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846-462

ITW DeVilbiss

August 14, 1996

NIOSH Docket Office
Robert A. Taft Laboratories
M/S C34
4676 Columbia Parkway
Cincinnati, OH 45226

The following is a response to your request for comments regarding 42 CFR Part 84.

ITW DeVilbiss has been manufacturing spray finishing equipment for over ninety years. We are very aware of the hazards associated with isocyanates and other toxins found in most automotive finishes. We are also equally aware of the lack of proper respiratory protection currently in use in the automotive refinish industry.

Industry estimates indicate the approximate number of U.S. body shops to be 50,000 establishments. These shops employ over 100,000 auto painters. In addition, numerous industries also finish or refinish such devices as boats, planes, trains, truck, motorcycles, trailers, emergency vehicles, etc. with isocyanate-based paints. Despite the obvious hazards associated with these paints, the respirator of choice continues to be charcoal cartridge half mask respirators. Various industry sources estimate that fewer than five percent of auto painters utilize the proper respiratory protection - supplied air. In contrast, over 95% of British auto painters utilize supplied air respirators. Compliance throughout Europe is well over 90% in all body shops.

Why such high-level protection in Europe and basic disregard for safety in the U.S. shops? Obviously, there are numerous reasons. Chief among them are convenience and price. European shops are allowed to supply both respirable air and spray air from a common air hose. This hose generally connects to a filter/regulator mounted on a waistbelt. Respirable air is filtered and regulated to meet air volume and quality requirements. Spray air is diverted to a short length air hose which is connected to a spray gun or other pneumatic tool. This offers significant benefit to the painter, as only one hose is required. The number one objection to supplied air systems in the U.S. is the necessity to drag around two air hoses. This greatly increases the opportunity for an air hose to contact wet paint on the car - requiring a complete redo. Since most painters are paid by the job, this could be a costly mistake. All painters really care about is a quality finish. Safety must never compromise the finish.

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Price is also a major concern. Although ambient air pumps with half-masks sell for around $700.00, they are rarely used because of the inconvenience of a separate hose as well as the discomfort of the hot air that these systems create. A great percentage of these systems are never used. They were purchased to meet OSHA requirements. Even those bought with good intentions are rarely used because of the inconvenience of the product. Grade D filter panels used to filter compressed air are also available, but they can easily cost over $2,000.00, far beyond the financial resources of most shops.

Current OSHA requirements for carbon monoxide monitoring and NIOSH requirements that the source of Grade D air be at the point of attachment add significant cost to these system. European air quality requirements are actually tougher than U.S. standards. However, they allow the source of clean air to be belt-mounted and do not require constant CO monitoring of the air supply. Most European systems are comprised of a water filter and coalescing filter mounted on a wall. The air hose connects these filters to a waistbelt assembly which comprises a charcoal filter and a regulator to which the respirator attaches. A spray hose is also attached to an outlet on the waistbelt assembly.

Our British partners have manufactured and sold over 800,000 of these respirators throughout the world with great success over the past 15 years. Not one complaint has ever been received regarding the safety of this type of system. It meets all European requirements for respiratory safety and is CE approved. Why, then, won't NIOSH approve this product for sale in the U.S.?

The main reason appears to be the lack of a written procedure to test the product. I suggest adopting the European testing protocol (attached). This would appear to be an expedient method to improve the respiratory protection of over 100,000 auto painters and tens of thousands of other workers overexposed to isocyanates and other hazardous materials in the spray finishing industry. The convenience and more affordable price of this system would certainly increase safety and compliance in the workplace.

Sincerely,

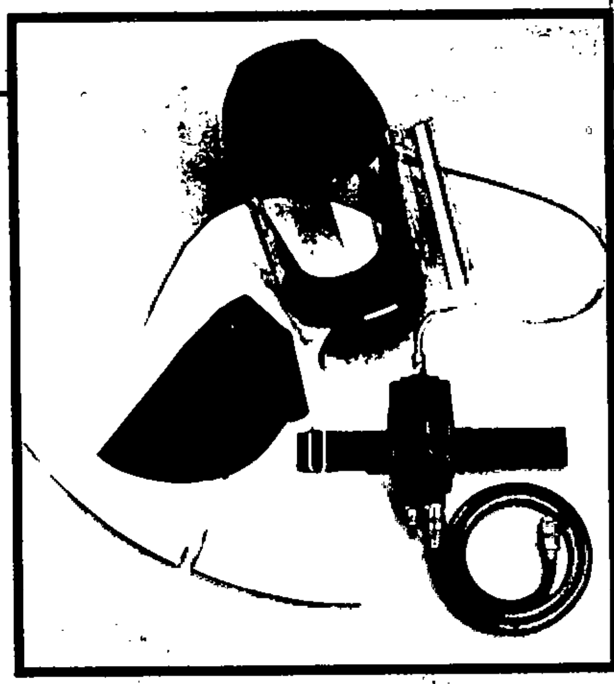
John Gulbronson

John Gulbronson

JG/mh
Attachment

DEV LB SS MPV

Air-Fed Face Vizor Breathing Outfits



- A SINGLE SUPPLY LINE PROVIDES BOTH SPRAYING AND BREATHING AIR
- LIGHTWEIGHT MOULDED CONSTRUCTION FOR MAXIMUM COMFORT
- WAISTBELT WITH ODOUR FILTER AND PRE-SET PRESSURE REGULATOR
- WRAP AROUND VIZOR PROVIDES EXCELLENT VISION
- RATCHET HEADBAND ADJUSTMENT IS FAST AND CONVENIENT
- FOAM SEALS ENSURE EFFECTIVE FACIAL AIR FLOW
- PADDED BROWGUARD & ADJUSTABLE CROWNSTRIP FOR EFFECTIVE FIT
- HIGH FLOW QUICK DETACH FITTINGS FOR USE WITH

DeVilbiss MPV Air-fed, safety systems provide the effective, practical and comfortable solution for operator respiratory protection in paint shop, bodyshop or production line spraying environments.

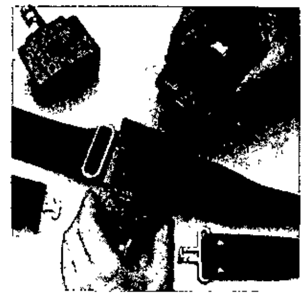
Without any compromise to protection and safety, these lightweight systems allow excellent freedom of movement with minimum encumberance to the wearer. The outfits include all the necessary components to provide both

DeVILBISS MPV

THE WAISTBELT FILTER REGULATOR HAS QUICK DETACH CONNECTIONS FOR THE AIR INLET AND BOTH AIR OUTLETS

THE FULL FACE VIZOR HAS A RATCHET HEADBAND ADJUSTMENT FOR FAST FITMENT

THE VIZOR IS SUPPLIED COMPLETE WITH A REMOVEABLE NECK COVER FOR ADDITIONAL OVERSPRAY PROTECTION



THE ODOUR REMOVAL CARTRIDGE IN THE WAISTBELT FILTER HOUSING IS EASILY AND QUICKLY REPLACED

DeVilbiss MPV Air-fed, Full face vizor outfits are approved by the Health and Safety Executive, fully CE approved and designed to satisfy the COSHH Regulations for protection against gas, vapours, dust, mists, particulates and fumes including isocyanates to Class 2 protection factor 100. The vizor is kitemarked to BS2092 for eye and face protection and satisfies G2C for impact and liquid splash.

THE VIZOR: The advanced design full-face vizor uses plastics moulding technology to provide a strong, servicable unit. A moulded headband allows fast positioning on the head and location is ensured by a rapid action ratchet. The crown strip is also adjustable and swivel bearings at the sides provide a useful vizor flip-up, nod-down facility.

Air to the facial area is gently dispersed at a positive pressure and diffused to avoid noise, misting and discomfort. The vizor shield has an excellent field of vision with sufficient clearance for spectacles.

Special disposable wrap around covers which prevent scratching or permanent contamination are available in kits. The vizor shield itself is snapped onto the browguard to allow replacement if necessary.

THE WAISTBELT: The waistbelt mounted filter/regulator assembly is the portable control centre where the incoming air is diverted for spraying or vapour filtered for breathing.

A high absorption, easily replaced activated carbon cartridge filter with a 1000 hour life expectancy provides effective odour filtration. Filter expiry is signalled by a colour change indicator. The system has been specifically designed to sustain high flow rates to operate HVLP or conventional spray guns.

The pre-set, waistbelt regulator now incorporates a rolling diaphragm to stabilise the airflow and provide a safer working pressure range. Pneumatic damping avoids internal 'noise' reaching the wearer.

Note: It is essential that the air supply is in sufficient volume and filtered to 0.01 micron through a coalescer before it reaches the final stage 'odour' filter cartridge.

AIR HOSES: Both MPV vizor outfits (see contents list below) include a 1.2m (4') length of high quality, rubber, 8mm (5/16") bore spray gun hose. An option is the inclusion of a 7.6m (25') length of 8mm (5/16") bore, PVC hose air supply.

QUICK DETACH CONNECTIONS: Self-sealing, 'High-flow', Q.D. fittings are supplied at all the air entry and air outlet ports. These fittings ensure complete convenience for the wearer.

The complete MPV-615 Air-Fed Face Vizor Outfit comprises of:

Vizor Assembly with ratchet headband, detachable vizor covers, neck cover, disposable hood, stowage bag and a clear flexible hose with a quick detachable stem to couple to the waistbelt.

Waistbelt Assembly: An adjustable nylon belt with quickfit buckle. The disposable carbon odour removal filter and pre-set regulator are contained in a moulded housing which is moveable on the belt.

Rubber 8mm (5/16") bore air hose 1.2m (4') with quick detachable fittings to connect to spray gun or air tool.

7.5m (25ft) long Air Supply Hose in durable PVC fitted with quick detach female connection and a 1/4" loose nut female fitting. The hose is 8mm (5/16") bore.

Note:- The MPV-616 Vizor Outfit comprises all the above but without the 7.5 metre air supply hose.

A complete range of spares and replacement items are readily available to maintain or improve the performance and comfort of your DeVilbiss full face vizor or rubber half-mask.

MPV VIZOR SPECIFICATION AND PERFORMANCE DATA

Operating inlet air pressure range	2.3 bar (34psi) - 7 bar (102 psi)
Maximum System Pressure:	10 bar (145 psi)
Carbon Cartridge Life:	1,000 hours at nominal airflow.
Nominal flow rate to the vizor	180 l/min
Maximum operating temperature	40°C (104°F)

As an alternative to the full face vizor DeVilbiss offer a half-mask and goggles outfit. Ask for leaflet reference MPV(MSK).

CE

DeVILBISS

ITW Finishing Systems and Products

HSE STANDARD FOR TYPE APPROVAL OF RESPIRATORY PROTECTIVE EQUIPMENT

AIR FED RESPIRATORY PROTECTIVE DEVICE INCORPORATING A VISOR:

TM14/7.25 ISSUE 7: 01/05/91

THIS STANDARD IS TO BE USED FOR HSE TYPE APPROVAL OF RPE

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REQUIREMENTS FOR HSE TYPE APPROVAL: AIR FED RESPIRATORY PROTECTIVE DEVICE INCORPORATING A VISOR : TM14/7.25: ISSUE 7: 01/05/91

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ACKNOWLEDGEMENT

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0 PREAMBLE

A given respiratory protective device can only be approved when the individual components satisfy the requirements of this specification which may be a complete standard or parts of standards and practical performance tests have been carried out on complete apparatus where specified.

1 OBJECT AND FIELD OF APPLICATION

This Standard specifies minimum requirements for air fed visors used as respiratory protective devices, except for escape purposes.

It does not cover devices for use in circumstances where there is or might be an oxygen deficiency (oxygen less than 17% by volume).

The devices are classified as shown in Table 1. Three classes of device are covered, the differentiation resulting from the respiratory protection level provided.

Laboratory and practical performance tests are included for the assessment of compliance with the requirements.

2 REFERENCES

EN148 Part 1	Threads for Facepieces; Standard Thread Connection
prEN132	Definitions
IEC 651	Specification for Sound Level Meters
BS 3928	Method for sodium flame test for air filters
ISO 2878	Rubber, vulcanised - antistatic conductive products; determination of electrical resistance

3 DEFINITIONS

3.1 AIR FED VISOR

An air fed visor is a device which consists of a transparent face shield which may be sealed to the face by a lightweight seal. This is supplied with breathable air from a compressed air source, providing internal ventilation to the device. The equipment provides adequate respiratory protection, when the wearers skin is dry or moist, when the head or body is moved and when the wearer is speaking. Typical examples of air fed visors are shown in Figure 18.

3.2 MEDIUM PRESSURE CONNECTING TUBE

The medium pressure connecting tube is the airline which connects the wearer to the high pressure air supply system via a pressure reducer.

3.3 LOW PRESSURE BREATHING HOSE

The low pressure breathing hose is the airline which connects the visor to the medium pressure connecting tube via a pressure reducer or supply control valve.

3.4 MANUFACTURER'S MINIMUM DESIGN FLOW RATE

The minimum design flow rate is the flow rate inside the visor, as stated by the manufacturer, above and at which the class requirements are met.

3.5 MANUFACTURER'S MAXIMUM DESIGN FLOW RATE

The maximum design flow rate is the maximum flow rate as stated by the manufacturer at which the class requirements are met.

3.6 MANUFACTURER'S DESIGN PRESSURE

The minimum and maximum pressures at which the minimum and maximum flow rates are obtained.

3.7 SHEFFIELD DUMMY HEAD

A dummy head developed by HSE and available from the Leyland and Birmingham Rubber Co Ltd, Golden Hill Lane, Preston PR5 1UB.

4 DESCRIPTION

4.1 AIR FED VISOR

The construction of this device enables the wearer to be provided with breathable air supplied at a continuous flow to a suitable visor via a supply control valve or pressure reducer which may be carried by the wearer, and a low pressure breathing hose. The exhaled and excess air flows into the ambient atmosphere. A medium pressure connecting tube connects the wearer to a supply of compressed air.

The air fed visor may be fitted with a flow indicator and/or low pressure warning device.

The air fed visor may also be fitted with a supplementary hose for connection to a compressed air operated tool.

5 REQUIREMENTS

5.1 MATERIALS

In submitting an application for approval testing the applicant shall certify compliance with the requirements shown in Clauses 5.1.1 to 5.1.7 in respect of which no specific tests will normally be carried out by the Testing Officer.

5.1.1 All materials used in the construction shall have adequate mechanical strength, durability, resistance to corrosion and resistance to deterioration by heat. Such materials shall be antistatic and fire resistant as far as is practicable.

5.1.2 Materials that may come into contact with the wearer's skin shall not be known to be likely to cause skin irritation or any adverse effect to health.

5.1.3 The complete apparatus shall be sufficiently robust to withstand the usage it is likely to receive in service.

5.1.4 The design of the apparatus shall be such as to facilitate the cleaning and decontamination and the materials used shall withstand the cleaning and disinfecting agents recommended by the manufacturer.

5.1.5 Where anti-fogging compounds are used as intended or specified by the manufacturer, they shall be compatible with eyes, skin and the components of the visor.

5.1.6 Materials used in the construction of the device shall not grossly deform or decompose when subjected to a flame in accordance with 6.17.

5.1.7 All connecting hoses and couplings shall be capable of withstanding without damage twice their maximum working pressure.

5.2 CONNECTIONS (COUPLINGS)

5.2.1 Components of the apparatus shall be readily separated for cleaning, examining and testing.

Tested in accordance with 6.1.

5.2.2 All demountable connections shall be readily connected and secured, where possible by hand.

Tested in accordance with 6.1.

5.2.3 Any means of sealing shall be retained in position when the joints and couplings are disconnected during normal maintenance.

Tested in accordance with 6.1.

5.2.4 The apparatus shall be constructed so that any twisting of the breathing hose or medium pressure connecting tube does not affect the fit or performance of the apparatus, or cause either hose or tube to become disconnected. At least one swivelling coupling shall be fitted into the medium pressure connecting tube.

Tested in accordance with 6.1 and 6.12.

5.2.5 When tested the connections of the breathing hose to the belt and to the visor shall withstand an axial force of 50 ± 2.5 N for 10 s.

Three devices shall be tested, one of which has been pre-conditioned in accordance with 6.2.

Tested in accordance with 6.8.

5.2.6 The connection between the visor and the remainder of the device may be achieved by a permanent or special type of connection or by a screw thread connection. The threads defined in EN 148 shall not be used.

If any screw thread is used it shall not be possible to connect it to the threads defined in EN 148.

Five devices shall be tested, two of which have been pre-conditioned in accordance with 6.2.

5.3 AIR FLOW RATE

5.3.1 When tested the air flow rate into the visor shall not be less than tl manufacturer's minimum design flow rate which shall not be less than 120 l/min.

The maximum flow rate shall not exceed the maximum stated by the manufactur

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.3.

5.3.2 The flow rate and distribution of the air into the visor shall not ca distress to the wearer by excessive local cooling of the head and face.

Tested in accordance with 6.12.

5.4 BREATHING HOSE

5.4.1 The breathing hose shall be of sufficient flexibility to enable the wearer to carry out the practical performance tests and it shall permit fre head movement.

NOTE: The hose should not be of a length which would enable it to be easily caught on obstructions.

Tested in accordance with 6.8.

5.4.2 When tested, the breathing hose, if extensible, shall not collapse ar the elongation shall not be less than 20% of the original length (a).

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.5.

5.4.3 When tested, the breathing hose shall not show a permanent deformati of greater than 10% of the original length (a).

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.6.

5.4.4 When subjected to a force of 50 $\pm$ 2.5 N the air flow shall not be reduced by more than 5%, or if the hose is permanently distorted after the force is released, it shall not be regarded as satisfactory.

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.4.

5.4.5 It shall not be possible to connect a low pressure breathing hose directly to a higher pressure part of the circuit.

Tested in accordance with 6.1.

5.4.6 When tested the connections of the breathing hose between belt and visor shall withstand axially a tensile force of 50 ± 2.5 N for 10 s. Following the test the requirements of 5.12 shall be met.

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.10.

5.5 MEDIUM PRESSURE CONNECTING TUBE

5.5.1 <u>Resistance to collapse</u>

When tested for resistance to collapse, with an applied load of 1000 ± 50N, the reduction in air flow shall not exceed 10%, or if the tube is permanently distorted after the force is released, it shall not be regarded as satisfactory.

Two devices shall be tested, one of which has been pre-conditioned in accordance with 6.2.

Tested in accordance with 6.4.

5.5.2 <u>Resistance to kinking</u>

When tested for resistance to kinking, the medium pressure connecting tube shall maintain a uniform near-circular shape and spiral from the loop configuration described and shall not deform to an extent that decreases the flow of air through it by 10% compared with that measured when the tube is straight and unstressed.

Two devices shall be tested, one of which has been pre-conditioned in accordance with 6.2.

Tested in accordance with 6.8.

5.5.3 <u>Strength of tube and couplings</u>

The medium pressure connecting tube and couplings shall remain leak tight and shall not separate or fail when a force of 1000 ± 50N is applied for a period of 5 minutes.

Two devices shall be tested, one of which has been pre-conditioned in accordance with 6.2.

Tested in accordance with 6.7.

5.5.4 <u>Leak tightness</u>

At the maximum designed working pressure, the tube and couplings shall not leak when immersed in water. This test shall be applied before and after the tube and couplings have been submitted to the test described in 5.5.3.

Two devices shall be tested, one of which has been pre-conditioned in accordance with 6.2.

5.5.5 Flexibility

The tube shall be flexible, such that when pressurised to the maximum working pressure it can be wound without difficulty on a drum 300mm in diameter.

Two devices shall be tested, one of which has been pre-conditioned in accordance with 6.2.

5.5.6 Heat resistance (optional)

If the tube is required to be resistant to damage from contact with hot surfaces, there shall be no sign of damage or indication of failure when tested.

Two devices shall be tested, one of which has been pre-conditioned in accordance with 6.2.

Tested in accordance with 6.9.

NOTE: Particular care should be taken in the choice of tube to be used in very high or very low ambient temperature.

5.5.7 Electrostatic properties (optional)

The surface resistivity of the medium pressure connecting tube, complete with couplings, shall not exceed 10^8 ohm per metre length of tube when measured by making a connection on the coupling, using the test method given in ISO 2878.

5.5.8 Couplings

When hand operated connections are fitted, the outlet of the tube shall be equipped with self sealing couplings.

Tested in accordance with 6.1.

5.5.9 Resistance to air pressure

The medium pressure connecting tube and couplings shall be capable of withstanding, without damage, an air pressure of 30 bar.

Two devices shall be tested, one of which has been pre-conditioned in accordance with 6.2.

5.6 HARNESS OR BELT

5.6.1 A harness or belt shall be provided to minimise the effect of a pull o the hose and visor.

Tested in accordance with 6.1

5.6.2 Buckles shall be so constructed that they will not slip when assessed during practical performance tests.

Tested in accordance with 6.12.

5.6.3 The belt, buckles and associated fixings, medium pressure connecting tube and supply valve couplings, shall not fail when tested with a force of 1000 ± 50N.

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.7.

5.7 HEAD HARNESS

The head harness, if provided, shall be designed so that the visor can be donned and removed readily. It shall be adjustable and shall hold the visor firmly and comfortably in position.

Tested in accordance with 6.12.

5.8 ADJUSTABLE PARTS

5.8.1 All parts requiring manipulation by the wearer shall be readily accessible and easily distinguishable from one another by touch.

Tested in accordance with 6.12.

5.8.2 All adjustable parts and controls shall be constructed so that their adjustment is not liable to accidental alteration during use.

Tested in accordance with 6.12.

5.8.3 Parts that are not intended for adjustment by the wearer shall require the use of tools for their adjustment.

Tested in accordance with 6.1.

5.9 SUPPLY VALVE

5.9.1 A variable continuous flow valve when fitted, shall be easily adjusted by the wearer to give a supply of air as required within the manufacturers designed flow rate limits.

Tested in accordance with 6.12.

5.9 2 The valve shall permit the minimum design flow as specified by the manufacturer which shall not be less than 120 l/min, at the stated supply pressure, when measured in the visor and with the stated length of medium pressure connecting tube, and filter and/or air conditioner if fitted.

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.3.

5.9.3 The valve shall permit the maximum flow as specified by the manufacturer at the stated supply pressure, when the flow is measured in the visor and with the stated length of medium pressure connecting tube, and filter and/or air conditioner, if fitted.

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.3.

5.10 VISORS

5.10.1 Visors shall not distort vision as determined in practical performance tests.

Tested in accordance with 6.12.

5.10.2 The manufacturer shall provide means to reduce misting of the visor so that there is no interference with vision.

Tested in accordance with 6.12.

5.10.3 Following an impact test the visor shall not be damaged in any way that may make it ineffective or likely to cause injury to the wearer. The requirement for inward leakage (5.12) shall be met after the test.

Three devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.20.

5.11 FIELD OF VISION

5.11.1 The device shall be designed so that the effective field of vision shall not be less than 70% related to the natural field of vision. The effective overlapped field of vision shall not be less than 80% when related to the natural overlapped field of vision.

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.11.

5.12 INWARD LEAKAGE

With the air supply at the minimum designed flow rate specified by the manufacturer the mean inward leakage of the test agent for each of the exercises and for any of the ten test test subjects shall not exceed the value shown in table 1 for any subject.

Five devices shall be tested, two of which have been preconditioned in accordance with 6.2.

Tested in accordance with 6.13.

Table 1 Total Inward Leakage.

Class	T.I.L %
1	5
2	1
3	0.5

5.13 BREATHING RESISTANCE

5.13.1 Inhalation resistance

The inhalation resistance i.e. the minimum pressure in the visor, shall not fall below zero, when tested at the manufacturer's minimum design flow rate.

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.14.

5.13.2 Exhalation resistance

The exhalation resistance shall not exceed 3 mbar, when tested at the maximum designed flow rate.

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.14.

5.14 CARBON DIOXIDE CONTENT OF THE INHALATION AIR

The carbon dioxide content of the inhalation air shall not exceed 1.0% (by volume).

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.15.

5.15 NOISE LEVEL

The noise measured at the ears shall not exceed 80 dB(A) at all air flows designated by the manufacturer.

Two devices shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.16.

5.16 FLAMMABILITY

All exposed materials of the visor and breathing hose shall not continue to burn when removed from the flame.

Two device shall be tested, one of which has been preconditioned in accordance with 6.2.

Tested in accordance with 6.17.

5.17 SPEECH TRANSMISSION

The transmission of speech shall be satisfactory when assessed during the practical performance tests.

Tested in accordance with 6.12.

5.18 LOW FLOW WARNING (Class 3 device only)

The air fed visor shall be fitted with a device that warns the wearer when the air flow rate falls below the minimum design flow rate.

Five devices shall be tested, two of which have been preconditioned in accordance with 6.2.

Tested in accordance with 6.18.

5.19 FLOW INDICATOR

A means shall be provided to check that the minimum design flow rate is exceeded prior to each use.

Five flow indicators shall be tested, two of which have been preconditioned in accordance with 6.2.

Tested in accordance with 6.19.

6 LABORATORY TESTS

NOTE; The purity of the air used for the tests shall comply with the requirements of prEN 132.

6.1 VISUAL INSPECTION

The visual inspection shall be carried out by the test station prior to laboratory or practical performance tests. This may entail a certain amount of dismantling in accordance with the manufacturers instructions for maintenance.

6.2 PRE-CONDITIONING

The complete device shall be exposed

a) for not less than 4 hours to a temperature of $-30 \pm 3^{o}C$ followed by

b) for not less than 4 hours to an atmosphere of $60 \pm 3^{o}C$ at 95% relative humidity.

It shall then be allowed to return to ambient temperature.

6.3 MEASUREMENT OF AIR FLOW RATE

1) Place the visor into a light weight plastic bag which is connected to a

variable suction device and rotameter. Seal the light weight plastic bag around the breathing hose or medium pressure connecting tube. See Figure 1.

2) Connect up the air supply system.

3) With the air supply on adjust the variable suction device until zero pressure is measured in the plastic bag. At this point the flow being measured on the rotameter, is equal to the flow being delivered to the visor.

4) Establish that, in any combination of hose length, supply pressure and control valve condition, the air flow rate does not fall below the manufacturer's minimum design flow rate or exceed the manufacturer's maximum design flow rate.

NB: If a supplementary tube is fitted to the device to supply a compressed air tool the tube shall be free flowing when measuring the minimum air flow rate.

6.4 RESISTANCE TO COLLAPSE OF HOSE OR TUBE

6.4.1 Apparatus

Two metal plates 100 mm square or circular with a diameter of 100 mm one of which is fixed and the other capable of moving at right angles to the plane of the plates and of being loaded to produce a range of pressures between the plates (see Figure 2), and a flowmeter.

6.4.2 Procedure

Place the hose or tube between the two plates and pass the manufacturer's minimum designed air flow through the hose or tube. Record the flow. Apply the specified test force to the movable plate and measure the air flow again when a constant reading has been reached. Calculate the percentage decrease in air flow.

6.5 ELONGATION OF BREATHING HOSE

Measure the length of the breathing hose excluding couplings when suspended vertically (a). Apply a force of 10 N to the hose. After 5 min remeasure the length of the hose (b). Remove the force and examine the hose for signs of collapse. Calculate the percentage elongation.

6.6 PERMANENT DEFORMATION OF BREATHING HOSE

After carrying out the test described in 6.5 measure the length of hose (a).
Apply a force of 10 N to the hose for 48 h.
Remove the force from the hose and after 6 h remeasure the length of the hose (c). Calculate the percentage permanent deformation.

6.7 HARNESS OR BELT, MEDIUM PRESSURE CONNECTING TUBE AND COUPLINGS

Fit the harness or belt with couplings and valve, (if fitted), to a dummy torso in an upright position. Apply a steady force of 1000 N to the medium pressure connecting tube in the direction of its axis for 5 minutes (see Figure 3).

6.8 RESISTANCE TO KINKING OF MEDIUM PRESSURE CONNECTING TUBE

Apply the minimum designed supply pressure to the supply end of the tube. Connect a flow meter to the tube.

Place a length of the tube on a horizontal surface and shape into a one-loop coil of 300 + 10 mm diameter. Clamp one end of the loop to prevent movement but not air flow.

Pull the free end of the loop tangentially to the loop and in the plane of tl loop until the tube takes the form of a straight line.

Observe the manner in which the tube unfolds and measure the air flow as it unfolded.

6.9 HEAT RESISTANCE OF MEDIUM PRESSURE CONNECTING TUBE

Subject a length of tube to the normal working pressure:

a) hold a length of it (about 100 mm) in contact with a hot plate maintained at 130 ± 15°C for 15 minutes.

b) immerse another length (about 100 mm) in boiling water for 15 minutes.

Examine the tube for signs of damage or indication of failure.

6.10 STRENGTH OF BREATHING HOSE COUPLINGS

<u>Visor to breathing hose coupling</u>

Connect the breathing hose to the visor in accordance with the manufacturers instructions.

Secure the visor to a fixed point such that a tensile force of 50 N can be exerted axially to the coupling.

Apply the load as near as possible to the coupling via the breathing hose (se Figure 4).

The force of 50 N is applied for 10 seconds.

Examine the coupling for signs of failure.

<u>Belt to breathing hose coupling</u>

Connect the breathing hose to the belt via the reducer or flow control valve (if fitted).

Secure the reducer or flow control valve to a fixed point such that a tensile force of 50 N can be exerted axially to the coupling. Apply the load as near as possible to the coupling via the breathing hose (see Figure 5).

The force of 50 N is applied for 10 seconds.

Examine the coupling for signs of failure.

6.11 FIELD OF VISION

The field of vision shall be measured with an "apertometer" according to Stoll (Figure 6). A diagram (Figure 7) shall be used for the evaluation.

6.11.1 Procedure

1) Fit the device on to the dummy head, and with both eyes lit, adjust the visor until the outline on the hemispherical shell is symmetrical.

2) Map the positions of the field of vision of each eye individually on to the printed diagram, using the grid lines as a guide.

3) Measure the natural field of vision and the natural overlapped field of vision according to Stoll, using a planimeter. These are the areas defined by the dotted line on the diagram (Figure 7).

4) Measure the areas of the effective field of vision and the effective overlapped field of vision with a planimeter. The field of vision is the innermost line at any point of either the field of vision of the device or the natural field of vision of men according to Stoll as shown on the printed diagram.

5) Express the results as percentage of the area of the natural field of vision of men according to Stoll (already marked on the diagram and as measured in 3).

6.12 PRACTICAL PERFORMANCE TEST

All tests shall be carried out by two test subjects at ambient temperature ($20^{o}C \pm 5^{o}C$, RH < 60%) and the test temperature and humidity shall be recorded. The background noise shall not be greater than 75 dBA.

The air supply to the visor shall be within the specified pressures and be of breathable quality. The length of medium pressure connecting tube shall be the maximum specified.

For the test, persons shall be selected who are familiar with using such or similar equipment. The subjects will be drawn from those people certified as fit to do so by the Medical Officer. The necessity of a medical examination before or supervision during the tests shall be at the Testing Officers discretion.

Prior to the test there is an examination that the device is in good working condition and that it can be used without hazard.

If more than one size of visor is manufactured, the test subjects are asked to select the appropriate size.

If spectacles designed to be worn with the visor under test are supplied then one of the test subjects shall wear them.

The test subjects are asked to read the manufacturers fitting instructions and if necessary are shown how to fit the visor correctly by the test supervisor, in accordance with the fitting instructions.

After fitting the visor each test subject is asked "Does the visor fit?". If the answer is "Yes", continue the test. If the answer is "No", take the test subject off the panel and report the fact.

Work simulation test

During this test the following activities shall be carried out in simulation of the practical use of the visor, the test shall be completed within a total working time of 30 minutes.

The sequence of activities (b-d) is at the discretion of the test station.

(a) Walking on the level at a regular rate of 6 km/hr for 10 minutes

(b) Walking on the level with headroom of 1.1 to 1.5 m for 5 minutes

(c) Crawling on the level with headroom of less than 0.75 m for 5 minutes

(d) Filling a small basket (see Figure 8, approximate volume = 8 l) with 12 mm chippings (e.g. limestone chippings) or other suitable material from a hopper which stands 1.5 m high and has an opening at the bottom to allow the contents to be shovelled out and a further opening at the top where the chippings may be returned. The subject stoops or kneels as he wishes and fills the basket with chippings. He then lifts the basket and empties the contents back into the hopper. This is repeated 15 to 20 times in 10 minutes.

After the test the subjects shall answer the Questionnaire at APPENDIX A.

6.13 INWARD LEAKAGE

For the test, persons shall be selected who are familiar with using such or similar equipment. The subjects will be drawn from those people certified as fit to do so by the Medical Officer. The necessity of a medical examination before or supervision during the tests shall be at the Testing Officers discretion.

Prior to the test there is an examination that the device is in good working condition and that it can be used without hazard. The visor is fitted with the appropriate sampling and pressure sensing ports, which are blanked off until required. The sampling probe is fitted to the visor and adjusted to suit the wearer. Five devices shall be tested, each being tested on two test subjects.

If more than one size of visor is manufactured, the test subjects are asked to select the appropriate size.

If spectacles designed to be worn with the visor under test are supplied then one of the test subjects shall wear them.

The test subjects are asked to read the manufacturers fitting instructions and if necessary are shown how to fit the visor correctly by the test supervisor, in accordance with the fitting instructions.

After fitting the visor each test subject is asked "Does the visor fit?". If the answer is "Yes", continue the test. If the answer is "No", take the test subject off the panel and report the fact.

6.13.2.1 Principle

The subject wearing the visor under test, walks on a treadmill over which there is an enclosure. Through this enclosure flows a constant concentration of the test agent, sodium chloride (NaCl) or sulphur hexafluoride (SF_6), in air.

The air inside the visor is sampled to determine the test agent content. The sample is extracted through a probe placed inside the visor.

The air flow rate to the visor is adjusted and maintained at the minimum designed flow rate. For typical arrangement see Figures 9 and 10.

6.13.2.2 Sodium Chloride method

Aerosol generator

The sodium chloride aerosol is generated from a 2% solution of reagent grade sodium chloride in distilled water. A single large Collison atomiser of the type described in BS 3928 : 1960 is used (see Figure 11). This requires an air flow rate of 100 l/min at a pressure of 7 bar. The atomiser and its housing are fitted into a duct through which a constant flow of air is maintained. It may be necessary to heat or dehumidify the air in order to obtain complete drying of the aerosol particles.

Test agent

The mean sodium chloride concentration within the enclosure shall be (8 $\pm$ 4) mg/m^3 and the variation throughout the effective working volume shall not be more than 10%. The particle size distribution shall be 0.02 um to 2 um equivalent aerodynamic diameter with a mass median diameter of 0.6 um. (See Figure 12).

Detection

The test atmosphere should preferably be analysed for NaCl continuously by means of a suitable flame photometer. The probe for sampling the test atmosphere must be positioned near the head. The NaCl concentration inside the visor is analysed and recorded by a flame photometer. This concentration, measured as near as possible to the mouth of the test subject (preferably with the ball probe just touching the lips) being a measure of the inward leakage.

The test is performed at ambient temperature and at a relative humidity of less than 60%.

Flame photometer

A flame photometer shall be used to measure the concentration of sodium chloride inside the visor. An instrument for this purpose must have the following essential performance characteristics:-

a) It should be a flame photometer specifically designed for the direct analysis of sodium chloride aerosol.

b) It must be capable of measuring concentrations of sodium chloride aerosol between 15 mg/m^3 and 10 ng/m^3.

c) The total aerosol sample required by the photometer should not be greater than 15 l/min.

d) The response time of the photometer, excluding the sampling system, should not be greater than 500 ms.

e) It is necessary to reduce the response to other elements, particularly carbon, the concentration of which will vary during the breathing cycle. This will be achieved by ensuring that the band pass width of the interference filter is no greater than 3 nm and that all necessary side-band filters are included.

Sample pump

If no pump is incorporated into the photometer an adjustable flow pump is used to withdraw an air sample from the visor under test. This pump is so adjusted as to withdraw a constant flow from the sample probe.

Sampling of chamber concentration

The chamber aerosol concentration is monitored during the tests using a separate sampling system, to avoid contamination of the visor sampling lines. It is preferable to use a separate flame photometer for this purpose. If a second photometer is not available, sampling of the chamber concentration using a separate sampling system may be made. However, time will then be required to allow the photometer to return to a clean background. Figure 9 shows a typical sampling arrangement.

6.13.2.3 <u>Sulphur Hexafluoride Method (SF_6)</u>

Test agent

This method employs SF_6 as a test gas. The subject wearing the visor under test stands with his head surrounded by the SF_6 test atmosphere (see Figure 10). Accurate determinations of leakage shall be possible within the range from 0.001% to approximately 20% dependent on the test challenge atmosphere, It is recommended to use a test atmosphere between 0.1 and 1% by vol.

Detection

The test atmosphere shall preferably be analysed for SF_6 continuously by means of a suitable analyser or spot checks as necessary to determine the concentration during tests. The probe for sampling the test atmosphere must be positioned at head height. The SF_6 concentration inside the visor is analysed and recorded. This concentration, measured as near as possible to the mouth of the test subject being a measure of the inward leakage.
A suitable analyser for the test atmosphere is one based on thermal conductivity or infrared spectroscopy. The visor concentration may be monitored by using an electron capture detector or infra red system. The test atmosphere may be monitored by an electron capture device in conjunction with a suitably accurate dilution system.

Sampling

In order to prepare the visor for the test the visor has to be perforated, and thin tube (4 mm ID) as short as possible, is connected from the probe to the analysing instrument. The sampling rate should be constant and in the range between 0.3 and 1.5 l/min.

6.13.2.4 Sampling probe

The probe consists of a length of suitable plastics tube fitted with a plastic ball of approximately 20 mm diameter and having 8 holes each of 1.5 mm diameter spaced equidistant around the circumference of the ball (see Figure 13). The probe is adjusted so that the ball just touches the wearer's lips,

6.13.2.5 Test chamber

This should be made from transparent material and have a minimum cross-sectional dimension of 0.7m (see Figure 9 and 10). It should be supported with adequate clearance above the head of the subject, minimum 0.75m, and extend down to the surface of a level treadmill capable of maintaining a constant speed of 6 km/hr. The test agent enters the top of the chamber through a flow distributor and is directed downwards over the head of the test subject at a flow rate of at least 0.12 m/s. This flow rate should be measured close to the subject's head. In addition the flow rate should not fall below 0.1 m/s inside the effective working volume (0.1 m from the chamber wall and above a height of 0.75 m). The concentration of the test agent inside the effective working volume shall be checked to be homogeneous.

6.13.2.6 Test procedure

6.13.2.6.1 The test subjects shall be informed that if they wish to adjust the visor during the test they may do so. If this is done the relevant section of the test will be repeated having allowed time for the system to re-settle

The subjects shall have no indication of the results as the test proceeds. Adjust the air flow rate to the manufacturer's minimum design flow rate.

NB: If a supplementary hose is fitted to the device four additional inward leakage tests shall be conducted with the supplementary hose free flowing.

Ensure the test atmosphere is off, and adopt the following test procedure.

6.13.2.6.2 Test Protocol.

	Estimated time taken for activity(min.)approx.
1 Subject to enter chamber - connect tubing to sampling point.	2
2 Start the treadmill, establish background reading at the sampling point with subject walking at 6 km/h - no test atmosphere until stable background reading obtained.	3
3 Turn on the test atmosphere and allow to stabilise.	3
4 Record leakage at the sample point.	2

5 Continue to record leakage whilst the subject performs the following exercises:

a) moving head side to side (approximately 15 times) as if inspecting the walls of a tunnel; 2

b) moving head up and down (approximately 15 times) as if inspecting the roof and floor; 2

c) reciting the alphabet (or an agreed text) out loud as if communicating with a colleague; 2

d) walking without head movement or talking 2

6 Stop the treadmill.

7 Continue to record leakage whilst the subject bends at the waist 2
approximately 15 times) .

8 Turn off the test atmosphere and when the test agent has cleared disconnect the sample tubes and remove the subject from the chamber. Carry out the exercises (a), (b) and (d) with a supplementary fan operating such that an additional air flow of 2 m/s is produced to impinge on the fro side and rear of the device in turn.

Repeat the procedure with the other nine test subjects but for these the exercises (a), (b) and (d) are performed with the additional air flow in on direction only. This will provide 4 sets of results for each of the directi for the additional air flow as shown in Table 2 where / indicates that a te is performed and a measurement made. Thus for the 10 test subjects, 4 sets results for each direction of air flow are obtained.

Table 2 - Experimental plan for exercises (a), (b) and (d)

Air velocity 'Direction'	Exercises	1	2	3	4	5	6	7	8	9	10
Front	a	/	/			/			/		
	b	/	/			/			/		
	d	/	/			/			/		
Side	a	/		/			/			/	
	b	/		/			/			/	
	d	/		/			/			/	
Rear	a	/			/			/			/
	b	/			/			/			/
	d	/			/			/			/

Note:-

(i) The total time may vary, all times are approximate and are to stable conditions.

(ii) Analyse results over the final 100 seconds of each 2 minute exercise period to avoid carry over of result from one exercise to the next.

(iii) Record challenge aerosol continuously using a separate detector.

6.13.2.6.2 Assessment of results

For each individual test calculate the arithmetic mean over the time period.

Calculate the percentage total inward leakage (TIL) as follows:

$$T.I.L = \frac{C_2}{C_1} \times 100$$

C_1 = concentration in enclosure.
C_2 = mean concentration in breathing zone for each exercise.

The questionnaire at Appendix A shall be completed for each test subject.

6.14 BREATHING RESISTANCE

Fit the visor to a 'Sheffield' dummy head or torso fitted with a 'Sheffield' dummy head, which is fitted with the insert shown in Figure 14. Ensure that the length of medium pressure connecting tube is that submitted with the visor and that half this length is coiled to an inside diameter oF 300 mm.

Connect a breathing machine to the head and operate at 25 strokes/min and 2.0 l/stroke.

a) supply the visor with the manufacturer's minimum design flow rate.

Measure the inhalation resistance.

b) Supply the visor with the manufacturer's maximum design flow rate.

Measure the exhalation resistance.

6.15 CARBON DIOXIDE CONTENT OF THE INHALATION AIR

Principle

The device is fitted to a 'Sheffield' dummy head (see Figure 14) which is connected to a breathing simulator set to deliver a 5% by volume carbon dioxide air mixture. The carbon dioxide content of the inhalation air is determined when stable conditions have been achieved.

The test is to be carried out in a well ventilated room.

Apparatus

The test may be performed using the twin cylinder method as shown in Figure 15 or the single cylinder method shown in Figure 16.

Procedure

Fit the visor to the dummy head in a leak tight manner but without deformation. Set the airflow to the visor to the minimum specified by the manufacturer.

Connect the breathing machine adjusted to 25 strokes/min and 2.0 l/stroke t the dummy head. The exhaled air shall have a carbon dioxide content of 5% b volume.

Position a fan with a flow of 0.5 m/s to remove the exhaled air to prevent inhalation.

Measure and record the level of carbon dioxide content in the inhalation ai continuously until a constant level is achieved.

6.16 NOISE LEVEL

6.16.1 Principle

The device is fitted to a dummy torso and the noise level (in dB(A)) measur at the ears.

6.16.2 Apparatus

Microphones with a diameter of not greater than 7 mm capable of being fitte inside the device to be tested at the ears.

Sound level meter of type 1 or 2 as specified in IEC 651.

6.16.3 Procedure

(1) Calibrate the sound level meter in accordance with the manufacturer's instructions.

(2) Fix the microphones to the dummy torso at the centres of each of the e and level with the tragions.

(3) Fit the visor on the torso and head.

(4) Supply the visor with air at one of the manufacturer's specified air f and measure, in succession, the sound pressure level at each of the two ea with the sound level meter set to indicate frequency weighting characteris A.

(5) Check that the background noise level in the test room is not less tha dB(A) lower than that measured for the device and adjust the background le as necessary to meet this condition.

(6) If the condition in (5) is satisfied repeat (2) to (5) for other speci air flows or pressure/tube length combinations. If not, after adjusting the background level, repeat (2) to (5) .

(7) Report the results from each of the specified air flows as the noise generated by the device.

6.17 FLAMMABILITY

6.17.1 Principle

The visor or component or breathing hose material is mounted either on the dummy head, or in a suitable manner on a rotating support arm and passed through the flame from a single burner and the effect observed.

6.17.2 Apparatus

A dummy head mounted on a support which enables it to be rotated to describe a horizontal circle (see Figure 17). Facility to attach to the rotating support arm any other parts of the device to be tested separately.

Gas supply rig consisting of a propane storage tank with flow control valve and fine pressure gauge, flash back arrestor and a single propane burner being adjustable in height.

6.17.3 Procedure

1) Fit the visor or component or breathing hose material to the dummy head.

2) Ensure that a speed of rotation of 60 mm/s can be obtained and rotate the head and visor or component over the burner.

3) Adjust the position of the burner such that the distance between the top of the burner and the lower part of the visor or component which is to pass through the flame to 20 mm and then rotate the head away from the burner.

4) Ignite the gas at the burner and adjust the pressure to be 0.5 bar. Ensure that the burner air vent is fully closed and adjust the flow control to give a flame height of 40 mm above the burner top. These setting should give a flame temperature of 800 $\pm$ 50^{o}C at a point 20 mm above the burner top.

5) Pass the visor or component mounted on the dummy head or support arm, once through the flame at the set speed of 60 mm/s.

6.17.4 Assessment and test report

Examine the visor or component it has passed through the flame and report whether it continues to burn.

6.18 LOW FLOW WARNING

6.18.1 Apparatus

As detailed in 6.3.

6.18.2 Procedure

(1) Mount the visor on a dummy head/torso which is connected to a variable suction device and rotameter. Seal a lightweight plastic bag round the breathing hose and medium pressure connecting tubes. See Figure 1.

(2) Connect up the air supply system and low flow warning device in accordance with the manufacturing instructions.

(3) Fully close the supply valve (if fitted).

(4) Adjust the supply pressure at the input to the medium pressure connecting tube until the low flow warning functions.

(5) Adjust the variable suction device until zero pressure is measured in the plastics bag. At this point the flow being measured on the rotameter is equal to the flow being delivered to the visor.

The flow indicated on the rotameter shall be at least the manufacturers minimum design flow rate.

If an audible warning device is incorporated, the sound pressure level shall be a minimum of 90 dB(A) when measured at the ears and the frequency shall be in the range 2000 Hz to 4000 Hz.

6.19 FLOW INDICATOR

6.19.1 Apparatus

As detailed in 6.3.

6.19.2 Procedure

(1) Mount the visor on a dummy head/torso which is connected to a variable suction device and rotameter. Seal a light weight plastics bag around the breathing and medium pressure connecting tubes. See Figure 1.

(2) Connect up the air supply system and flow indicator in accordance with the manufacturing instructions.

(3) Fully close the supply valve (if fitted).

(4) Adjust the supply pressure at the input to the medium pressure connecting tube until the flow indicator indicates the minimum flow rate according to the manufacturers instructions.

(5) Adjust the variable suction device until zero pressure is measured in the plastics bag. At this point the flow being measured on the rotameter is equal to the flow being delivered to the visor.

The flow indicated on the rotameter shall be at least the manufacturers minimum design flow rate.

6.20 IMPACT RESISTANCE OF VISOR

Impact resistance shall be tested using a completely assembled visor mounted on a dummy head such that a steel ball (approximately 22mm diameter, 44 ± 0.5g) falls normally from a height of 1300 ± 5mm on the centre of the visor.

7 MARKING

7.1 All units of the same model shall be provided with a type identifying marking. Sub-assemblies and piece parts with considerable bearing on safety shall be marked so that they can be identified. The manufacturer shall be identified by name, trade mark or other means of identification.

7.2 Where the reliable performance of piece parts may be affected by ageing, the date (at least the year) of the manufacture shall be marked. For parts which cannot be marked the relevant information shall be included in the operating instructions.

7.3 The marking shall be provided with the following particulars:

(a) Serial number.

(b) Year of manufacture.

(c) Where equipment is intended for use outside the temperature range specified in this Standard.

(d) where the medium pressure connecting tube meets the requirements of 5.5.6 the words 'heat resistant';

(e) where the medium pressure connecting tube meets the requirements of 5.5.7 the word 'antistatic';

(f) The title, TM number and Issue number of this Standard.

7.4 The marking shall be as clearly visible and as durable as possible.

8 <u>INSTRUCTIONS FOR USE, MAINTENANCE AND STORAGE</u>

8.1 Instructions for use, maintenance and storage shall accompany all equipment.

8.2 The instructions shall be in English.

8.2 The instructions shall comprise the range of application and instructions necessary for correct fitting, care, maintenance and storage and shall include the following:

a) information on correct selection and fitting of the visor;

b) information on correct selection of the medium pressure connecting tube used with the apparatus.

c) the maximum length and bore of medium pressure connecting tube as tested to be used with the apparatus.

d) the pressure range of the air supply to the visor for each length of medium pressure connecting tube and tube bore, together with the words "the user shall assure himself that the pressure range of the air supply to the apparatus is within the limits recommended by the manufacturer";

e) a warning that adequate protection may not be provided by the apparatus in atmospheres that are immediately dangerous to life;

f) the maximum and minimum flow in l/min of the air supply to the apparatus and include details of how the flow rate should be checked prior to each use;

g) warning that at high work rates the pressure in the visor may become negative at peak inhalation flow;

h) a warning against the use of oxygen and oxygen enriched air;

i) a warning indicating the need to ensure the purity and identity of the breathing air supply;

NOTE: Attention should be drawn to the details of breathing air given in prEN 132:

j) instructions for suitable means of cleaning and decontamination;

k) any other information the supplier may care to provide.

APPENDIX A

PRACTICAL PERFORMANCE TEST AND INWARD LEAKAGE

SUBJECT		DATE	
VISOR NAME		VISOR NO	
AMBIENT TEMPERATURE	C	HUMIDITY	%RH
NOISE LEVEL	dB(A)		

QUESTIONS	COMMENTS
Is the head harness comfortable?	
Is the body harness or belt comfortable?	
Did the buckles slip?	
Is the visor easy to don and doff?	
Is the visor comfortable?	
Did the visor distort vision?	
Did any misting of the visor interfere with vision?	
Are the fastenings and coupling secure?	
Is the flow control easy to manipulate?	
Were the controls distinguishable by touch?	
Is the resistance to breathing acceptable?	
Is the supply hose easy to manoeuvre?	
Did the air flow rate into the visor cause any distress?	
Did the hose become twisted during connection?	
Did the hose permit free head movement?	
Could the hose be caught on obstructions?	
Could any parts or controls be adjusted accidentally?	
Was speech transmission satisfactory?	
Any other comments?	

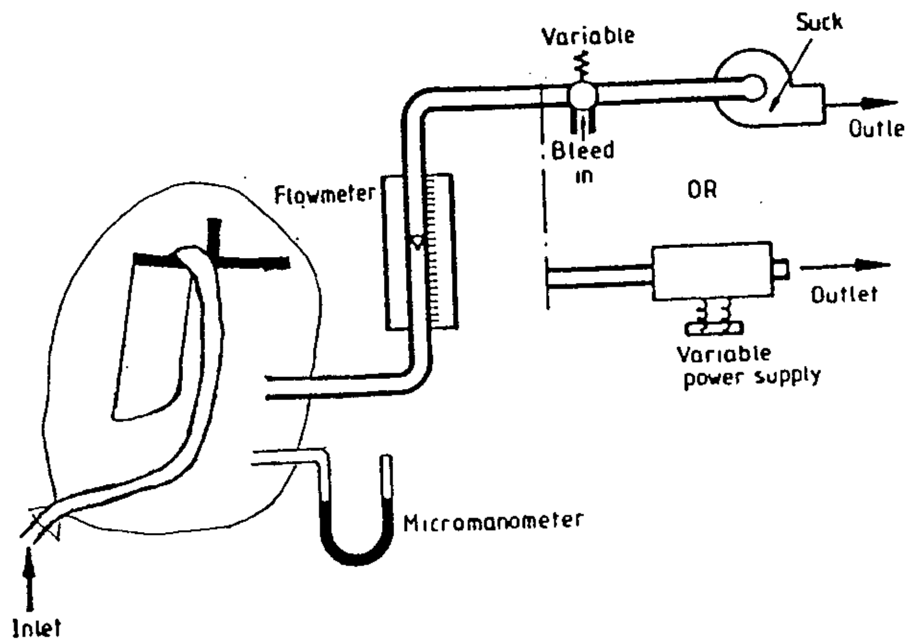


FIGURE 1: AIR FLOW RATE

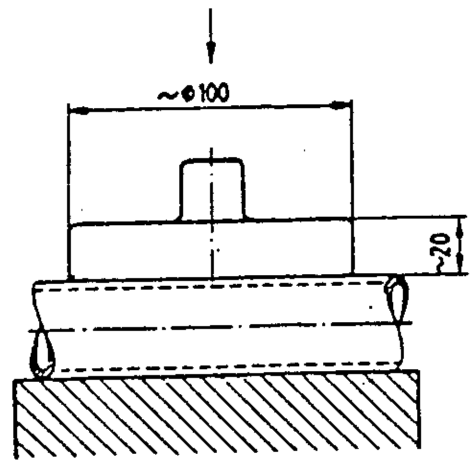


FIGURE 2: RESISTANCE TO COLLAPSE OF HOSE OR TUBE

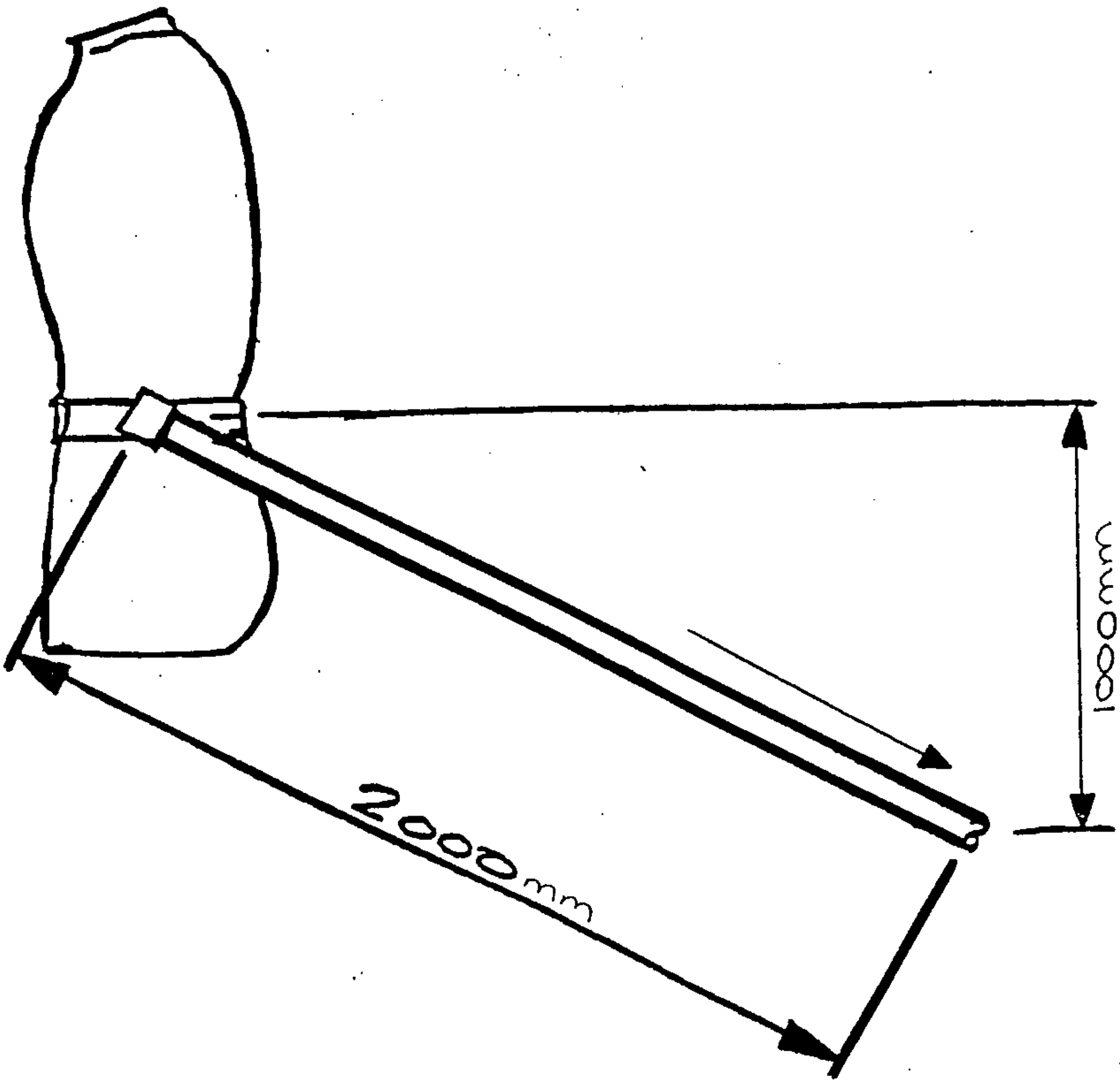


FIGURE 3: HARNESS OR BELT, TUBE AND COUPLINGS

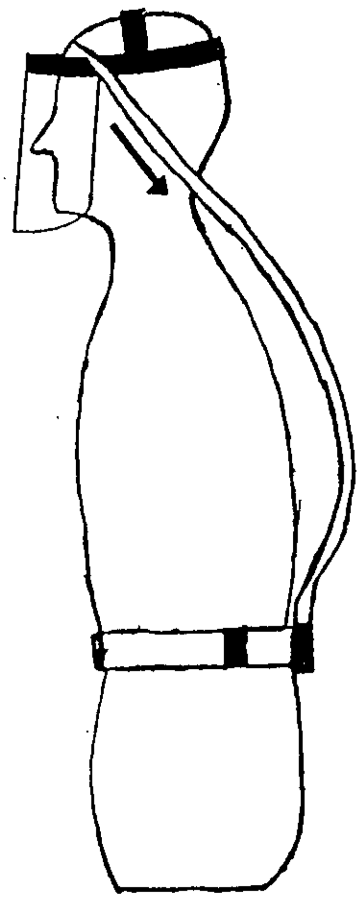


FIGURE 4: STRENGTH OF BREATHING HOSE COUPLING TO VISOR

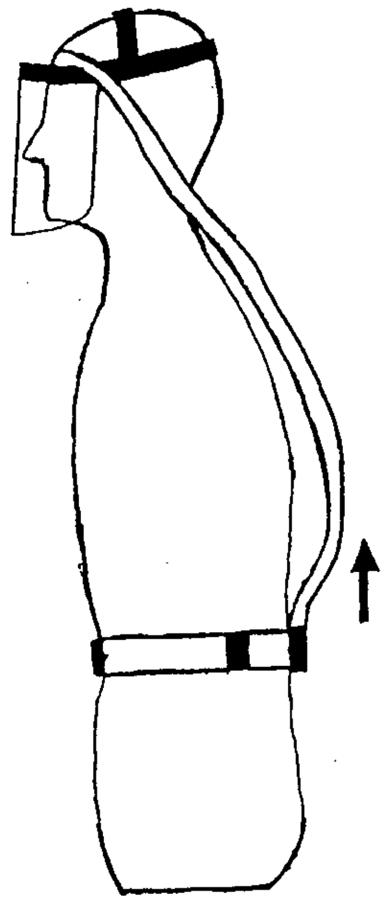


FIGURE 5: STRENGTH OF BREATHING HOSE COUPLING TO BELT

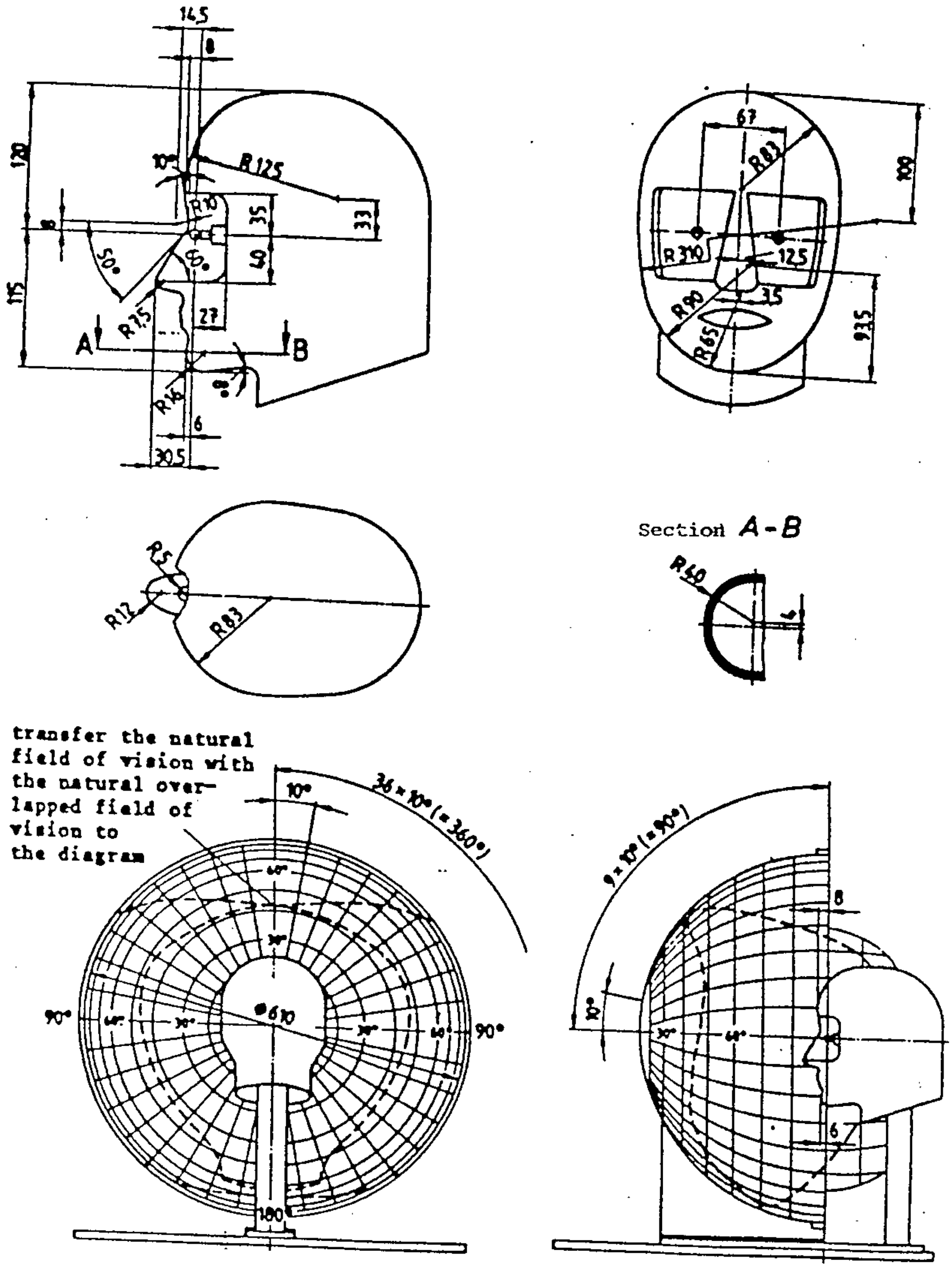
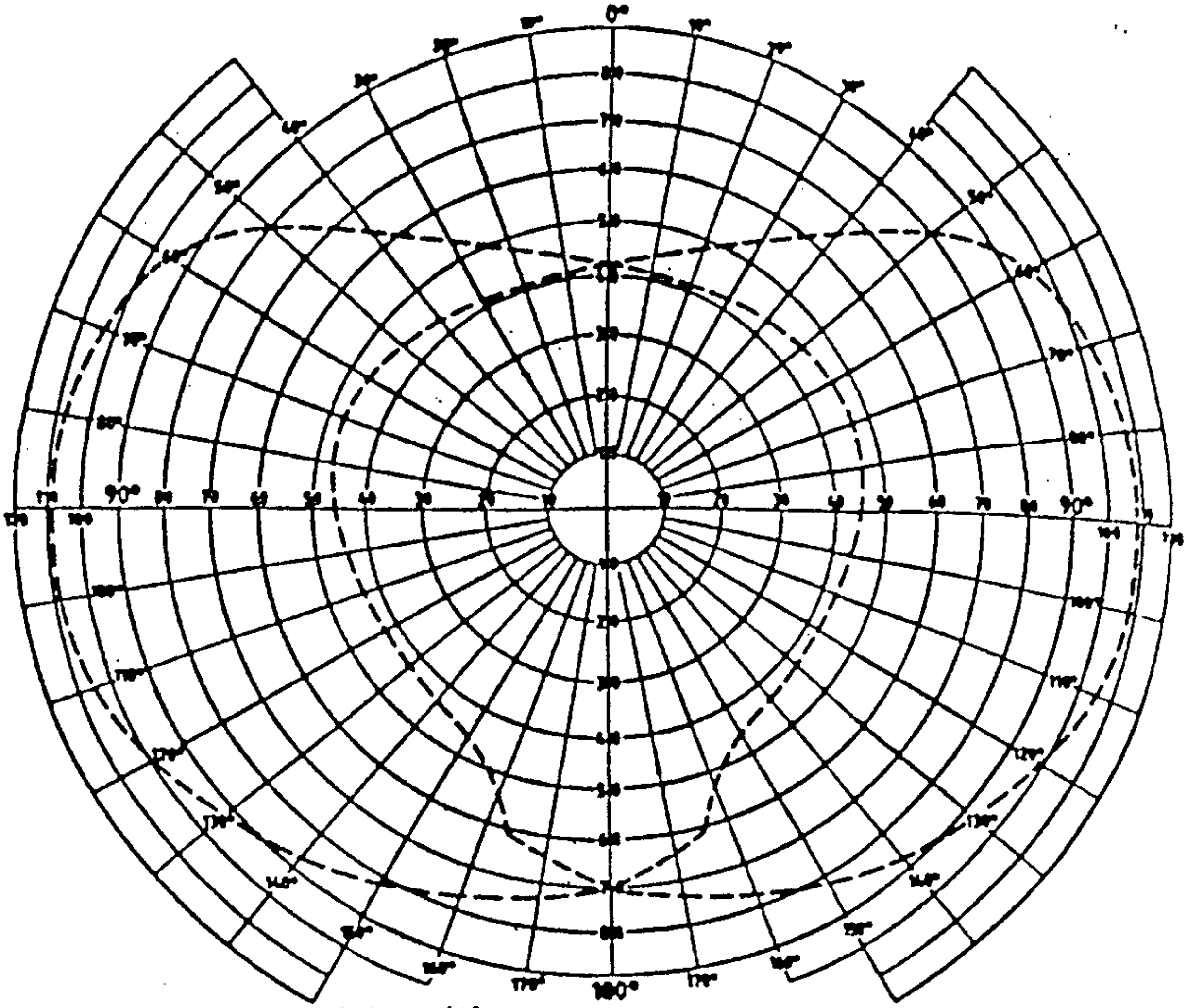


FIGURE 6: 'STOLL' APERTOMETER



... natural field of vision with
natural overlapped field of vision.

The circle closed surfaces of the diagram are of same ratio to each other as the adherent ball cups of the apertometer.

Semi-circular surface represented inside of the 90° circle = ... cm²
Natural field of vision inside of the 90° circle (78,8%)... Bn_1 = ... cm²
Natural field of vision outside of the 90° circle .... Bn_2 = ... cm²
Natural field of vision totally = Bn_1 + Bn_2 .... Bn = ... cm² %

Natural overlapped field of vision .... BnÜ = ... cm² %

Shape of lenses: ____________ facepiece model: ____________
(dimensions) ____________ ____________

The effective field of vision as observed by the apertometer shall be transferred to the diagram. Only the effective field of vision within the natural field of vision respectively the effective overlapped field of vision shall be planimetered and noted in cm².

Planimetered area of effective field of vision (totally) .... cm²
Planimetered area of effective overlapped field of vision .... cm²

Effective field of vision (totally) .... %
Effective overlapped field of vision .... %
Bn = natural field of vision
BnÜ = natural overlapped field of vision

FIGURE 7: APERTOMETER MAP

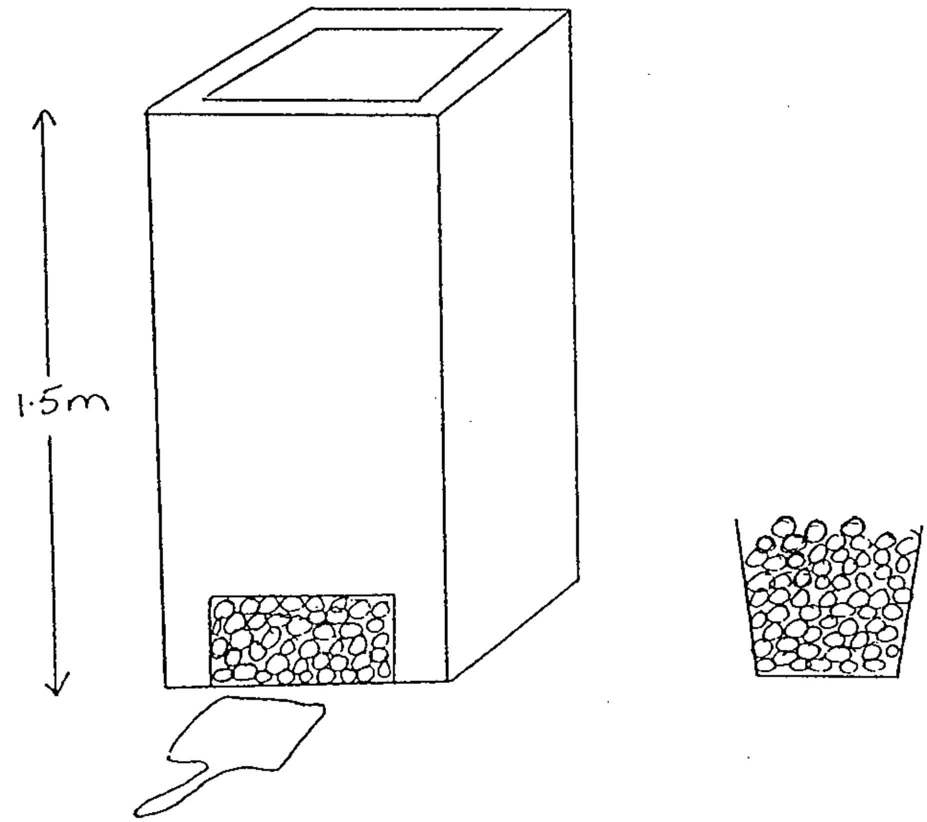


FIGURE 8: 'HOPPER' PRACTICAL PERFORMANCE

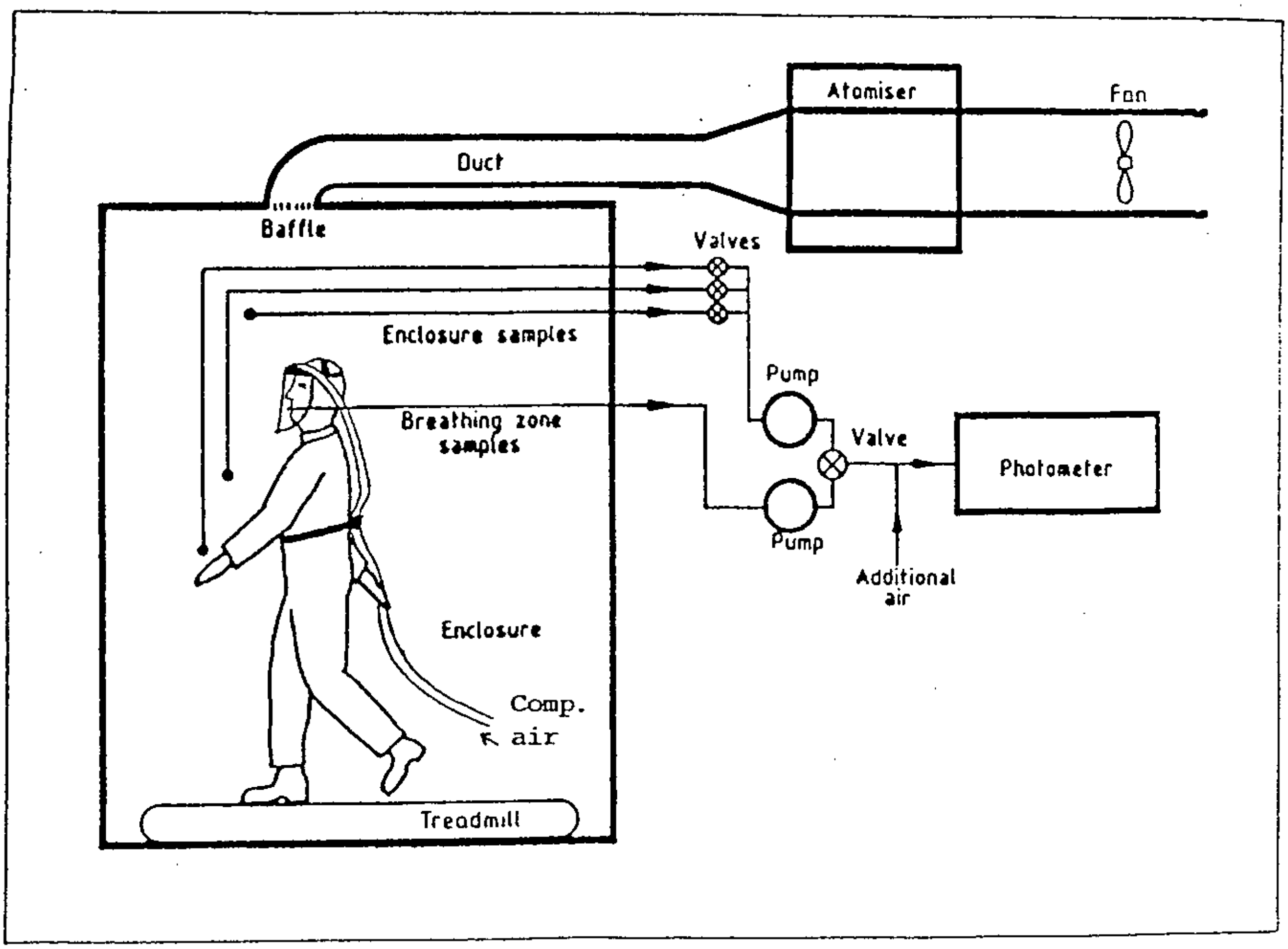


FIGURE 9: NaCL TEST ARRANGEMENT

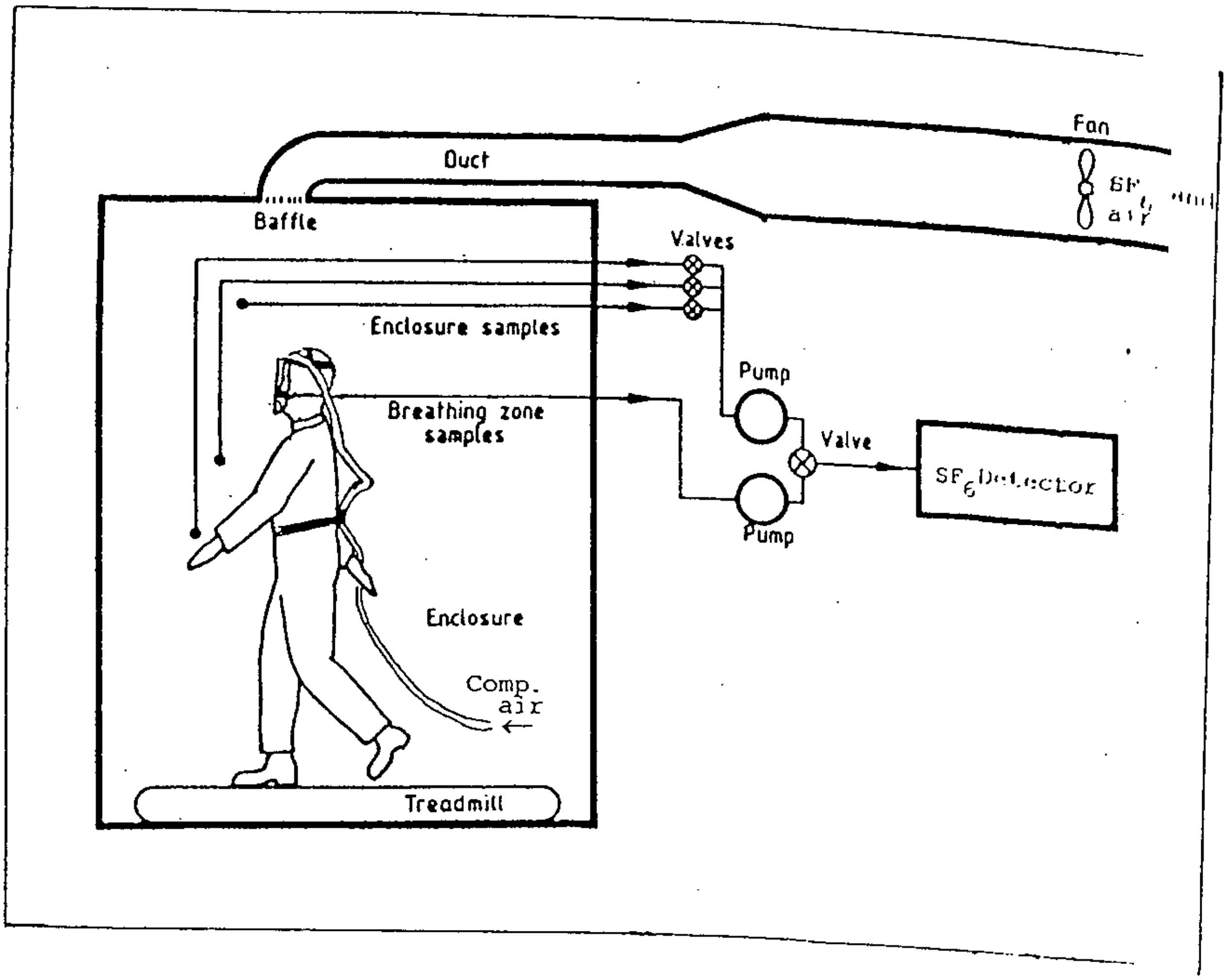
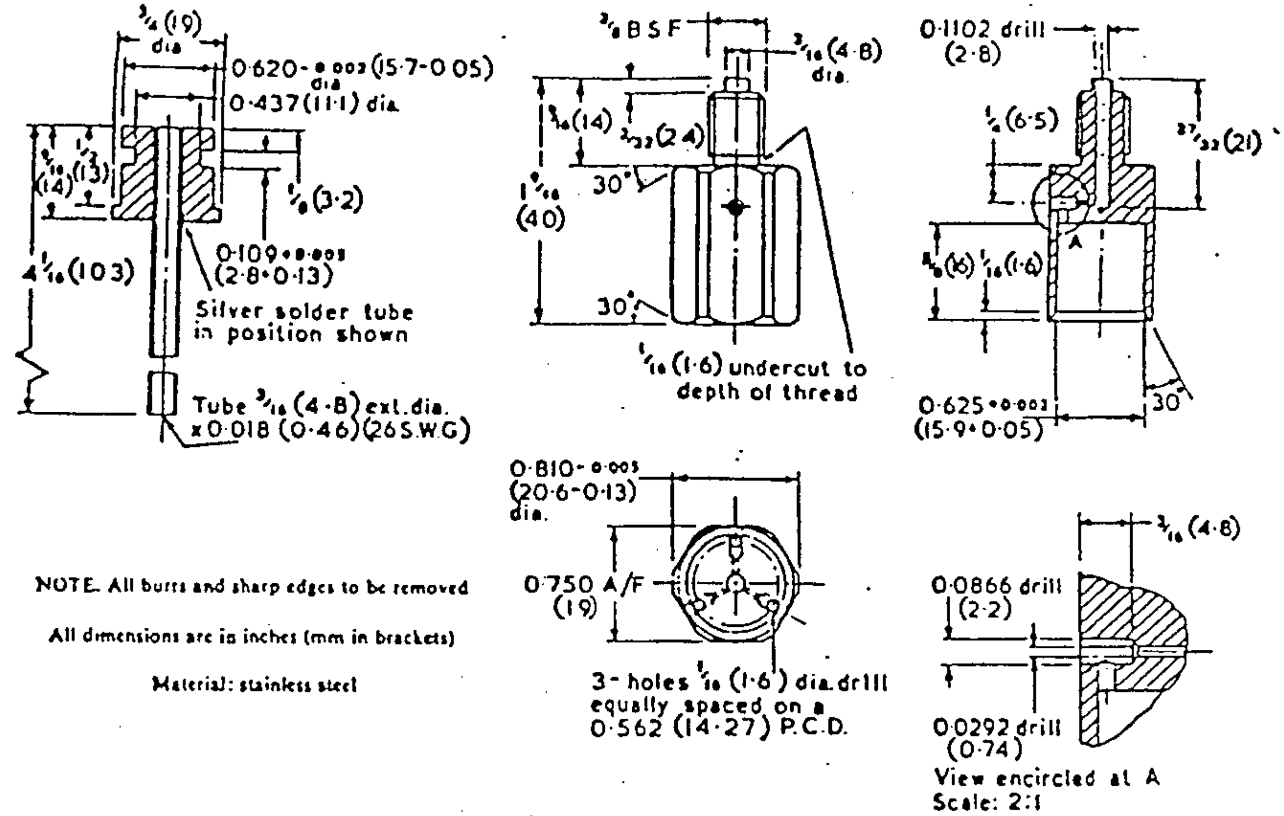
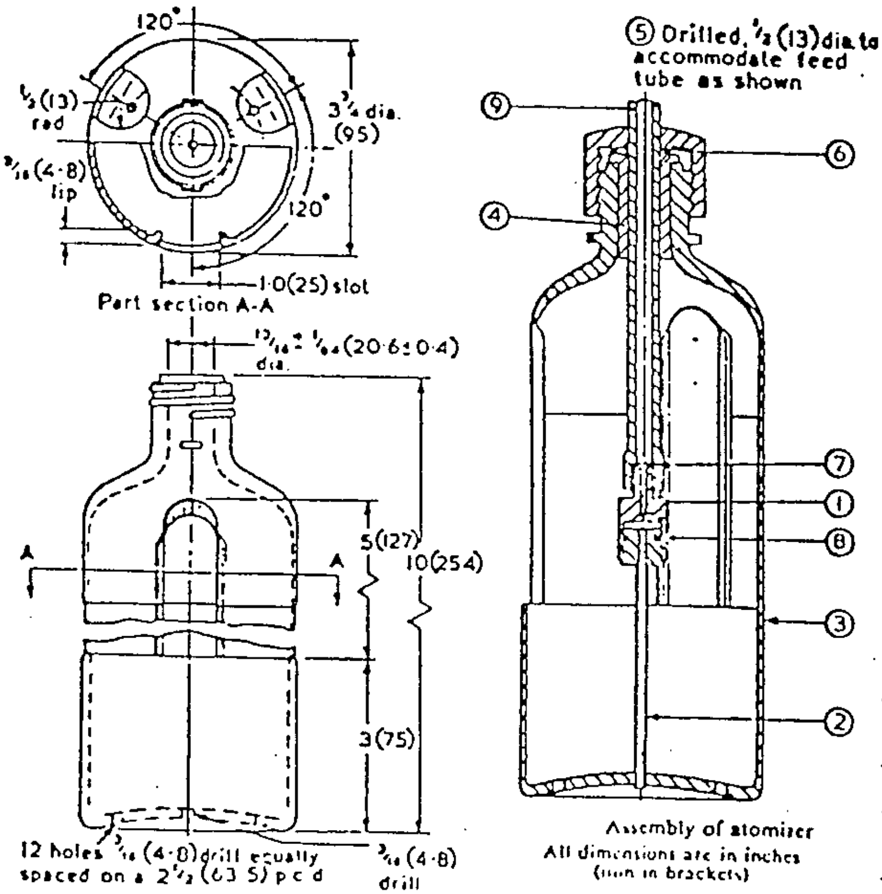
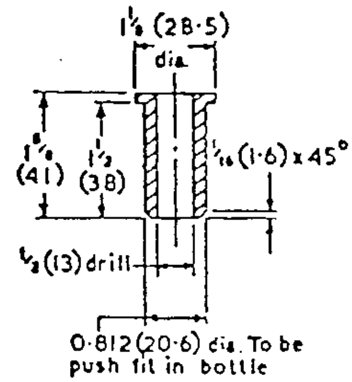


FIGURE 10: SF_6 TEST ARRANGEMENT







ITEM LIST

Item	Name	No. off	Remarks
—	Assembly of atomizer	1	
1	Nozzle	1	
2	Feed tube, salt solution	1	
3	Bottle, polythene	1	Modified
4	Sleeve	1	
5	Screw cap for bottle	1	Modified
6	Washer 1 x 1/2 x 1/8 (25 x 13 x 3.2)	1	Hard rubber
7	Washer 3/8 x 3/16 x 3/32 (9.5 x 4.8 x 2.4)	1	Hard rubber
8	'O' seal 0.5 9	1	To BS 1806
9	Air tube 1/2 (13) o.d. 1/4 (6.5) [illegible]	As read	Stainless steel

FIGURE 11: ATOMISER FOR NaCL

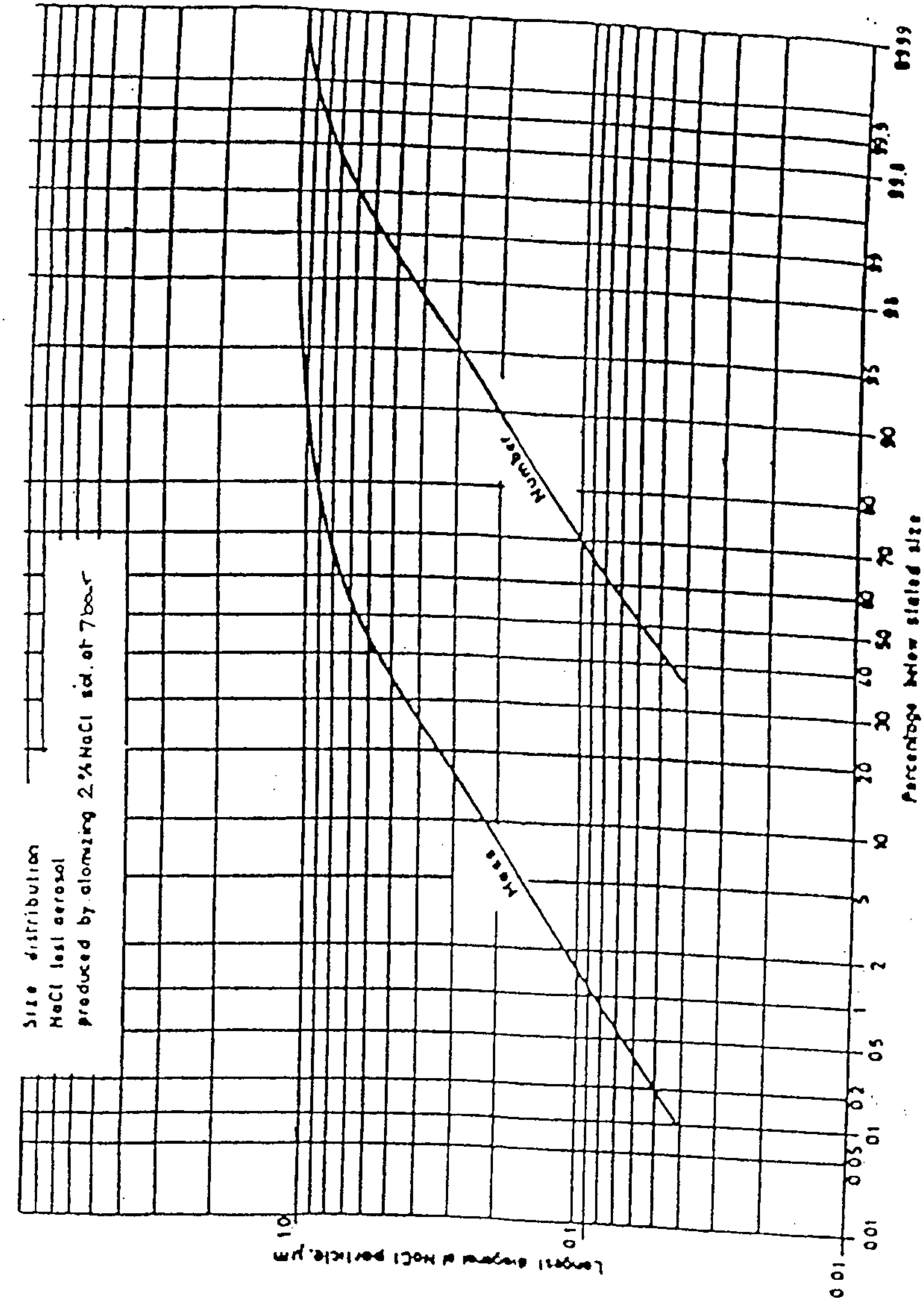


FIGURE 12: PARTICLE SIZE DISTIBUTION FOR NaCL

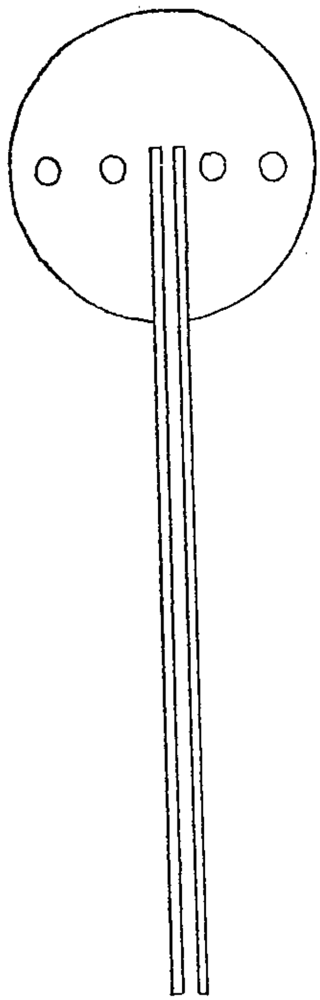


FIGURE 13: BALL SAMPLE PROBE

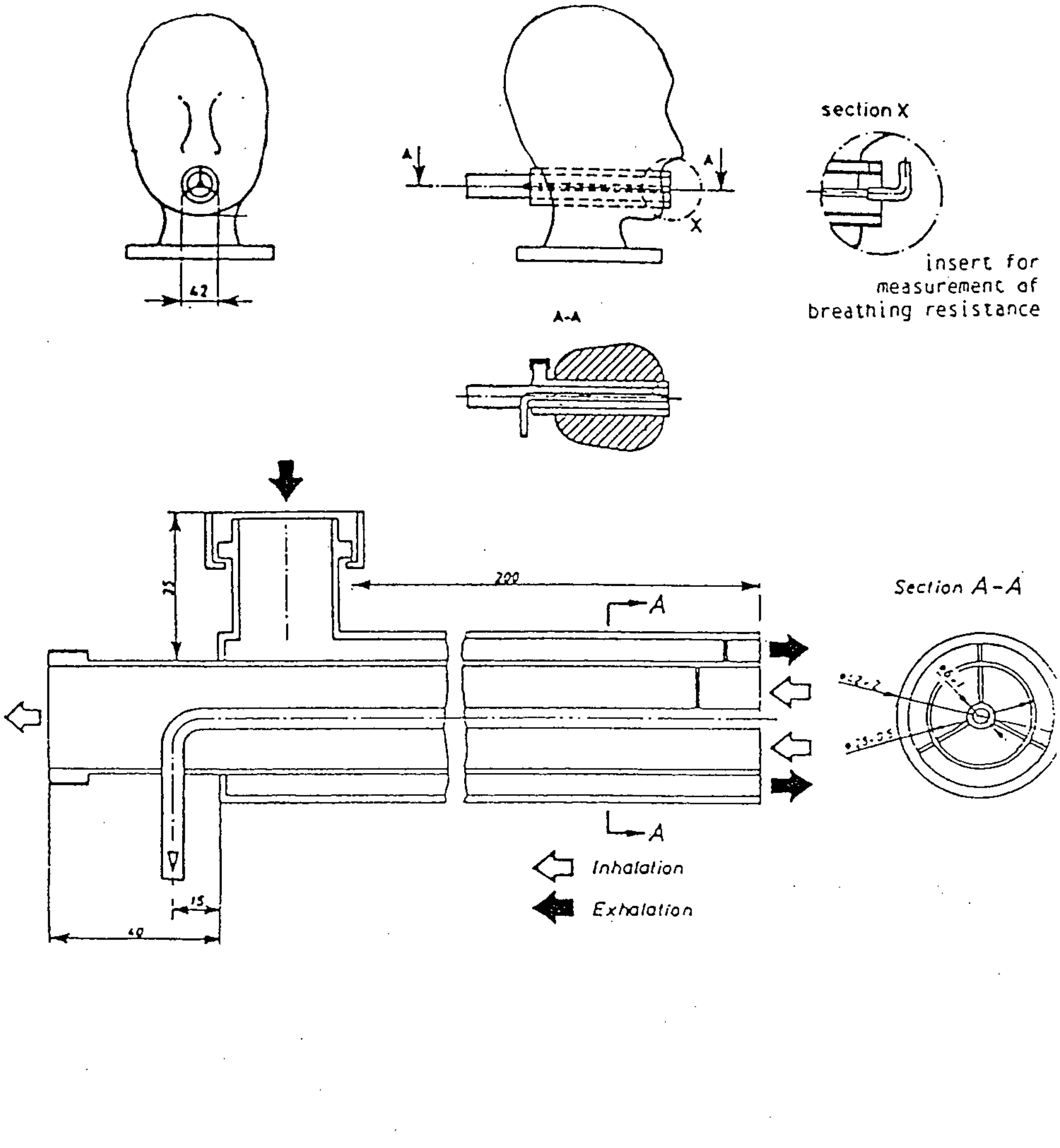
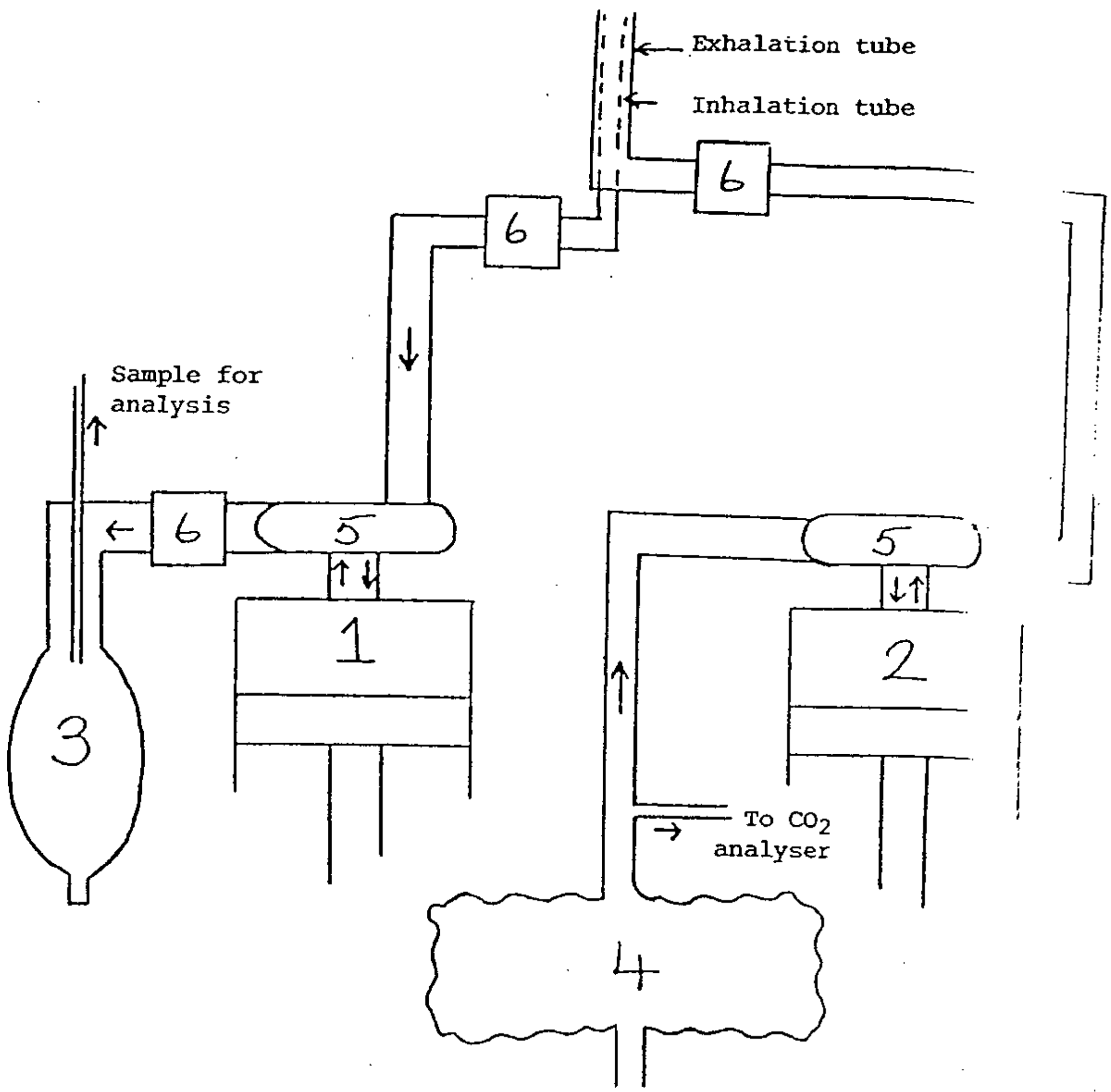


FIGURE 14: 'SHEFFIELD' HEAD CONCENTRIC TUBES



1 Cylinder No 1

2 Cylinder No 2

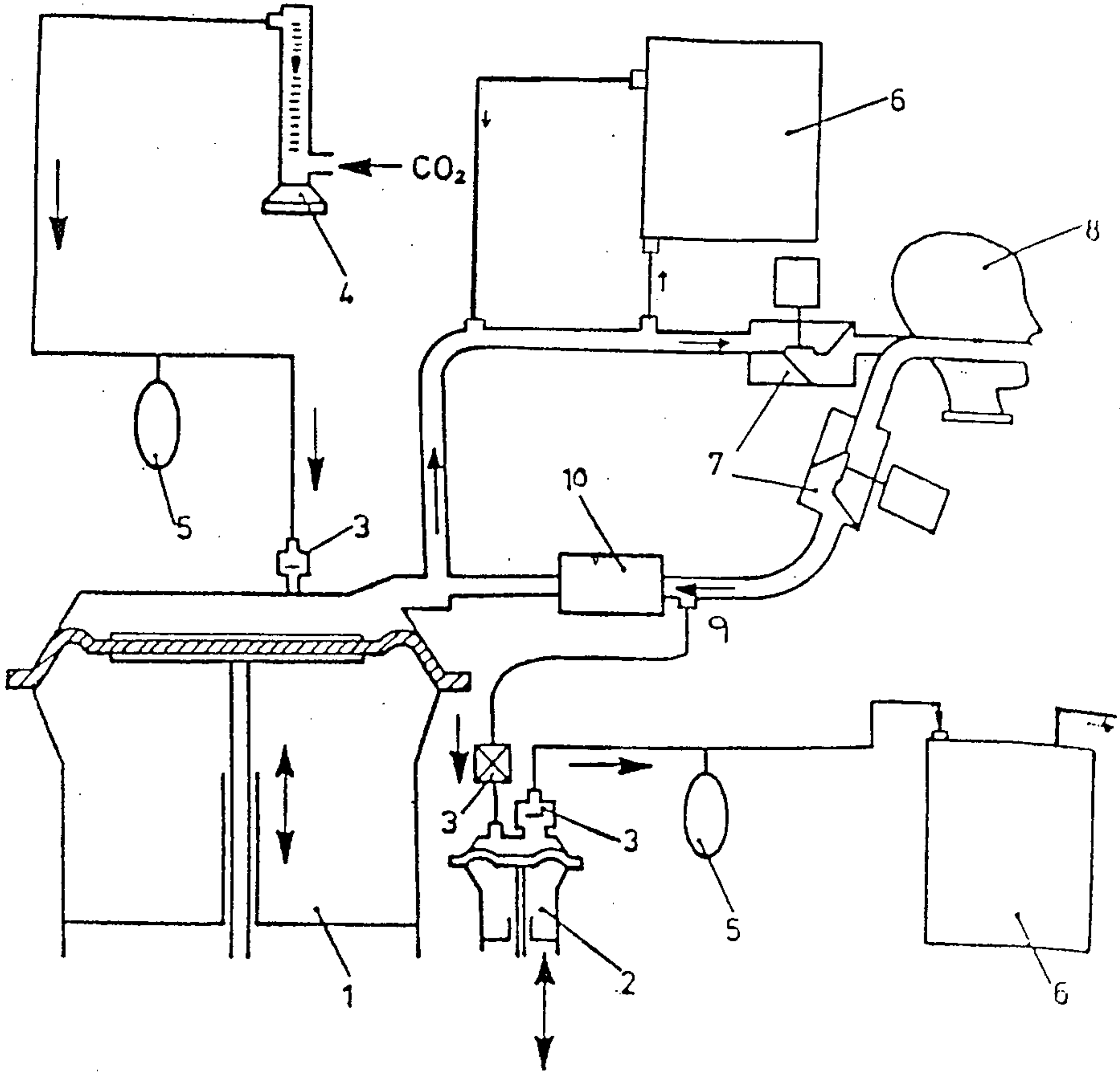
3 Sample bladder

4 5% CO_2/air supply

5 Mica valve

6 Solenoid valve

FIGURE 15: CO_2 - TWIN CYLINDER METHOD



1 Breathing machine
2 Auxiliary lung
3 Non-return valve
4 Flowmeter
5 Compensator
6 Carbon dioxide analyser
7 Solenoid valves
8 Dummy head
9 Sampling tube for inhalation air
10 Carbon dioxide absorber

FIGURE 16 : CO_2 - SINGLE CYLINDER METHOD

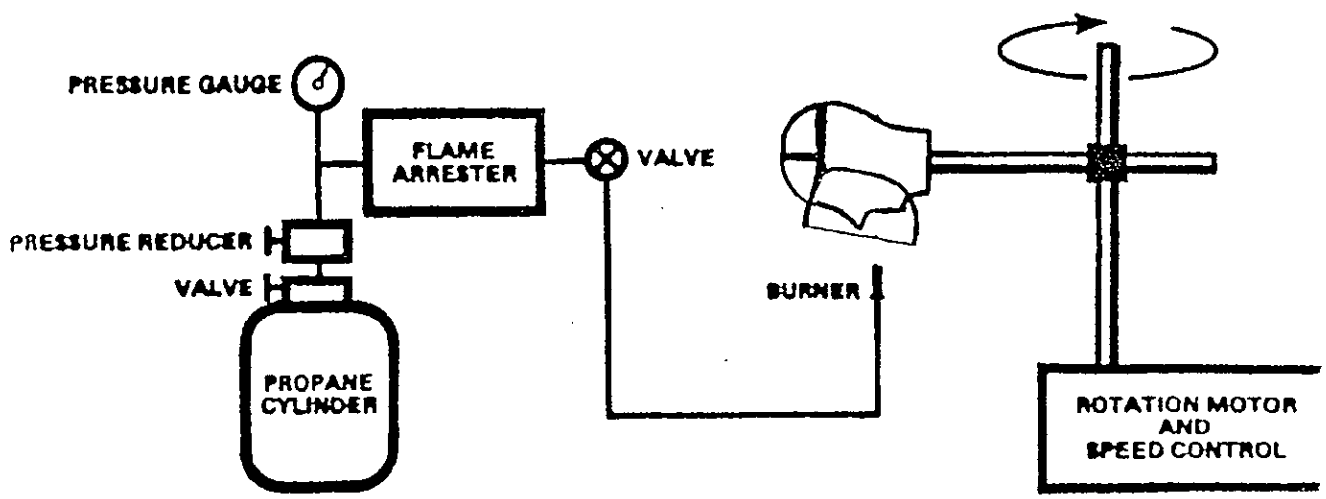


FIGURE 17: FLAMMABILITY TEST RIG

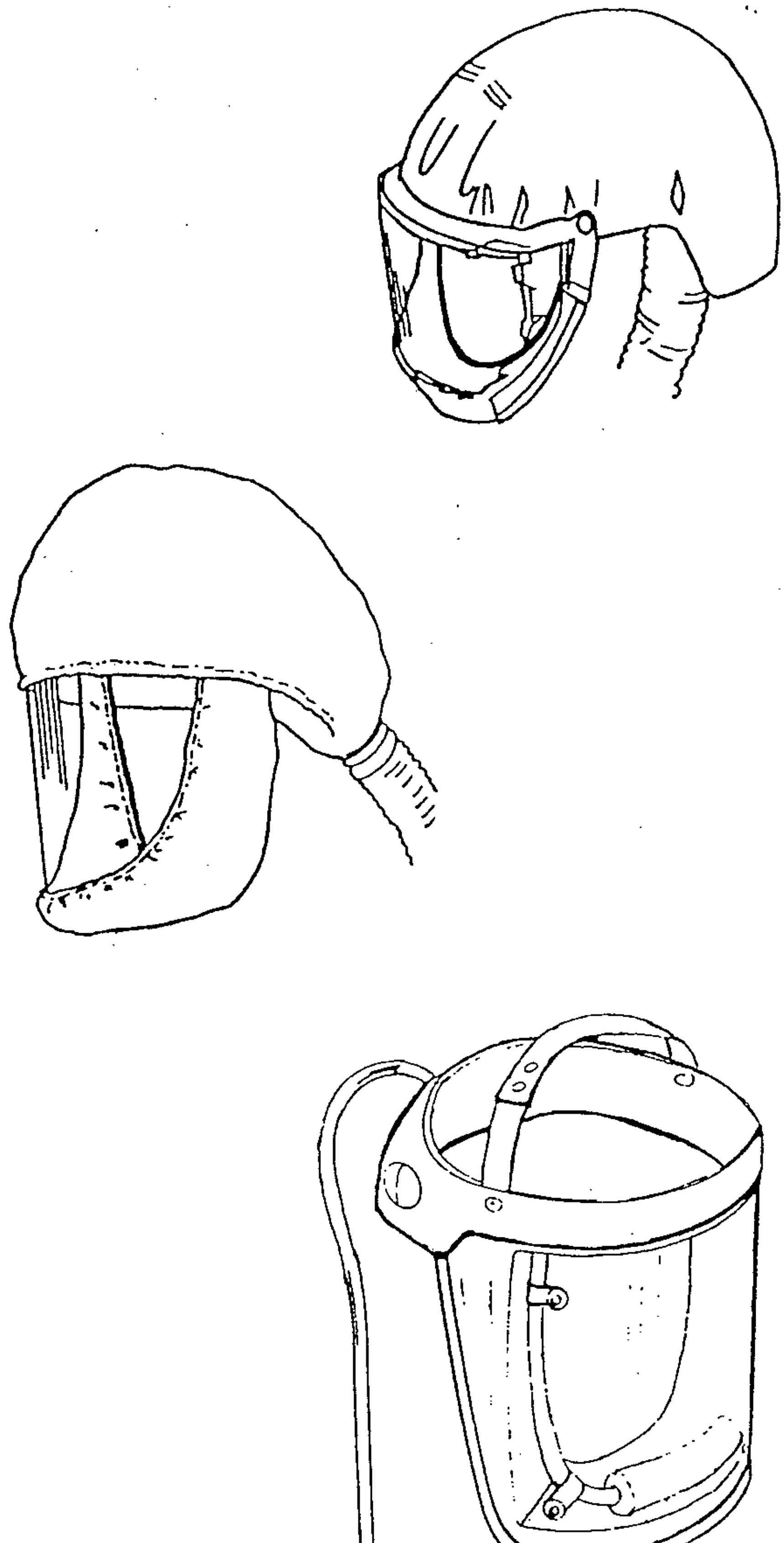
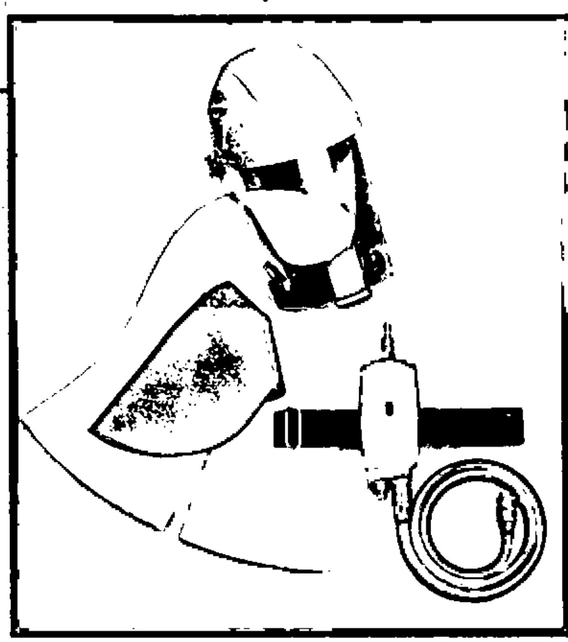


FIGURE 18: TYPICAL EXAMPLES OF AIR FED VISORS

DeVILBISS MPV

Air-Fed Face Vizor Breathing Outfits



- A SINGLE SUPPLY LINE PROVIDES BOTH SPRAYING AND BREATHING AIR
- LIGHTWEIGHT MOULDED CONSTRUCTION FOR MAXIMUM COMFORT
- WAISTBELT WITH ODOUR FILTER AND PRE-SET PRESSURE REGULATOR
- WRAP AROUND VIZOR PROVIDES EXCELLENT VISION
- RATCHET HEADBAND ADJUSTMENT IS FAST AND CONVENIENT
- FOAM SEALS ENSURE EFFECTIVE FACIAL AIR FLOW
- PADDED BROWGUARD & ADJUSTABLE CROWNSTRIP FOR EFFECTIVE FIT
- HIGH FLOW QUICK DETACH FITTINGS FOR USE WITH HVLP SPRAY GUNS
- 8MM BORE RUBBER GUN HOSE WITH ALL OUTFITS.
- HINGED VIZOR WITH FLIP UP AND NOD DOWN FACILITY

DeVilbiss MPV Air-fed, safety systems provide the effective, practical and comfortable solution for operator respiratory protection in paint shop, bodyshop or production line spraying environments.

Without any compromise to protection and safety, these lightweight systems allow excellent freedom of movement with minimum encumberance to the wearer. The outfits include all the necessary components to provide both breathing and spraying air by the connection of a single air supply line to the waisthelt filter regulator.

DeVILBISS MPV

THE WAISTBELT FILTER REGULATOR HAS QUICK DETACH CONNECTIONS FOR THE AIR INLET AND BOTH AIR OUTLETS

THE FULL FACE VIZOR HAS A RATCHET HEADBAND ADJUSTMENT FOR FAST FITMENT

THE VIZOR IS SUPPLIED COMPLETE WITH A REMOVEABLE NECK COVER FOR ADDITIONAL OVERSPRAY PROTECTION

THE ODOUR REMOVAL CARTRIDGE IN THE WAISTBELT FILTER HOUSING IS EASILY AND QUICKLY REPLACED

DeVilbiss MPV Air-fed, Full face vizor outfits are approved by the Health and Safety Executive, fully CE approved and designed to satisfy the COSHH Regulations for protection against gas, vapours, dust, mists, particulates and fumes including isocyanates to Class 2 protection factor 100. The vizor is kitemarked to BS2092 for eye and face protection and satisfies G2C for impact and liquid splash.

THE VIZOR: The advanced design full-face vizor uses plastics moulding technology to provide a strong, servicable unit. A moulded headband allows fast positioning on the head and location is ensured by a rapid action ratchet. The crown strip is also adjustable and swivel bearings at the sides provide a useful vizor flip-up, nod-down facility.

Air to the facial area is gently dispersed at a positive pressure and diffused to avoid noise, misting and discomfort. The vizor shield has an excellent field of vision with sufficient clearance for spectacles.

Special disposable wrap around covers which prevent scratching or permanent contamination are available in kits. The vizor shield itself is snapped onto the browguard to allow replacement if necessary.

THE WAISTBELT: The waistbelt mounted filter/regulator assembly is the portable control centre where the incoming air is diverted for spraying or vapour filtered for breathing.

A high absorption, easily replaced activated carbon cartridge filter with a 1000 hour life expectancy provides effective odour filtration. Filter expiry is signalled by a colour change indicator. The system has been specifically designed to sustain high flow rates to operate HVLP or conventional spray guns.

The pre-set, waistbelt regulator now incorporates a rolling diaphragm to stabilise the airflow and provide a safer working pressure range. Pneumatic damping avoids internal 'noise' reaching the wearer.

Note: It is essential that the air supply is in sufficient volume and filtered to 0.01 micron through a coalescer before it reaches the final stage 'odour' filter cartridge.

AIR HOSES: Both MPV vizor outfits (see contents list below) include a 1.2m (4') length of high quality, rubber, 8mm (5/16") bore spray gun hose. An option is the inclusion of a 7.6m (25') length of 8mm (5/16") bore, PVC hose air supply.

QUICK DETACH CONNECTIONS: Self-sealing, 'High-flow', Q.D. fittings are supplied at all the air entry and air outlet ports. These fittings ensure complete convenience for the wearer.

The complete MPV-615 Air-Fed Face Vizor Outfit comprises of:

Vizor Assembly with ratchet headband, detachable vizor covers, neck cover, disposable hood, stowage bag and a clear flexible hose with a quick detachable stem to couple to the waistbelt.

Waistbelt Assembly: An adjustable nylon belt with quickfit buckle. The disposable carbon odour removal filter and pre-set regulator are contained in a moulded housing which is moveable on the belt.

Rubber 8mm (5/16") bore air hose 1.2m (4') with quick detachable fittings to connect to spray gun or air tool.

7.5m (25ft) long Air Supply Hose in durable PVC fitted with quick detach female connection and a 1/4" loose nut female fitting. The hose is 8mm (5/16") bore.

Note:- The MPV-616 Vizor Outfit comprises all the above but without the 7.5 metre air supply hose.

A complete range of spares and replacement items are readily available to maintain or improve the performance and comfort of your DeVilbiss full face vizor or rubber half-mask.

MPV VIZOR SPECIFICATION AND PERFORMANCE DATA	
Operating inlet air pressure range	2.3 bar (34psi) - 7 bar (102 psi)
Maximum System Pressure:	10 bar (145 psi)
Carbon Cartridge Life:	1,000 hours at nominal airflow.
Nominal flow rate to the vizor	180 l/min
Maximum operating temperature	40°C (104°F)

As an alternative to the full face vizor DeVilbiss offer a half-mask and goggles outfit. Ask for leaflet reference MPV(MSK).

CE

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