New South Wales
Department of Mineral Resources

MDG 37

DESIGN GUIDELINES FOR

COMPRESSED AIR POWERED VENTILATION DEVICES USED FOR DILUTING OR REMOVING METHANE IN UNDERGROUND COAL MINES

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FOREWORD

Guidance information for air powered Venturi Ventilators was initially published on 3 June 1982 to provide manufacturers and operators of Venturi Ventilators with criteria on the construction, safety features and use of these devices.

This guideline MDG 37 extends that documentation to include all types of compressed air powered ventilation devices and contains more information pertaining to safety considerations.

The preparation of guideline involved input and support in particular from Wally Koppe, Leo Roberts, Les Gardner (Department of Mineral Resources). Contributions were received from representatives of coal mines, manufacturers and industry including Les Lunarzewski (Lunagas), Hank Pinkster (BHP Mine Manager), Bill Roberts (UniRod) which provided valuable input, feedback and guidance in it's development. All contributions are gratefully acknowledged.

This guideline dated March 1999 replaces the previous document issued in 1982. As required from time to time it will be reviewed to reflect current safety expectations and legislative changes should they occur.

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1 Scope

1.1 Regulations

The Coal Mines Regulation (Ventilation Underground Mines) Regulation 1984 Clause 55 states:

<u>*Release of compressed air in mine*</u>

55. No person shall release in a mine compressed air for the purpose of diluting or removing methane other than by means of equipment approved for the purpose and used only in accordance with a system approved by the district inspector.

1.2 Purpose

This guideline specifically addresses the safety issues considered relevant for the type approval of Compressed Air driven ventilation devices as per Coal Mines Regulation (Methods and Systems of Working Underground Mines) Regulation 1984 under Clause 55.

The document also provides some information considered to be relevant for the installation of the compressed air driven ventilation device in underground coal mines which should be of assistance to manufacturers and end users of this equipment.

The following guidelines are intended to help ventilation device designers by indicating those factors which will be taken into account in the mechanical assessment of ventilation devices submitted for approval to the Chief Inspector of Coal Mines.

Additionally, reference is made to certain factors associated with the operation of the ventilation devices which must be considered at the design stage so that operational requirements can be met.

1.3 Limits

The guidelines do not generally give quantitative information as it is not intended to restrict innovative design. Where a manufacturer seeks test procedure information or proposes variation from the guidelines, advice should be sought from Inspectors of Mechanical Engineering for Coal Mines of the Department of Mineral Resources (DMR).

1.4 Standards and Guidelines

Unless otherwise specified, the appropriate Australian Standards shall apply. Refer to Appendix B for a list of appropriate standards, guidelines and references.

1.5 Occupational Health and Safety

Please note that this guideline does not in any way negate the requirements of the Coal Mines Regulation Act, 67/1982 or the NSW Occupational Health and Safety Act 1983 N° 20.

1.6 Use

Compressed air driven ventilation devices are used in the following situations:-

a) where electric power is not available

b) where electric power is undesirable as the Coal Mines Regulation Act requires inspection of the electric power supply and equipment at more frequent intervals

c) where the period of time between inspections of equipment is required to be as long as possible

d) where only a small quantity of air movement is required

e) where methane content in the general body may exceed 1.25%

f) where localised additional ventilation is required to dilute or remove concentrations of methane

g) where the potential for frictional ignitions from cutting picks is present.

1.7 Limitations

There are two (2) major limitations in the use of air powered ventilation devices as follows:-

1) The device may not perform consistently for numerous reasons besides the obvious ones of air pressure and volume. This limitation of the device shall be clearly identified by the approval applicant for the purposes of the end user.

2) The location of the device relative to other ventilation devices and its surroundings/obstructions may result in re circulation and or "dead" spots. This limitation needs to be identified for each type of situation and hence is site specific and needs to be identified by the end user and appropriate training conducted.

2 Definitions

2.1 Approved

Approved by the Chief Inspector of Coal Mines in accordance with the Coal Mines Regulation Act, 1982.

2.2 CMRA

Coal Mines Regulation Act, 1982 N° 67 and includes Regulations made pursuant to the Act.

2.3 Compressed air powered ventilation device -

Is a device which is designed to move air and is powered by compressed air. These devices include but are not limited to:-

a) venturi devices

b) vacuum extractors

c) fans driven by air motor

d) fans driven by compressed air released at the tips of the fan blades (driven by reaction forces)

2.4 DMR

Department of Mineral Resources (NSW).

2.5 Emergency Stop

A machine mounted device using fail-safe components that override all other machine controls, removes power from the machine (ie, auxiliary fan) actuator(s), and causes all moving parts to stop.

2.6 Ergonomics

Is the design of equipment, processes and environments so that tasks and activities required of humans are within their limitations but also make the best use of their capabilities. More simply, ergonomics is designing for people in the workplace. The application of ergonomics enhances people's ability to work safety and efficiently.

2.7 Fail to Safety (fail safe)

Any failure of the machinery, its associated safeguards, control circuits to its power supply that leaves the machinery in a safe condition.

2.8 MDG

Mechanical Design Guideline.

2.9 OEM

Refers to the Original Equipment Manufacturer.

2.10 OH&S

Occupational Health and Safety Act 1982 N° 20

2.11 *Risk Assessment*

The overall process of risk analysis and risk evaluation, refer to AS4360 - Risk Management, AS/NZS 3931 Risk analysis of technological systems - application guide, MDG 1010 and MDG 1014.

2.12 *Risk Management Process*

The systematic application of management policies, procedures and practices to the tasks of analysing, evaluating and controlling risk.

2.13 *Shall*

Means that the requirement is strongly recommended if it is applicable to the type of equipment under consideration unless it is used in association with a legislative requirement then it is mandatory.

2.14 *Should*

Means that the requirement is recommended.

If any of the parameters as recommended under a "shall or "should" instruction are not adhered to, the approval applicant shall justify the alternative to the recommendation through a process of technical assessment, risk assessment and risk management.

3 General Design, Performance and Installation Requirements

3.1 *Anti Static Requirements*

All compressed air powered ventilation devices shall be so designed, constructed and installed to prevent accumulation of electrostatic charges. This requires:-

a) All components including any attachments to be made from electrically conducting materials or from anti static materials

b) The device shall be suitably connected to earth whilst ever it is installed underground.

NOTE: Metal surfaces past which air and dust particles move also need to be earthed. (eg metal ventilation tubes suspended from nylon rope has resulted in a charge of up to 300 volt built up on each tube. This problem was overcome by using metal chain to metal roof bolts to support the ventilation tubes).

3.2 *Noise*

The Noise level requirements in this section are related to noise generated by the ventilation device itself. They are not intended to cover noise sources produced by other equipment in the underground mine environment. However, the designer should consider reduction measures that cater for the underground coal mining environment that the ventilation device will operate in, in addition to those generated by the ventilation device.

Noise levels shall not exceed:-

1) A continuous (A) weighted sound pressure level, LAeq 8h, of 85dB(A).

2) A peak level, Lpeak, 140dB(1in)

Noise tests of the completed unit (for a particular design) should be conducted in accordance with Australian Standard AS1269-1989 "Acoustic-Hearing Conservation".

3.3 *Performance*

3.3.1 The minimum dilution ratio for venturi devices of the compressed air device should be at least 5 to 1 where 5 is the delivered air flow and 1 is the compressed air flow at the specified operational duty;

3.3.2 The supplier shall provide technical data for each ventilation device including performance efficiency and settings of adjustable devices to achieve the performance criteria eg:-

a) gap settings for venturi devices;

b) inlet air pressure and flow for all types of ventilation devices and delivered air volume;

c) noise level for typical range of operational settings;

3.3.3 Provision should be made for the quantity (volume), quality (gas content) and pressure of the moving air to be monitored either by permanently installed instrumentation or by easily accessed tapping points for attachment of instrumentation.

3.4 *Air Supply*

3.4.1 All air supply hose shall conform with AS 2660.

3.4.2 The air supply should be filtered just prior to the inlet of the device to such an extent that any contaminants that pass the filter will not lead to deterioration of the performance of the ventilation device. The filter should at least entrap all particles that are larger than 1/3rd off the smallest aperture gap of the ventilation device.

3.4.3 Air filters should be readily cleanable without the use of tools.

3.4.4 A pressure gauge suitably dampened against excessive fluctuations or normally isolated to prevent wear should be provided just after the filter.

3.5 Materials

3.5.1 Exposed aluminium or light metal alloy as defined in MDG 11 shall not be used for any external part of the ventilation device.

3.5.2 Surface protection coatings shall not contain in metallic form any light metals or alloys of light metals (refer MDG 11)

3.5.3 All non metallic materials shall be fire resistant and anti static in accordance with the requirements as detailed in Appendix C.

3.6 Risk Assessment

A risk assessment shall be carried out to examine the failure modes of the ventilation device and its components. The risk assessment shall include but be not limited to:-

- design
- installation/location
- operations
- maintenance
- prevention of ignition of methane
- continued compliance with the performance requirements
- isolation
- guarding
- cleaning

3.7 Accessories

3.7.1 Attachments for lifting shall be fitted to the ventilation device. All attachments shall be adequate for the loads applied and have minimum factor of safety of 2:1.

3.7.2 A durable engraved or stamped nameplate shall be fitted in a permanent location on the ventilation device and shall include the information as per Appendix A - Part B.

3.7.3 An operating procedure nameplate as per 3.7.2 should be fitted and shall include ventilation device performance information.

3.7.4 Mounting attachments should be provided to suit the intended location eg close to the roof for removing methane layering.

3.8 Ergonomics

The ergonomic design in this section of the guidelines is based on the following fundamental premise:

3.8.1 Ergonomics use the process of Risk Identification, Risk Assessment and Risk Control to examine the likelihood of risks associated with a job or a piece of equipment and how these might cause harm to a person. Ergonomics applied using this process enables the compilation of information on how risks might be minimised or eliminated, particularly at the design stage.

3.8.2 The OEM shall provide a procedure for safe access and maintenance.

3.8.3 It is the responsibility of the user to determine how site specific safety issues should be addressed.

3.8.4 All controls and their direction of movement shall be clearly and permanently marked with durable engraved or stamped nameplates.

3.8.5 The OEM shall advise the user of the weight of the assembled ventilation device where this exceeds 10 kilograms.

4 Installation and Use

4.1 As part of Clause 55 of the Coal Mines Regulation (Ventilation Underground Mines) Regulation 1984, it is required that a compressed air powered ventilation device installed in any part of the mine, shall only be used in accordance with a system approved by the District Inspector.

The District Inspector can impose conditions in the approval in relation to the installation, use and maintenance of the compressed air powered ventilation device.

4.2 Provision shall be made in the scheme for systematic examination and testing of the ventilation device as required by Section 103 of the Coal Mines Regulation Act, 1982 to include:-

a) Inspection of the ventilation device housing for undue deformation or other defect;

b) The measurement and recording of vibration in motor/fan bearings at regular intervals where applicable; and

c) measurement of performance where this may deteriorate over time.

5 Design Requirements for Fans Driven by Compressed Air (additional to other sections)

The following is a slightly modified version of MDG 3 which covers Electrically Powered Auxiliary Fans.

5.1 General

5.1.1 The fan housing should be of robust construction with external stiffening around the impeller casing to reduce the potential for damage to occur during moves underground, transport or handling.

5.1.2 The fan housing shall have the design direction of rotation prominently and permanently marked. There shall be a means whereby any official of the mine can check the direction of rotation.

5.1.3 The recommended grade and type of lubricant should be indicated on the motor or bearing housing.

5.1.4 A method for draining water from the fan housing should be provided.

5.2 Motor

5.2.1 Where foot mounted motors are used positive means shall be provided additional to holding down bolts to prevent relative movement between the motor and fan housing.

5.3 Drive Train

5.3.1 Anti-friction bearings for the electric motor and fan impeller shall be designed for a L10 working life of at least 50,000 hours. Factors to be included are:-

a) combined axial and radial loadings; and

b) normal acceptable fan out of balance (as nominated by the manufacturer).

5.3.2 The maximum surface temperature generated from any source shall not exceed 150°C under any circumstances.

5.3.3 Anti friction bearings should not have non-metallic cage material.

5.3.4 Bearing seals should be suitable for use in both dusty and wet conditions.

5.3.5 The motor and all bearings in any drive train shall be mounted on a single drive frame. This does not preclude:

a) use of flange mounted motors; or

b) mounting of the impeller directly onto the motor output shaft.

5.4 Impeller

5.4.1 Accurate and positive locating and locking of the impeller on its support shaft shall be provided.

5.4.2 Fan impellers should be designed to ensure that pockets in which dust can collect are minimised.

5.4.3 The fan impeller shall be made of a material which cannot produce a spark capable of igniting methane during normal operation. Note: Impellers shall not be manufactured from aluminium or light metal alloys (Refer MDG 11).

5.4.4 Impellers manufactured from non-metallic materials shall be fire resistant and anti-static. Fire resistant and anti-static properties shall meet the requirements of the appropriate standard. (Refer Appendix C).

5.4.5 The fan impeller and surrounding components shall be designed to prevent the generation of sparks which may ignite methane under any condition of operation. The design shall be such that displacement of the impeller and its support shaft to prevent steel parts of the unit to rub or strike each other.

5.4.6 As a minimum the following design, installation and operational conditions for the fan shall be assessed:

a) Axial movement of the shaft or impeller;

b) measurable wear, but not collapse of impeller or bearings;

c) incorrect setting of shaft or guards during assembly;

d) limited damage to the external drive guard and unit casing.

5.4.7 Those parts of the fan which would first come into rubbing contact shall have one part made of either copper or brass (lined with copper or brass is acceptable).

5.4.8 The fan impeller shall not be belt driven.

5.5 Guarding

5.5.1 Guarding should be provided at the fan inlet to prevent particles of stone, ventilation tube seals, coal or other material from entering the impeller. Maximum width of opening in the guard to be not more than 50mm.

5.5.2 Access to the guard for cleaning purposes should be provided.

5.5.3 Every inspection or access cover attached to the fan or associated material traps shall be provided with positive locking devices and appropriate danger signs.

5.5.4 All exposed rotating components shall be effectively guarded as per AS4024.1 - Safeguarding of Machinery - General Principles.

5.6 Controls

The following list of (Electric Powered) Auxiliary Fan controls from MDG 3 shall be considered during the risk assessment required by Clause 3.6.

Where the following controls are not provided the adequacy of alternative barriers are to be reviewed and where appropriate these alternative barriers shall be provided:

Controls for (Electric Powered) Auxiliary Fans;

Automatic protection devices should be fitted to detect abnormal bearing temperature;

Automatic protection devices should be fitted to detect abnormal vibration of critical elements.

NOTE: If the OEM does not install an automatic vibration protection device then provision shall be made in the design of the fan for routine testing and assessment of vibration levels.

These devices should indicate when abnormal vibrations occur and shall trip the power to the fan motor before unacceptable operational limits are exceeded.

The interval and type of test should be stated in the operation and service schedule.

A nameplate indicating alarm and shut down levels shall be fitted to the fan control.

NOTE: Bearing temperature monitoring be carried out by means which minimise response time.

External contact type temperature sensing devices mounted on the bearing cap may not have adequate response time to detect the sharp rise in temperature which can occur when cage and rolling elements break up.

A means to minimise response time is to position the temperature probe as close as possible to the bearing by using the greaseway access point using an adapter which still allows the bearing to be greased.

6 Documentation

6.1 Appendix A Part A:- Documentation required to be supplied by manufacturers to approval authority.

6.2 Appendix A Part B:- Documentation required to be supplied by manufacturers to customers.

7 Appendices

A Documentation required to be supplied

B List of Standards, Guidelines and References

C Fire Resistance and Anti Static Testing

APPENDIX A

COMPRESSED AIR DRIVEN VENTILATION DEVICE DOCUMENTATION REQUIREMENT

PART A

MANUFACTURER TO SUPPLY TO APPROVAL AUTHORITY

In addition to the requirements of this guideline, the following information shall be supplied with an application for approval and for each new ventilation device supplied in NSW.

1 General arrangement drawing. Commonly known as the approval drawing. This drawing shall include where appropriate:-

1.1 The overall dimensions of the ventilation device

1.2 Details of:-

a) Locations of all controls

b) Location of all indicators

c) Position of all inlet, outlet and control ducts

d) Lifting points and mounting brackets

1.3 Specifications where applicable for

a) Motor power rating

b) Motor speed

c) Fan flow speed and performance or venturi performance including air consumption and delivery characteristics for a range of air pressure

d) Fan rotation (direction).

e) Unit mass

f) Maximum recommended bearing temperature

g) Maximum vibration limits

h) Cross section drawing showing where applicable

- Blade Clearances
- Rubbing material
- Fan impeller to shaft retaining method as well as shaft assembly retaining method

i) Type of grease for bearings

1.4 The results of noise testing

1.5 Calculations for approvals purpose where applicable.

2 The application for approval shall also include:-

2.1 A marked up copy of the MDG 37 showing compliance and non compliance

2.2 The noise test report

2.3 All relevant approval letters and drawing for associated items

2.4 Letters or test reports for attachments

2.5 Other test reports as may be required by the approvals authority.

2.6 Calculations where applicable.

2.7 A credible Risk Assessment report which effectively identifies, assesses and controls hazards relating to the safety of persons associated with the operation, maintenance and testing of the equipment and the potential for the ventilation device to ignite methane or generate sufficient heat to result in a fire or cause dust to be raised in suspension.

APPENDIX A (cont'd)

PART B

APPROVAL HOLDER (MANUFACTURERS) TO PROVIDE TO CUSTOMERS(S)

1 Manufacturers are required to supply a copy of:-

1.1 Approval letter

1.2 Approval drawings

1.3 A letter of Compliance including:

a) The manufacturer's letter head

b) A statement indicating compliance with MDG 37

c) The ventilation device model number, serial number, date of manufacture and approval number

d) An authorised person's signature indicating compliance

1.4 Requirements for Parts, Service, Maintenance and Inspection

1.5 Operators manuals

1.6 Approval Nameplate showing:-

a) Approval Number

b) Serial and Model Number

c) Date of manufacture

d) Suppliers name/make

e) Gross weight of the ventilation device assembly

f) recommended air consumption and pressure

g) air delivered for (f)

APPENDIX B

LIST OF STANDARDS, GUIDELINES AND REFERENCES

Australian Standards

AS 1269	Acoustics - Hearing Conservation
AS 1319	Safety Signs for the Occupational Environments
AS 2012.2	Acoustics - Measurement of airborne noise - Operator's position
AS 2660	Hose and Hose Assemblies - Air/Water for Underground Coal Mines
AS/NZS 3931	Risk Analysis of technological systems - application guide
AS 4024.1	Safety Guarding of Machinery - General Principles
AS 4360	Risk Management

Mechanical Design Guidelines

MDG 3	Design Guidelines for Auxiliary Fans (Electric Powered)
MDG 11	Design Guidelines for the Use of Aluminium Underground
MDG 29	Guideline for Diesel and Operator Environment Testing in Underground Coal Mines Appendix D - Noise Assessments
MDG 30	Mechanical Compendium - Notices to Mines and Manufacturers
MDG 1010	Risk Management Handbook for the Mining Industry
MDG 1014	Guide to Reviewing a Risk Assessment of Mine Equipment and Operations.

APPENDIX C

FIRE RESISTANCE AND ANTI-STATIC TESTING

NSW DEPARTMENT OF MINERAL RESOURCES: MINE SAFETY UNIT MATERIALS TESTING MANUAL ISSUE N° 2

ITEM: VENTILATION DUCTING - *Flexible & Semi-Rigid*

PARAMETER N° 1 *ELECTRIC RESISTANCE*

includes testing of:-

i) matrix material

ii) finished ducting with supporting spiral, coupling band any accessories

Test Method: NCB 245:1985 Appendix 5

Quantity Sample Material Required for Testing: 2 x (300mm x 300mm) sections of ducting material from:-

i) matrix

ii) finished ducting

Requirements:

The average value of Electrical Resistance on both the upper and lower surfaces of the ducting shall be no greater than 300 Megohms (300 x 10^6ohms) and shall remain so in use.

PARAMETER N° 2 *FIRE RESISTANCE*

includes testing of

i) matrix material

ii) finished ducting

Test Method 1: Spirit (Barthel) Burner Test NCB 245:1985 Appendix 2

Quantity Sample Material Required for Testing: 6 x (50mm x 360mm) strips of ducting material from:-

i) matrix

ii) finished ducting

Requirements: The material shall fail the test if any of the following occur:

a) <u>If at any time:</u>

  1) flame on two or more test pieces extends above the marker wire

  or

  2) glow on two or more test pieces extends above the marker wire.

b) <u>If after the burner flame has been removed:</u>

  1) the means persistence time of the flame of the six test pieces exceeds 3 seconds, or if the persistence time of the flame on any test piece exceeds 10 seconds;

  2) the mean persistence time of the glow of the six test pieces exceeds 10 seconds, or if the persistence time of the glow on any test piece exceeds 30 seconds.

  NOTE: if the sample shrivels away from the flame then test method three (3) shall be followed.

Test Method 2: **Spirit Lamp Test** NCB 245:1985 Appendix 3 shall be conducted in addition to test method 1.

Quantity Sample Material Required for Testing: 6 x (50mm x 360mm) strips of ducting material from:-

i) matrix

ii) finished ducting

Requirements:

The material shall fail the test if any of the following occur:

a) the mean persistence time of the flame of the six test pieces exceeds 6 seconds, or if the persistence time of the flame on any test piece exceeds 12 seconds;

b) the mean persistence time of the glow of the six test pieces exceeds 10 seconds, or if the persistence time of the glow on any test piece exceeds 30 seconds.

  NOTE: if the sample shrivels away from the flame then test method three (3) shall be followed.

Test Method 3: "Follow-up" Flame Test NCB 245:1985 Appendix 4

Quantity Sample Material Required for Testing: 6 x (50mm x 360mm) strips of ducting material from:-

i) matrix

ii) finished ducting

Requirements:

The material shall fail the test if any of the following occur:

a) the mean persistence time of the flame of the six pieces exceeds 60 seconds, or if the persistence time of the flame on any test piece exceeds 80 seconds;

b) the mean persistence time of the glow of the six test pieces exceeds 60 seconds, or if the persistence time of the glow on any test piece exceeds 80 seconds.

c) The material is completely consumed.

PARAMETER N° 3 *AIR PERMEABILITY*

Test Method: NCB 441:1964 Part 1.7

Quantity Sample Material Required for Testing: section of area at least $106mm^2$ from:-

i) matrix

ii) finished ducting

Requirements:

There shall not a rate of air flow greater than $25.4L^{-1}sec^{-1}m^{-2}$ through the material when it is subjected to a pressure differential of 127mm of water gauge from atmospheric pressure.

PARAMETER N° 4 *DETERMINATION OF FLAMMABILITY BY OXYGEN INDEX*

Test Method: ISO 4589 1984 (e)

Quantity of Sample Material Required for Testing:

At least 20 strips (140mm x 10mm x < 10mm) cut from ducting matrix material.

Requirements:

The Oxygen Index will serve as a bench mark for continuing quality assurance of the product with respect to flammability.

When the ducting material is tested in accordance with ISO 4589, using a Type *III* test specimen form, the result shall be within ± 3 points of that originally obtained at the time of approval.

Reference: AS 1333-1994 Section 6.8(b)(iv)

ITEM: RIGID VENTILATION DUCTING

PARAMETER N° 1 *ELECTRICAL RESISTANCE*

includes testing of:-

i) matrix material

ii) finished ducting with supporting coupling band and any accessories.

Test Method: AS 1180.13A-1982

Quantity of Sample Material Required for Testing: 3 metre length split into 3 x 1 metre free sections.

Requirements:

When the ducting is tested in accordance with AS 1180.13A-1982, using the flexible ring electrodes for the external surface and the plug electrodes for the internal surface, the Electrical Resistance shall not be greater than 1 Megohm metre^{-1}.

Reference: AS 2660-1982.

PARAMETER N° 2 *FIRE RESISTANCE*

Test Method: AS 1180.10B-1982

Quantity of Sample Material Required for Testing: 6 x 300mm length sections taken from submitted 3 metre length.

Requirements:

When the ducting is tested in accordance with AS 1180.10B-1982, the mean persistence time for flaming and glowing shall not exceed 30 seconds.

Reference: AS 2660-1982.

PARAMETER N° 3 *DETERMINATION OF FLAMMABILITY BY OXYGEN INDEX*

Test Method: ISO 4589-1984 (E)

Quantity of Sample Material Required for Testing: At least 20 strips (150mm x 10mm x 10mm) cut from submitted lengths of ducting.

Requirements:

The Oxygen Index will serve as a bench mark for continuing quality assurance of the product with respect to flammability.

When the ducting is tested in accordance with ISO 4589, using a Type *IV* test specimen form, the result shall be within ± 3 points of that originally obtained at the time of approval.

Reference: AS 1333-1994 Section 6.8(b)(iv).

ITEM: RUBBER/PLASTIC PIPES AND HOSES

PARAMETER N° 1 *ELECTRICAL RESISTANCE*

Test Method: AS 1180.13A-1982

Quantity of Sample Material Required for Testing: 3 metre length split into 3 x1 metre free sections.

Requirements:-

When the hose (or pipe) is tested in accordance with AS 1180.13A-1982, using the flexible ring electrodes for the external surface and the plug electrodes for the internal surface, the Electrical Resistance shall not be greater than 1 Megohm metre^{-1}.

Reference: AS 2660-1982.

PARAMETER N° 2 *FIRE RESISTANCE*

Test Method: AS 1180.10B-1982

Quantity of Sample Material Required for Testing: 6 x 300mm length sections taken from submitted 3 metre length.

Requirements:

When the hose (or pipe) is tested in accordance with AS 1180.10B-1982, the mean persistence time for flaming and glowing shall not exceed 30 seconds.

Reference: AS 2660-1982.

PARAMETER N° 3 *DETERMINATION OF FLAMMABILITY BY OXYGEN INDEX*

Test Method: ISO 4589-1984 (E)

Quantity of Sample Material Required for Testing: At least 20 strips (150mm x 10mm x 10mm) cut from submitted lengths of pipe/hose.

Requirements:

The Oxygen Index will serve as a bench mark for continuing quality assurance of the product with respect to flammability.

When the hose (pipe) is tested in accordance with ISO 4589, using a Type *IV* test specimen form, the result shall be within ± 3 points of that originally obtained at the time of approval.

Reference: AS 1333-1994 Section 6.8(b)(iv)

ITEM: FAN BLADES

PARAMETER N° 1 *ELECTRICAL RESISTANCE*

includes testing of:-

i) matrix material

ii) finished fan blades

Test Method: NCB 245 : 1985 Appendix 5

Quantity of Sample Material Required for Testing:

i) Matrix material: 2 x 300mm x 300mm sheets

ii) Finished fan blades: as supplied

Requirements:

The average value of the Electrical Resistance shall not exceed 300 megahms (300×10^6 ohms) and shall remain so in use (this implies reliance on surface paint coat is not satisfactory)

PARAMETER N° 2 *FIRE RESISTANCE*

includes testing of:

i) matrix material

ii) finished fan blades

Test Method: AS1180.10B-1982

Quantity of Sample Material Required for Testing:

i) Matrix material: 2 x 300 mm x 300mm tests

ii) Finished fan blades: as applied

Requirements:

When the material is tested in accordance with AS 1180.10B-1982, the mean persistence time of flaming and glowing shall not exceed 30 seconds.