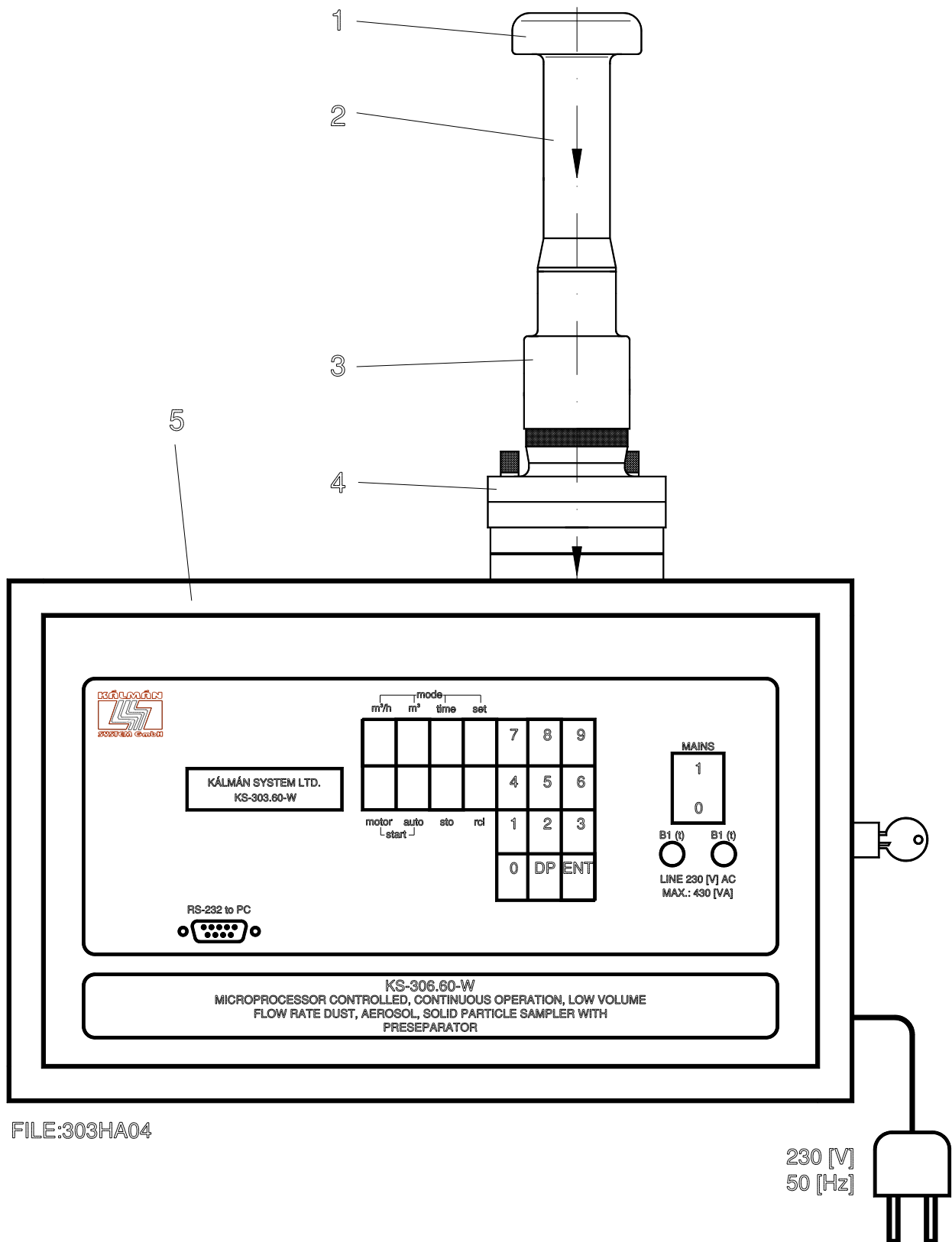


Figure 1.

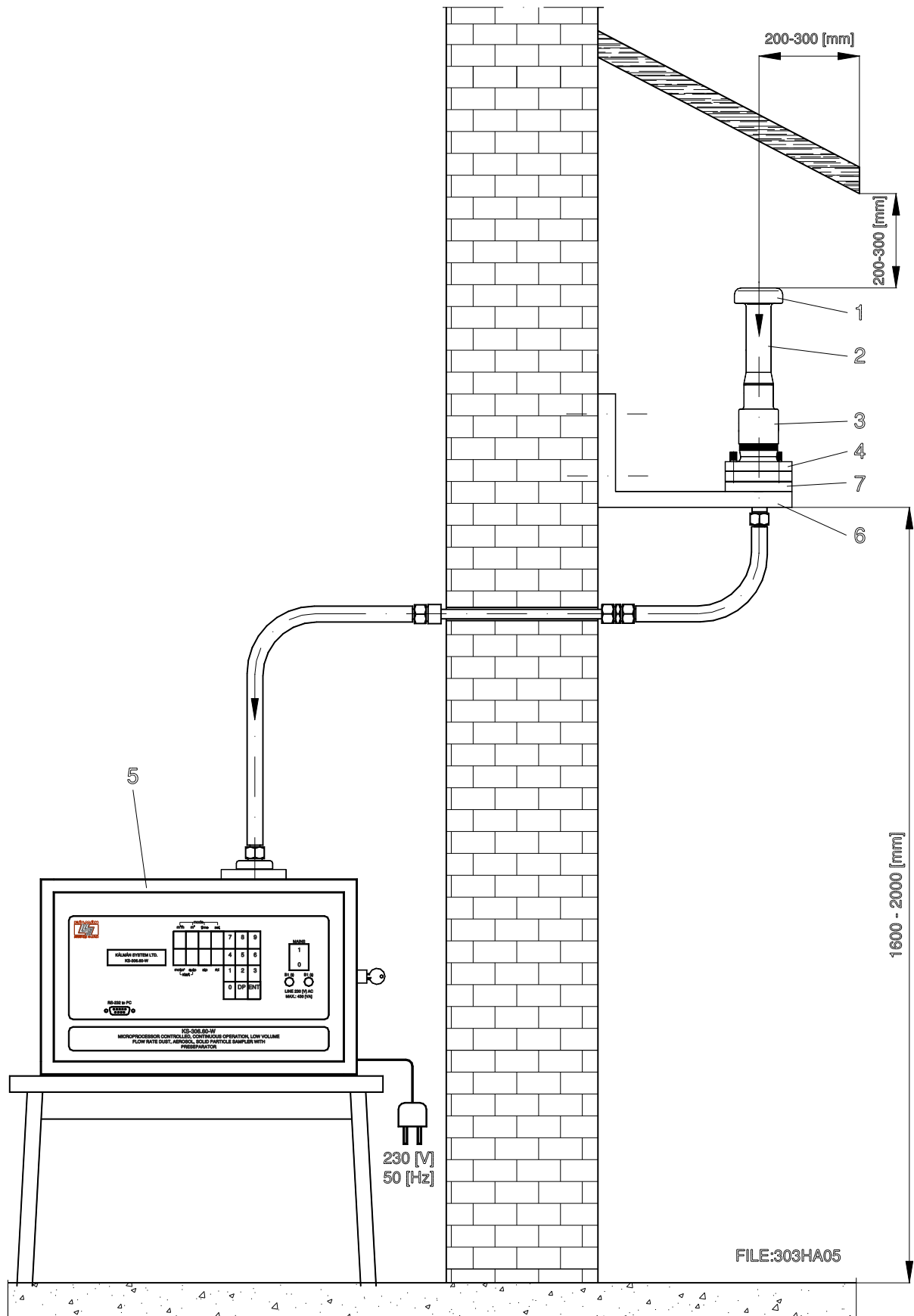


Figure 2.

the outer atmosphere. The evaluation unit /5/ of the volume flow rate meter, processing the electric signal proportional to the temperature of the intake air and the pressure signal /6/ of the Venturi meter, measures the quantity of the through-suctioned air [m³/h], the total volume through-suctioned during the sampling, in [m³] and, the duration of the sampling.

Setting of the slow flow rate change originating from clogging of the filter - to the requested value - is effected automatically by the electronic rotational speed controller. Protection of the measuring and control unit against unauthorised intervention and drip water is ensured by a corrosion-proof, lightweight structure.

From the pressure output / Dpv / of the volume flow rate meter, the volume flow rate /q/ can be calculated with use of the following equation:

$$q = kv * \sqrt{Dpv * (t + 273,16)}$$

- q - volume flow rate [m³/h]
- kv - constant admeasured by accuracy test
- Dpv - pressure output of volume flow rate meter [mbar]
- t - temperature of the intake air [°C]

3. Technical data

<input checked="" type="checkbox"/> Denomination	Low volume dust sampler
<input checked="" type="checkbox"/> Main functions to be fulfilled	Measurement of particulate matter in ambient air
<input checked="" type="checkbox"/> Field of application	24-hour measurement of PM₁₀ , PM_{2,5} , PM₁ concentrations in ambient air
<input checked="" type="checkbox"/> Main functional requirements	Principle of method: gravimetric
<input checked="" type="checkbox"/> Unattended continuous sampling	for 1 week
<input checked="" type="checkbox"/> Sampling head	PM₁₀ , PM_{2,5} , PM₁ cascade impactor
<input checked="" type="checkbox"/> Sampler head, impactor material quality	Stainless steel, Al.Mg.Si.h3,t titanium
<input checked="" type="checkbox"/> Sampling method	Semi-automatic
<input checked="" type="checkbox"/> Operating time	Continuous
<input checked="" type="checkbox"/> Sampling channel	Automatic or manual
<input checked="" type="checkbox"/> Channel change	1-24 hours, programmable
<input checked="" type="checkbox"/> Material quality of the sampler	Corrosion-proof, where necessary
<input checked="" type="checkbox"/> Usage of the sampler	Easy access to operating parts
<input checked="" type="checkbox"/> Handling and operation	Simple and fast with special regard to changing sample in the field
<input checked="" type="checkbox"/> Data display	Alphanumeric LCD display for the major parameters
<input checked="" type="checkbox"/> Flow rate measuring range	q = 1 - 4 [m³/h]

- | | |
|-------------------------------------------------------------------------------|------------------------------------------------------------|
| <input checked="" type="checkbox"/> Flow rate stability | $\pm 0,5$ [%] |
| <input checked="" type="checkbox"/> Power supply | 230 [V], 50 [Hz], |
| <input checked="" type="checkbox"/> Display of sampling data, by channel | [m ³ /h], [m ³], [°C], [bar] |
| <input checked="" type="checkbox"/> Data storing and printing | AR-COM software |
| <input checked="" type="checkbox"/> Power consumption, max. | 250 [VA] |
| <input checked="" type="checkbox"/> Mass of sampler | 14 [kg] |
| <input checked="" type="checkbox"/> Motor speed control | Electronic |
| <input checked="" type="checkbox"/> Control to the set volume flow rate value | Automatic |
| <input checked="" type="checkbox"/> Floor area demand | Approx.. 460 x380 [mm] |

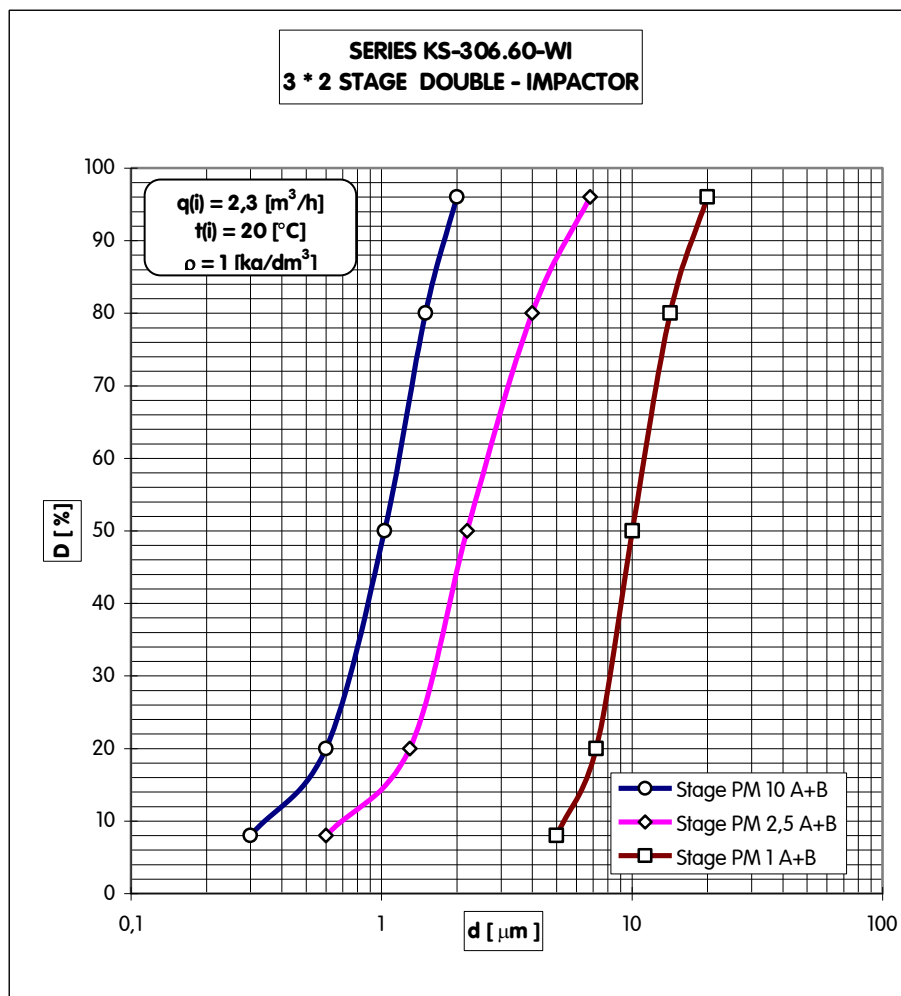


Figure 3.

KS-306.60-IW IW.MDB					
Datei Kontakt Optionen					
Masse					
	Leer Masse [gramm]	Voll Masse [gramm]	Netto Staubmasse [mg]	Massen- rückstand [%]	Aerodynamischer Durchmesser d(ae) [µm]
PM 10 A :	0,0640	0,0651	1,1	4,07	10,20
PM 10 B :	0,104	0,1046	0,6		10,11
PM 2.5 A :	0,089	0,0919	2,9	9,09	2,53
PM 2.5 B :	0,105	0,1059	0,9		2,51
PM 1 A :	0,084	0,0878	3,8	11,72	1,02
PM 1 B :	0,101	0,1021	1,1		0,98
Endfilter :	0,288	0,3194	31,4	75,12	
Insgesamt :	0,8350	0,8768	41,8		
Auswertung					
Netto Staubmasse (Gf):			41,8	[mg]	
Abgesaugte Luftmenge (SDv):			575,758	[m ³]	
Staubkonzentration (Cpk):			72,60	[µg/m ³]	
				2001.08.08.	14:20:22
Datei Zeit-Diagramm Zeit-Tabelle Auswertung					

Figure 4.

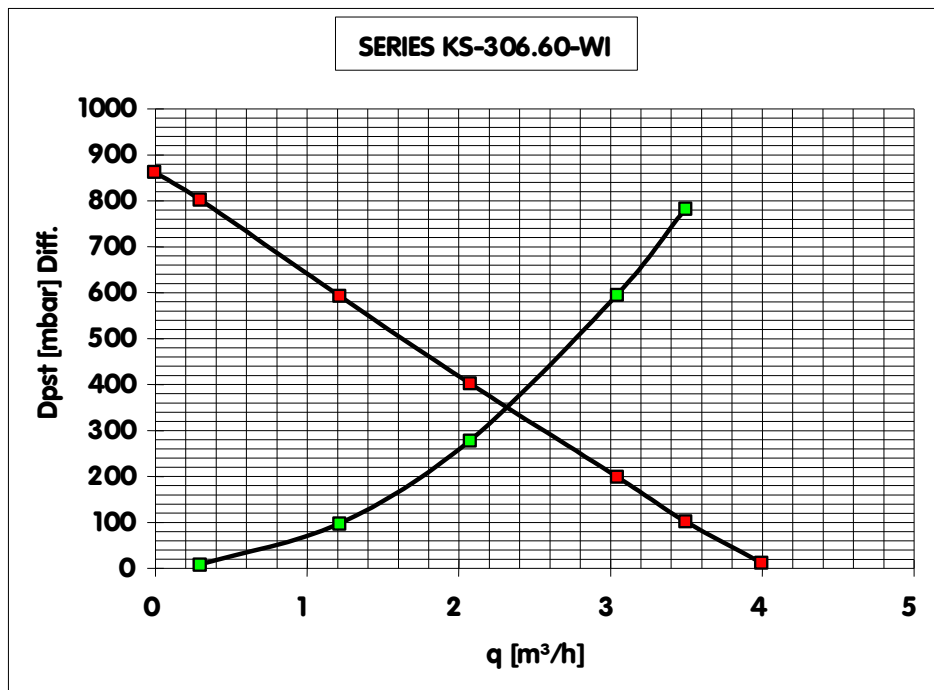


Figure 5.

4. Literature

- Ágnes Mészáros:
Determining separating characteristics of pre separator impactor applied to HV 100 high-capacity sampler for aerosols, developed by Research Institute for Iron Industry Central Institute for Air Physics, VASKUT, March, 1983
- László Köver, Judith B. Schag, József Tóth, Ildikó Borbély-Kiss, Gyula Szabó, Péter Barna, Imre Pozsgai, Ferenc Medve:
Examining air contaminants collected from the area of Debrecen by micro- and surface-analytical methods. MTA Nucleus Research Institute, Debrecen, MTA Technical Research Institute for Physics, Budapest, Public Health and Epidemic Station in county of Hajdu-Bihar, Debrecen
Science of Hygiene 30, 319-329 (1986)
- István Kálmán:
Development results and operation experiments gained by using impactor with circular gap shaped nozzle. Research Institute for Iron Industry, H-Budapest
Aerosols in Science 23-25 September 1981, Duisburg, Germany 264-272
- Friedhelm Sporenberg:
Comparative analysis performed on Andersen type impactor and that of circular shaped nozzles. University of Essen 1987.03.01.
- Sporenberg, G. Ruther, E. Weber:
Collection characteristics of inertial impactor.
The Tenth Annual Conference of the Association Aerosol Res. 1983. 308-313.
- I. Kálmán, Cs. Kálmán, W. Burger:
Seminar für Emissionsmessungen von Stäuben, Aerosolen und Schwermetallen
CH-Egerkingen, 11-12.10.1994
- T. Cziczó, I. Kálmán, Cs. Kálmán, P. Zombori
High Volume Airborne Particle Sampler for Environmental Monitoring with Built-in PM 2-10 Pre-separator Installed in Containers.
International Environmental Technology P. 13-15. 09-10. 1996
- M. Óvári: Speciation of nickel and vanadium in airborne dust.
26th ISEAC (Intern. Symposium on Environmental Analytical Chemistry), A-Wien, 09.-12.04.1996
- M. Óvári: Speciation of nickel and vanadium in airborne dust.
Eu. Research Course on Atmospheres. Fr-Grenoble 13.01-12.02.1997
- Á. Mészáros, I. Kálmán
The application of PM2 pre-separator impactor for high volume flow dust sampling.
Science of Hygiene XLIV. 65-72 (2000. 1.)