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METHODS FOR MEASUREMENT OF AIR POLLUTION

PART V SAMPLING OF GASEOUS POLLUTANTS

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0. FOREWORD

0.1 This Indian Standard (Part V) was adopted by the Indian Standards Institution on 25 September 1975, after the draft finalized by the Air Pollution Sectional Committee had been approved by the Chemical Division Council.

0.2 For determination of concentration of a gaseous pollutant in air, it is necessary to obtain representative samples of air at a number of strategic points. The concentrations are likely to vary with time and distance from the source of pollution depending upon the nature of release, meteorological factors and local conditions such as topography and presence of buildings or vegetation. The measured concentrations are also known to depend upon the average time, namely, the period of sampling. These aspects are required to be taken into account for sampling and interpretation of the measured values. There should be a number of strategic points and samplings. Recommended practice prescribed in this standard is based on the experience gained in sampling air at conditions prevalent in this country.

0.2.1 In the preparation of this standard considerable assistance has been derived from the work done in this field by National Environmental Engineering Research Institute (NEERI), Nagpur.

0.3 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard (Part V) describes the method of sampling applicable to the gaseous pollutants in the air, such as oxides of nitrogen and sulphur, ozone and hydrogen sulphide which react with liquid absorbing reagents at atmospheric temperature and pressure when air is bubbled through the absorbing solution in the impinger (also known as bubblers).

*Rules for rounding off numerical values (*revised*).

2. SAMPLING STATION

2.1 Location

2.1.1 The sampling station should be selected so as to serve the exact purpose of investigation. For general city level it should be so located with respect to various sources, and the meteorological factors prevailing in the area that it gives a sample of pollution prevalent in the area reasonably representative. For local industrial pollution survey, it may be located to give maximum levels from that particular source.

2.1.2 The sampling station should have a free exposure, so that it does not collect air from a stagnant pocket. It should be away from large buildings which may interfere in free air circulation. It should be located at a height of minimum 1·5 m but not exceeding 15 m from the ground.

2.1.3 The sampling point should be such that it is not directly influenced by any local source emission meant for general study pollution level survey. For local investigation, it should be located to serve the exact purpose. Public buildings like city schools, laboratories, police stations, hospitals, municipal and government offices are more suitable because of their easy accessibility and security. The sample site should avoid contamination due to heavy automobile traffic or any such type of local effects.

2.2 Number of Sampling Stations — The number of stations in the sampling network will depend upon the purpose of investigation, availability of equipment and analytical facilities. Broadly, area survey and long term survey require a network which is more or less uniformly distributed, preferably in a rectangular grid. Individual short term surveys or spot surveys for single stations should be along the mean plume centreline as far as possible, backed by background readings from upwind regions.

3. APPARATUS

3.1 The equipment to be used for community air sampling will consist of a standard impinger of 35 ml capacity, a trap, manometer, a flowmeter or critical orifice device and a suction pump. The arrangement of the sampling train is illustrated in Fig. 1.

3.2 Sampling Train — A typical sampling train is shown in Fig. 1 comprising an impinger, trap, manometer, flowmeter, valve and pump. However, if desired, critical orifice device may be substituted for conventional trap, flowmeter and valve assembly. The impinger shall be protected from direct sunlight.

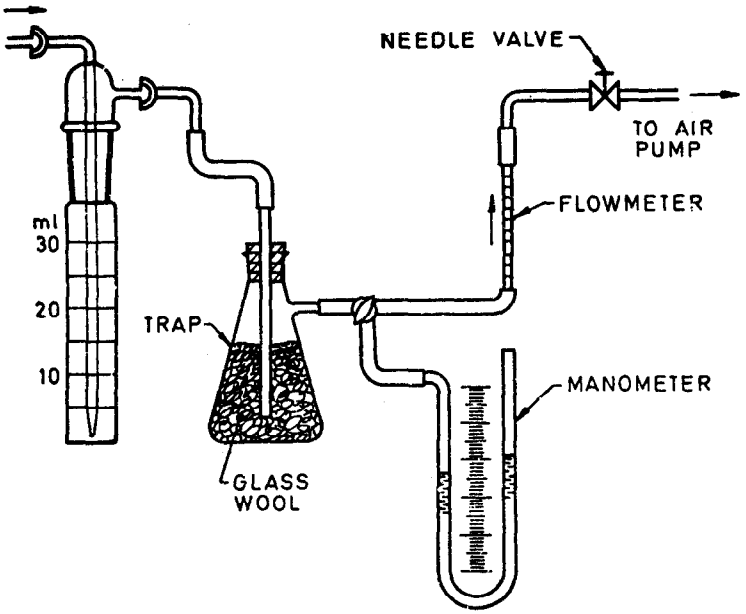


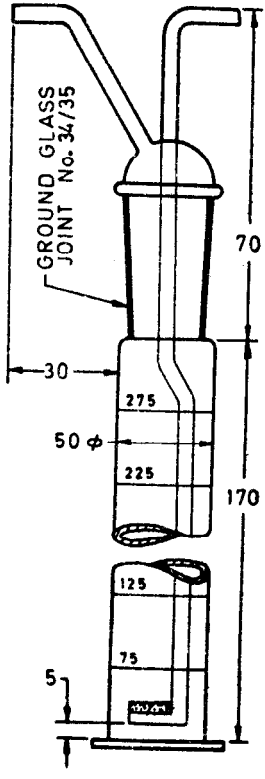
FIG. 1 SAMPLING TRAIN

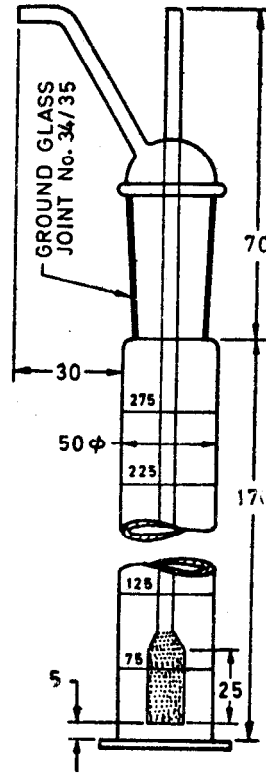
3.3 Impingers — A great variety of shapes and sizes of these are being used. A few of them which are generally used as standard practice are illustrated in Fig. 2 to 6. These glass impingers shall be made from type 1 glass conforming to IS : 2303-1963*. Details regarding these impingers are given in Table 1.

3.3.1 All-glass impingers, commonly called midget impingers, are of 35 ml capacity, 22 cm in length and 2·6 cm wide, impinging end of the tube 1 mm bore size or preferably with fritted disc with porosity 50 microns or less. Details of two types of midget impingers are given in Fig. 7 and 8.

3.3.2 These units usually provide the most efficient collection of gaseous pollutants. In addition to the commercially available types, some devices may be made by using normal gas dispersion tubes. The fritted part of the dispersion tube is readily available in the form of a disc or cylinder of various pore sizes. Under the optimum conditions of flow rate, absorbing medium and type of pollutant, many of the fritted glass impingers have a collection efficiency in excess of 90 percent.

*Method of grading glass for alkalinity.



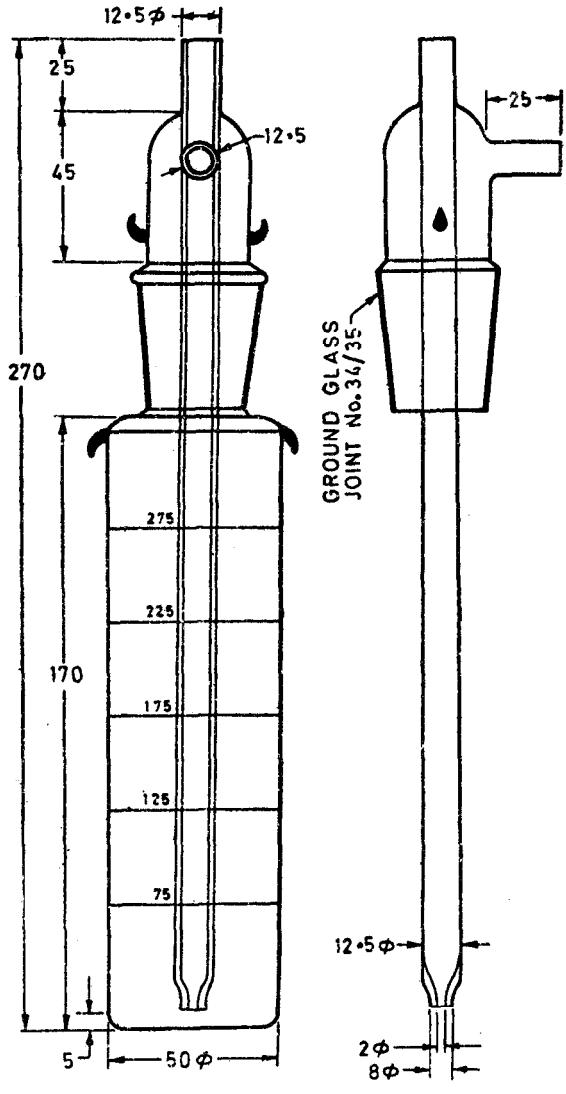


All dimensions in millimetres.

FIG. 2 LARGE IMPINGER WITH FRITTED DISC

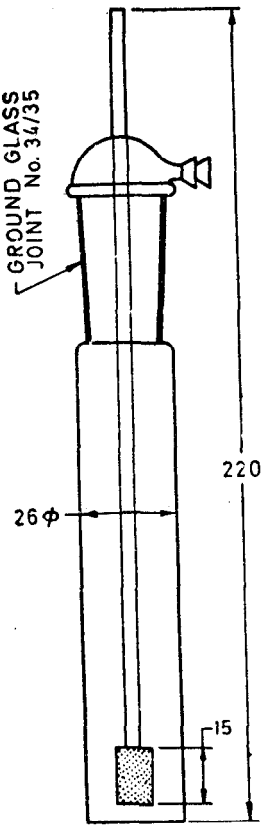
FIG. 3 LARGE IMPINGER WITH CYLINDRICAL FRIT

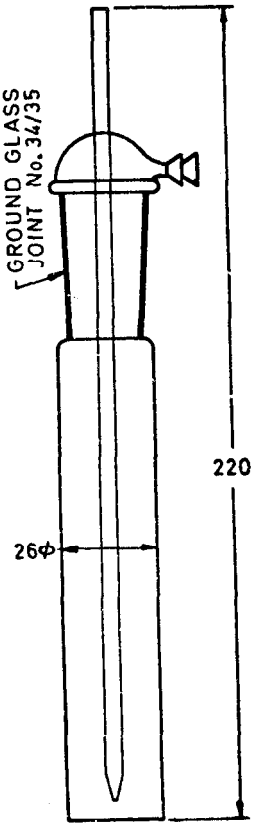
3.3.3 Units which use frits of approximately 50 microns or less pore size gradually become clogged with use. They may be cleaned by surging the appropriate cleaning solution back and forth through the frit and then rinsing with distilled water in the same fashion. Various substances may be removed from the frits by cleaning with the appropriate solvent, namely, hot hydrochloric acid for dirt, hot concentrated sulphuric acid containing sodium nitrite for organic matter, etc.



All dimensions in millimetres.

FIG. 4 STANDARD LARGE IMPINGER





All dimensions in millimetres.

FIG. 5 MIDGET FRITTED IMPINGER

FIG. 6 STANDARD MIDGET IMPINGER

TABLE 1 DETAILS REGARDING VARIOUS AIR SAMPLING IMPINGERS

(*Clause* 3.3)

Sl No.	Details	Large Impinger with Fritted Disc (*see* Fig. 2)	Large Impinger with Cylindrical Frit (*see* Fig. 3)	Standard Large Impinger (*see* Fig. 4)	Midget Fritted Impinger (*see* Fig. 5)	Standard Midget Impinger (*see* Fig. 6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Absorbent capacity, ml	100	100	100	20 to 30	20 to 30
ii)	Sampling rate, (*l/Min*)	1 to 5	1 to 5	1 to 5	0·1 to 0·5	0·1 to 0·5
iii)	Application	Short period stack gas sampling and for ambient air when large volume of sample is needed		For sampling aerosols from stacks and air	For gas sampling in air	Commonly used for gas sampling

NOTE — These can be locally fabricated. Normally impingers shown in Fig. 5 and 6 are used for ambient air sampling programme. Large impingers as shown in Fig. 2 to 4 are used for collecting large volume of samples especially from industrial locations. Fritted discs of porosity 50 microns or less shall be used.

3.4 Flowmeter — A rotameter or a total air gas meter calibrated accurately for the flow range 0 to 3 litre per minute.

3.5 Critical Orifice Device — Critical orifice (*see* Fig. 9) to give a flow of about 1 litre per minute. Normally hypodermic needles are used as critical orifice. Details are as follows:

Hypodermic Needle Gauge No.	*Needle Length*	*Air Flow Obtained*
23	1·58 cm	0·5 litre/minute
27	0·95 cm	0·2 ,,

3.6 Trap — This can be a glass wool trap or a membrane filter as shown in Fig. 1 or Fig. 9.

3.7 Pump — A suction device capable of drawing air into the sampling train of 5 to 10 litres per minute capacity with 500 mmHg vacuum capability, and fitted with moisture trap. A light weight pump of continuous rating for 24 hours, self lubricating and operating on 230-250 V ac, 50 Hz shall be suitable for field work.

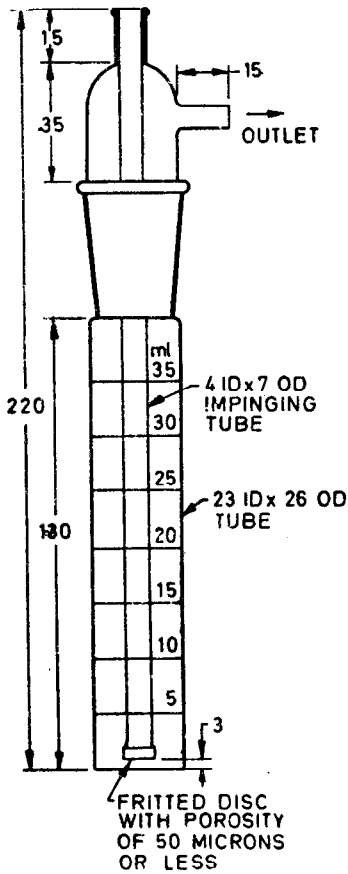
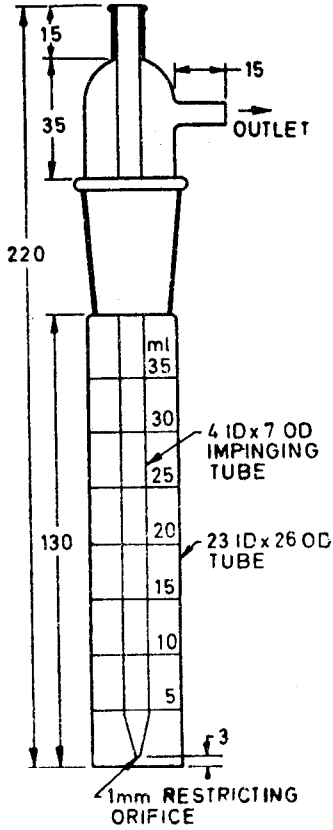


FIG. 7 FRITTED IMPINGER FOR AIR SAMPLING



All dimensions in millimetres.

FIG. 8 STANDARD IMPINGER FOR AIR SAMPLING

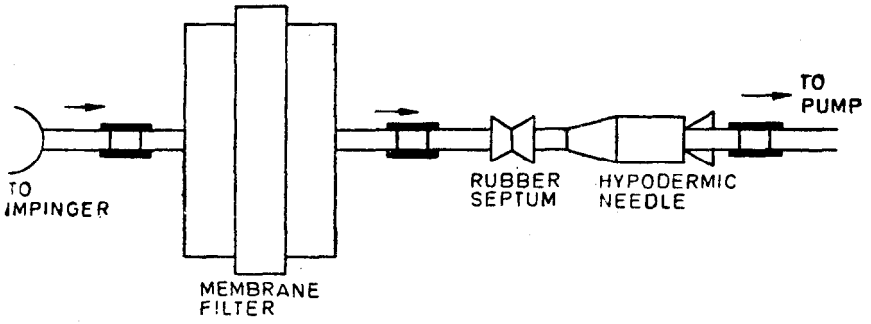


FIG. 9 CRITICAL ORIFICE DEVICE

4. SAMPLING PERIOD

4.1 Exact period shall vary with the type of sampling programme and its purpose. But normally sampling range is from half-an-hour to 24 hours depending upon the expected concentration of the pollutant, its nature and the investigation patterns. Based on practical experience over the years of sampling in India, it is recommended that air sampling rates which give minimum of evaporation with reliable efficiency should be as follows:

Period of Sampling	*Rate of Sampling* (litre/minute)
30 minutes	2
1 hour	1
1 to 4 hours	0·5
8 hours	0·2
8 to 24 hours	0·1 to 0·2