

Australian/New Zealand Standard™

AS/NZS 3580.10.2:2013

Methods for sampling and analysis of ambient air

Method 10.2: Determination of particulate matter—Impinged matter—Gravimetric method

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EV-007, Methods for Examination of Air, to supersede AS 2724.5—1987, *Ambient air—Particulate matter, Part 5: Determination of impinged matter expressed as directional dirtiness, background dirtiness and/or area dirtiness (directional dust gauge method)*.

This Standard deals with the measurement of particles that impinge upon vertical surfaces as a result of surface winds.

Impinged matter consists of particles which are airborne under the influence of surface winds and which may collide with projections from the earth's surface. Common sources of such particles are minerals processing, bulk materials handling, mining operations, industrial processes, incineration, agricultural soil cultivation and natural sources of windblown dust.

The material sampled by this method can represent a wide range of particle sizes depending on wind speed. Small particles can cause a nuisance by soiling property. Larger particles can cause weathering of property through abrasive action. Other factors such as colour, shape and size of the particulate matter can influence the perception of nuisance.

METHOD

1 SCOPE

This Standard sets out a method for the sampling of particulate matter in air which impinges on vertical surfaces and procedures for the gravimetric determination of the insoluble solids, ash, combustible matter, soluble solids and total solids content of the collected material.

It should be noted that, despite the equivalence of the units used to report the impinged matter mass flux results of this Standard ($\text{g/m}^2/\text{month}$) and AS/NZS 3580.10.1 (dust deposit gauge), there is no relationship between the results obtained.

NOTES:

- 1 The samples obtained by the specified sampling procedure may subsequently be subject to physical or chemical analysis.
- 2 The method provides an estimate of the mean impinged matter flux over a sampling period, typically one month. Particulate matter impingement rates of $0.1 \text{ g/m}^2/\text{month}$ and above may be determined using a monthly sampling period.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1152	Specification for test sieves
2162	Verification and use of volumetric apparatus
2162.1	Part 1: General—Volumetric glassware
2164	Laboratory glassware—One-mark volumetric flasks
2166	Laboratory glassware—One-mark pipettes
3580	Methods for sampling and analysis of ambient air
3580.14	Part 14: Meteorological monitoring for ambient air quality monitoring applications

AS/NZS

3580	Methods for sampling and analysis of ambient air
3580.1.1	Method 1.1: Guide to siting air monitoring equipment
3580.10.1	Method 10.1: Determination of particulates—Deposited matter—Gravimetric method

NATA

Technical Note 13—User checks and maintenance of laboratory balances

ISO/IEC

Guide	Uncertainty of measurement—Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)
98-3:2008	

3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

3.1 Ash

The mass of that portion of the insoluble impinged matter remaining after combustion at 850°C

3.2 Combustible matter

The mass of that portion of the insoluble impinged matter lost during combustion at 850°C

3.3 Constant mass

Within ± 1 mg of the previous mass.

3.4 Impinged matter

Particles which are collected in the collecting cylinders of a directional dust gauge (see Clause 6.2) and pass through a 1 mm mesh sieve complying with AS 1152.

3.5 Insoluble matter

The mass of the water insoluble portion of the impinged matter.

3.6 Soluble matter

The mass of the water soluble portion of the impinged matter.

3.7 Total solids

The mass of the soluble and insoluble portions of the impinged matter.

3.8 U_{95}

A measurement of uncertainty at a confidence interval of 95% according to ISO/IEC Guide 98-3.

4 PRINCIPLE

Over a given period, particles which impinge on the vertical, internal surface of four collecting cylinders of the directional dust gauge are sampled in collecting pots at the bases of the cylinders.

The samples are passed through a sieve to remove any extraneous matter (e.g. leaves, insects), with the sieved sample containing the impinged matter subsequently transferred to a filtration apparatus. The insoluble and soluble materials are separated by filtration and the mass of dried insoluble solids determined gravimetrically. Soluble solids are determined by evaporation of the filtrate and gravimetric analysis.

The ash and combustible matter content are determined by loss on combustion of the insoluble solids. Total solids are obtained by the addition of the insoluble solids and the soluble solids.

The mass flux rate of impinged matter for each collecting cylinder is calculated from the mass of solids obtained, the slot cross-sectional area and the exposure period.

5 REAGENTS

5.1 General requirements

Only reagents of recognized analytical grade, distilled water or water of an equivalent or better purity shall be used.

5.2 Copper sulfate solution

Dissolve 7.80 g of copper sulfate pentahydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) in water and dilute to 1 L in a volumetric flask.

6 APPARATUS

6.1 Glassware

Grade A volumetric glassware shall be used throughout. Volumetric flasks shall comply with AS 2164 and pipettes with AS 2166. Use of volumetric glassware shall comply with AS 2162.1.

All beakers, flasks, evaporating dishes and crucibles (including filters) shall be uniquely identified to ensure traceability of each sample as it proceeds through the analytical process.

6.2 Directional dust gauge

A directional dust gauge consists of four vertical collecting cylinders, each with a slot of dimensions 45 mm by 340 mm, commencing approximately 10 mm from the top of the cylinder. The edges of each slot shall be at right angles to the width of the slot and not radial (see Figure 1). The cylinders shall be mounted at 90° to each other with the slots facing outwards. An easily detachable collecting pot shall be fitted to the bottom of each collecting cylinder. The combined length of a collecting cylinder and its attached collecting pot shall be at least 640 mm with the collecting pot having a capacity of approximately 1 L. For areas of high rainfall a larger collecting pot may be required.

The collecting cylinders and pots shall be constructed of chemically resistant material such as polyvinyl chloride. The external diameter of the collecting cylinders shall be 75 mm. The collecting cylinders shall be located with their axes at the corners of a 150 mm square mounting plate. All gauge dimensions and tolerances are provided in Figure 1.



6.3 Lid

A tight-fitting lid is required for sealing each gauge collecting pots during transport, made of an impermeable material that does not react with the expected constituents of the collected impinged matter.

6.4 Stand

The stand supports the directional dust gauge such that the top of the gauge is 1.5 m to 2 m above ground level. The stand shall maintain the gauge rigidly in a vertical position, made of painted steel, galvanized steel or other strong, corrosion resistant material. A typical stand and gauge is illustrated in Figure 2.

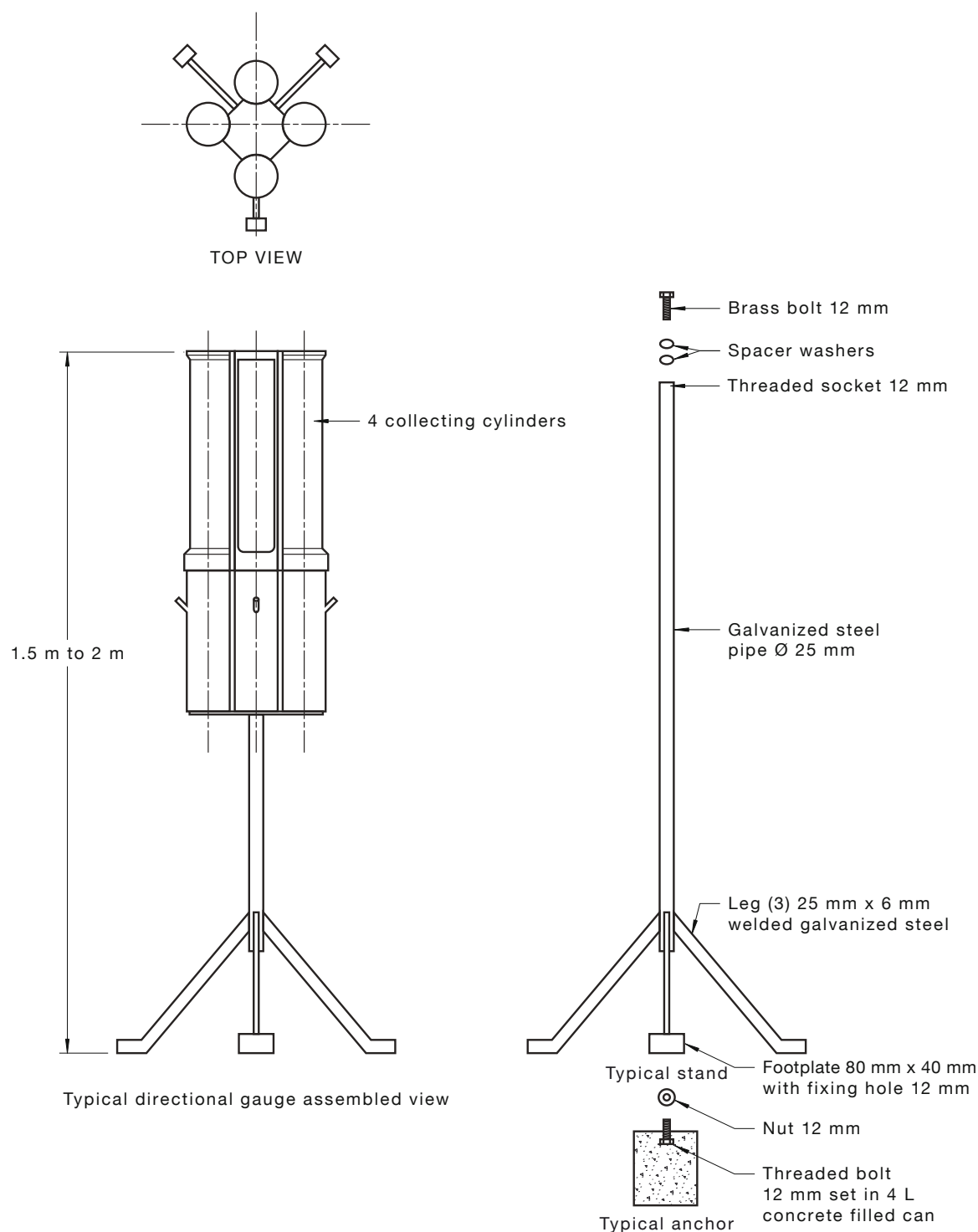


FIGURE 2 STAND FOR DIRECTIONAL DUST GAUGE

6.5 Filtration apparatus

Silica crucibles with porous filter bases (porosity 3) or Gooch crucibles of porcelain, silica or alundum with filter pads of equivalent retention are acceptable for separation of the insoluble fraction from the soluble fraction. Alternatively, Buchner funnels, with an appropriate glass, quartz, ashless or membrane filter paper may be used.

NOTE: Consideration should be given to the hygroscopic nature of the filter.

The choice of filter apparatus is based on the difficulty of filtering the impinging material and any requirement for subsequent analysis of the collected material.

6.6 Test sieve

The test sieve shall have a 1 mm aperture size and comply with AS 1152.

7 SAMPLING

7.1 Location

The sampling site shall be selected in accordance with AS/NZS 3580.1.1. For interpretation of results it is beneficial to measure wind speed and wind direction data in accordance with AS 3580.14 at the gauge location.

7.2 Positioning of the gauge

For general surveys, the collecting slots in the collecting cylinders shall face the cardinal compass points, i.e. north, south, east and west.

If a known or suspected emission source is to be monitored, locate the gauge in a position which is expected to be affected by the source. Orient the gauge such that the slot of one of the collecting cylinders is facing the emission source and take a compass bearing. Allow for magnetic variation (refer AS 3580.14).

7.3 Period of exposure

For routine monitoring programs, the period of exposure is typically one month.

NOTE: Shorter monitoring periods are acceptable provided sufficient sample is collected.

7.4 Procedure

7.4.1 Preparation of directional dust gauge

The inside surface of the directional dust gauge shall be cleaned with washing agents that do not react with the materials of construction. After cleaning, the gauge shall be rinsed with distilled water in order to remove any remaining extraneous matter and residual washing agent.

Pipette 10 mL of copper sulfate solution (Clause 5.2) into each collecting pot to prevent algal growth. Tightly seal each collecting pot. The assembled gauge should be packed for transport to the sampling site.

7.4.2 Gauge exchange

Directional dust gauges should be changed on the first day of each month or as near as possible to the first day of each month, when monitoring is conducted on a monthly basis. When a collecting pot has overflowed, soluble matter cannot be determined.

The gauge exchange procedure shall be as follows:

- (a) At the end of the exposure period, wash any impinged matter adhering to the inside of the collecting cylinder into the collecting pot using a minimal volume of distilled water from a wash bottle.

NOTES:

- 1 A brush or rubber policeman can be used to dislodge any foreign/particulate matter adhering to the internal surfaces of the collecting cylinders. Ensure any particles adhering to the brush or rubber policeman are washed into the collecting pot.
 - 2 It is recommended that any contamination of the sample (e.g. spider webs, insects, leaves, seeds, apparent human interference etc.) be noted for inclusion in the test report.
- (b) Remove and seal the collecting pots with firmly fitting lids. Seal the overflow pipes on each collecting pot. Identify each collecting pot with a label detailing site location, directional position of collecting pot on the gauge and the period of exposure. Return the collecting pots to the laboratory for analysis.