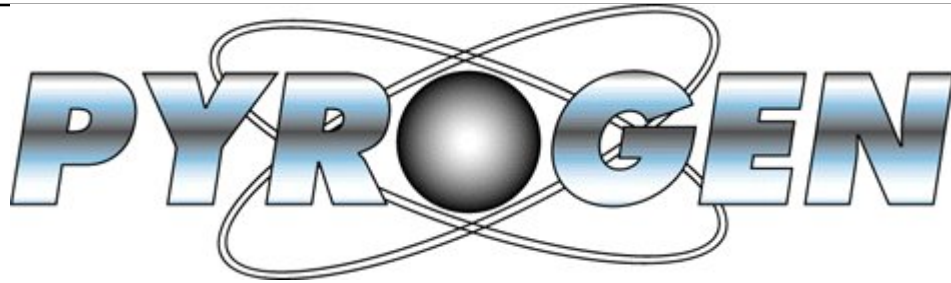

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PRE-ENGINEERED FIXED AEROSOL FIRE SUPPRESSION SYSTEM IN CNC MACHINES



DESIGN, OPERATION & MAINTENANCE MANUAL

This manual is issued by Pyrogen Fire Suppression LLC and Pyrogen Technologies (AUST) Pty. Ltd. and is for use by trained and authorised personnel only. Unauthorised copying of this manual and its contents and use by unauthorised personnel is strictly forbidden and may lead to legal action against those who do so.

This document is accurate at time of issue and Pyrogen reserves the right to make changes to its content from time to time.

FOREWORD

This Manual is specifically intended for use with Pyrogen Pre-Engineered Fixed Fire Suppression Systems installed in CNC machines

Pyrogen systems for total flooding applications shall comply with the requirements of the following Standards:

- AS/NZS 4487:1997 Australia/New Zealand Standard
Pyrogen Fire Extinguishing Systems; and

- AS/NZS 1851.16:1997 Australia/New Zealand Standard
Maintenance of Fire Protection Equipment
Part 16: Pyrogen Fire Extinguishing Aerosol Systems

Those who design, operate, own and maintain these systems should read the entire Manual. Specific sections would be of particular interest depending on one's responsibility. If there should be any questions regarding this manual, please contact our representatives from the Pyrogen office.

System Design Approval Certificates must be completed and sent to Pyrogen office for endorsement prior to supply and installation of a Pyrogen Fire Suppression System.

The Pyrogen Fire Suppression System requires minimal maintenance, mainly supervision of electrical circuitry, however the system should be inspected at regular intervals to provide maximum assurance that your fire suppression system will operate effectively and safely. Inspection and maintenance should be conducted in accordance with the inspection and maintenance schedule included in this Manual.

This Manual is limited for use with Pyrogen Pre-Engineered Fixed Fire Suppression Systems installed in CNC machines. The below part numbers are applicable within the requirements and limitations detailed of this Manual. A suffix indicates the controller used Example: **PCNC-5A** is a FO&GI controller with a single MAG5 generator.

FO&GI Kit Part number	Protected Volume	
PCNC-1	10 cuft	Dental and desktop grinders
PCNC-2	18 cuft	Small tool grinders
PCNC-3	35 cuft	Small EDM machines
PCNC-5	88 cuft	Standard normal grinder or EDM kit
PCNC-5/5	175 cuft	Special system for gang mist collectors
PCNC-4	175 cuft	Normal mist extractor kit
PCNC-4/5	250 cuft	specialized chip and mist extractors
PCNC- 4/5/5	350 cuft	Large vertical turning lathes / centers
PCNC-4/4/5	425 cuft	Large machines with ganged mist systems
PCNC-4/4/4	525 cuft	Monster Machines with multi pallets

<p>FO&GI Controller PN suffix #A</p>	<p>ISO / EU OEM Controller PN #B</p>	<p>Sp-1 miniature Controller #C</p>	<p>Multi Zone with Auto release # D</p>

TABLE OF CONTENTS

Section 1. Terminology.....	5 of 47
Section 2. Product Description	
2.1 <i>What is Pyrogen?</i>	7 of 47
2.2 <i>Pyrogen Chemical Identity</i>	8
2.3 <i>Pyrogen Extinguishing Action</i>	10
2.4 <i>Pyrogen Application & Limitation</i>	12
2.5 <i>Pyrogen Safety Data</i>	14
2.6 <i>Pyrogen Environmental Characteristics</i>	16
2.7 <i>Pyrogen Technical Characteristics</i>	17
2.8 <i>Pyrogen Discharge</i>	18
Section 3. System Supply	
3.1 <i>List of Components</i>	19 of 47
3.2 <i>Pyrogen Aerosol Generator</i>	19
3.3 <i>Controller (Fire Panel)</i>	19
3.4 <i>Break Glass</i>	23
3.5 <i>Thermal Probe Detector</i>	23
3.6 <i>Strobe/Sounder</i>	24
3.7 <i>Elbow Mounting Unit</i>	24
Section 4. System Design	
4.1 <i>General</i>	26 of 47
4.2 <i>Pyrogen MAG-5 Aerosol Generator</i>	26
4.3 <i>Enclosure Requirements</i>	27
4.4 <i>Pyrogen Service Life</i>	29
Section 5. System Operation	
5.1 <i>Operation mode</i>	30 of 47
5.2 <i>Operation in Fire Situation</i>	30
Section 6. System Installation	
6.1 <i>Design & Acceptance Documentation</i>	31 of 47
6.2 <i>System Integrity</i>	31
6.3 <i>Prior to Installation</i>	32
6.4 <i>Installation Location</i>	32
6.5 <i>Mounting</i>	32

6.6 Electric Wiring.....33

Section 7. System Marking

7.1 Installation & Expiry Date Label.....36 of 47

7.2 Warning & Instruction Sign.....36

Section 8. System Commissioning.....37 of 47

Section 9. System Maintenance.....37 of 47

Appendix a - Approval Documentation

Form 1- System Design Approval Certificate.....38 of 47

Form 2- Commissioning & Acceptance Testing.....41

Form 3- Notice of Completion.....45

Form 4 - Maintenance Check List.....46

Form 5 - Annual Maintenance Certificate.....47

SECTION 1: TERMINOLOGY

The following definitions apply to this document:

Actuating mechanism: automatic or manual activation leading to the physical discharge of the extinguishant.

Aerosol: an extinguishant consisting of finely divided solid particles and gaseous matter, these being combustion products of a solid aerosol-forming compound.

Aerosol-forming compound: a mixture of a solid combustible component, a solid potassium salt-based oxidant and solid technical admixtures producing fire-extinguishing aerosol upon activation.

Aerosol generator: same as Pyrogen generator

Aggressive environment: where environmental variables such as temperature and/or vibration undergo cycling at or close to the extreme limits of the Pyrogen generator. Corrosive atmosphere may also be a factor.

Automatic: performing a function without the necessity of human intervention.

Automatic/Manual Switch: a device that can be operated before a person enters a space protected by Pyrogen fire suppression system to prevent automatic release of fire extinguishing aerosol. Normal detection sequence is unaffected.

Class A fires: fire involving solid materials, usually of organic nature. Can be further categorised into surface burning fires and deep-seated fires. Deep-seated fires smoulder and may combust slowly beneath the surface of the hazard.

Class B fires: fires involving liquids or liquefiable solids.

Class C fires: fires involving electrically energised

Class E fires: other fuels to be used later.

Class F fires: fats and cooking oils.

Control device: a device to control the sequence of events leading to the release of the extinguishant. Sometimes referred to as the “controller”

Cooling element: a heat absorbing material contained inside a Pyrogen generator.

Design application density (g/m³): the mass of Pyrogen solid aerosol-forming compound per m³ of enclosure volume required to extinguish a specific type of fire, including a safety factor.

Design quantity (g): the mass of Pyrogen solid aerosol-forming compound necessary to extinguish a fire in a particular risk, including a safety factor.

Extinguishant: aerosol produced from Pyrogen generator.

Generator: same as Pyrogen generator.

Holding time: the period during which the extinguishant is required to maintain a minimum effective concentration.

Hot Work: grinding, welding, thermal or oxygen cutting or heating and other related heat-producing or spark-producing operations.

Location drawing: a plan of the risk clearly indicating the as-installed location of all Pyrogen generators, controls and maintenance isolate switch.

Manual: requiring human intervention to accomplish a function.

Monitoring: the supervision of the operating integrity of an electrical control feature of a system.

Normally occupied area: an area where, under normal circumstances, humans are present.

Normally unoccupied area: an area that is not occupied by humans under normal circumstances but may be entered occasionally for brief periods.

Operating device: any component involved between actuation and release.

Pyrogen generator: a device capable of generating the Pyrogen aerosol extinguishant when activated either electrically or thermally. Consists of an electrical and/or thermal activation device, an aerosol-forming compound and a cooling element enclosed within a corrosion-resistant casing incorporating an end-plate nozzle.

Release: the action leading to the physical discharge or emission of the extinguishant into the enclosure.

Smouldering: slow combustion of material without visible light and generally evidenced by smoke and an increase in temperature.

System isolate switch: see Automatic/Manual switch.

Total flooding system: a fixed fire suppression system, which distributes the extinguishing medium throughout the protected enclosure.

SECTION 2: PRODUCT DESCRIPTION

2.1 What is Pyrogen?

Pyrogen is a self-generated Aerosol Fire Extinguishing Agent, and is **one of the most efficient Halon Alternative products currently available.**

The principle of extinguishing action employed by Pyrogen is unique - a special solid chemical, Pyrogen aerosol-forming compound, when electrically or thermally activated, undergoes a combustion reaction to produce micron sized dry chemical particles and gases. Dry chemical particles - mainly potassium carbonates, and gases - mainly carbon dioxide, nitrogen and water vapour, mix together into an uniform aerosol, which represents an actual extinguishing medium.

Before being released into a protected area, the aerosol propels itself through a Pyrogen cooling element, which absorbs heat, thus ensuring a low temperature discharge and uniform distribution of the aerosol within the area.

As aerosol is self-generated it requires **no pressure cylinders** and does not need to be stored. The aerosol generating chemical reaction provides a sufficient driving force for a rapid discharge and efficient distribution of the aerosol. **No piping is required.**

The solid aerosol-forming compound together with the solid cooling element and activation devices is contained in a small non-pressurised canister with one or two end-plate delivery nozzles. The canisters are called MAG generators and vary in size depending on the mass of the solid aerosol-forming compound contained in the generator.

MAG canisters are very compact and normally placed inside the protected enclosure.

Operation of the generator is either electrical automatic, electrical manual or thermal automatic.

The electric activation device functions upon receipt of an electrical signal, while the thermal activation device functions upon a direct contact with naked flame or heat exceeding 175 °C to ignite a special booster charge, which, in turn, ignites the aerosol-forming compound to produce Pyrogen aerosol. The aerosol propels itself through the cooling element and out of the delivery nozzle into the protected area.

Pyrogen aerosol is a whitish gas-like medium that is close in density to air. **Small particle size ensures three-dimensional distribution qualities and long suspension times.**

Pyrogen aerosol is non-conductive and non-corrosive.

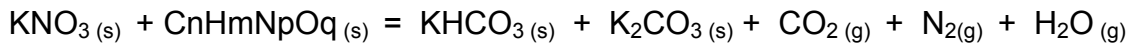
As Pyrogen aerosol stays in suspension for extended periods, it can be removed from the protected area by any airflow. Solid fraction of the aerosol that has settled can easily be brushed, blown or washed away.

2.2 Pyrogen Chemical Identity

The secret to Pyrogen's power is in two unique formulations contained in Pyrogen canister - the solid aerosol-forming compound and the solid cooling element.

The solid aerosol element is a thermoplastic mixture consisting of an oxidiser, a combustible binder and technological additives. The oxidiser is a solid potassium nitrate ($\text{KNO}_{3(s)}$), the combustible binder is an organic polymer ($\text{C}_n\text{H}_m\text{N}_p\text{O}_q(s)$) and technological additives include an activator of the oxidiser's decomposition, chemical and mechanical stabilisers and some other ingredients.

When activated the solid aerosol element undergoes a combustion reaction, which can schematically be represented as follows:



Combustion products mainly consist of potassium carbonates (KHCO_3 , K_2CO_3), carbon dioxide gas ($\text{CO}_{2(g)}$), nitrogen gas ($\text{N}_{2(g)}$) and water vapour ($\text{H}_2\text{O}_{(g)}$) and represent the actual extinguishing agent.

As the reaction temperatures are high, potassium carbonates are formed in the gas phase, but as the vapour cools, the potassium carbonates condense to a liquid and then a solid. As solid potassium carbonates are produced by condensation, **the particle size is very small - approximately from 1 to 10 microns**. Micron sized solid particles mix with the gaseous carbon dioxide, nitrogen and water into a uniform homogeneous gas-like phase - an aerosol.

Thus, **Pyrogen extinguishing aerosol is a suspension of the micron sized solid particles, mainly potassium carbonates, in the gas mix of carbon dioxide, nitrogen and water vapour.**

Being a combustion product of the aerosol-forming compound, Pyrogen aerosol is hot upon formation. Although, Pyrogen aerosol is the most effective in terms of the actual fire extinguishment when in its hottest state, the negative impacts of very high temperatures are obvious. That is where a second unique formulation - the cooling element - comes into action. When the hot Pyrogen aerosol passes through the cooling element, the latest absorbs heat. Application of the Pyrogen cooling element provides uniform distribution of the aerosol within the area, which certainly contributes to the reliability and safety of the extinguishment. Moreover, additional amounts of inert gases are formed due to a thermal decomposition of the cooling element, which contribute to the effectiveness of the extinguishment.

PYROGEN GENERATOR: CONSTRUCTION

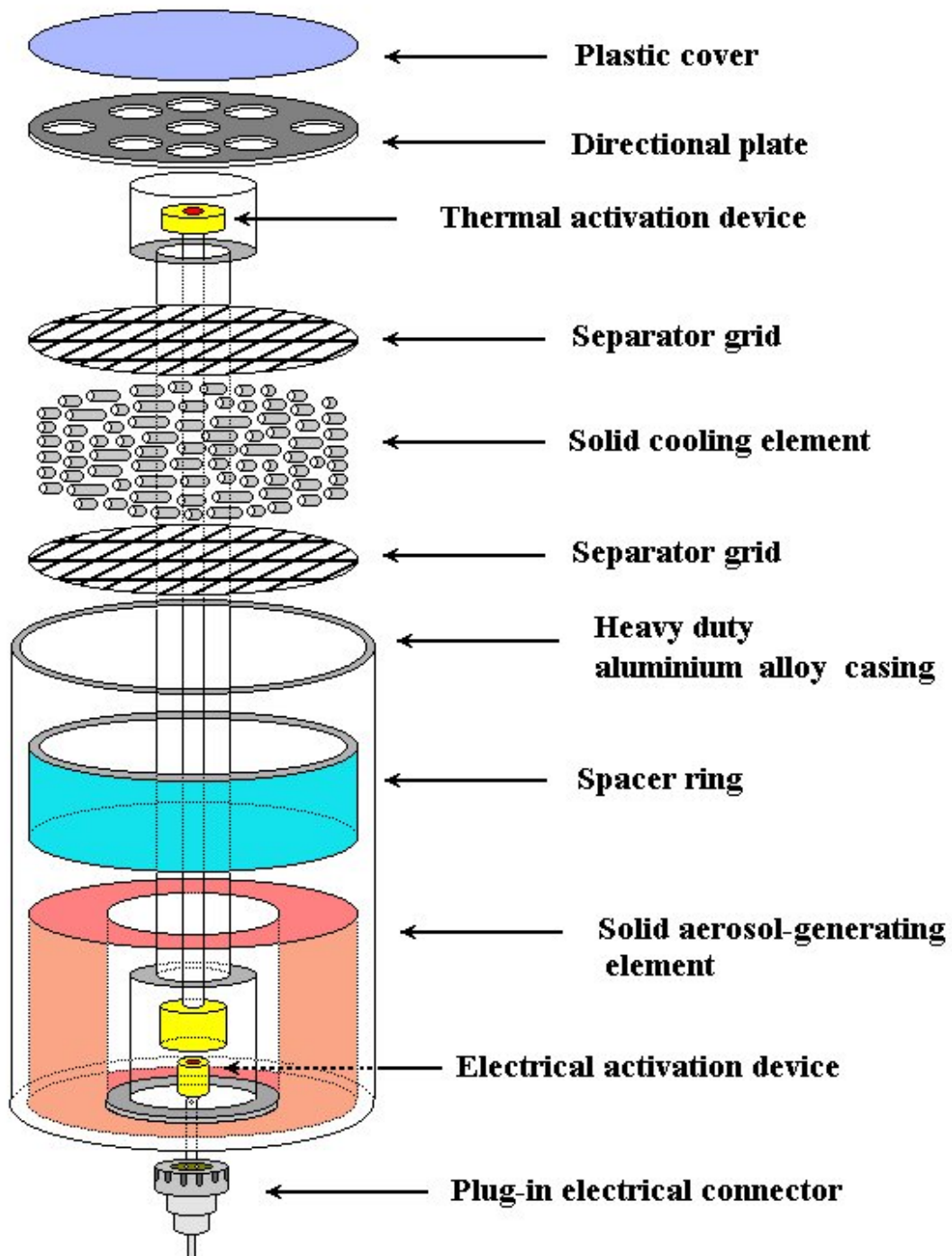


Diagram 1-1

2.3 Pyrogen Extinguishing Action

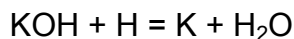
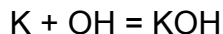
Pyrogen aerosol is an exceptional fire suppressant.

Pyrogen extinguishing action is achieved primarily by interfering chemically with the fire reaction. Two chemical mechanisms can be underlined:

1. Removal of flame propagation radicals - “chain carriers” OH, H and O in the flame zone:

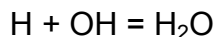
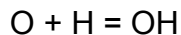
As it has been mentioned above, the main component of Pyrogen aerosol - potassium carbonates - are formed in a gaseous phase. In the flame zone they dissociate producing potassium radicals K. Potassium radicals are very active and react with the “chain carriers” OH, H and O removing them from the fire zone, and as such disrupting the fire reaction.

The chemical action of potassium radicals in Pyrogen is similar to that of bromine radicals in Halons and can be schematically represented as follows:



2. Recombination of flame propagation radicals - “chain carriers” OH, H and O on aerosol particle surface:

Gaseous potassium carbonates condense to a liquid and then a solid form producing a large number of micron sized particles. Being so small, the particles produce a large surface area, where recombination of “chain carriers” takes place:

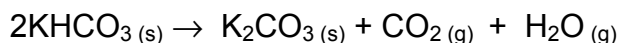


Secondarily, Pyrogen extinguishing action is achieved by lowering fire temperature to a temperature below which the fire reaction cannot continue (thermal cooling). Several physical mechanisms can be underlined:

1. Heat absorption via endothermic phase changes:



2. Heat absorption via endothermic decomposition reaction:



3. Dilution of the fire combustion zone by the aerosol cloud (additional fuel molecules cannot participate in the combustion process); *physical hindrance to flame propagation (aerosol particles slow down velocity of a flame front propagation) and etc.*

The extremely high surface area of the micron-size aerosol particles increases the likelihood of radical recombination and heat absorbing reactions, thus ensuring rapid extinguishment with a small amount of agent.

Pyrogen has the lowest extinguishing concentration known among commercially available agents - flammable liquids (class B fires) are extinguished at the design application density of 100 g/m³ compared to 330 g/m³ for Halon 1301.

The high rate of aerosol discharge ensures a tremendous knockdown effect.

Micron sized aerosol particles exhibit gas-like three-dimensional qualities that allow the agent to rapidly distribute throughout enclosure and reach the most concealed and shielded locations. Homogeneous distribution is achieved in a matter of seconds, while long holding times all help to prevent fire re-ignition.

Pyrogen aerosol is suitable for the protection of a variety of potential fire hazards, including those involving flammable liquids, combustible solids, oils and energised electrical equipment.

2.4 Pyrogen Applications and Limitations

Pyrogen may be used as a fixed fire suppressant system in total flooding (prime application) and local applications to fight fires of classes A, B, C, E and F.

For class C fires consideration should be given to the use of vapour detection, explosion venting or explosion suppression systems where an explosion potential may exist, owing to the possible presence of gaseous, volatile or atomised fuels either before or following a fire. It may be dangerous, under certain conditions to extinguish a burning jet of flammable gases without first shutting off its supply.

The design application density required to suppress normal fires involving flammable gases and liquids at atmospheric pressure shall apply if it can be shown that a potentially explosive atmosphere cannot exist in the enclosure either before or as a result of the fire.

Total Flooding Applications: May be used where the hazard is within an enclosure that will permit the establishment of the required concentration and the maintenance of that concentration for the required period, for example, for-

■ *Industrial:* enclosed flammable liquid storage, storage tanks & processing areas.

enclosures such as rooms, warehouses, garages, control rooms, engine rooms, vaults.

enclosed machines, data processing equipment, mining equipment.

enclosed electrical hazards such as transformers, control cubicles, switchboards, circuit breakers & rotating equipment.

security boxes (ATM, tender & post boxes) & remote locations.

■ *Marine:* machinery spaces, engine rooms.

■ *Transport:* engine compartments.

■ *Aviation:* aircraft dry-bays, cargo compartments, engine nacelles.

For total flooding applications in occupiable areas standard safety operating devices, such as system isolate switch, warning and evacuation signs and alarms, time delay, etc shall be incorporated.

Pre-engineered Systems: Designed and tested for a specific application.

Pyrogen system installed on CNC machines has been specifically tested for the application and is a pre-engineered system.

Limitations of Pyrogen Systems:

Pyrogen systems are not suitable for fires involving the following:

- Certain chemicals or mixtures of chemicals such as cellulose nitrate and gunpowder, which are capable of rapid oxidation in the absence of air.
- Reactive metals such as sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium.
- Metal hydrides or metal amides.
- Chemicals capable of undergoing auto-thermal decomposition such as certain organic peroxides and hydrazine.
- Pyrophoric materials such as white phosphorous or metal-organic compounds.
- Oxidising agents such as nitric oxides and fluorine.

Non Enclosed and Local Applications

Where a fire hazard requires a local application, due to the protected area being an open space or one with high leakage rates, special application and engineering of the Pyrogen product will be required. In these instances the local main Pyrogen office should be contacted.

Electrical Machinery/Equipment:

In the event of fire due to electrical hazards, power to the electrical machinery/equipment must be cut-off prior to operation of the fire protection system for effective suppression of fire.

2.5 Pyrogen Safety Data

Visibility: Pyrogen aerosol produces smoke-like obscuration during and after discharge.

Oxygen Levels: Pyrogen chemically attacks the fire, breaking the flame chain reaction. It **does not extinguish fires by oxygen depletion**. After discharge, oxygen levels will remain at or about normal.

Toxicity: **Inadvertent exposure to Pyrogen aerosol should always be avoided.** Toxicological information refers to an inadvertent exposure to the aerosol in the event of accidental discharge in a non-fire situation.

The main ingredients of the Pyrogen aerosol are solid potassium carbonates, nitrogen gas, carbon dioxide gas and water vapour. At normal extinguishing concentrations these products present little health hazard to personnel. However, small amounts of potentially hazardous by-products of the aerosol-generating combustion reaction, such as carbon monoxide and nitrogen oxides will be produced. Their actual concentrations depend on Pyrogen design application density used and type of enclosure under protection. Their toxicological characteristics depend upon the actual concentrations achieved and duration of exposure.

Exposure to a Pyrogen design application density of 100 g/m³, which is typical for class B fires in total flooding applications, for up to 5 minutes, is normally considered to represent a minor risk to personnel and may cause only moderate local irritation of the upper respiratory tract and to the eyes.

Post Fire Exposure: One of the key advantages of Pyrogen over Halon 1301 and over some of the replacement agents available, is that **Pyrogen does not produce toxic and highly corrosive halogen acids when exposed to fire or hot surfaces**. Safety requirements dictate, however, that unnecessary exposure to post-fire atmospheres should be avoided. **CAUTION! Venting of the post-fire atmosphere should be to an open-air area, where possible, to prevent the inadvertent exposure of personnel to any combustion products of the fire and aerosol-generating reaction.**

Thermal Hazard: There is a potential hazard of high temperatures (250°C+) of Pyrogen aerosol at the end-plate nozzle, but within the minimum clearance from the discharge nozzle as specified for every type of MAG generator, the temperature does not exceed 75°C. Those distances should be observed during installation.

Immediately after discharge the generators can be hot, therefore, protective gloves should be worn before handling generators up to 15 minutes after discharge.

Hot Work: As naked flame or prolonged exposure to temperatures above 400°C may cause activation of the generators, **hot work must not be carried out within the vicinity of any generator.** If so they shall be removed prior to any hot work being carried out.

Re-entry: Following the use of Pyrogen, **personnel should not enter the protected area until it has been thoroughly ventilated.** Exposure to the fire by-products and extinguishant mixture should be avoided. Wearing a respirator or other available means of protection may be required should it be necessary to enter the area before it is fully ventilated.

Clean-up: Following a system discharge the aerosol particles that have settled should be wiped, blown, brushed or, if appropriate, washed away. **Protective gloves and goggles should be worn.** A respirator or mask may be required.

Large amounts of residue that is allowed to absorb moisture may become electrically conductive over a period of time.

Dangerous Goods Classification: Pyrogen is a Class 4.1 article in accordance with the United Nations Dangerous Goods Classification Code.

CoSHH Statement: A product of Pyrogen aerosol-generating combustion reaction is fine potassium carbonate particles, small enough to be respirated by persons not wearing RPE. **There are no known toxicological long term effects** of these soluble micron sized particles, and physiological effects of deep lung penetration are usually a concern for *insoluble* sub-micron particles as they can interfere with pulmonary functions.

However, there are clear European guidelines controlling the exposure of persons to fine particles, irrespective of their nature. Further information is available in BS EN 481:1993 & BS EN 451:1993, and in CoSHH supportive documents EH40/98 & EH44 and MDHS 14/2.

Noise. *The sound output & frequency at the time of activation and during discharge is similar to that produced by other extinguishing agents. Consequently, no specific precautions need to be taken.*

2.6 Pyrogen Environmental Characteristics

Pyrogen does not affect earth's ozone layer, since it does not contain chlorine or bromine in its molecular structure.

Ozone Depleting Potential (ODP) is a calculated ozone depletion per unit mass of material released relative to a standard, normally CFC-11 (CCl₃F).

Ozone Depleting Potential (ODP) of Pyrogen is zero.

Contribution of Pyrogen to global warming is negligible, since the only one component that could contribute to global warming - carbon dioxide - is present in minor quantities at normal extinguishing concentrations.

Global Warming Potential (GWP) is a calculated change in warming resulting from the emission of a unit mass of a chemical relative to that of a reference. In the past CFC-11 was often used as a reference; carbon dioxide is now typically used.

The GWP depends on three variables:

- 1) the integrated infrared radiation absorption spectrum band strength.
- 2) the location of the infrared bands; and
- 3) the atmospheric lifetime

Global Warming Potential (GWP) of Pyrogen relatively to carbon dioxide is zero.

2.7 Pyrogen Technical Characteristics

Chemical Composition of Solid Aerosol-forming Compound

potassium nitrate	62.3 mass %
combustible binder	22.4 mass %
carbon	9 mass %
technological admixtures	6.3 mass %

Chemical Composition of Aerosol (at 100 g/m³ design application density)

Aerosol output (per 1 kg of the aerosol-forming compound)	3.0 m ³
potassium carbonates solid	3.3 mass %
nitrogen	70 mass %
oxygen	18.2 mass %
water vapour	1.7 mass %
carbon dioxide	up to 6.0 mass %
carbon monoxide	up to 0.4 vol. %
nitrogen oxides	up to 37 ppm

Min System Design application density

class B and surface class A fires	100 g/m ³
dense cable fires	200 g/m ³

Min Particle Size

1 micron

Min/Max Suspension of Aerosol

30 / 60 min

ODP

0

GWP

0

Obscuration

high

Toxicity

low

Temperature range of application

from -50°C to + 65°C

Humidity range of application

0-98 %, non-condensing

<u>Electric activation:</u> nominal resistance	2.5 - 4.5 Ohms
activation current	400 milliamps
maximum test current	≤ 50 milliamps / 5 min
supervisory current	less than 5 milliamps
actuation time	2 milliseconds

Dangerous Goods Classification

4.1 class, category C

Service Life

5 - 10 years

2.8 Pyrogen Discharge

Depending on the selected size(s) of MAG generators the discharge of Pyrogen aerosol lasts from 5.5 to 10.5 seconds. Such rapid discharge ensures attaining of Pyrogen design concentration in a very short time upon actuation of the MAG generators.

As Pyrogen does not rely on oxygen depletion to extinguish the fire, the ambient atmosphere inside the enclosure during and after discharge remains breathable, with oxygen level remaining approximately at 18-19%.

As **Pyrogen** does not contain any halogen compounds in its molecular structure, it **does not produce corrosive halogen-acid by-products when in contact with flame.**

As Pyrogen's prime extinguishing action is a chemical interference with a fire chain reaction, a certain amount of the discharged aerosol will be consumed during extinguishing process, the actual amount depending on the type and size of the fire as well as Pyrogen system design parameters. The rest of the aerosol will be left to prevent any likelihood of fire re-ignition.

Being a suspension of finely dispersed solids in a gaseous medium, Pyrogen aerosol has a natural ability to stay in suspension for approximately 30-40 minutes after discharge into a sealed enclosure.

Following this period of natural suspension the remaining aerosol, if not ventilated, will start settling down due to agglomeration and sedimentation of the micron sized solid particles. Settled down aerosol forms a dust-like fine fire retardant residue, which is easily wiped off, brushed, blown or, if appropriate, washed away.

Due to a low extinguishing concentration of Pyrogen aerosol and its very fine structure, the amount of residue left is minimal.

The actual Pyrogen aerosol is non-conductive and non-corrosive. However, the settled aerosol residue, being an ionic compound (salt), may become conductive if allowed to build up in large quantities and to absorb adequate amounts of moisture. Therefore, for sensitive applications it is recommended that the protected area be ventilated immediately after post-discharge minimum holding time period.

SECTION 3. SYSTEM SUPPLY

3.1 List of Components

Pre-engineered Pyrogen fire suppression system installed on CNC machines consists of the following components.

1. Pyrogen aerosol generator (s) with a single or dual end-plate nozzle;
2. Controller (Fire Panel FACP)
3. Strobe light/sounder
4. Thermal Probe Detector
5. Elbow Mounting Unit
6. Vibration Bracket

3.2 Pyrogen Aerosol Generator

Pyrogen products are represented in form of non-pressurised metal canisters, called MAG or EXA generators. Each Pyrogen generator contains as a minimum an aerosol element, a cooling element, an actuation device and one or two end-plate discharge outlets.

Depending on the mass of the aerosol element contained in the generator and the generator's dimensions, MAG generators are classified into small range generators and large range generators.

Small range generators include MAG-02, MAG-1, MAG-2, MAG-3, MAG-4, MAG-5/1 and MAG-5/2 Pyrogen generators. They have been designed to protect enclosures from 0.2 m³ up to 50 m³.

Large range generators include MAG-11, MAG-12, MAG-13, MAG-14, MAG-15, MAG-16 and MAG-16 Pyrogen generators. They have been designed to protect enclosures exceeding 50 m³.

Apart being different in mass and dimensional characteristics small and large range MAG generators differ in their design and construction.

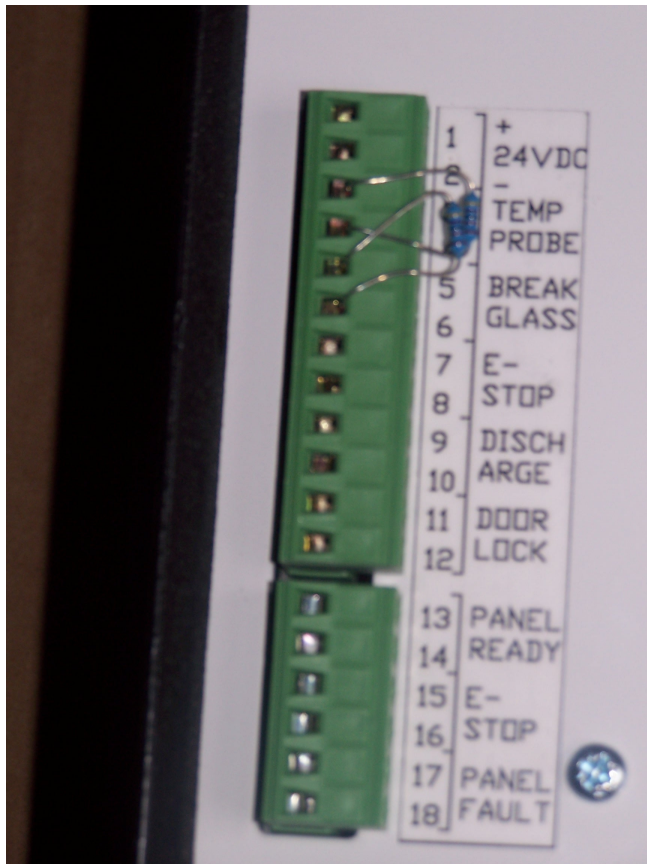
All current CNC machines protected with the pre-engineering Pyrogen fire suppression systems use only one MAG generator model, specifically MAG-5/1 with a single end-plate discharge nozzle.

3.3 Controller (Fire Panel)

A special fire panel manufactured by Digitron Pty Ltd is used in Pyrogen fire suppression systems installed in CNC machines.

An sample of the FO&GI FACP made by Artek is shown below.





3.3.1 Electrical Specifications

External power supply: 24VDC, 1.5A capable

Internal standby battery: 12V, 1.3AH

Panel normal current on external power supply: 100mA

Panel normal current on internal battery supply: 40mA

Suppressant generator monitoring current: 1mA

Suppressant generator discharge current: 1.0A

Battery float charge voltage: 13.75V

Battery charger current limit: 0.8A

Temperature probe end-of-line resistor: 8K2 ohms, 1/4W

External break glass end-of-line resistor: 8k2 ohms, 1/4W

Time duration for battery support after external power is switch off: 5-6 minutes

Monitor contact outputs: E-Stop, normally closed, 2 off
Fire System Ready, normally closed, fail-safe
Fire System Fault, normally closed

3.3.2 Mechanical Dimensions

Fascia dimensions: 180mm long, 130mm high

Equipment box dimensions: 153mm long, 103mm high, 83mm deep

3.3.3 Pluggable connectors terminal assignment

12-way

1, 2	External power input, 24VDC, 1 positive, 2 negative
3, 4	Temperature probe input, 8K2 end-of-line
5, 6	Manual break glass input, 8K2 end-of-line
7, 8	E-Stop output contact, normally closed, first set. This output is composed of 3 normally closed contacts in series, being the alarm relay contact of each input as well as the discharge relay contact.
9, 10	Discharge output
11, 12	Safety door lock input, normally closed

6-way

13, 14	Fire System Ready contact output, normally closed
15, 16	E-Stop output contact, normally closed, second set
17, 18	Fire System Fault contact output, normally closed

3.3.4 Front panel key switch and LEDs

When the key switch is turned to NORMAL, and provided the safety door is closed, and there is no fault in the system, the control panel is ready to function.

When the key switch is turned to ISOLATE, the discharge circuit is disabled. The alarm and fault sensing functions of the control panel are still active. The alarm sounder volume is reduced to 1/50th when the key switch is turned to this position. DO NOT turn the key switch back to normal if the OUTPUT ACTIVE LED is lit and the sounder is operated, indicating an alarm condition is present. Alarm conditions are not latched, and the panel will go back to normal when the alarm initiating situations are removed.

LED functions when lit:

MACHINE 24V SUPPLY ON: green, external power supply is available to the panel
SAFETY INTERLOCK: amber, safety door is NOT closed, or the key switch NOT on
NORMAL

OUTPUT FAULT: amber, open circuit on suppressant discharge

INPUT FAULT: amber, open circuit on temperature probe or break glass

OUTPUT ACTIVE: red, an alarm condition exists

NORMAL: green, key switch is on NORMAL, safety door is closed and there is no fault

ISOLATE: amber, key switch is on ISOL, discharge circuit is disabled

3.3.5 Operation

The fire panel is switched on by the application of the external 24VDC power supply. When the external power is present, the 12V battery is under constant-voltage float charge condition. The battery is used to maintain the panel alive for 5 to 6 minutes after the external power is turned off. The switch-over from external power to internal battery power is seamless, and does not involve any relay operation. At the end of the battery backup period, the panel will be completely switched off, and no current will be drawn from the battery.

The continuity of the wiring to the temperature probe, the manual break glass and the suppressant discharge are constantly checked for open-circuit fault. The suppressant discharge is prevented if a fault occurs, as indicated by the amber INPUT FAULT or OUTPUT FAULT LEDs. The sounder will not operate under a fault condition, but the FIRE SYSTEM FAULT output contact will change state from closed to open.

The fire system is ready for protection when no fault exists, the key switch is turned to NORMAL, and the safety door is closed. This is indicated by the green NORMAL LED, and by the FIRE SYSTEM READY closed contact output. When the safety door is open, or when the key switch is turned to ISOLATE, the amber SAFETY INTERLOCK LED will be lit, and the SYSTEM READY contact output is open, indicating the system is not ready for discharge.

An alarm condition exists when the temperature probe threshold is exceeded, or when the manual break glass is operated, producing a short-circuit across their respective terminals, and indicated by the OUTPUT ACTIVE red LED, and the sounder. The alarm is not latched, so that if the alarm condition has passed, the panel will go back to normal. The suppressant discharge will occur instantaneously if the fire system is ready.

The sounder volume is reduced to a very low level, if the key switch is turned to ISOLATE, and an alarm condition exists with the panel. During periodic tests of the temperature or the break glass, this low level sound is useful as a reminder NOT to turn

the key switch to NORMAL until the alarm condition is removed.

3.3.6 Maintenance

The fire panel is designed to be as maintenance-free as possible. There are no fuses, and all external connections are current-limited, so that accidental short-circuits will not harm the system. The critical alarm sensing and discharge circuitry contains no electronics. Active components are only used for voltage regulation, fault sensing and battery backup timing. There is no grounding; the complete system is isolated from the metal enclosure.

3.4 Break Glass (optional)

Manual Break Glass has been designed to manually activate the Pyrogen fire suppression system prior to fire detection by a Thermal Probe Detector. The Manual Break Glass has a protective flap to prevent an inadvertent activation of the Pyrogen system. The Break Glass is connected to the Controller (refer to 3.3 above) allowing activation of a sounder, shutdown of a ventilation fan and other operation functions prior to the Pyrogen system discharge.

3.5 Thermal Probe Detector

Thermal probes are used to automatically activate the system in the event of a fire.

The set points of the thermal detectors are generally 20% or 20°C (whichever is higher) above the maximum temperature they will be exposed to in normal operation. They have normally open contacts with a resistor wired across the probe wires to allow monitoring of the circuit by the controller.

3.6 Strobe/Sounder

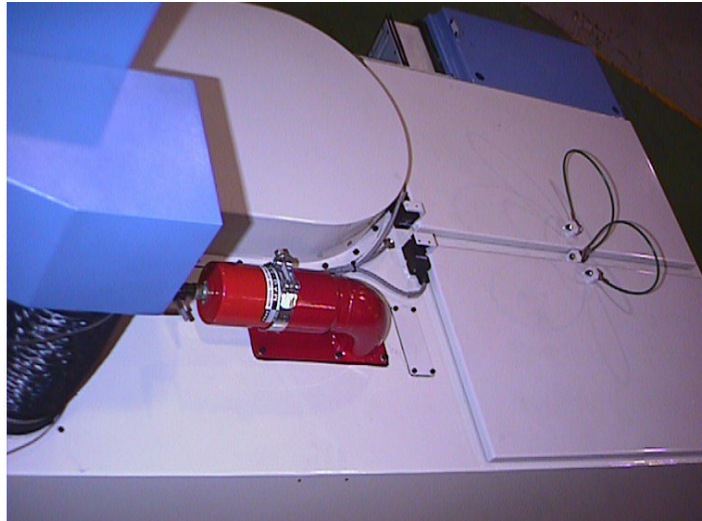
In Pyrogen system pre-designed for specific application in CNC machines, the sounder is incorporated inside the strobe light provided in the kit.. Power is via the NO/NC/NO relay output on the controller. The alarm tone is adjustable with the dip switched

3.7 Elbow Mounting Unit

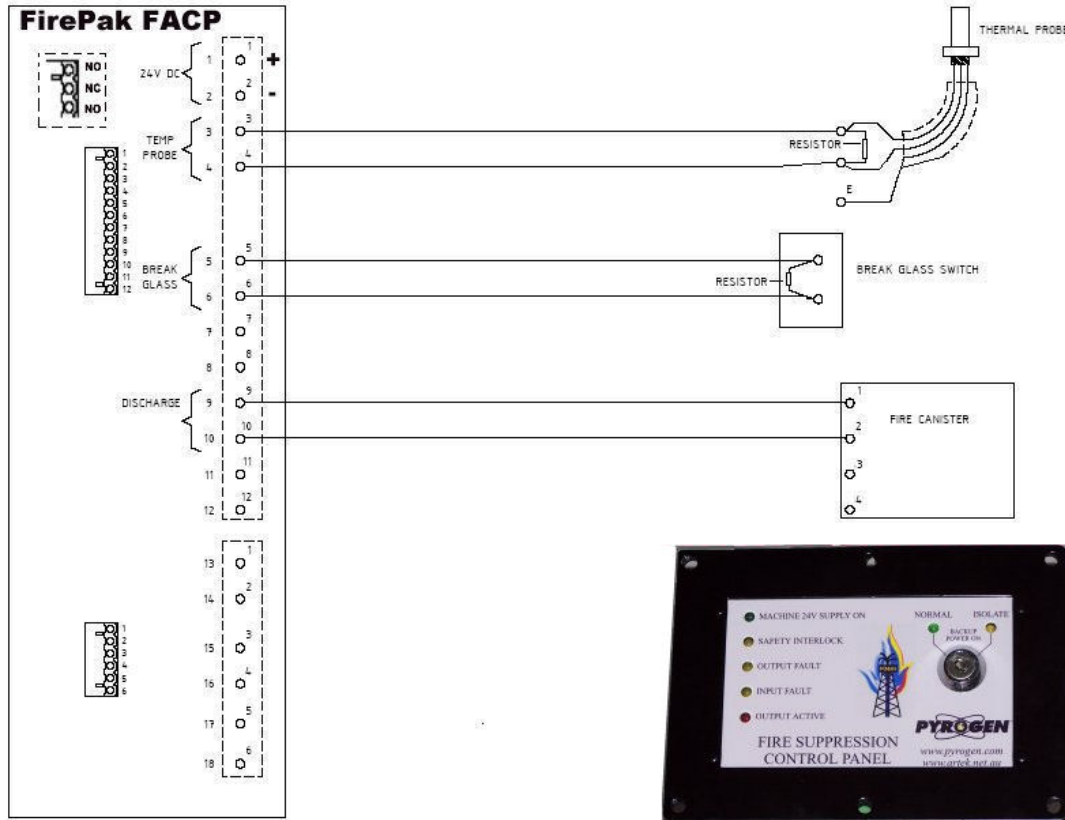
Although Pyrogen aerosol MAG generator is normally installed inside a protected area, in CNC machines it is mounted outside on the upper panel of the machine with a custom-made elbow unit being attached to MAG or EXA series generator. The elbow

unit has been specifically designed to direct the discharged aerosol into the CNC machine. Outside mounting of MAG-5 aerosol generator solves a challenging task of its accommodation inside already clustered CNC machine and allows its easy installation and maintenance.

An image of elbow and generator unit is shown below.



A schematic of a typical system layout is given below.



SECTION 4: SYSTEM DESIGN

4.1 General

The Pyrogen system of aerosol generators distributed within the risk eliminates the complications associated with traditional gaseous agent systems. ***Pyrogen does not***

require pressurised cylinders of liquefied gas, traditional pipe and nozzle networks, or engineered hydraulic calculations to determine nozzle orifices.

The Installer only needs to determine the size and number of Pyrogen generators required as well as their location within the enclosure.

Since most current CNC machines use one single model of Pyrogen MAG aerosol generators, specifically MAG-5/1 model, the design information below refers to this model only.

4.2 Pyrogen MAG-5 aerosol generator

4.2.1. Typical mass and dimensional characteristics

Pyrogen generator	Number of discharge nozzles	Generator mass, kg	Generator dimensions, mm		Mass of aerosol element, kg
			Length	Diameter	
MAG-5/1	1(mono)	2.0	200	95	0.5

4.2.2. Typical Extinguishing Performance Characteristics

Pyrogen generator	Number of discharge nozzles	Mass of aerosol element, kg	Max protected volume, sealed enclosure, m ³		Aerosol discharge time at ambient temperature, s		
			Flammable liquids and non-smouldering solids	Electrical cables and smouldering solids	+50°C	20°C	-50°C
MAG-5/1	1(mono)	0.5	5	2.5	6.5	7.5	9

Maximum protected volume is normally calculated using a simple formula:

$$\text{Maximum volume (m}^3\text{)} = \text{mass of aerosol element (g)/design application density (g/m}^3\text{)}$$

Pyrogen design calculations refer not to the design concentration of the actual extinguishing agent - aerosol, but to the design application density, which is mass of the solid aerosol-generating compound per unit of enclosure volume required to extinguish a specific type of fire, including a safety factor.

Pyrogen design application density is expressed in g/m³.

Pyrogen minimum design application density for Class B fires, involving flammable liquids such as petrol, diesel, hydraulic oil and automotive distillate is 100 g/m³.

Pyrogen minimum design application density for Class A surface fires, involving non-smouldering combustible solids such as wood, textile and ordinary plastics is 100 g/m³.

Pyrogen minimum design application density for Class A non-surface fires, involving dense cables is 200 g/m³.

Please note that the installed application density in pre-engineered systems Pyrogen systems, such as in CNC machines, can exceed the minimum design application density as it already includes compensation for openings, obstructions and other possible losses of aerosol extinguishing agent.

4.2.3 Discharge Outlet Minimum Clearance

Due to elevated temperatures of Pyrogen aerosol at the discharge outlet, the minimum clearances from the outlet have been introduced to minimise a potential heat impact during the discharge. The minimum clearances refer to three different temperature limitations – 75, 200 and 400°C. The maximum limitation of 75°C normally refers to the locations within the enclosure where people may be present. The maximum limitation of 200°C refers to combustible materials, while 400°C refers to standard equipment located within the protected enclosure.

Depending on the intended application of Pyrogen system, the appropriate minimum clearances shall be observed during installation.

MAG generator	Minimum clearance from the discharge outlet, m			Heat released during discharge, kJ
	75°C	200°C	400°C	
MAG-5/1	1.2	0.5	0.3	422

4.3 Enclosure Requirements

4.3.1 Enclosure Height Limitations

The Pyrogen extinguishing agent, being a hot aerosol, has a tendency to rise upward on its release due to buoyancy forces. As such, the aspect of spatial distribution needs to be addressed. This requires that a height limitation for the protected enclosure be set for each individual Pyrogen generator:

Pyrogen MAG generators	Maximum enclosure height, m
MAG-5	3.0

4.3.2 Discharge Pressure Relief Venting

Like all total-flooding agents, Pyrogen aerosol is most effective when used in an enclosed risk area. Therefore, the area of non-closable openings shall be kept to a minimum. The presence of un closable openings in the ceiling should be avoided.

Similar to gaseous total flooding systems application of Pyrogen in standard building type enclosures requires venting arrangements to relieve pressure build-up due to the discharge of the large quantities of the gas-like aerosol.

The table below has been prepared to simplify the design calculations for the minimum venting area and maximum weight loading. All calculations refer to a single Pyrogen MAG generator and lowest aerosol discharge times (at +50°C ambient temperature).

Pyrogen generator	Strong building enclosures (concrete, brick): $\Delta P=600\text{Pa}$			Medium to light enclosures (timber frame, compressed fibre, etc): $\Delta P=400\text{Pa}$		
	Min vent area, m ²	Vent area size, mm	Max weight load, kg	Min vent area, m ²	Vent area size, mm	Max weight load, kg
MAG-5/1	0.0222	149X149	1.33	0.0272	165X165	1.09

Due to the design specifics of the CNC machine the installation of Pyrogen MAG and EXA generators in CNC machine do not require provision of any additional pressure venting. Pressure relief is effected via an existing non-closable ventilation horizontal slot.

4.3.3 Minimum Holding Time

Upon Pyrogen discharge a minimum holding time of 3 minutes should be allowed for fires involving flammable oil based coolant liquids (class B fires) and non-smouldering combustible solids (class A surface fires).

For fires involving electrical cables and smouldering solids the minimum holding time should be extended to 10 minutes.

To ensure the requirements for the minimum holding time period are complied with the following should be observed.

1. ***Integrity of the enclosure.*** The enclosure should not have any unclosable openings.
2. ***Pressure relief vents.*** Pressure relief vents should be of an appropriate type to ensure maximum possible containment of the Pyrogen aerosol within the enclosure during and after its discharge.
3. ***Air-handling systems.*** Air-handling systems serving the protected area should generally be shut down or isolated by dampers. ***In CNC machine a ventilation fan stops and an automatically operated main vent closes prior to Pyrogen discharge leaving only a non-closable ventilation horizontal slot (refer to 4.3.2 above) used for pressure relief venting during and after discharge.***

4. Services within the enclosure. Any services within the enclosure, such as fuel valves and pumps, heating appliances and others which if left running would impair the efficiency of Pyrogen, shall be shut down prior to or simultaneously with the release of the extinguishant.

4.4 Pyrogen Service Life

The **Service life** of Pyrogen fire suppression system is a period from the date of installation to expiry date. The service life depends on the ambient conditions inside the protected area and conditions of generators' use.

Operation conditions	Service life - 10 yrs	Service life - 5 yrs
Temperature range	From 0 ° C to + 40 ° C	from - 50 ° C to 0 ° C; from + 40 ° C to +65 ° C
Humidity range	0 – 90 %	Above 90 %
Environments which subject the system to continuous or intense vibrations	No	Yes
Exterior situations exposed to the sun, ultraviolet radiation, wind, rain, or salt spray	No	Yes
Corrosive atmospheres	No	Yes
Abnormally dusty or moisture-laden atmospheres	No	Yes

A durable and easily accessible during maintenance installation and expiry dates label shall be attached to the MAG generator prior to installation. The label shall contain the date of the generator's installation and the expiry date.

SECTION 5. SYSTEM OPERATION

5.1 Operation Mode

The operation of a Pyrogen fire suppression system installed in CNC machine is

electrical automatic with an option of electrical manual. The Controller/Fire Panel is set in Automatic Mode. Manual operation could be achieved by using a Break Glass.

5.2 Operation in Fire Situation

In fire situation the sequence of events is as follows:

- I. Automatic Operation
 - a) A fire is detected by a Thermal Probe Detector;
 - b) A Sounder is activated, the ventilation fan is stopped and the main ventilation vent is closed;
 - c) CNC machine stops;
 - d) Pyrogen system is activated.
- II. Manual Operation

Should manual activation is chosen to override detection by the Thermal Probe Detector the sequence of events is as follows:

- a) A fire is visually detected;
- b) An Operator lifts a flap on the Manual Break Glass and firmly presses the Break Glass;
- c) The Manual Break Glass sends a signal to the Controller;
- d) A Sounder is activated, the ventilation fan is stopped and the main ventilation vent is closed;
- e) CNC machine stops;
- f) Pyrogen system is activated.

SECTION 6. SYSTEM INSTALLATION

6.1 Design & Acceptance Documentation

- a) Form 1 - System Design Approval Certificate

Please refer to Appendix A - form 1.

Pyrogen System Design Approval Certificate must be completed by the contractor prior to installation. A copy of the certificate shall be forwarded to Pyrogen Office or the Pyrogen Distributor and, where required, to an appropriate authority.

b) Form 2 – Commissioning and Acceptance Test Report
Please refer to Appendix A – form 2.

The installed Pyrogen system shall be commissioned by the contractor in accordance with the Commissioning Check list. On completion and acceptance of the commissioning, the installation contractor shall issue a commissioning test report in accordance with Form 2. A copy of the report shall be forwarded to the Pyrogen Distributor.

c) Form 3 – Notice of Completion
Please refer to Appendix A – form 3.

Shall be completed by the installation contractor following the commissioning check. A copy of the form shall be forwarded to the Pyrogen Distributor.

d) Form 4 – Maintenance Check List
Form 5 - Annual Maintenance Certificate
Please refer to Appendix A – forms 4 and 5.

Shall be completed by the installation contractor after regular annual maintenance of the installed system. A copy of each form shall be forwarded to the Pyrogen Distributor.

6.2 System Integrity

It is important that prior to the installation of the MAG generator the integrity and resistance of the electric activation circuit for each MAG generator is checked with the use of a **digital** multi-meter. The maximum test current shall not exceed 50 milliamps for a period of 5 minutes. The monitoring current shall not exceed 5 milliamps.

Resistance of the electric activation circuit shall be within 2.5-4.5 Ohms.

It is also important to check earth fault of every MAG generator. Earth fault resistance must not be less than 0.1 MOhm.

6.3 Prior to Installation

Before commencing the installation:

System components

Ensure completeness of the Pyrogen system, including accessories. Please refer to the completed System Design Approval Certificate (form 1, Appendix A) for identification.

MAG-5/1 aerosol generator

Check that there is no sign of corrosion on the generator's casing and that a plastic membrane covering a discharge outlet is intact.

Service life labels

Attach the installation and expiry date label to MAG-5 generator. Ensure the service life is in accordance with the system's operation conditions (refer to 4.4).

6.4 Installation Location

The Pyrogen MAG generator should be installed in the best possible position to ensure that:

- The aerosol will be mixed evenly and contained within the protected area;
- The minimum clearance from the discharge outlet as specified in 4.2.3 is observed;
- The generator is not directed towards sensitive or delicate instrumentation;
- Possible exposure to high temperatures (above +50°C) or high humidity is avoided;
- Close proximity to exit or potential human exposure areas or outlets is avoided;
- Close proximity to unavoidable non-closable openings is avoided;

6.5 Mounting

The MAG-5/1 generator is mounted to the CNC machine via an elbow unit. Ensure the MAG-5/1 generator is firmly and reliably attached to the elbow unit and the elbow unit is firmly attached to the CNC machine.

Warning! Loose mounting may result in MAG-5/1 generator being propelled out of the elbow unit or its detachment from the CNC machine during system discharge.

6.6 Electric Wiring

The following minimum requirements to the electrics should apply:

- Cables should be fire-resistant. Conductors should be of copper, each having a cross-sectional area of not less than 1 mm², or if stranded, not less than 0.5

mm². Should there be any possibility of the mechanical damage, the cables shall be enclosed into a plastic or metal conduit. All cabling shall be grounded in accordance with standard requirements.

- A standard power source that provides at least 2 Amp current and 24 Volts voltage shall be used. The power source shall have a backup power supply. ***For CNC installation a backup power supply is already incorporated inside the Controller. Due to specific design requirements for CNC machines the backup power supply to the Controller is disconnected 5 minutes after the CNC machine shutdown.***

The wiring procedure should be as follows:

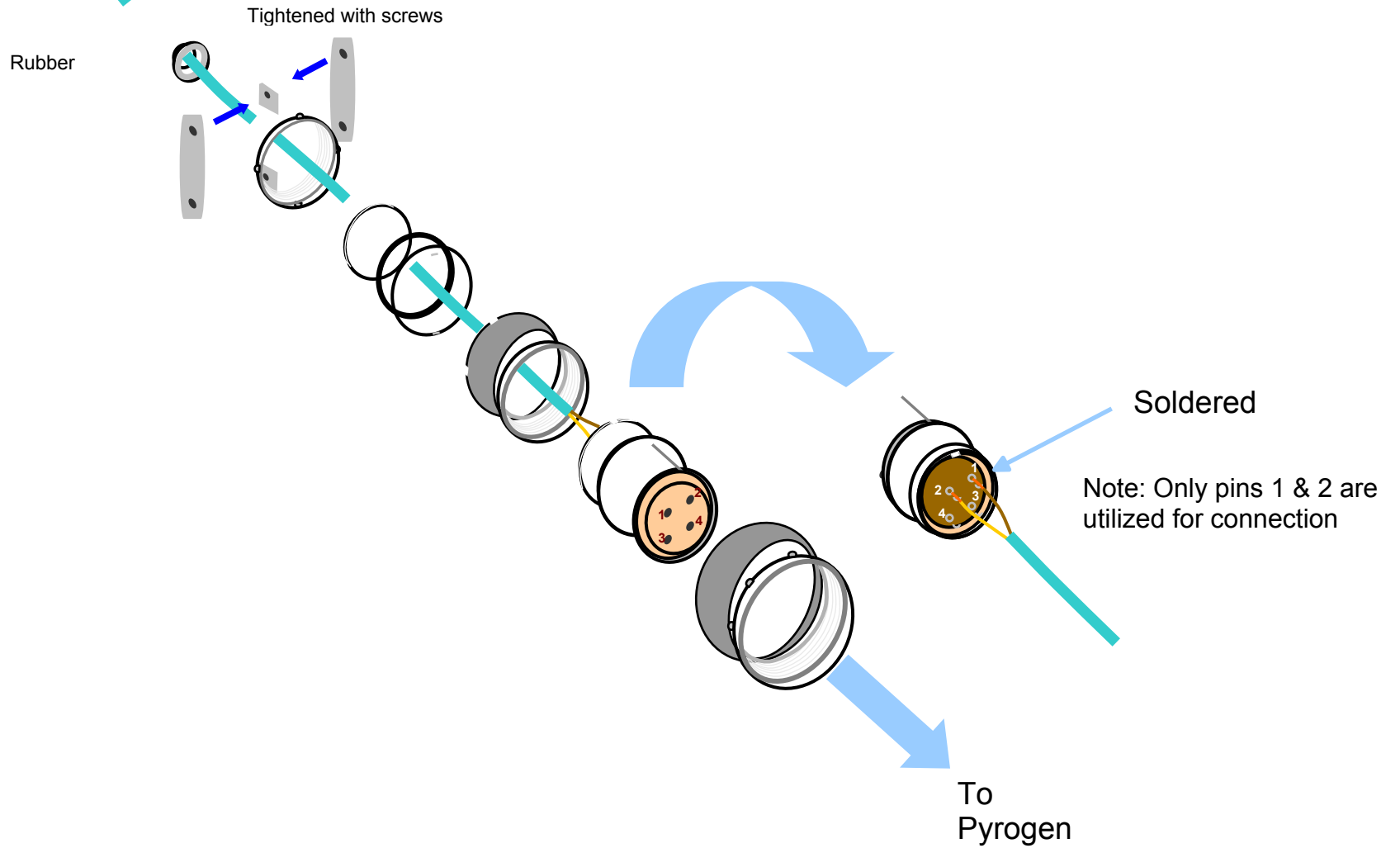
- Install electrical wiring;
- Install and connect such devices as strobe/sounder, manual break glass, Controller, detectors, etc;
- Connect a miniature filament lamp with 12 Volts voltage and current up to 50mA ***in place of MAG generator; (FO&GI manufactures this test lamp)***
- Ensure the manual break glass has a protective flap to avoid the accidental discharge;
- Connect the circuit to a power supply;
- Activate the system. All devices shall operate and the lamp shall glow. Should the system fail to operate properly, disconnect the power supply, check connections between the devices, reconnect the power supply and try again;
- Reset the system. The lamp shall be switched off;

WARNING! Prior to connecting MAG generator ensure the wires leading to the generator are not carrying voltage. Connection of MAG generator(s) should always be the last function in electrical wiring procedure.

- Disconnect the lamp and connect the MAG generator in its place. Install MAG generator in accordance with the installation recommendations;

From control panel

Diagram 6 - 4 -- 2RMDT Connector Assembly and Wiring for Pyrogen Connectors



SECTION 7. SYSTEM MARKING

7.1 Installation and Expiry Date Label

The following label is “filled in” and affixed to every generator used in the system by the installation contractor.

PYROGEN GENERATOR	
INSTALLED DATE:	_____
EXPIRY DATE:	_____

Pyrogen expiry date depends on the ambient conditions inside the protected area and conditions of use of the system. Please refer to 4.4 for the guidelines on establishing the correct expiry date for a specific installation.

After filling out these details the installer places the clear protective self-adhesive film over the front of the label and attaches the label onto the generator adjacent to the body label.

7.2 Warning & Instruction Signs

The following Warning and Instruction Sign shall be firmly attached to a CNC machine by the installer on completion of Pyrogen installation.



SECTION 8. SYSTEM COMMISSIONING

The completed Pyrogen installation shall be commissioned in accordance with Commissioning Checklist attached in Appendix A (Form 2).

On completion and acceptance of the commissioning procedure, the installation contractor shall issue a Notice of Completion in Appendix A (Form 3).

Commissioning should be carried out by trained and authorised personnel only.

SECTION 9. SYSTEM MAINTENANCE

The user of the installation should ensure that the system is in good working order at all times. The user should carry out monthly inspections of the fire suppression equipment. This should include looking out for obstruction of the discharge nozzle, extension/alteration of the protected enclosure, openings left unclosed that were not catered for during design, and that the position and orientation of the Pyrogen generators remain in the designed position.

The installation should be inspected at least twice a year by an authorised inspector. The inspection plan should include all components of the system and parts of the premises necessary for the effective operation of the system.

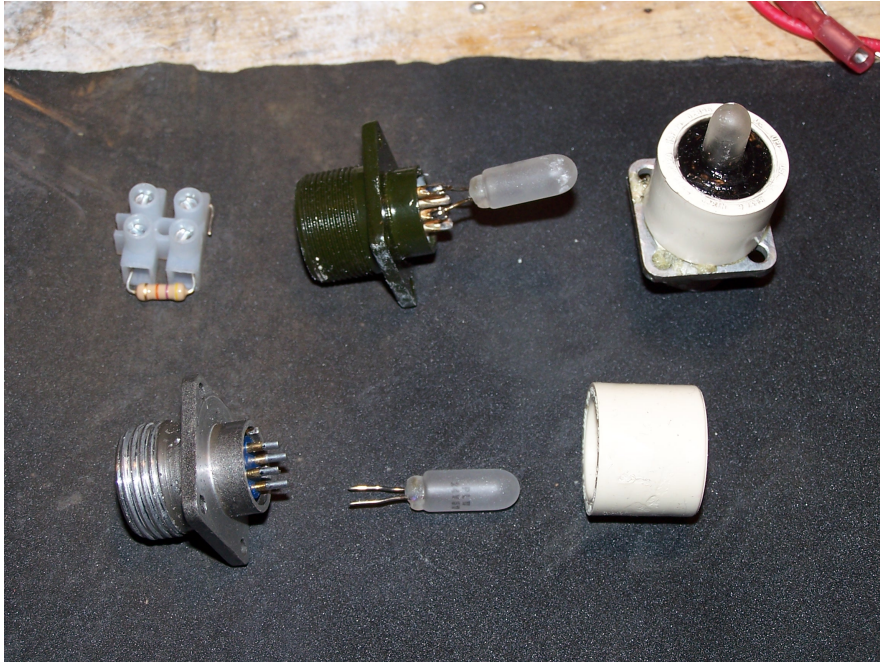
A system maintenance log should be kept and status of every maintenance visit is recorded. For a typical system maintenance report refer to the attached Maintenance Checklist in Appendix A (Form 4).

Periodic check-up is required for electrical circuitry of Pyrogen system. The following steps shall be undertaken:

If the control system is designed to transmit alarm signals to a remote manned centre, always ensure that the link is disabled, or in the event that disabling the link is not an option, it would be essential to notify the centre before undertaking the test. Occupant of the premises should also be notified that the system test might result in the sounders being activated.

WARNING! Prior to the start of ANY maintenance work, always ensure as the first step, that the wiring to the Pyrogen generator has been electrically isolated. Failure to do so may result in unwanted spurious discharge.

- 1) **Disconnect the wiring at the MAG generator.** This is extremely important to ensure that the generator has not inadvertently been left connected.
- 2) Connect the special miniature filament test lamp plug \with 24 Volts voltage and current up to 50 mA **in place of MAG generator.**



Test lamp showing sub-assemblies

- 3) Connect the circuit to a power supply.
- 4) Activate the system. All devices shall operate and the lamp shall glow. Should the system fail to operate properly, disconnect the power supply, check connections between devices, reconnect the power supply and try again.
- 5) Reset the system. The lamp shall be switched off.

WARNING! Prior to connecting MAG generator, ensure the wires leading to the generator are not carrying voltage. Connection of MAG generator should always be the last function in electrical wiring procedure.

- 6) Disconnect the lamp and connect the MAG generator in its place. Install MAG generators in accordance with installation recommendations.

APPENDIX A -- APPROVAL DOCUMENTATION

PYROGEN FIXED FIRE SUPPRESSION SYSTEM

FORM 1 -- SYSTEM DESIGN APPROVAL CERTIFICATE

Must be completed by the contractor prior to Pyrogen installation. A copy of the certificate shall be forwarded to the Pyrogen Key Representative/Distributor and, where required, to an appropriate authority.

Forms an integral part of Pyrogen Warranty Card to be completed upon Pyrogen installation and sent to a local Pyrogen Key Representative/Distributor.

1. CLIENT INFORMATION

Company name:.....
Address:.....
Telephone:..... Fax:.....
Contact person:.....

2. CONTRACTOR

Company name:.....
Address:.....
Telephone:..... Fax:.....
Contractor's name:.....

3. PROTECTED ENCLOSURE IDENTIFICATION

CNC machine (model, identification):.....

Location:.....

Occupancy: unoccupied.....
normally unoccupied.....
intermittently occupied.....

Number of entrance doors/inlets used by personnel.....

4. FIRE HAZARD CLASSIFICATION (Class of Fire)

Flammable liquids and non-smouldering solids undergoing surface combustion (Class B and surface class A fires).....

Electrical cables and smouldering solids (Class E and non-surface Class A fires).....

5. NUMBER AND ELECTRICAL CHARACTERISTICS OF EQUIPMENT TO BE SHUTDOWN

.....

6. DESIGN CALCULATIONS

6.1 Ambient conditions inside the protected enclosure

Maximum estimated temperature during a hot season, °C.....

Minimum estimated temperature during a cold season, °C.....

Vibration: high..., medium....., low.....; nil.....

6.2 System service life expectancy, years.....

6.3 Enclosure dimensions

Height, m.....

Length, m.....

Width, m.....

Gross volume, m³

Add for exhaust and inlet ducts, m³

Deduct non-removable non-penetrable solid structure, m³

Design Net volume, m³

6.4 Pyrogen MAG generators

Type and number of MAG generators selected:

MAG-.....;unit(s)

MAG-.....;unit(s)

Height limitation for the selected MAG generators, m.....

Total flooding quantity (mass of the aerosol-forming compound in combined MAG generators), g.....

6.5 Minimum clearance from discharge outlet

Temperature at the minimum clearance: 75 °C; 200°C; 400 °C (circle the selected option);

Minimum clearance for selected MAG generators:

MAG-.....;m
MAG-.....;m

6.6 Pressure relief venting

- Installed vent(s): Installed vent area, m².....;
Type of vents(s).....;
Size and number of vents.....mm x mm;
Total max weight load.....kg
Location of vent(s).....

7. METHOD OF ACTUATION

a) Automatic Electrical
b) Manual Electrical.....

8. REQUIRED ACCESSORIES

Electric power supply:

Main.....; Emergency.....

Fire Panel:

Model and designation.....
Zoning.....
Supervision module.....

System isolate switch/stop gas unit (quantity and location).....
Time delay device.....
Detectors and bases (type and quantity).....
Warning signs (quantity and location).....
Instruction signs (quantity and location).....

9. POST FIRE VENTILATIONS MEANS

.....

FORM 2 -- COMMISSIONING AND ACCEPTANCE TESTING

Criteria for Acceptance

The completed Pyrogen system shall be commissioned in accordance with this Commissioning Checklist. On completion and acceptance of the commissioning, the installation contractor shall issue a commissioning report.

COMMISSIONING CHECK LIST

TX7+/RX7 PYROGEN FIRE SYSTEM TEST SHEETS

MACHINE TYPE	MACHINE SERIAL NUMBER	
PYROGEN 'MAG' SERIAL NUMBER		
TESTER NAME	DATE	
SIGNATURE	WITNESED	

TEST 1: To be conducted whenever a new MAG canister is installed on a machine. This verifies the canister ignition circuit is within specification.

SAFETY

Ensure that the MAG generator (canister) is secured in a soft jaw vice, that there are no flammable substances within 700mm of the outlet side of the canister and that there are no personnel within 2 metres of the outlet side of the canister. Alternatively, this test can be conducted with the canister secured in its mounting frame on the machine. Again insure there are no personnel near the outlet side of the canister.

Using a digital multimeter that is capable of measuring more than 10M Ω and does not provide a monitoring current of more than 5mA, check the resistance of the electric ignition circuit in the MAG generator. The resistance shall lie between 2.5 to 4.5 Ohms, between pins 1 and 2.

RECORD VALUE:

Check the earth fault resistance is no less than 100K Ω , between pin 1 and the housing and pin 2 and the housing.

RECORD VALUES:

If the resistance values are not as specified the canisters must be rejected. Repeat the tests for replacement canisters.

If the resistance values are as specified record the serial number of the canister and the manufacture date.

SERIAL No: DATE:

Record the installation date and the expiry date of the canister. (The expiry date is the installation date plus ten years). Indelibly mark these dates on the canister.

INSTALLED ON: EXPIRY:

Insert the canister in its mounting elbow and check that it is held securely when the clamp is tightened. Do not connect the canister plug at this stage. Retain this test sheet in the machine folder. If fitted at a Branch, return a copy of this test sheet to commissioning at ANCA Australia. It is required to complete a Pyrogen warranty card.

When all other tests are complete and the machine is fully installed, check that there is no voltage on the generator line (pins 1 & 2) and plug the connector into the canister.

TX7+/RX7 PYROGEN FIRE SYSTEM TEST SHEETS

MACHINE TYPE		MACHINE SERIAL NUMBER	
ARTEK SERIAL NUMBER			
TESTER NAME		DATE	
SIGNATURE		WITNESED	

TEST 2: Verify the correct operation of the Brooks Fire system controller.

NOTE: If machine does not perform e-stop, check that fire system e-stop is not linked out

CAUTION: Ensure canister is not connected, connect and use a 12V automotive testing bulb instead.

- Open or close door as per table for each test.
- Toggle isolate key switch as per table for each test.
- For tests on battery remove power line to fire system. (RX7: X3 4.4B, TX7: XEXTN 34B)
- The battery back up will only be available for 5 minutes.
- The LED's and sounder are on the front of the Fire control box
- Pins 1&2 are on the MAG canister connector.
- PLC warnings will be displayed on the machine control panel display.

Check that all the results listed in the tables below are true and tick each OK box:

2.1: Short circuit the line that the break glass switch is on. This can be done by using the test key supplied with the switch. (Refer to manufactures notes for instructions)

ACTION			RESULT				
Door position	Isolate switch	Power	LEDs on	Alarm Sounder	Test Lamp	PLC warnings	OK
Closed	Normal	Power	Supply, Output Active	On	On	ALM8010	
Open	Normal	Power	Supply, Interlock, Output Active	On	Off	ALM8010	
Closed	Isolate	Power	Supply, Interlock, Output Active, Isolate	1/50 th	Off	ALM0258, ALM8010	
Closed	Normal	Battery	Output Active, Normal	On	On	ALM0256, ALM8010	
Open	Normal	Battery	Interlock, Output Active	On	Off	ALM0256, ALM8010	
Closed	Isolate	Battery	Interlock, Output Active, Isolate	1/50 th	Off	ALM0256, ALM0258, ALM8010	

TX7+/RX7 PYROGEN FIRE SYSTEM TEST SHEETS

MACHINE TYPE		MACHINE SERIAL NUMBER	
ARTEK SERIAL NUMBER			
TESTER NAME		DATE	
SIGNATURE		WITNESED	

2.2: Check that the wire integrity monitoring functions of the fire controller are working. In turn, disconnect the various lines as shown in the table. Restore wires after each test. Verify that the results are as shown in the table below and tick the OK boxes if so.

ACTION			RESULT			
Door position	Isolate switch	Power	LEDs on	Test Lamp	PLC warnings	OK
Closed	Normal	Power	Supply, Input Fault	Off	ALM0256	
Disconnect break switch (Fire System Terminal 6)						
Disconnect probe line (Fire System Terminal 4)			Supply, Input Fault	Off	ALM0256	
Disconnect canister test lamp.			Supply, Output Fault	N/A	ALM0256	
Activate machine explosion hatch E-stop and short circuit the break glass switch line			Supply, Output Active	On	ALM8010	
Closed	Normal	Battery	Normal stays on for 5 minutes	Off	ALM0256, ALM 0258	
Isolate fire controller supply (RX7: X3 4.4B TX7: XEXTN 34B)						

TX7+/RX7 PYROGEN FIRE SYSTEM TEST SHEETS

MACHINE TYPE		MACHINE SERIAL NUMBER	
HEAT PROBE SERIAL NUMBER			
TESTER NAME		DATE	
SIGNATURE		WITNESED	

TEST 3: To check that the machine heat probe functions correctly.
Using a heat gun and a hand held temperature probe, determine the temperature at which the contacts of the machine fitted heat probe close. This should lie between 60°C and 70°C.

RECORD SWITCH POINT TEMPERATURE:

Verify that when the machine heat probe contacts close the results in the table below are true. Tick (✓) the OK box if so.

ACTION			RESULT				
Door position	Isolate switch	Power	LED's on	Sounder	Test Lamp	PLC warnings	OK
Closed	Normal	Power	Supply, Output Active	On	On	ALM8010	

TEST 4: Check that the aerosol extinguishant fire system label is fitted to the machine sliding door and that it is clearly visible.

LABEL OK

TEST 5: Verify that the system design approval certificate for the machine is valid.
e.g. The canopy volume and area of unclosable openings must be as stated.

--

ALL FIGURES MUST BE RECORDED AND ALL TICK BOXES MUST SHOW THAT THE RESULTS ARE OK FOR THE FIRE CONTROL SYSTEM TO BE PASSED OFF.
The fire system controller batteries should be disconnected during transportation.

FORM 3 -- NOTICE OF COMPLETION

**TO BE COMPLETED BY INSTALLER FOLLOWING THE
COMMISSIONING CHECK**

I (name of installer).....

of (company).....hereby certify that

*we have completed on (date).....
at (name/address/identification of protected area).....or
on CNC machine..... Type..... Serial No.....*

*a PYROGEN Fire Suppression System installation in accordance with the requirements
detailed in the System Design Approval Certificate.*

Commissioning test(s) were conducted by.....

.....Date.....

Commissioning test(s) were witnessed by.....

.....Date.....

This notice of completion shall have the following attached:

- a) System Design Approval Certificate
- b) Commissioning Check List

Signature of installer.....

Date.....

FORM 4 -- MAINTENANCE CHECK LIST

Maintenance Contractor.....

Premises.....

Address.....

No	ITEM	QUARTERLY BY OWNER	ANNUALLY, BY AUTHORISED INSPECTOR
1	Electrically isolate Pyrogen generator.	√	√
2	Confirm the generator is secure, undamaged and free from corrosion	√	√
3	Check that generator's nozzle is unobstructed within the specified minimum clearances	√	√
4	Confirm all electrical wiring and connections are intact	√	√
5	Open the manual release point enclosure	√	√
6	Check that instruction and warning signs are legible	√	√
7	Inspect power source condition	√	√
8	Inspect emergency power source (back-up battery) condition	√	√
9	Inspect controls for shut off valves. Inspect for damage, corrosion, accessibility and test correct operation.	-	√
10	Check the post fire ventilation facilities are functional.	-	√
11	Check that the expiry date of Pyrogen generator will not occur within the next 12 months and report to the owner.	-	√
12	Check the generator's electric activation circuit. Follow steps 1-6 in Section 9.	-	√
13	Check that all system controls are returned to normal and system is "on line"	-	√
14	Reconnect Pyrogen generator.	-	√
15	Record all inspections and necessary rectification's	-	√
16	Inform owner	-	√

Signed:.....

Date:.....

FORM 5 -- ANNUAL MAINTENANCE CERTIFICATE

*TO BE COMPLETED BY THE MAINTENANCE CONTRACTOR AFTER EACH ANNUAL
MAINTENANCE SERVICE*

I
(name of Service Person)

of.....
(company)

hereby certify that we have completed the Annual Maintenance on

.....
(type and serial number of CNC machine)

on.....
(date)

at.....
(location)

in accordance with the attached Maintenance Checklist.

Signature of Service Person.....

Date.....