Q. **Tab C, 2014 Capital Projects $500,000 and Over: Explanations – Install Fire Protection System, p. C-58**

According to p. C-58 Hydro expects the Nain program to cost $107,100 in 2014 and $892,200 in 2015 for a total of $999,300. Hatch's report of March 29, 2012 put the total cost for Nain at $655,000 (*sic*) (Hatch Report at Vol. II, Tab 22, at p. A6). What is the reason for this increase?

A. When the proposal was submitted to the Board it included a copy of the Hatch report dated March 29, 2012. An error was discovered in this report and subsequently it was revised and a new report resubmitted by Hatch dated May 15, 2013 (see Attachment A). The estimate for Nain in the 2012 report was based on old drawings of the plant which were no longer accurate and showed a smaller plant than the one existing today. The existing plant falls into the category of a large plant in the group sizes considered by Hatch (see page 18 of Attachment A). The cost to install a fire protection in this size of a plant would be comparative to replacing the plant at Natuashish which is estimated to be $1,140,000 (see page 24 of Attachment A).

HATCH™

Newfoundland and Labrador Hydro

Diesel Plant Fire Protection Study
Final Report

H340127-0000-50-124-0001
Rev. 1
May 15, 2013

Newfoundland and Labrador Hydro

Diesel Plant Fire Protection Study
Final Report

H340127-0000-50-124-0001
Rev. 1
May 15, 2013

Newfoundland and Labrador Hydro
Diesel Plant Fire Protection Study

Final Report

PROVINCE OF NEWFOUNDLAND AND LABRADOR
PEG Newfoundland and Labrador
PERMIT HOLDER
This Permit Allows
HATCH LTD.
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEG D0090
which is valid for the year 2013

REGISTERED PROFESSIONAL ENGINEER
PEG Newfoundland and Labrador
DERRICK FRENCH
SIGNATURE
16 May 2013
DATE
NEWFOUNDLAND & LABRADOR

2013-05-15	1	Issued for Information	Peter Macpherson Kerry Savoury	Derrick French	Greg Saunders	
Date	**Rev.**	**Status**	**Prepared By**	**Checked By**	**Approved By**	**Approved By**
			HATCH			**Client**

Disclaimer

This report is prepared for Newfoundland and Labrador Hydro (the "Client"), by Hatch Ltd. (the "CONSULTANT") and is subject to the following limitations, qualifications and disclaimers:

1. The report is intended for the exclusive use of the Client and it may not be used or relied upon in any manner or for any purpose whatsoever by any other party.
2. The report is **Diesel Plant Fire Protection Study** (the "Project"). Data required to support detailed engineering assessments have not always been available and in such cases engineering judgements have been made which may subsequently turn out to be inaccurate. There are, therefore, risks inherent in the Project which are outlined in the report. The CONSULTANT accepts no liability beyond using reasonable diligence, professional skill and care in preparing the report in accordance with the standard of care, skill, and diligence expected of professional engineering firms performing substantially similar work at the time such work is performed, based on the circumstances the CONSULTANT knew or ought to have known based on the information it had at the date the report was written and after due inquiry based on that information.
3. The CONSULTANT shall not be responsible or liable for any interpretation or recommendation made by others including any determination in respect of any sale by the Client or any purchase by any third party or any valuation in respect of the Project based in whole or in part on the data, interpretations and/or recommendations generated by the CONSULTANT in the report.
4. The investigation described in the report is based solely upon information received from the Client.
5. The report speaks only as of its date and to conditions observed at that time, which conditions may change (or may have changed) by virtue of the passage of time or due to direct or indirect human intervention causing any one or more changes in plans or procedures or due to other factors.
6. The report does not extend to any latent defect or other deficiency in the Project which could not have been reasonably discoverable or discovered by such observation, with the exception of any latent defect or other such deficiency of which the CONSULTANT had actual knowledge.
7. The report is to be read in conjunction with all other data and information received and referenced throughout the report, and all correspondence between the Client and the CONSULTANT. Except as stated in the report, the CONSULTANT has not made any independent verification of such data and information and does not have responsibility for the accuracy or completeness thereof.

Table of Contents

Appendices

List of Tables

Executive Summary

Newfoundland and Labrador Hydro (NL Hydro) own and operate twenty six (26) diesel powered electrical generation plants that are not manned twenty four hours per day and are located in rural and remote areas of the island and the Labrador coast. None of these plants are equipped with automatic fire suppression systems and in the past several of these plants have had fires resulting in the loss of equipment and facilities.

Based on Hatch's firsthand knowledge of many of these plants, in November 2011, NL Hydro contracted Hatch to prepare a study into the fire protection of all their diesel plants. This included the development of a decision matrix to determine the risk ranking of the plants and the recommendation of three plants for detailed study. The matrix was sorted into three main groups; small size plants, medium size plants and large size plants. Based on the outcome of the matrix and discussions with NL Hydro the three plants chosen were as follows:

1. Williams Harbour (Small)
2. Makkovik (Medium) 1
3. Natuashish (Large)

Many fire protection systems were reviewed and evaluated based on their general advantages and disadvantages as applicable for existing diesel electrical generation facilities in remote locations. From this evaluation it was determined the best alternative was a water mist system for the generator area and a Novec gas/chemical system for all other interior areas. Water mist systems should only be used in the generator rooms with volume ranging from 4,591ft3 to 36,727 ft3. In addition, if the generator room at a particular site has electrical and electronic equipment installed, the equipment may need to be enclosed or relocated as protection in the case of a discharge. These items requires further investigation on a case by case basis during the next stage of engineering stage. Since each site is different, the cost associated with enclosing or relocating electrical equipment is excluded from these estimates. 1

Conceptual drawings showing the general arrangement of the recommended fire protection systems were prepared and issued to vendors to obtain preliminary sizing and costing information.

As this was a high level study order of magnitude (+/- 50%) cost estimates were prepared for the design, supply and installation of the recommended fire detection and suppression systems for each of the three sites as presented in the following table.

Table 1: Summary of Budgetary Cost Estimates 1

Site	Engineering Cost (A)	Equipment Cost (B)	Equipment Supply and Install Cost (C=Bx2.5)	Accessibility and Logistical Factor* (D)	Total (A+CxD)
Williams Harbour	$30,000	$42,000	$105,000	2.5	$293,000
Makkovik	$50,000	$123,000	$307,500	2.0	$665,000
Natuashish	$75,000	$213,000	$532,500	2.0	$1,140,000

** This factor applies to the equipment supply and installation cost only and is not applied to the engineering cost.*

In conclusion we have determined there are very few practical options for an automated fire protection system for these plants. The solution chosen is the same for each site and would only vary in the scale which is proportional to the volume of the building or area to be protected.

As a recommendation we feel there needs to be further engineering performed to optimize the design. Further engineering, in general or at specific sites, would be needed to simplify the design and consequentially lower equipment and installation costs.

1. Introduction

In the following communities in Newfoundland and Labrador (NL), Newfoundland and Labrador Hydro (NL Hydro) own and operate diesel plants, consisting of diesel powered, electrical generators. In most of these communities, these diesel plants are the only source of electrical power.

Transmission and Rural Operations (TRO) Labrador Region

- Black Tickle (BKT)
- Cartwright (CWT)
- Mud Lake (MDL)*
- Hopedale (HPD)
- Makkovik (MAK)
- Happy Valley Goose Bay (North Plant) (HVY)*
- Nain (NAN)
- Natuashish (NAT)
- Paradise River (PDR)
- Postville (POV)
- Rigolet (RIG)

TRO Northern Region

- Charlottetown (CHT)
- Norman Bay (NOB)
- Hawke's Bay (HBY)*
- L'Anse-au-Loup (LAL)
- Mary's Harbour (MSH)
- Port Hope-Simpson (PHS)
- St. Anthony (STA)*
- St. Lewis (SLE)
- Williams Harbour (WHR)

TRO Central Region

- Francois (FRS)
- Grey River (GYR)
- Little Bay Islands (LBI)
- McCallum (MCC)
- Ramea (RAM)
- St. Brendan's (SBN)

* *standby plants*

As such, the continuous operation (or availability in the case of the standby plants) of these generators is critical to the operation of these communities. Any disruption of the operation of these diesel plants is not acceptable.

Multiple generating units are installed at each of NL Hydro's diesel generating stations. Each station also has the ability to generate enough power to meet full community load upon loss of one generating unit.

There is however, one area where these plants are extremely vulnerable: Fire.

Since these plants are not manned twenty four hours per day, seven days per week and most (if not all) have either no or inadequate fire suppression systems, catastrophic consequences would result if a fire broke out and was left unchecked. The community could be left without electricity for an extended period resulting in operational, health and safety concerns for communities.

NL Hydro has recognized the vulnerability of these communities, having experienced fires in the past.

As a result in November 2011, NL Hydro engaged Hatch to review all diesel plants and develop a decision matrix to determine the risk ranking and to establish a list of three of the most critical plants for more detailed study. A high level recommendation with cost estimate was also to be provided for the recommended fire protection system for each of the plants.

2. Study Goals and Methodology

Hatch was selected by NL Hydro to perform this "desk top study" due to past project experience with many of the plants. On a previous project in 2009, Hatch visited fourteen of the existing plants.

This study is based solely on information gathered by Hatch on previous projects, from information supplied to Hatch by NL Hydro and from consultation with suppliers and contractors. No site visit was conducted specifically for this study. Based on this information, this report will:

- Review each of the diesel plant locations
- Develop a decision matrix with risk ranking
- Identify three diesel plants for further study
- Identify and discuss the available fire suppression options
- Recommend the best fire suppression option(s) for each of the three locations selected for further study
- Provide a preliminary layout drawing that shows the recommended fire protection system layout for the three locations selected for further study
- Provide a budgetary cost estimate for the design, supply and installation of the proposed system types for each location selected for further study.

Note: The final pricing and equipment selection can only be provided after a detailed design has been completed (not in the scope of this study).

3. Loss and Near Miss History

According to information provided to Hatch by NL Hydro, the primary driver for this study came from the root cause analysis conducted for the Nain Diesel Plant fire in 2008.

In addition to the fire at the Nain Diesel Plant, there have been several other fire losses and near misses at diesel plants. Below is the list of reported incidents provided to Hatch by NL Hydro involving fire within NL Hydro Diesel Plants. In addition to these, there may have been other fires that were not reported.

NL HYDRO DIESEL PLANT FIRE HISTORY

Cartwright

- 2002 - Engine fire caused by leak in oil supply line to the oil pressure gauge, fire was extinguished by mechanic.
- 1995 - Exhaust blanket caught fire.

Hopedale

- 1991 - Extensive damage to plant, injection line failed resulting in fuel spraying on manifold of adjacent engine.
- 1999 - Engine [Mitsubishi] caught fire. Fuel plunger handle backed off resulting in fuel spraying on manifold.

L'Anse au Loup

- 2007 - Electrical short, wiring fire. Fire was extinguished by an employee with a fire extinguisher.

Little Bay Islands

- October 28, 2004 – Fire on Unit 2031 due to pressure base regulator failure on Unit 565 that resulted in discharge of oil through oil filter on adjacent host engine (Unit 2031). Operator extinguished the fire.

Makkovik

- 1997 - Engine caught fire in base, catastrophic failure.

Mary's Harbour

- 2002 - Lube oil spill, oil ignited.
- 2008 - Injector line broke spraying fuel, near miss.
- 2008 - Injector line broke spraying fuel, near miss.
- 2009 - Injector line broke spraying fuel, near miss.
- Fire was extinguished by an employee with a fire extinguisher.

Nain

- 1973 - Plant destroyed in spring under ownership of Labrador Services Division, actual cause unknown.
- 1993 - Extensive damage to plant, catastrophic engine failure, crankcase explosion.

Natuashish

- 2003 - Unit fire. Fire was extinguished with a fire extinguisher.

North Plant

- 2001 - welding debris caused fire in ceiling, contractor cutting and welding.

Port Hope Simpson

- 2006 - Rags ignited near work area.
- 2006 - Chafed fuel line, fuel ignited.
- 2007 - Bearing/housing failed, caused fire.
- 2007 - Exhaust wrap caught fire.
- 2009 - Oil sprayed on hot turbo after oil line broke on turbo.

In each case above, fire was extinguished by an employee with a fire extinguisher.

Rigolet

- 1993 - Engine fire caused by broken oil filter housing, oil sprayed on exhaust manifolds.

Roncontre East

- 2002 - Plant fire, suspected engine failure. Fire was beyond extinguishing, caused a complete loss of plant, cost estimate of approximately $1,700,000.

4. Industry Practice

Below is a table provided to Hatch by NL Hydro outlining current industry practices. This table is presented to provide a comparison of the fire suppression systems recommended in this report to current industry practice.

It is worthy to note that the sites that do not have fire suppression systems have taken other measures to prevent fires or reduce the effects of a fire such as:

- Separation of their mobile units such that, in the event that a unit is lost to a fire the other mobile units should remain operational.
- Production units are separated by fire retardant barriers to confine fire.
- Back up generation and switchgear are located in separate building to minimize the impact of a fire.

Table 2: Summary of Industry Practice

Company	Fire Suppression System	Fire Detection System	Description
BC Hydro	None	Present	• They utilize alarms, fire stop valves, anti-siphon valves and fire retardant materials. • Separation of their mobile units is their best defense. In the event that a unit is lost to a fire the other mobile units should still be operational.
Hydro-Quebec	None	Present	• They utilize fire stop valves on fuel lines, fire stop flap in ventilation duct and fire retardant materials. • Production units are separated to confine fire and fire retardant materials.
Manitoba Hydro	Present	Present	• They also utilize fuel shut-off valves. • The suppression system was installed because of plant layouts which house all generators in a common powerhouse without fire breaks or isolation between units. • Extinguishing agents used are Argon, FM200 and Integrated Compressed Air Foam (ICAF) systems.
Atco Electric	Present (Only at Fort Chipewyan)	Present	• They utilize the “Hi-Fog” system; a series of water bottles charged and discharged by Nitrogen. It produces a 12-15 minute fog that cools the fire and creates a steam environment which chokes out oxygen. • The “Hi-Fog” system is used with heat and flame detection and shut-off valves to all fluids. • In plants where suppression systems are not in place back up generation and switchgear are present in a separate building to minimize the impact of a fire.
Hydro One	Present	Present	• Utilize Inergen or FM200 (site dependent). • A concern with installing a fire suppression system in older buildings is the air tightness of the building. (The rooms had to be sealed but equipped with a relief vent) to contain the gas in the system. Space is also a concern. • They have experienced unexpected agent releases, but have pre-action alarms and abort switches to reduce the effect of these incidences. The false releases are believed to be an issue with the seals; they have a 10 year life span. • Inspections are performed bi-annually; they should be inspected annually to keep the systems certified, but the fire suppression systems are optional and as such it is not necessary to keep them certified.

5. Review of Fire Suppression Systems

5.1 General

Starting and sustaining a fire requires three things to be present at the same time:

- Oxygen
- Spark or an ignition source
- Fuel

If any of these are missing, there can be no fire. Fire suppression systems disrupt one or more of these items to extinguish the fire.

There are several fire suppressing methods on the market (from a number of reputable suppliers). The following is a summary of the most commonly used methods along with the advantages and disadvantages of each. While in some cases this report will refer to trade names, each method may be readily available from a number of suppliers.

The selection of a fire suppression method is on a location specific basis and takes into consideration such things as:

- Type of fire
- Potential harm to occupants as a result of system activation
- Potential damage to equipment as a result of system activation

5.2 Halon

Until banned in the mid 90's (for environmental reasons), this type of system was widely use in areas were damage to building contents was not acceptable (such as computer rooms).

The system saturates the affective area with Halon gas and works by absorbing heat, reducing oxygen levels and interfering with the combustion process.

While very affective, there were some drawbacks:

- It was not advisable to activate the system with people in the area. Once a fire was detected, there would be a time delay prior to activation to allow evacuation of personnel.
- It was proven that the Halon gas was damaging to the earth's ozone layer. As a result, Halon systems were banned.

Since this system is no longer available, it was not considered as an option and was given only for historical background information.

5.3 CO_2

Carbon dioxides systems work by flooding the area with CO_2 to rob the fire of oxygen. While very affective (and not causing damage to contents), it can, however, be lethal to anyone in the area.

For this reason, CO_2 systems were not considered for use in this report.

5.4 Water Sprinklers

5.4.1 General

The most common fire suppression system is the sprinkler system (seen in most buildings). When actuated, the affect area is sprayed (soaked) with water.

Sprinkler systems come in four main types.

5.4.2 Wet Systems

Wet systems are the most common and are used where there is no risk of freezing. The sprinkler headers are always filled with water and the system will start as soon as one of the sprinkler nozzles opens (either by fire actuation or by physical damage). Flow through subsequent nozzles will only happen as they open (either by fire actuation or by physical damage).

5.4.3 Dry Systems

Dry systems are used when there is a risk that freezing will occur in the spray headers.

In this system, water is prevented from entering the freeze zone by a flapper valve that is held shut by compressed air in the spray header.

The sprinkler headers are always filled with pressurized air and water flow will start once the air pressure is released when one of the sprinkler nozzles opens (either by fire actuation or by physical damage). Flow through subsequent nozzles will only happen as they open (either by fire actuation or by physical damage).

5.4.4 Pre-Action

Pre-action systems are similar to dry systems except that external, electronic interlocks are used to start the flow of water and prevent accidental flow (i.e., in the event that a sprinkler nozzle is damaged).

5.4.4.1 Pre-Action (Single Interlock)

In this system, the flapper valve (dry system) is replaced by a solenoid actuated valve that will only open on automatic fire detection (smoke, heat detection). Once open, the system will behave like a wet system.

5.4.4.2 Pre-Action (Double Interlock)

This is similar to the single interlock system with the exception that the air pressure inside the spray header is also electronically monitored. The solenoid actuated valve will only open when there is a lowering of air pressure AND there is fire detection. In this way, there will not be any water flow if a sprinkler nozzle is accidently damaged.

5.4.5 Sprinkler Systems Conclusion

Although sprinkler systems are effective and widely used, they are generally used in areas were water damage is not an overriding concern. Sprinkler systems require flooding with water which is not the most appropriate method for extinguishing a fuel or liquid fire.

In addition, sprinkler systems require a reliable water source with sufficient flow capacity and residual pressure. Based on our knowledge of sites visited in the past, it is our opinion that the existing municipal infrastructure, where it exists, would not have sufficient residual pressure or flow capacity to meet the requirements of a sprinkler fire suppression system and could required significant upgrades and a dedicated water supply would expensive.

On review, it was determined that this option would cause significant collateral damage with an associated high cost in the event of a discharge. As a result, water sprinklers were not considered as a viable option in this study.

5.5 Aqueous Film Forming Foam (AFFF) Suppression

Foam systems are common for the suppression of fuel spill fires (i.e., airport hangers). On actuation, foam is delivered by sprinkler type system to covers the fuel spill. The fire is suppressed by:

- Cooling the spill by providing a water film between the foam and the fuel. This water film also prevents the formation of flammable vapours, preventing re-ignition.
- The foam provides a barrier between the fuel spill and the oxygen in the air.

The foam used in this application is Aqueous Film Forming Foam which is a mixture of water and foaming agent.

While being effective, there are a few disadvantages.

- A reliable, high volume water source is required (typically 0.16 gpm/ft2 for 10 minutes of operation).
- After deployment, the foam will slowly degrade to water contaminated with the foaming agents. This liquid must be contained, collected and sent to a treatment plant for proper disposal.

Considering the remoteness of the sites being studied, the above concerns are important enough to disqualify foam systems from consideration.

5.6 Novec Systems (i.e., Ansul SAPHIRE)

5.6.1 General

With the banning of Halon systems, Novec 1230 has been developed to become a clean and environmentally friendly fire suppression agent. Novec 1230 works by absorbing heat.

Generally used in areas where harm to people or equipment is unacceptable.

5.6.2 Typical Systems

Typical Novec systems are comprised of:

- Fire detection system
- Multiple canisters of the Novec liquid that are pressurized by nitrogen to 360 psig

- Piping and spray nozzles
- Nitrogen cylinders

Once activated, the Novec fluid is supplied to the spray nozzles and, once airborne, the liquid vaporizes to blanket the affected area.

5.6.3 Pros

- Environmentally friendly
- Safe for occupied spaces (per NFPA 2001)
- FM certified for occupied spaces (NL Hydro to request confirmation from FM)
- Non-conductive and will not harm electrical equipment
- Will not harm building contents
- Not harmful to occupants due to the low concentration level required
- The Novec liquid can be easily re-charge on site with a sufficient quantity of nitrogen for multiple discharges. Novec liquid can be shipped to site and the liquid can be easily transferred to the storage cylinder. Once transferred, the cylinder can be re-pressurized with Nitrogen.

5.6.4 Cons

- Ceiling height limitation of 14 ft (4.3 m), above which a second layer of nozzles is required
- Cannot work multiple areas independently from one system. Separate rooms require individual systems
- Requires a closed area that is fairly well sealed
- NL Hydro has no experience with this type of system
- Shipping nitrogen to isolated sites, if required, outside of seasonal shipping window may prove to be costly. Identification of a sufficient quantity of nitrogen to be maintained at various sites to manage this risk should be determined during detailed design and risk assessments.

5.7 Inergen (Ansul Product)

5.7.1 General

INERGEN is an Ansul product that reduces the oxygen content of the space sufficiently to extinguish the fire but not to a level that would be harmful to occupants.

Generally used in areas where harm to people or equipment is unacceptable.

5.7.2 Typical Systems

Typical INERGEN systems include:

- Fire detection system
- Multiple canisters of high pressure INERGEN gas
- System pressure in the distribution piping is reduced by an orifice plate during activation
- Piping and spray nozzles

Once activated, the Inergen gas is supplied to the spray nozzles and, once airborne, blankets the affected area.

5.7.3 Pros

- Environmentally friendly
- Safe for occupied spaces (per NFPA 2001)
- FM certified for occupied spaces (NL Hydro to request confirmation from FM)
- Non-conductive and will not harm electrical equipment
- Will not harm building contents
- Not harmful to occupants
- One system can handle multiple independent areas (i.e., If there is a fire in one of multiple rooms connected to the system, the system can deploy Inergen only in the affected area)
- NL Hydro has experience with this type of system

5.7.4 Cons

- Requires a closed area that is fairly well sealed
- Since Inergen is a gas and is pressurized to approximately 3000 psi, the empty cylinders must be removed from site and re-charged at the Inergen supplier

5.8 High Pressure Water Mist

5.8.1 General

These systems use a spray of water and nitrogen to produce a blanket of atomized water particles that absorb heat and smoother the fire.

Water mist systems are readily available from various suppliers such as:

- Ansul (AQUASONIC)
- Victaulic (VORTEX)

These types of system are typically used in open areas where there are flammable and combustible liquid hazards.

5.8.2 Typical System

A typical water mist system will include:

- Fire detection system
- Multiple cylinders of nitrogen (pressurized to approximately 3000 psi)
  - Cylinders are equipped with regulators to lower the system pressure to approximately 115 psi
- Multiple water cylinders (pressurized by the nitrogen cylinders to approximately 115 psi)
- Piping and spray nozzles

5.8.3 Pros

- Environmentally friendly
- Safe for occupied spaces
- Victaulic VORTEX brochure claims that the system can be used in areas containing computer and other sensitive electrical equipment
- No requirement for a sealed spray area
- FM certified for occupied spaces (NL Hydro to request confirmation from FM)
- Not harmful to occupants
- With a sufficient quantity of nitrogen for multiple discharges, the system can be easily re-charge on site
- No special chemicals required

5.8.4 Cons

- May cause minimal harm to building contents
- Ansul does not recommend its use in areas containing critical electrical equipment (i.e., computers)
- NL Hydro has no experience with this type of system
- Shipping nitrogen to isolated sites, if required, outside of a seasonal shipping window may prove to be costly. Identification of a sufficient quantity of nitrogen to be maintained at various sites to manage this risk should be determined during detailed design and risk assessments.

5.9 Selection Matrix

As a summary, the following is a matrix of the pros and cons of each of the system under consideration.

Table 3: Fire Suppression Type Selection Matrix

	Pros							Cons									
System	Safe for occupied spaces	Will not harm computer equipment	Doe s not require sealed areas	Enviromentally friendly	Will not harm building contents	Can handle multiple areas	Can be easily re-charged on site	Banned	Not environementally friendly	May harm building contents (water damage)	Require Reliable Water source	Potentially Lethal	Cannot be recharged on site	Cannot handle multiple areas	Requires sealed ares	Requires containment and special desposal	Not safe for occupied spaces
Halon								**x**	**x**								
CO2		x			x							**x**					x
Water Sprinkler	x		x	x		x				x	**x**						
Foam Supression										x	**x**					**x**	
Novec (Ansule Sapphire)	x	x		x	x		x							x	x		
Inergen (Ansul)	x	x		x	x	x							**x**		x		
Water Mist (Ansul/Victaulic)	x		x	x	x		x			x							

x (red cell) Desigates an overriding concern

6. Decision Matrix

6.1 General

In close consultation with NL Hydro, Hatch developed a decision matrix to determine the risk ranking for the 26 diesel plants. This matrix includes a list of criteria which has been assigned a rating and weighting factor. NL Hydro provided input for identification of criteria and the assigning of an appropriate rating and weighting factors.

6.2 Rating Methodology

Each plant is assessed based on a predetermined set of criteria. Each criteria item is rated from 1 to 5 based on the level of risk, probability of a fire and/or effects of a fire.

- 1 - Represents a “Low risk of the criteria causing a fire or relatively few consequences as a result of a fire”
- 5 - Represents a “High risk of the criteria causing a fire or relatively significant consequences as a result of a fire”

6.3 Weighting Methodology

The relative level of importance for each individual criteria item is identified by a weighting system, with 1 representing “Least Important” and 10 representing “Most Important”.

6.4 Matrix Criteria

6.4.1 Accessibility

5 No ferry/road. Limited access by air

4 Access only by air with seasonal ferry

3 Access by seasonal ferry/road

2 Direct access by year round ferry

1 Complete access (located in major center)

6.4.2 Population Served

5 >1000

4 750-1000

3 500-750

2 250-500

1 <250

6.4.3 Weather/Climate vs. Accessibility

5 Air access only

4 Air access, seasonal ferry, no road access

3 Air access, seasonal ferry and road only

2 Year round ferry only

1 Very little to no effect

6.4.4 Number of Units

This criterion excludes Mobile Units.

5 Five or more units

4 Four units

3 Three units

2 Two units

1 One unit

6.4.5 Total Generating Capacity

5 >5000 KW

4 3001-5000 KW

3 1501-3000 KW

2 751-1500 KW

1 <750 KW

6.4.6 Average Age of Units

5 Average Installed date of 1990 or before

4 Average Installed date of 1991- 1995 to present

3 Average Installed date of 1996- 2000 to present

2 Average Installed date of 2001- 2005 to present

1 Average Installed date of 2006 to present

6.4.7 Continuous Operation vs. Standby Operation

5 Continuous operation

1 Standby operation

6.4.8 Community Fire Protection Capability

5 No fire department

4 Volunteer fire department with no fire truck. Fire Hydrants present.

3 Volunteer fire department with fire truck. Fire Hydrants present. No winter roads.

2 Volunteer fire department with fire truck. Fire hydrants present. Winter roads.

1 Fully functional fire department. Major center.

6.4.9 Replacement Cost of Plant, i.e., Cost of new plant

This criterion assumes replacement cost to be a direct function of total generating capacity.

5 >5000 KW

4 3001-5000 KW

3 1501-3000 KW

2 751-1500 KW

1 <750 KW

6.4.10 Material of Construction/Plant Layout

5 Exposed wooden construction and congested

4 Exposed wooden construction and spacious

3 Combination of wood and steel

2 Steel construction and congested

1 Steel construction and spacious

6.4.11 Industrial/ Large Commercial Customers

5 Yes

1 No

6.4.12 Maintenance Record

5 0-20% Complete (from 2006 to 2011)

4 20-40% Complete (from 2006 to 2011)

3 40-60% Complete (from 2006 to 2011)

2 60-80% Complete (from 2006 to 2011)

1 80-100% Complete (from 2006 to 2011)

6.5 Ranking

Table 4 gives a summary of the results, ranking each plant in terms of risk and/or consequences of a fire. The plants in Hopedale, L'Anse-au-Loup and Nain received the highest ranking, whereas St. Brendan's received the lowest ranking.

The Risk Assessment Matrix indicates the need for improvement in maintenance practices related to a number of plants, most notably those in the northern region of the Labrador coast. It appears however that, from the maintenance records provided, NL Hydro has recognized this need and is improving its compliance. In 2011, approximately 70 percent of scheduled preventive maintenance tasks were completed for those plants in the northern region of the Labrador coast. During the review process of this report, NL Hydro advised Hatch that a corporate target of 90% has been set across all plants.

The Risk Assessment Matrix provides a good guide for comparing risk between plants; however other issues may need to be considered if plans are made to reduce risk at specific sites. Projected load growth, customer growth, and the possibilities for emergency alternate power supply may also need to be considered at that time.

The table does not relate to the dollar amount required to implement a fire suppression system. As a result, Hatch does not necessarily recommend that fire suppression systems be implemented in the order as presented in this matrix. NL Hydro may, at its discretion, determine that it is more desirable to implement fire suppression systems in a different order than presented in this matrix.

Table 4: Risk Assessment Matrix

Site	Accessibility	Population Served <250 - 1, 250-500 - 2, 500-750 - 3, 750-1k - 4, >1k - 5	Weather Climate vs. Accessibility Weather Greatly Affects Accessibility - 5	Number of Units >4 = 5	Total Generating Capacity	Average Age of Units	Continuous Operation vs Standby Operation Continuous = 5, Standby = 1	Community Fire Protection Capability No Capability - 5	Relative Replacement Cost of Plant vs. Relative cost of new plant	Material of Construction/ Plant Layout	Industrial/ Large Commercial Customers Yes - 5, No - 1	Maintenance Record	Total
St. Brendan's	2	1	2	3	1	3	5	5	1	1	1	1	194
McCallum	2	2	2	3	1	3	5	5	1	1	1	1	202
Mud Lake	5	1	1	1	1	3	1	5	1	1	1	5	204
Grey River	2	1	3	3	1	3	5	5	1	2	1	1	212
Norman Bay	3	1	3	3	1	1	5	5	1	1	1	2	214
Francois	2	1	4	3	1	4	5	5	1	2	1	1	227
Little Bay Islands	2	1	3	4	2	4	5	5	2	2	1	1	240
St. Lewis	3	2	3	3	2	1	5	4	2	1	5	2	255
Ramea	2	3	2	3	3	3	5	5	3	1	1	2	256
Port Hope Simpson	2	3	3	3	2	3	5	4	2	2	5	1	261
Hawkes Bay	1	5	1	2	5	5	1	5	5	1	1	3	263
Williams Harbour	5	1	5	3	1	2	5	5	1	2	1	2	267
Marys Harbour	3	2	3	3	2	4	5	2	2	2	5	2	268
St. Anthony	1	5	1	5	5	5	1	1	5	1	5	3	278
Charlettetown	3	2	3	2	3	4	5	2	3	2	5	2	281
Black Tickle	4	1	4	3	2	1	5	5	2	2	5	3	290
Paradise River	3	1	3	3	1	4	5	5	1	5	1	5	291
Postville	4	1	4	3	2	2	5	3	2	2	5	4	295
Goose Bay	1	5	1	5	5	5	1	1	5	1	5	5	298
Makkovik	4	2	4	3	2	4	5	3	2	1	5	4	305
Rigolet	4	2	4	4	3	3	5	3	3	2	1	4	311
Cartwright	3	3	3	4	3	3	5	2	3	2	5	4	314
Natuishish	4	3	4	4	4	2	5	2	4	1	1	5	329
L'Anse- au-Loup	3	5	3	5	4	5	5	2	4	1	5	2	335
Hopedale	4	3	4	3	3	2	5	3	3	4	5	4	345
Nain	4	5	4	3	4	2	5	3	4	1	5	4	355
Weight	10	8	10	5	8	5	10	5	10	8	5	10	

7. Selection of Plants for Further Study

7.1 Grouping by Size

To choose three plants for further study that best represent the range of plants, the plants were sorted by size (volume) and separated into three main groups:

- Small Size Plants
- Medium Size Plants
- Large Size Plants

Table 5: List of Diesel Plants by Size and Volume

Site	Region	Ranking	Powerhouse Size					
			Length (ft)	Width (ft)	Height (ft)	Floor Area (ft2)	Volume (ft3)	
Francois	TRO Central	21	27	19	12	513	6156	
Paradise River	TRO Labrador	10	30	18	12	540	6480	
St. Brendan's	TRO Central	26	31	21	12	651	7487	
Cartwright	TRO Labrador	5	40	20	11	800	8800	
Norman Bay	TRO Northern Region	22	30	30	12	828	9936	
Postville	TRO Labrador	9	50	20	11	1000	11000	
Rigolet	TRO Labrador	6	50	20	11	1000	11000	
Little Bay Islands	TRO Central	20	52	20	11.5	1040	11960	
Williams Harbour	**TRO Northern Region**	**15**	**40**	**25**	**12**	**1000**	**12000**	
Macallum	TRO Central	25	38	34	16	1076	17216	
Black Tickle	TRO Labrador	11	81	20	11	1670	18370	
Grey River	TRO Central	23	38	26	17	1084	18432	
Makkovik	**TRO Labrador**	**7**	**60**	**30**	**14**	**1800**	**25200**	1
Mary's Harbour	TRO Northern Region	14	66	33	14	2178	30492	
Hopedale	TRO Labrador	2	41	40	19	1640	31160	
Port Hope Simpson	TRO Northern Region	17	66	35	15	2310	34650	
Charlottetown	TRO Northern Region	12	60	31	19	1860	35340	
Ramea	TRO Central	18	54	40	17	2160	36720	
St. Lewis	TRO Northern Region	19	72	36	22	2592	57024	
Nain	TRO Labrador	1	100	45	19	4500	85500	1
Natuashish	**TRO Labrador**	**4**	**86**	**55**	**19**	**5138**	**97622**	
L'Anse-au-Loup	TRO Northern Region	3	92	40	27	3680	99360	
St. Anthony	TRO Northern Region	13	160	50	15/20	8000	149500	
Goose Bay	TRO Labrador	8	135	67		9045		

Units without a powerhouse

Hawkes Bay	TRO Northern Region	16
Mud Lake	TRO Labrador	24

7.2 Sites Chosen for Further Study

7.2.1 Williams Harbour

Williams Harbour was chosen since it is the largest of the plants in the small group and best represents that group in terms of size and volume.

7.2.2 Makkovik

1

Makkovik was chosen because it was a good representative of that group in terms of size and volume.

7.2.3 Natuashish

1

Natuashish was chosen because it is the largest of all plants in the group that is not directly connected to the grid and is a good representative of that group in terms of size and volume.

8. Proposed Fire Protection Systems

8.1 General

The purpose of automatic fire suppression is twofold:

1. Automatically detect and extinguish fires
2. Provides valuable time for fire-fighters or first responders to reach the sites

On review of the available systems, Hatch believes the best solution is to have a combination of:

- High pressure water mist for the generator areas
- Novec system for the balance of the plant areas
- Hand held extinguishers in all areas

During the course of this study, manufacturers information on suitability and application of the water mist systems were found to vary.

- Victaulic indicated that the VORTEX system is suitable for areas where there is sensitive electronics (i.e., computers)
- Ansul does not recommend the AQUSONIC system for areas with sensitive electronic equipment.

For the purposes of this study, we recommend that the water mist systems only be used in the generator rooms with volume ranging from 4,591ft^3 to 36,727 ft^3. In addition, if the generator room at a particular site has electrical and electronic equipment installed, the equipment may need to be enclosed or relocated as protection in the case of a discharge. This requires further investigation on a case by case basis during the next stage of engineering stage. Since each site is different, the cost associated with enclosing or relocating electrical equipment is excluded from these estimates. 1

The selection of the Novec system over the INERGEN system was due to the fact that, with sufficient nitrogen, the Novec liquid can be re-charged on site. While there are operational advantages of using INERGEN, we believe the re-charging issue is an overriding concern. This issue can be examined in detail in the design phase of the project.

In the selection of equipment, a number of items should be noted:

- Volume of equipment inside the building was not taken into consideration in the sizing of the system
- Building dimensions were taken from drawings supplied by NL Hydro
- Some building dimensions were estimated due to insufficient information
- The sizing of some of the Novec systems was performed by pro-rating known supplier information (i.e., from specific quotes given from suppliers) based on room volume.

8.2 Williams Harbour (Reference Drawing H340127-A1-M-001)

8.2.1 Generator Room

A water mist system is recommended in this area. Due to the small area to be covered, a pre-package AQUASONIC 260 system is recommended (for 10 minute operation) and is comprised of the following components:

- Six (6) Nitrogen cylinders
- One (1) 50 gal water tank assemblies
- Two (2) Atomizers (spray nozzles)
- One (1) smoke detector
- Four (4) thermal detectors

8.2.2 Other Areas

All areas apart from the Generator room will be serviced by a Novec system (similar to the Ansul Sapphire system). The following is a summary of the sizing of the main components based on information from Ansul (Appendix B).

Table 6: Williams Harbour Diesel Plant - Areas outside of the Generator Room

Room	Nitrogen Cylinders	Novec Qty (lbs)	Qty Nozzles	Thermal Detectors	Smoke Detectors
Office/Washroom	1 - 90 lbs	65 lbs	2	2	2

8.2.3 Fire System Control

For the purposes of this study, we are assuming a single controller will be used to control all the fire suppression systems (such as the Ansul Auto Pulse IQ 318C).

8.2.4 Challenges

The fire suppression system takes up a significant amount of floor space (i.e., 6 tanks and cylinder assemblies). To alleviate this, it may be necessary to add an extension to the building to house the fire suppression equipment or to install the equipment in a self contained unit. This can be investigated during the detail design phase of the project.

8.3 Makkovik (Reference Drawing A1-64503-57) 1

8.3.1 Generator Room

A water mist system is recommended in this area. Based on information received from Ansul, an AQUASONIC system (for 10 minute operation) and is comprised of the following components:

- Sixteen (16) Nitrogen cylinders
- Four (4) 50 gal water tank assemblies
- Six (6) Atomizers (spray nozzles)

- One (1) smoke detector
- Five (5) thermal detectors

8.3.2 *Other Areas*

All areas apart from the Generator room will be serviced by a Novec system (similar to the Ansul Sapphire system). The following is a summary of the sizing of the main components based on information received from Ansul (Appendix B).

Table 7: Makkovik Diesel Plant - Areas outside of the Generator Room 1

Room	Nitrogen Cylinders	Novec Qty (lbs)	Qty Nozzles	Thermal Detectors	Smoke Detectors
Washroom	1 x 90 lbs	19 lbs	1	1	1
Office	1 x 90 lbs	60 lbs	1	1	1
Kitchen	1 x 280 lbs	95 lbs	1	1	1
Workshop	1 x 280 lbs	151 lbs	1	1	1

8.3.3 *Fire System Control*

For the purposes of this study, we are assuming a single controller will be used to control all the fire suppression systems (such as the Ansul Auto Pulse IQ 318C).

8.3.4 *Challenges*

The fire suppression system takes up a significant amount of floor space (i.e., 21 tanks and cylinder assemblies). To alleviate this, it may be necessary to add an extension to the building to house the fire suppression equipment or to install the equipment in a self contained unit. This can be investigated during the detail design phase of the project.

8.4 Natuashish (Reference Drawing H340127-A1-M-003)

Natuashish is the largest and most complex of the three systems with large areas and multiple rooms. The following is a brief summary of the systems recommended.

8.4.1 *Generator Room*

A water mist system is recommended in this area. Based on information received from Ansul, an AQUASONIC system (for 10 minute operation) and is comprised of the following components:

- Thirty (30) Nitrogen cylinders
- Six (6) 50 gal water tank assemblies
- Ten (10) Atomizers (spray nozzles)
- One (1) smoke detectors
- Nine (9) thermal detectors

8.4.2 *Other Areas*

All areas apart from the Generator room will be serviced by a Novec system (similar to the Ansul Sapphire system). The following is a summary of the sizing of the main component based on information from Ansul (Appendix B).

Table 8: Natuashish Diesel Plant - Areas outside of the Generator Room

Room	Nitrogen Cylinders	Novec Qty (lbs)	Qty Nozzles	Thermal Detectors	Smoke Detectors
Electrical Control Room	1 x 390 lbs	286 lbs	2	3	1
Computer Room	1 x 90 lbs	54 lbs	1	1	1
Battery Room	1 x 90 lbs	42 lbs	1	1	1
Storage Room	1 x 280 lbs	98 lbs	1	1	1
Lunch Room	1 x 90 lbs	73 lbs	1	1	1
Maintenance/Workshop	1 x 280 lbs	138 lbs	1	2	1
Consumable Storage	1 x 280 lbs	131 lbs	1	2	1
Heat Exchanger Room	1 x 280 lbs	147 lbs	1	2	1
Corridor	1 x 90 lbs	52 lbs	1	1	1
Washroom	1 x 90 lbs	28 lbs	1	1	1

8.4.3 Fire System Control

In many cases, each fire suppression zone will have its own dedicated controller (i.e., Ansul Autopulse Z-10). However, with a building consisting of multiple zones it should be more efficient to have the entire building controlled by a single control unit (such as the Ansul Auto Pulse IQ 318C).

For the purposes of this study, we are assuming a single controller will be used to control all the fire suppression systems.

8.4.4 Challenges

The fire suppression system takes up a significant amount of floor space (i.e., 46 tanks and cylinder assemblies). To alleviate this, it may be necessary to add an extension to the building to house the fire suppression equipment or to install the equipment in a self contained unit. This can be investigated during the detail design phase of the project.

9. Costing

9.1 Fire Suppression System

Budgetary (+/- 50%) cost estimates were prepared for the design, supply and installation of the recommended fire detection and suppression systems for each of the three sites as presented in Table 9.

Table 9: Summary of Budgetary Cost Estimates 1

Site	Engineering Cost (A)	Equipment Cost (B)	Equipment Supply and Install Cost (C=Bx2.5)	Accessibility and Logistical Factor* (D)	Total (A+CxD)
Williams Harbour	$30,000	$42,000	$105,000	2.5	$293,000
Makkovik	$50,000	$123,000	$307,500	2.0	$665,000
Natuashish	$75,000	$213,000	$532,500	2.0	$1,140,000

* *This factor applies to the equipment supply and installation cost only and is not applied to the engineering cost.*

The estimates assume:

- all new equipment fits within the existing building envelope
- construction during the summer season

The estimates exclude:

- telecommunication cost associated with fire detection
- owners costs, a contingency or any applicable taxes

Engineering costs are estimated as follows:

- Small size plants - $30k
- Medium size plants - $50k
- Large size plants - $75k

Equipment cost has been provided by vendors. See Appendix B. For this exercise the costing was based on one specific manufacturer's product. Final system selection will be made during the detailed design phase of the project.

Installation cost has been estimated based on consultation with vendors. At the recommendation of the equipment supplier, a factor of 2.5 has been applied to the total equipment cost to include the installation cost in a very accessible metro location.

In addition, based on past project experience and consultation with local contractors, Hatch has applied the following historical cost factors to adjust for site accessibility and logistical

issues. Hatch recommends that NL Hydro review these factors and revise if necessary, based on their past project experience for each site.

- A 1.5 factor is applied to the total cost to for sites accessible by road, i.e., sites on the southern Labrador Coast.
- A 2.0 factor is applied to the total cost for sites only accessible by seasonal ferry and freight service, i.e., sites on the Northern Labrador Coast.
- A 2.5 factor is applied to the total cost for sites with no access by road or seasonal ferry, i.e., Williams Harbour.

9.2 Relative Replacement Costs of Each Plant

It is our understanding that NL Hydro's design standard, for any new or replacement diesel generation plants, is the St. Lewis facility. As provided by NL Hydro, this plant commissioned in 2006 cost in the order of $2.8 million dollars. Based on current construction market conditions and pricing of recent tenders, it is highly likely the escalation factor for construction of a similar plant could be as high as 1.5, indicating a cost in 2012 dollars of over $4million.

The previous plant in St. Lewis was approximately 800ft^2 in floor area and 8000ft^3 in volume with three generating units. Comparing to the other plants in Table 5, all of which have at least three generating units, the previous plant in St. Lewis would have ranked as one of the smallest plants.

The new plant in St. Lewis is now larger than all but four other plants, two of which are standby plants. Based on this it is assumed that the majority of the diesel plants, if replaced with a plant built to NL Hydro's new standard, would be as large as the St. Lewis plant or larger. Therefore the replacement cost of the majority of these diesel plants would be as high or higher than the escalated replacement cost of the St. Lewis plant.

10. Conclusions

The decision matrix was completed and from it we were able to rank the plants in order of risk.

The codes and standards below are a compilation of those most applicable to general fire protection of diesel powered electrical generation plants and those specifically applicable to the fire suppression options proposed:

- National Building Code of Canada
- National Electrical Code of Canada
- National Fire Code of Canada
  - NFPA 10 – Standard for Portable Fire Extinguishers
  - NFPA 37 – Standard for the Installation and use of Stationary Combustion Engines and Gas Turbines
  - NFPA 72 – National Fire Alarm and Signalling Code
  - NFPA 80 – Standard for Fire Doors and other Opening Protective's.
  - NFPA 101 – Life Safety Code
  - NFPA 750 – Standard on Water Mist Fire Protection Systems
  - NFPA 2001 – Standard on Clean Agent Fire Extinguishing Systems

The study was successful in determining which fire suppression systems are most applicable for remote diesel electrical generation plants. The systems that we believe would work the best are:

- Water mist
- Novec

These systems where chosen because they can be retrofitted into existing facilities and are effective in suppressing both fuel and electrical fires. In addition, they have the lowest possibility of causing collateral damage to the mechanical and electrical equipment and are the least likely to cause a clean-up problem.

These systems were investigated in detail for Williams Harbour, Makkovik and Natuashish and cost estimates for these plants were prepared. 1

- Williams Harbour – $293,000
- Makkovik - $665,000 1
- Natuashish - $1,140,000

11. Recommendations

11.1 Areas for Further Study

As the current designs are only conceptual, we feel there are areas available for optimization which will lower or simplify the design, lower equipment costs and lower installation costs. This optimization can be dealt with in the detailed engineering phase of the project.

1. Existing Fire Detection Systems

   In this study, it has been assumed that a new fire detection system will be required for each plant. During the detailed design phase of the project, further investigations can be conducted to determine if the existing fire detection systems are compatible with the proposed fire suppression systems.

2. Optimization of the Novec System

   In this study, it has been assumed that each room will have its own, stand alone Novec system. This is due to the fact that a single system cannot handle multiple, independently controlled areas. During the detail design phase of the project, further investigations can be conducted to determine if there are cost savings possible by having multiple rooms serviced by one system. For example: Is it practical or desirable to have the Natuashish Lunchroom and Maintenance shop be serviced by one Novec system?

3. Modularization

   Given the remoteness of the site locations, ease of construction will be of paramount importance. Consideration should be given to the use of self contained equipment modules that can be manufactured off site and shipped to site complete, thus minimizing the site work.

4. Maintaining a “Sealed” Environment

   NL Hydro operations staff indicated that sometimes doors are propped open to maintain airflow and cooling in the summer months. As stated in this report, Novec systems require a relatively air tight environment, to work properly. In order to mitigate this situation, a concept that is used in many hospitals can be considered.

   Each door can be equipped with an electro magnet to hold the door open. In the event of a fire alarm, the magnets would de-energize, allowing the doors to close automatically.

11.2 Interim Measures

As the implementation of the proposed fire suppression systems would take a considerable amount of time, the following measures could be taken now to reduce the plants risk of damage by fire:

- A quick review of Section 3 – Loss and Near Miss History shows that most of the fires are related to combustible liquids. We recommend a thorough inspection of the fuel and lubrication delivery systems paying particular attention to the fuel and lubrication piping

and completion of all maintenance required to repair or replace faulty equipment, piping and pipe supports.

- Similarly, complete a thorough inspection of the electrical equipment. Complete all maintenance required to repair or replace any faulty electrical equipment and wiring.
- Design and install fire barriers between units in plants where there may be sufficient space.

In addition, we recommend the following:

1. Initiate good housekeeping practices
2. Ensure all operators are fully trained in the area of safety and fire prevention
3. Installation of fire alarms and fire stop valves at each location where none currently exist or aren't operational
4. Implement proper control/safety procedures for contractors working on site
5. Perform annual fire/safety drills at each location
6. Provide training to diesel plant operators to enhance their capability to perform inspections of equipment/components that have a high risk of causing fire upon failure.

Appendix A

Vendor Documentation

FM APPROVED

Certificate of Compliance

FIXED EXTINGUISHING SYSTEMS, HYBRID FIRE EXTINGUISHING SYSTEMS

This certificate is issued for the following:

System Designation:	AquaSonic Water-Atomizing Fire Suppression System for the protection of combustion turbines and machinery spaces in enclosures with volumes not exceeding 36,730 ft3 (1040 m3) and a maximum height of 26 ft. 5 in. (8.0 m).
Design, Installation, Operation, and Maintenance Manual:	Ansul AquaSonic Water-Atomizing Engineered Fire Suppression System Design, Installation, Recharge, and Maintenance Manual, part number 437250, Rev. 0, March 1, 2010

Prepared for: ANSUL INCORPORATED
ONE STANTON STREET
MARINETTE, WI 54143

FM Approvals confirms that the products above have been found to comply with the following standards:

FM 5580 –Hybrid (Water and Inert Gas) Fire Extinguishing Systems, November 2009

Approval Identification: 3036042 Approval Granted: May 7, 2010

Said Approval is subject to satisfactory field performance, continuing follow-up Facilities and Procedures Audits, and strict conformity to the constructions as shown in the Approval Guide, an online resource of FM Approvals.

For more than 160 years FM Approvals has partnered with business and industry to reduce property losses.

Richard B. Dunne

5/7/10
Date

Richard B. Dunne
Group Manager- Hydraulics
FM Approvals
1151 Boston Providence Turnpike
Norwood, MA 02062

FM Approvals®

Member of the FM Global Group

AQUASONIC™ WATER-ATOMIZING FIRE SUPPRESSION SYSTEM

Data/Specifications

ANSUL

FEATURES

- FM Approved
- Effective suppression of Class B combustibles (i.e. flammable liquids, oils, greases, tars, oil-based paints, lacquers and flammable vapors)
- Environmentally safe
- Fully self-contained
- Minimal water discharge
- Optimized protected volume with minimal piping and system discharge devices
- Flexible system piping and atomizer location

APPLICATION

The AQUASONIC™ Water-Atomizing Fire Suppression System utilizes water droplets as the suppression agent. These droplets can effectively be applied in total flooding fire suppression applications having a free volume up to and including 9200 ft^3 (260 m^3). Applications include:

- Machinery Spaces
- Both Insulated and Non-Insulated Combustion Turbine Enclosures
- Generator Enclosures
- Flammable Liquid Storage

Note: Non-acceptable hazards include rack or palletized storage of flammable or combustible liquids.

PRINCIPLES OF OPERATION

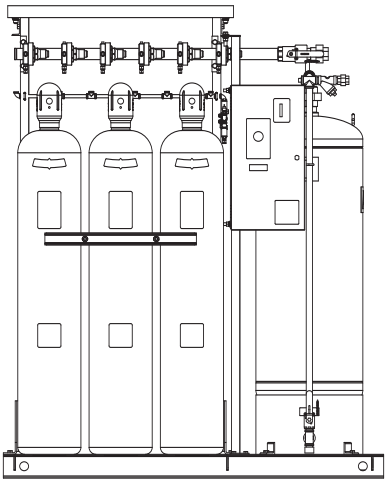
The AQUASONIC System suppresses a Class B fire by causing one or more of the following reactions:

- Heat extraction from the fire as water is converted into vapor and the fuel is cooled
- Dilution of flammable vapors by the entrainment of water vapor
- Cooling of liquid hydrocarbon fuels below vaporization temperature

When a fire condition is detected in the protected hazard, the detection and control system will actuate the AQUASONIC System which contains nitrogen cylinders and a water tank. The nitrogen storage cylinders provide pressure to drive the water to the system atomizers. When the system is operated, quick-opening valves on the nitrogen cylinders open and the gas pressure flows through pressure regulators which maintain the pressure at 125 psi (8.6 bar). This pressure drives the water through the opened water valve and to the system atomizers. The nitrogen discharge also provides the necessary pressure to create the water discharge plume.

Note: Water-atomizing systems shall not be used for direct application to materials that react with water to produce violent reactions or significant amounts of hazardous products. Such materials include the following:

- Reactive metals such as lithium, sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium
- Metal alkoxides, such as sodium methoxide
- Metal amides, such as sodium amide
- Carbides, such as calcium carbide
- Halides, such as benzoyl chloride and aluminum chloride
- Hydrides, such as lithium aluminum hydride
- Oxyhalides, such as phosphorus oxybromide
- Silanes, such as trichloromethylsilane
- Sulfides, such as phosphorus pentasulfide
- Cyanates, such as methylisocyanate



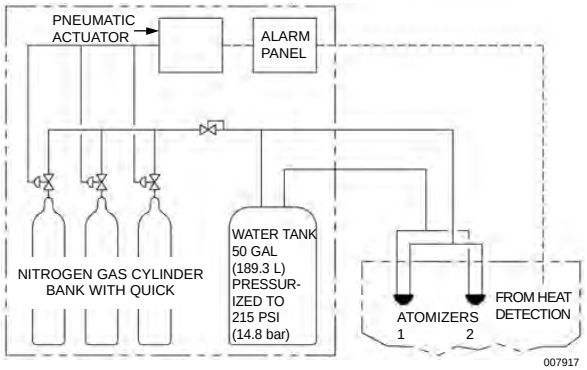
007888

DESCRIPTION

The AQUASONIC Water-Atomizing Fire Suppression System is a total flood system designed to protect Class B flammable liquid hazards in machinery spaces, both insulated and non-insulated combustion turbine enclosures, generator enclosures, and flammable liquid storage. The AQUASONIC system can protect a potential hazard with a free volume up to 9200 ft^3 (260 m^3) with two (2) atomizers that use low pressure, dual flow, supersonic atomization technology to create a minimum 10-minute discharge plume of water droplets that are the optimum size to suppress a Class B fire. When sprayed within an enclosure, the AQUASONIC Atomizer spray pattern expands slightly and the water droplets are primarily distributed (circulated) around the space via the high velocity atomizing media discharge. As the high velocity discharge plume of water droplets approaches the floor, or other horizontal obstruction, a large majority of the plume is diverted laterally, as well as vertically upwards, to fill the spaces between the core spray patterns and above the atomizers. The circulation characteristics of the AQUASONIC Atomizer plume result in rapid, homogenous distribution of water droplets throughout the protected environment. The AQUASONIC System has been fire tested within compartmentalized areas and found effective for the suppression of a wide variety of exposed and shielded Class B hydrocarbon pool, spray, and cascading pool fires.

DESCRIPTION (Continued)

The system is capable of automatic detection and actuation and/or remote manual actuation.



The above figure provides a system schematic. The engineered AQUASONIC System provides a less complex alternative to high pressure water mist systems. It is primarily comprised of a pre-packaged AQUASONIC Supply Skid containing both compressed nitrogen and stored water which upon actuation automatically supplies the necessary quantity of each to the AQUASONIC Atomizers.

A system installation and maintenance manual is available containing information on system components and procedures concerning design, operation, inspection, maintenance, and recharge.

The system is installed and serviced by authorized ANSUL distributors that are trained by the manufacturer.

COMPONENTS

AUTOPULSE® Control System – The AUTOPULSE Control system is designed to monitor fixed fire hazards. The control system can automatically actuate the AQUASONIC system after receiving an input signal from one or more initiating devices, i.e. manual pull station or detector. The control system incorporates an internal power supply, on-line emergency batteries, and solid state electronics.

ANSUL AUTOMAN® II-C Releasing Device – The ANSUL AUTOMAN II-C Releasing Device consists of a metal enclosure which contains a spring-loaded puncture pin release mechanism, an actuation cartridge, electrical circuitry, and an input/output terminal strip for making electrical connections. The ANSUL AUTOMAN II-C releasing device provides automatic pneumatic actuation of the AQUASONIC System. When wired to an AUTOPULSE Control System, it will provide supervised electric detection and release. It also provides manual actuation using the strike button on the release enclosure and with optional remote manual cable pull station. When an AUTOPULSE Control System is used, manual actuation is accomplished using an electric manual pull station. The ANSUL AUTOMAN II-C Releasing Device requires an LT-10-R nitrogen cartridge for system actuation. Cartridge must be ordered separately.

Remote Actuator (Optional) – The Remote Actuator is a device that allows for system actuation from a location either on or away from the AQUASONIC skid assembly. The actuator contains an LT-10-R nitrogen cartridge; when actuated, it will supply pressure to the quick-opening valves on the skid unit, allowing nitrogen to flow through the system.

50 Gallon Water Tank Assembly – The AQUASONIC System agent tank is a 50 gal (189.3 L) capacity water tank featuring a 0.17 in. (4.3 mm) thick ASME pressure vessel that is certified to 215 psi (14.8 bar). The tank features a 2 in. (5.1 cm) fill opening; the tank also has an outlet that is positioned for optimal flow, containing a Y strainer to stop any foreign particles in the water stream from reaching the Atomizer(s). The tank is internally coated with a black two-part epoxy primer which serves as a rust inhibitor.

Quick-Opening Valve and Cylinder Assembly – The AQUASONIC skid assembly contains multiple 3AA 2400 DOT rated 400 ft^3 (11.3 m^3) nitrogen cylinder assemblies. Each cylinder assembly contains a quick-opening valve and actuator. When the actuation pressure reaches the nitrogen actuation line to the cylinder assembly, the piston on the quick-opening valve actuator forces the lever of the valve to the open position, allowing nitrogen to flow through the system.

Regulator – The AQUASONIC skid assembly contains a regulator for each of the nitrogen cylinders. Each regulator is factory set at 125 psi (8.6 bar), allowing the proper nitrogen pressure to discharge the water from the tank to the atomizer. It also allows the necessary nitrogen pressure to flow directly to the atomizer to activate its supersonic atomization technology.

Atomizer – The AQUASONIC Atomizer utilizes patented supersonic technology, combining separate feeds of compressed nitrogen gas and water to generate and uniformly distribute water droplets throughout a protected volume. Each atomizer is delivered pre-trimmed with the appropriate water flow control orifice, strainer, mounting plate, and dust cap in place. The water supply inlet is 1/2 in. NPT, and the nitrogen supply inlet is 1 in. NPT. The AQUASONIC Atomizer utilizes an in-line restricting orifice to generate the appropriate water flow.

Note: When ordering an AQUASONIC system, the Atomizer Assembly must be specified.

APPROVALS/STANDARDS

Applicable Standards – The AQUASONIC Water-Atomizing Fire Suppression System complies with NFPA 750 (2006) “Standard on Water Mist Fire Protection Systems.”

FM Approved

INSTALLATIONS

All system components and accessories must be installed by personnel trained by the manufacturer. All installations must be performed according to the guidelines stated in the manufacturer’s design, installation, operation, inspection, recharge, and maintenance manual and NFPA 750.

AVAILABILITY AND COST

Availability – AQUASONIC Water-Atomizing Fire Suppression Systems are sold and serviced though a network of independent distributors located in most states and many foreign countries.

Cost – Cost varies with type of system specified, size and design.

TECHNICAL SERVICES

For information on the proper design and installation, contact a local authorized AQUASONIC System distributor. The ANSUL Technical Services Department is also available to answer design and installation questions. Call 800-TO-ANSUL (862-6785) or 715-735-7415.

ORDERING INFORMATION

Weight Part No.	Description	Shipping lb	Shipping (kg)
17728	ANSUL AUTOMAN II-C Releasing Device Shipping Assembly	26	(11.8)
423423	LT-10-R Nitrogen Cartridge Shipping Assembly	2	(1.0)
26310	Cocking Lever	1	(0.5)
30595	Remote Actuator Shipping Assembly	8	(3.6)
11160	Quick-Opening Valve Actuator	2	(1.0)
31059	400 ft^3 (11.3 m^3) N_2 Cylinder with Quick-Opening Valve	216	(98.0)
472014	Regulator	3	(1.4)
435877	Atomizer Shipping Assembly, including Restriction Orifice 0.092 in. (2.34 mm), Pressure Range 66-80 psi (4.6-5.5 bar)	19	(8.6)
435878	Atomizer Shipping Assembly, including Restriction Orifice 0.088 in. (2.24 mm), Pressure Range 81-95 psi (5.6-6.6 bar)	19	(8.6)
435879	Atomizer Shipping Assembly, including Restriction Orifice 0.084 in. (2.13 mm), Pressure Range 96-115 psi (6.7-7.9 bar)	19	(8.6)
435880	Atomizer Shipping Assembly, including Restriction Orifice 0.080 in. (2.03 mm), Pressure Range 116-140 psi (8.0-9.7 bar)	19	(8.6)

SPECIFICATIONS

An ANSUL AQUASONIC Water-Atomizing Fire Suppression System shall be furnished.

1.0 GENERAL

1.1 References

1.1.1 Factory Mutual (FM)

1.1.2 National Fire Protection Association (NFPA)

1.1.2.1 NFPA 750

1.2 Submittals

1.2.1 Submit two sets of manufacturer's data sheets

1.2.2 Submit two sets of piping design drawings

1.3 System Description

1.3.1 The system shall be an automatic fire suppression system using patented supersonic technology for Class B combustibles

1.3.2 The system shall be capable of suppressing fires in the following areas: machinery spaces, both insulated and non-insulated combustion turbine enclosures, generator enclosures, and flammable liquid storage.

1.3.3 The system shall be an engineered type with a self-contained supply skid. The system design shall require limits set by the manufacturer and require that the final piping design be established utilizing calculations stated in the manufacturer's design manual. All design limitations shall be approved by Factory Mutual (FM).

1.3.4 The system shall be installed and serviced by personnel trained by the manufacturer.

1.3.5 The system shall be capable of protecting machinery spaces by utilizing total flooding application.

1.4 Quality Control

1.4.1 Manufacturer: The AQUASONIC Water-Atomizing Fire Suppression System shall be manufactured by a company with at least thirty years experience in the design and manufacture of engineered fire suppression systems. The manufacturer shall be ISO 9001 registered.

1.5 Warranty, Disclaimer, and Limitations

1.5.1 The engineered water-atomizing fire suppression system components shall be warranted for five years from date of delivery against defects in workmanship and material.

1.6 Delivery

1.6.1 Packaging: All system components shall be securely packaged to provide protection during shipment.

1.7 Environmental Conditions

1.7.1 The AQUASONIC system shall be capable of operating in a temperature range of 40 °F (4 °C) to 130 °F (54 °C).

SPECIFICATIONS (Continued)

2.0 PRODUCT

2.1 Manufacturer

2.1.1 Ansul Incorporated, One Stanton Street, Marinette, Wisconsin 54143-2542, Telephone (715) 735-7411.

2.2 Components

2.2.1 The system shall consist of an AUTOPULSE Control system which is designed to monitor fixed fire hazards. The control system can automatically actuate the AQUASONIC system after receiving an input signal from one or more initiating devices, i.e. manual pull station or detector. The control system incorporates an internal power supply, on-line emergency batteries, and solid state electronics.

2.2.2 The ANSUL AUTOMAN II-C Releasing Device shall consist of a metal enclosure which contains a spring-loaded puncture pin release mechanism, an actuation cartridge, electrical circuitry, and an input/output terminal strip for making electrical connections. The ANSUL AUTOMAN II-C releasing device shall provide automatic pneumatic actuation of the AQUASONIC System. When wired to an AUTOPULSE Control System, it shall provide supervised electric detection and release. It also provides manual actuation using the strike button on the release enclosure and with optional remote manual cable pull station. When an AUTOPULSE Control System is used, manual actuation shall be accomplished using an electric manual pull station. The ANSUL AUTOMAN II-C Releasing Device requires an LT-10-R nitrogen cartridge for system actuation.

2.2.3 Remote Actuator: The Remote Actuator shall allow for system actuation from a location either on or away from the AQUASONIC skid assembly. The actuator shall contain an LT-10-R nitrogen cartridge; when actuated, it will supply pressure to the quick-opening valves on the skid unit, allowing nitrogen pressure to flow through the system.

2.2.4 Agent Tank: The AQUASONIC System agent tank shall be a 50 gal (189.3 L) capacity water tank featuring a 0.17 in. (4.3 mm) thick ASME pressure vessel that is certified to 215 psi (14.8 bar). The tank shall feature a 2 in. (5.1 cm) fill opening; the tank also has an outlet that is positioned for optimal flow, containing a Y strainer to stop any foreign particles in the water stream from reaching the atomizer(s). The tank shall be internally coated with a black two-part epoxy primer which serves as a rust inhibitor.

2.2.5 Quick-Opening Valve and Cylinder Assembly: The AQUASONIC skid assembly shall contain multiple 3AA 2400 DOT rated 400 ft^3 (11.3 m^3) nitrogen cylinder assemblies. The cylinder assembly shall contain a quick-opening valve and actuator. When the actuation pressure reaches the cylinder assembly, the piston on the quick-opening valve actuator forces the lever of the valve to the open position, allowing nitrogen to flow through the system.

2.2.6 Regulator: The AQUASONIC skid assembly shall contain a regulator for each of the nitrogen cylinders. Each regulator shall be factory set at 125 psi (8.6 bar), allowing the proper nitrogen pressure to discharge the water from the tank to the atomizer. It also allows the necessary nitrogen to flow directly to the atomizer to activate its supersonic atomization technology.

2.2.7 Atomizer: The AQUASONIC Atomizer shall utilize patented supersonic technology, combining separate feeds of compressed nitrogen gas and water to generate and uniformly distribute water droplets throughout a protected volume. Each atomizer shall be delivered pre-trimmed with the appropriate water flow control orifice, strainer, mounting plate, and dust cap in place. The water supply inlet shall be 1/2 in. NPT, and the nitrogen supply inlet 1 in. NPT. The AQUASONIC Atomizer utilizes an in-line restricting orifice to generate the appropriate water flow.

3.0 IMPLEMENTATION

3.1 Installation

3.1.1 The AQUASONIC Water-Atomizing Fire Suppression System shall be designed, installed, inspected, maintained, and recharged in accordance with the manufacturer's listed instruction manual and NFPA 750.

3.2 Training

3.2.1 Training shall be conducted by representatives of the manufacturer.

THE CLEAR WINNER

SAPPHIRE® Clean Agent Fire Suppression Systems

ANSUL
Innovative Fire Solutions

WHEN IT COMES TO PROTECTING CRITICAL ASSETS, NOTHING COMES CLOSE TO SAPPHIRE

Using water as a fire suppressant in areas where electronics operate and irreplaceable, high-value assets are stored could be as devastating as fire itself. Protect them instead with an ANSUL® SAPPHIRE® clean agent system, custom-engineered to quickly suppress fires and protect sensitive equipment without causing harm to people or the environment.

THE DIFFERENCE IS CRYSTAL CLEAR

The heart of the system is revolutionary 3M™ Novec™ 1230 fire protection fluid, a clear, colorless and odorless clean agent. Stored in cylinders in its fluid form, Novec 1230 instantly vaporizes upon discharge, totally flooding protected spaces and absorbing heat better than water. In tandem with a sophisticated ANSUL AUTOPULSE® control panel, the SAPPHIRE system suppresses a fire before it can start by detecting it at invisible levels. And once the danger has passed, Novec 1230 quickly evaporates without harming any valuable assets.

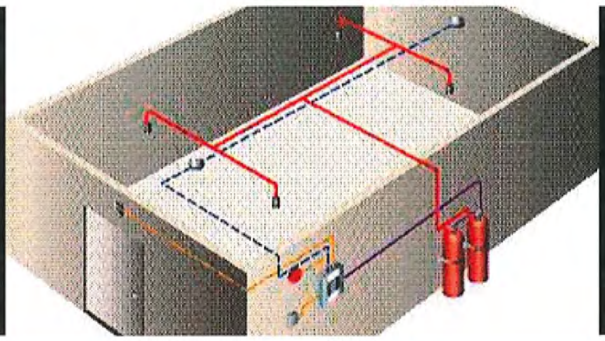
SAPPHIRE suppression systems represent the most effective fire protection on the market today. These systems are especially suited to suppress fires in areas where an electrically non-conductive medium is required, where electronic systems cannot be shut down in an emergency, where cleanup of other agents poses a problem, and in normally occupied areas that demand a non-toxic agent.

REPLACES HALON, HFC'S AND PFC'S ■ EFFECTIVE ON CLASS A, B AND C FIRES

ZERO OZONE DEPLETION ■ LOW DESIGN CONCENTRATION REQUIREMENTS

UL/ULC, FM AND OTHER INTERNATIONAL APPROVALS

TYPICAL SAPPHIRE SYSTEM DESIGN



SAFE FOR PEOPLE

Because it is used at concentrations of only 4 to 6% by volume, well below the 10% concentration maximum for safe exposure, Novec 1230 provides the widest safety margin of any chemical clean agent available today. In accordance with NFPA 2001, Novec 1230 is safe for occupied spaces.

SAFE FOR THE PLANET

An ozone depletion potential (ODP) of zero, a global warming potential (GWP) of one and a five-day atmospheric lifetime (the next closest product is 33 years) makes Novec 1230 the cleanest, most environment-friendly chemical agent in existence.

TOTAL AREA PROTECTION

The standard ANSUL SAPPHIRE fixed nozzle system is capable of automatic detection and actuation and/or remote manual activation. Detection is provided 24/7 through an ANSUL AUTOPULSE® Control System, with other detection options available. Each system is custom engineered to the specific application by trained ANSUL distributors.

APPLICATIONS THAT BENEFIT FROM SAPPHIRE SUPPRESSION SYSTEMS:

- AVIATION FACILITIES
- COMMERCIAL/NAVAL VESSELS
- COMPUTER AND ELECTRONIC CONTROL ROOMS
- CRITICAL MILITARY SYSTEMS
- DATA PROCESSING CENTERS
- MEDICAL FACILITIES
- MUSEUMS
- OFFSHORE PLATFORMS
- POWER GENERATION PLANTS
- TAPE STORAGE AND VAULTS
- TELECOMMUNICATIONS SWITCH ROOMS

ANSUL
Innovative Fire Solutions

tyco

Ansul Incorporated
One Stanton Street
Marinette, WI 54143-2542

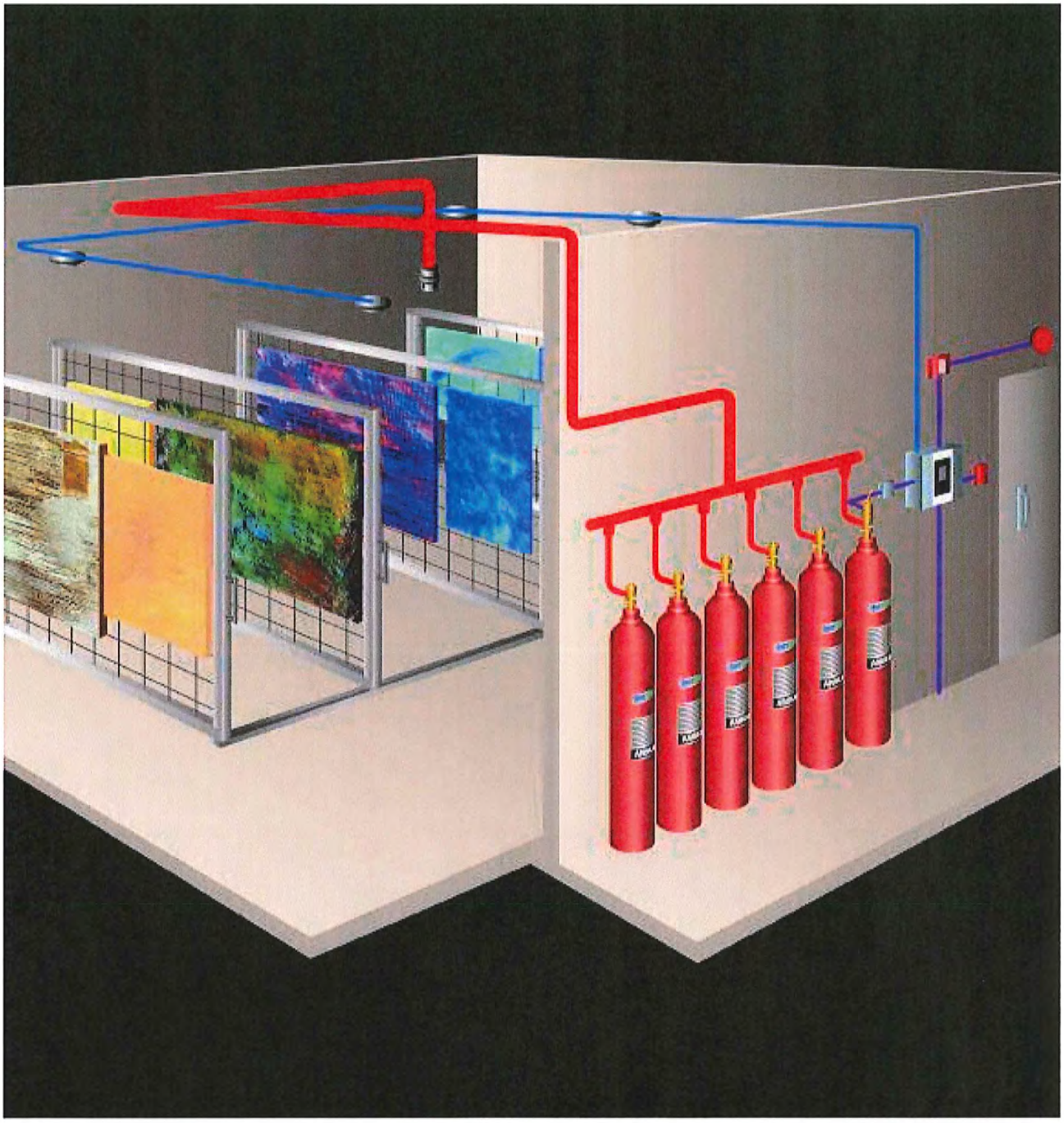
800-862-6785 (United States, Canada)
715-735-7411 (International)
www.ansul.com

Form No. F-2006076-1

PRICELESS PROTECTION

INERGEN® Clean Agent Fire Suppression Systems

ANSUL®
Innovative Fire Solutions



DETECT-SUPPRESS-PROTECT

THE INERGEN CLEAN AGENT SYSTEM

FROM ANSUL

INERGEN IS BETTER FOR YOUR PROPERTY

Upon discharge, INERGEN instantly floods the room, remaining suspended to suppress fires quickly and effectively. An inert gas mixture, INERGEN is absolutely free of residues and corrosive by-products that may produce further property damage. In performance testing, INERGEN easily exceeded the NFPA Standard 2001 allowance of one-minute discharge, with documented extinguishments of 22 seconds for a Class A fire and 17 seconds for a Class B fire.

Reliable and field proven, INERGEN delivers the performance you would expect from the world leader in fire suppression.

BETTER FOR YOUR PEOPLE

One of the most remarkable aspects of INERGEN is that it is safe for people. Unlike halocarbon (chemical) alternatives, which can create dangerous levels of hydrogen fluoride when in the presence of fire, INERGEN is entirely nontoxic, producing no corrosive decomposition products whatsoever. Plus, because INERGEN will not produce a fog when discharged, escape routes remain visible.

With INERGEN, the oxygen level is reduced enough to put out the flames, yet more than enough remains to breathe. In fact, those who breathe normally around INERGEN in extinguishing concentrations receive the same amount of oxygen to the brain as they would in an ordinary atmosphere, vital in cases where immediate evacuation may not be possible.

BETTER FOR THE ENVIRONMENT

The production of Halon 1301 was banned in 1993, a direct result of its negative effects on the ozone layer. We engineered INERGEN to be environmentally kind from the very start. INERGEN is non-synthetic, made exclusively of gases we already breathe: nitrogen, argon, and carbon dioxide. Once discharged, it simply returns to the atmosphere in its natural state. And because it poses no ozone depletion or global warming potential, INERGEN will never be subject to future legislative bans.




STATE-OF-THE-ART DETECTION AND CONTROL

INERGEN systems combine exclusive AUTOPULSE® microprocessor units with highly sensitive smoke, heat and flame detectors, and specialized agent distribution components, designed to detect and suppress a fire even before it reaches the flame stage. The AUTOPULSE units also perform other key functions in case of fire, including sounding alarms, closing doors, and shutting down equipment. In conjunction with manual pull stations, the system provides automatic detection, day and night.

FLEXIBILITY IS ALREADY BUILT IN

INERGEN agent is stored as a gaseous mixture in DOT-approved steel cylinders filled to nominal capacities of 200 to 435 cu. ft. (5.7 to 12.3 cu. m). Available in four sizes, you can choose to install your cylinders either vertically or horizontally, allowing for a design that requires the fewest number of cylinders and the lowest cost. You then have a choice of setting up your cylinders to open electrically, pneumatically or manually, depending on your need.

MAKE ANSUL YOUR FIRE PROTECTION PARTNER THROUGHOUT YOUR BUSINESS

From INERGEN automatic detection and suppression systems to a full range of wheeled and portable extinguishers and more, no other fire suppression brand promises the full range of solutions or the quality of ANSUL. And we back all of our products with a worldwide network of factory-trained distributors — the largest and best qualified in the industry.

APPLICATIONS THAT BENEFIT FROM INERGEN SUPPRESSION SYSTEMS:

- AUTOMATED TAPE STORAGE LIBRARIES
- COMPUTER AND DATA PROCESSING FACILITIES
- CULTURAL AND HISTORICAL SITES
- HOSPITAL AND MAJOR MEDICAL FACILITIES
- MARINE/OFFSHORE/ NAVAL
- MUSEUMS AND ART GALLERIES
- POWER GENERATION FACILITIES
- TELECOMMUNICATION FACILITIES




EVEN AFTER THE FIRE, YOU'RE UP AND RUNNING

In minutes, fire and the attempts to put it out can destroy the equipment that keeps your operation in action. And yet, without the right defenses in place — those that protect people, property and the environment — many businesses are putting themselves at needless risk every day. Others, however, have an INERGEN® system at the ready.

Created as an ozone-safe replacement for Halon 1301, INERGEN is the nucleus of ANSUL's contemporary approach to fire protection: protect lives, protect property and protect the environment.

Clean, non-conductive INERGEN is a natural fire suppression agent particularly suited to areas where damage from conventional agents cannot be tolerated, such as sensitive data storage, information processing and systems operation electronics. In addition, many archival organizations use INERGEN to protect valuable, irreplaceable items such as artwork, historic documents and antiquities.

NO OZONE DEPLETION, GLOBAL WARMING POTENTIAL OR ATMOSPHERIC LIFETIME

ENTIRELY INERT ■ SAFE FOR SENSITIVE ELECTRONICS AND IRREPLACEABLE ITEMS

ALL-NATURAL ■ UL/ULC, FM, USCG AND MANY INTERNATIONAL APPROVALS/LISTINGS

EVERGREEN DISCHARGE WARRANTY ■ ENVIRONMENTAL WARRANTY

ANSUL
Innovative Fire Solutions

tyco

Ansul Incorporated
One Stanton Street
Marinette, WI 54143-2542

800-862-6785 (United States, Canada)
715-735-7411 (International)
www.ansul.com

Form No. F-2006100

AUTOPULSE® Z-10 AGENT RELEASE CONTROL PANEL

Data/Specifications

FEATURES

Agent Release Control Panel designed specifically for suppression release operation with:

- Four initiating device circuits (IDCs)
- Two notification appliance circuits (NACs)
- Two release appliance circuits (RACs)
- Two special purpose monitor inputs (SPMs) for manual release request and manual abort request
- Three auxiliary relays with selectable functions
- Easily selected activity timing options

Agent release operation includes:

- Automatic extinguishing release
- Deluge and preaction sprinkler system release
- Dual or single hazard area protection
- Combined agent release and preaction operation*
- IDCs are selectable for cross-zoning or for activation from a single detection input
- Short circuit RAC supervision

Operator interface provides:

- Status LEDs per circuit for Alarm, Trouble, and Supervisory (where appropriate)
- Acknowledge, alarm silence, and system reset
- Operating mode and timer selection when in programming mode

Audible Escalation of Events:

- Single Audible Appliance Tone: Stage 1 activates Temporal or 20 bpm March Time pattern; Stage 2 activates 120 bpm March Time pattern to indicate release timer active; Release activates On Steady to indicate release timer expired and actuator is activated
- Dual Audible Appliance Control* (Single Hazard): RAC 2 provides a third NAC for dedicated Stage 1 Bell control; NACs 1 & 2 indicate release as On Steady

Compatible with Listed/Approved 24 VDC coil automatic water control valves

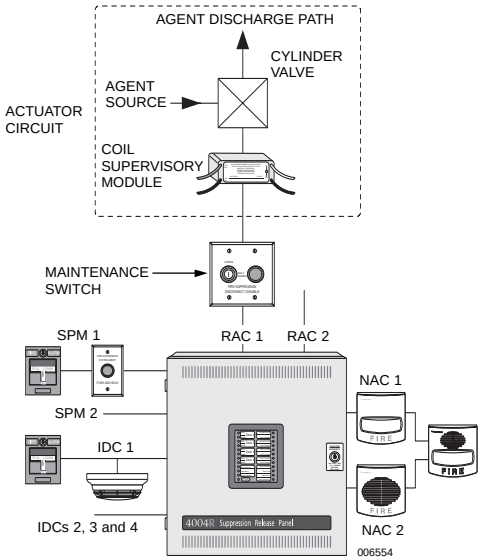
Required system components:

- Coil supervision module, Part No. 430687, one per solenoid control RAC
- Maintenance Switch, Part No. 433936 or 433937, one per solenoid control RAC

Recommended accessory (where appropriate):

- Abort Switch:
  – Part No. 433940, Flush Mount

* Requires software revision 4.01 or higher



AUTOPULSE Z-10 Agent Release Control Panel One-Line System Reference Drawing

INTRODUCTION

Dedicated for Agent Release: AUTOPULSE® Z-10 Suppression Release Panels provide conventional fire alarm control circuits and are equipped with the features required for a wide variety of single or dual hazard suppression release applications. Capabilities include automatic extinguishing agent release and deluge and preaction sprinkler control.

Flexible I/O Capabilities: Four IDCs allow for either four separately monitored zones or two, cross-zoned connections. Two SPMs allow dedicated manual inputs for release or abort. Two releasing appliance circuits (RACs) supervise to the actuator coils and activate the actuators when required. The two NACs and the three panel auxiliary relays provide status condition information.

Easy Program Selections: The operator panel has a program mode that allows selection of panel operation type and detailed operating selections using an easily selected sequential programming operation.

History Log: The last 50 events are stored in non-volatile memory. This information is accessed by connecting a technician's computer to the service port which is also used to set the date and time.

PANEL FEATURE DESCRIPTION

Operator Panel: The operator panel has alarm and trouble status indicating LEDs for each input and output, visible through the locking cabinet door. Unlocking the door provides access to the Acknowledge, Alarm Silence, and System Reset push-button switches.

Four Class B IDCs provide coverage for either two cross-zoned areas or four separately zoned areas. IDCs are capable of supporting up to 30 current-limited smoke detectors or electronic heat detectors as well as manual stations and other compatible contact closure initiating devices. IDCs are capable of Class A operation with an optional adapter module and can be programmed as Class C (short or open initiates a trouble) for use with current limited devices only. Single hazard agent release applications monitor low pressure switches on IDC3 and tamper switches with IDC4.

PANEL FEATURE DESCRIPTION (Continued)

Two Class B Special Purpose Monitoring Circuits (SPMs) are dedicated for manual release or abort, waterflow and supervisory, or release/abort and pressure, depending on system type. Inputs are normally open switches. An abort switch stops release while activated and upon deactivation, the release operation occurs after a selectable time delay. Manual release inputs override abort switches and activate the release after selectable delays of from 0 to 30 seconds in 5 second increments. For Dual Hazard applications, current limited abort operation is required. SPMs are programmable as Style C and capable of Class A operation with the optional adapter module.

Two Class B NACs are provided for reverse polarity, notification appliance operation, each rated 2 A. Class A operation is available with the optional adapter module. NAC operation is selectable per application.

Two Class B Release Appliance Circuits (RACs): Rated 2 A each, these circuits are dedicated to operating release control actuators. RAC cutout timing is selectable as no cutout, 45 seconds, or 1, 3, 3.5, 4, 5, 6, 7, 21, 25, 34, 44, or 64 minutes. For bell/horn/strobe single hazard applications, RAC 2 functions as a third NAC (NAC 3).

Auxiliary Power Output: Rated at 750 mA, this output can be wired as continuous or as resettable. Resettable is normally used to power 4-wire smoke detectors.

Standard Auxiliary Relay Outputs: Three relays outputs are available, selectable as normally open or normally closed, rated 2 A @ 30 VDC.

Trouble Relay (Aux Relay 1) is energized when Normal and is de-energized with a Trouble condition.

For Single Hazard Operation: Aux Relay 2 is the Alarm relay and Aux Relay 3 indicates Time Delay Started or can optionally be selected as a Supervisory relay.

For Dual Hazard Operation: Aux Relay 2 is for Hazard Area 1 Alarm; Aux Relay 3 is for Hazard Area 2 Alarm.

Power Supply and Battery Charger: During alarm, the power supply provides 3 A at 25.5 VDC, filtered and regulated. The temperature compensated battery charger provides 27.5 VDC for charging batteries suitable for up to 90 hour standby and 10 minutes of alarm. External battery chargers and cabinets can be used for more battery backup.

RELEASE CONTROL SYSTEM REFERENCE

Automatic Agent Release Systems: These systems automatically activate solenoid control valves for the release of a fire extinguishing agent in response to fire detection device input.

Automatic Extinguishing Release Systems with Separate Bell Control (single hazard) (SW rev. 4.01 or higher). RAC 2 operates as a bell control NAC. When cross-zoned, stage 1 alarm activates the bell until the release timer starts. When not cross-zoned, stage 1 alarm activates the bell until expiration of the release timer. In both cross-zoned and non cross-zoned applications, NAC2 may be programmed to indicate either a tamper switch supervisory condition or the start of the release timer using a cadence pattern operation.

UL and FM Extinguishing Release System Panels must have a minimum of 24 hours of standby power. Initiating devices must be Listed/Approved for the application, and may be wired either Class A or B. Actuators must be electrically compatible with the control panel circuits and power supplies, and are wired Class B to provide coil supervision.

Deluge and Preaction Sprinkler Systems automatically activate water control valves in response to fire detection device input.

Deluge Sprinkler Systems employ open sprinkler heads and provide water flow when the fire detection system activates a common automatic water control valve. They are used to deliver water simultaneously through all of the open sprinkler heads. This type of system is applicable where the immediate application of large quantities of water over large areas is the proper fire response.

Preaction Sprinkler Systems are similar to deluge systems except that normally closed sprinkler heads are used and supervisory air pressure is maintained in the pipe. Operation requires both an activated sprinkler head and an activated fire alarm initiating device.

Combined Agent Release and Preaction Systems provides agent release and preaction control. (Available with software revision 4.01 or higher.) For applications where agent release may not be sufficient for fire control, sprinklers are put in preaction mode to allow waterflow to continue the fire response. (Preaction is assumed, selected deluge could be provided, determined by the sprinkler installation, panel operation is the same.)

UL requirements for Fire Alarm Systems Listed for Automatic Release or Deluge and Preaction Sprinkler Systems are the same as described above for Automatic Extinguishing Release Systems.

FM Approved requirements for Fire Alarm Systems for Automatic Release of Deluge and Preaction Sprinkler Systems require operation of specific compatible FM Approved Automatic Water Control Valves, a minimum secondary power capacity of 90 hours, and all circuits for the automatic release initiating devices must be capable of operation during a single open circuit fault condition (Class A).

AUTOPULSE Z-10 PRODUCT SELECTION

RELEASE CONTROL PANEL

Part No.	Description	Reference
430525	Basic Releasing Panel, operates with AC input of: 120/220/230/240 VAC, 50/60 Hz (auto-select)	Includes: Four IDCs, two NACs, two SPMs, two RACs, 3 A power supply with battery charger, cabinet and door

EXPANSION MODULES

Part No.	Description	Reference	
430529	Auxiliary Relay Module; four relays, Form C, rated 7 A @ 120 VAC, 5 A @ 30 VDC, unsupervised contacts	Two maximum	Select as required
430531	Two Circuit Class A Adapter Module for IDCs, SPMs, or NACs	Four maximum	

Batteries

Part No.	Description	Reference
417692	7.0 AH Battery Pack, 24 VDC	Select one battery shipping assembly per system standby requirements; two batteries are included
417693	12 AH Battery Pack, 24 VDC	
417694	17 AH Battery Pack, 24 VCD	Requires external battery cabinet
417695	25 AH Battery Pack, 24 VDC	

Release Control System Modules

Part No.	Description
430687	Coil Supervision Module, **one required per RAC;** refer to pages 6 and 7 for detail
433936 or 433937	Maintenance Switch, **one required per RAC**
433940	Abort Switch
431196	Abort Supervision Module

FM APPROVED WATER CONTROL VALVES

FM Group	Manufacturer	Model Number	Details
A	Skinner	LV2LBX25	24 VDC, 11 W, 458 mA, 1/2 in NPS, 1/2 in orifice
B	ASCO	T8210A107	24 VDC, 16.8 W, 700 mA, 1/2 in NPS, 5/8 in orifice
		R8210A107	
		8210A107	
C	Star Sprinkler	5550	24 VDC, part of Model D deluge valve
D	ASCO	8210G207	24 VDC, 10.6 W, 440 mA, 1/2 in NPS, 1/2 in orifice
		V2648571, N.C.	
		HV2648581, N.O.	
E	Skinner	73218BN4UNLVNOC111C2	24 VDC, 10 W, 420 mA, 1/2 in NPS, 5/8 in orifice
		73212BN4TN00N0C111C2	24 VDC, 10 W, 420 mA, 1/2 in NPS, 5/8 in orifice; 5-300 psi rated working pressure
F	Skinner	73212BN4TNLVNOC322C2	24 VDC, 22 W, 1/2 in NPS, 920 mA, 250 psi (1725 kPa),1/2 in orifice
G	Skinner	71395SN2ENJ1NOH111C2	24 VDC, 10 W, 420 mA, 1/4 in NPS, 1/16 in orifice, 250 psi (1725 kPa) rated working pressure
H	Viking	HV-274-060-001	24 VDC, 22.6 W, 940 mA, 1/2 in NPS, 250 PSI (1725 kPa), 3/4 in orifice

SPECIFICATIONS

Power Ratings		
AC Input	Voltage Ratings	120 VAC, 60 Hz; 220/230/240 VAC, 50/60 Hz, auto-select
	Current Ratings	2 A maximum @ 120 VAC input; 1 A maximum @ 240 VAC input
Power Supply Output		3 A maximum available for external loads
Battery Charger		Temperature compensated, capable of recharging batteries required for 90 hour standby and 10 minute alarm (contingent on auxiliary power load)
Standby Current		100 mA; with IDCs fully loaded, tone-alert silenced, trouble LED on, charger off
Alarm Current		264 mA + external loads; (2 zones in alarm & 2 internal relays, NACs and RACs on)
Standard Circuit Ratings		**(NOTE:** Total DC current = 3 A maximum; see NAC ratings for details)
Initiating Device Circuits (IDCs)	Supervisory	3 mA maximum; 3.3 kΩ end-of-line resistor per circuit
	Alarm Current	75 mA maximum
	Output Voltage	28 VDC maximum
	Capacity	Each IDC supports up to 30 detectors (smoke or electronic heat) and manual stations as required; wiring distance is limited to 50 Ω maximum
Special Purpose Monitoring Circuits (SPMs)	Application	For Manual Release, Abort Switches, or Supervisory functions only; not for detectors; wiring distance is limited to 50 Ω maximum
	For Dual Hazard Applications	Dual Hazard Application Abort Switches require a current limiting resistor of 1.2 kΩ, 1 W, or an external Abort Supervision Module per SPM
	Supervisory	6 mA; 3.3 kΩ end-of-line resistor per circuit
	Activated	75 mA maximum
	Output Voltage	28 VDC maximum
Notification Appliance Circuits (NACs)		Special Application appliance rating = 2 A maximum on a NAC **NOTE:** Special Application appliance rating = full 3 A power supply rating
	Alarm Current	Regulated 24 DC appliance power = 1.5 A maximum on a circuit **NOTE:** Regulated 24 DC strobe load = 1.35 A maximum total for power supply
	Output Voltage	Alarm = 26 VDC max.; supervisory = 29 VDC maximum; 10 kΩ end-of-line resistor
	Synchronized Strobe Operation	Requires NAC dedicated to strobe control with non-coded output; use an external Synch Module; up to 33 strobes can be synchronized per Z-10
Notification Appliance Reference	Regulated 24 DC Appliances	Power for other appliances listed to UL Standard 1971 or UL Standard 464; use associated external synchronization modules where required
	Output Current	2 A maximum per circuit
Release Appliance Circuits (RACs)	Output Voltage	Activated = 26 VDC maximum; non-alarm = 29 VDC maximum; 10 kΩ end-of-line resistor
Auxiliary Power Output; for Special Application loads only		Two outputs are available, continuous operation or resettable operation; combined output is 750 mA maximum; output voltage = 19.25 to 27 VDC
Auxiliary Relay Outputs (Trouble, Aux Relay 2, Aux Relay 3)		Contacts rated 2 A @ 30 VDC, 0.35 p.f., inductive, selectable as N.O. or N.C. by jumper
Wiring Connections for Above and AC Input		Terminals rated for 18 AWG to 12 AWG (0.82 mm^2 to 3.31 mm^2)
Auxiliary Module Ratings		
Class A Adapter Module 430531		Two circuits per module, rated same as circuits; not applicable to RACs (no additional current required)
Auxiliary Relay Module 430529	Relay Type	Four relays with two outputs per relay; individually selectable as N.O. or N.C.
	AC Ratings	7 A @ 120 VAC, resistive
	DC Ratings	5 A @ 30 VDC, 0.35 power factor, inductive

SPECIFICATIONS (Continued)

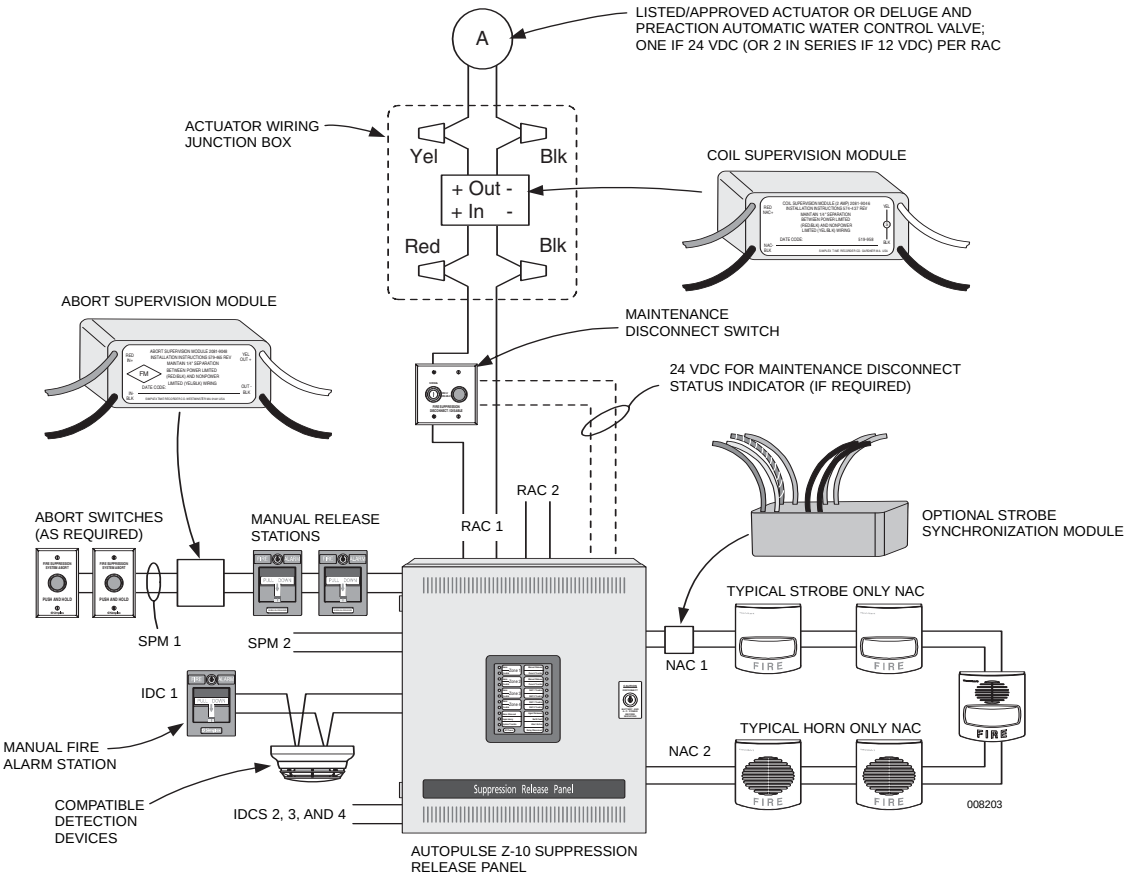
Auxiliary Module Ratings (Continued)		
Auxiliary Relay Module 430529 (Continued)	Module Current	12 mA standby; 70 mA with all four relays energized; @ 24 VDC
	Wiring	Terminals rated for 18 AWG to 12 AWG (0.82 mm^2 to 3.31 mm^2)
Coil Supervision Module		
	Construction	Epoxy encapsulated
	Dimensions	1-3/8 in. W x 2-7/16 in. L x 1-1/16 in. H (34 mm x 62 mm x 27 mm)
	Wiring	18 AWG (0.82 mm^2) wire leads, color coded
	Coil Supervision Module Current Rating	2 A maximum; internally fused at 3 A, non-replaceable
Environmental Ratings		
	Operating Temperature Range	32 °F to 120 °F (0 °C to 49 °C)
	Operating Humidity	Range up to 93% RH, non-condensing @ 100.4 °F (38 °C) maximum

REFERENCE INFORMATION, COMPATIBLE DETECTORS

Part No.	Type	Component Sheet
430559	LIFEalarm® Photoelectric Detector 2.8%/ft Obscuration (Standard)	T-2007153
430562	LIFEalarm® Photoelectric Detector 3.5%/ft Obscuration	
430565	135° F (57°C) Fixed Heat Detector	T-2007159
430566	200° F (93°C) Fixed with Rate-of-Rise Heat Detector	T-2007159

NOTE: For proper detector bases, refer to Component Sheet T-2007153.

AUTOPULSE Z-10 SYSTEM CONNECTION REFERENCE



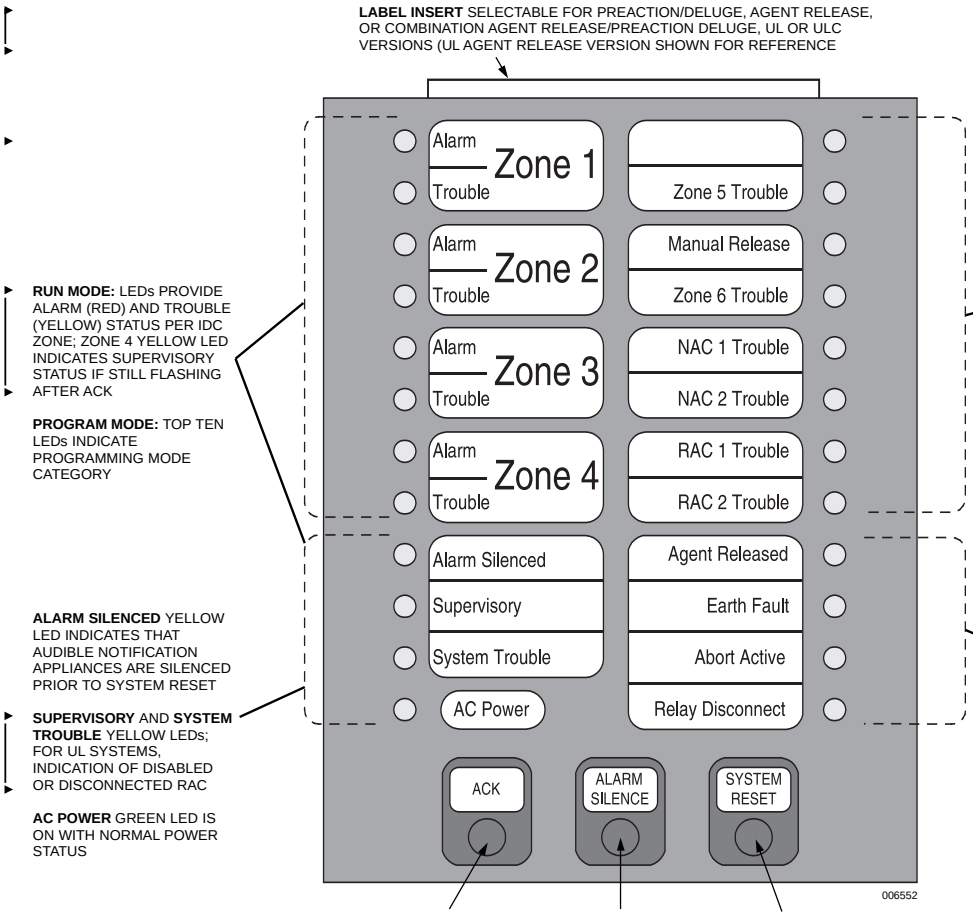
GENERAL WIRING NOTE:
WIRING SHOWN IS FOR REFERENCE ONLY, REFER TO SPECIFIC INSTALLATION INSTRUCTIONS FOR DETAILED WIRING INFORMATION.

PROGRAMMING MODES AND SELECTION CHOICES

Sequence	Select one of 13 Application Modes *(numbered 1 through 13)*				
1	Agent Release	Single Hazard	Cross-Zoned	1	Combined Release (RACs activate together)
			Either Zone	2	
		Dual Hazard	Cross-Zoned	3	Independent Release (RACs are separate)
			Either Zone	4	
	Preaction/Deluge	Single Hazard	Cross-Zoned	5	Combined Release (RACs activate together)
			Either Zone	6	
		Dual Hazard	Cross-Zoned	7	Independent Release (RACs are separate)
			Either Zone	8	
	Agent Release; Single Hazard	Cross-Zoned	9	NYC Abort (not UL listed)	
	Agent Release & Preaction; Single Hazard	Cross-Zoned Either Zone	10 11	RAC 2 provides Preaction Control; RAC 1 is Agent Release Control	
	Agent Release, Bell/Horn/Strobe; Single Hazard	Cross-Zoned Either Zone	12 13	RAC 2 operates as NAC 3 for Stage 1 Bell Control (separate sound from release alarm)	

Sequence	Programming Mode Description	Description	
2	Select Relay Operation for Application Modes 1-9	Select “Original” operation mode or “Enhanced" mode	
3	IDC and SPM Circuit Style	Class B/Class A or Style C	
4	Automatic Release Time Delay	Selectable in 5 second increments from 0 to 60 seconds (default is 60 seconds)	
5	RAC Cutout Timer	No cutout, 45 seconds, or 1, 3, 3.5, 4, 5, 6, 7, 21, 25, 34, 44, or 64 minutes	
6	Manual Release Time Delay	0, 5, 10, 15, 20, 25, or 30 seconds	
7	Abort Release Time Delay	UL Standard 864 listed	Immediate or 10 seconds remaining
		Not UL Standard 864 listed	IRI abort (cross-zoned systems only), NYC abort, or original release delay
8	NAC Coding (where selectable)	Temporal pattern or 20 beats per minute (first cross-zone alarm)	
9	NAC Operation — Standard Operation	No inhibit or one minute inhibit selected as: both on until silence, NAC 1 on until reset and NAC 2 on until silence, or both on until reset;	
	NAC Operation — Pre-Discharge Operation	**NOTE:** For clean agent release, a pre-discharge NAC must be configured to warn of impending discharge, the release timer selects the duration of the pre-discharged signal	
10	Supervisory Latching	Latching or non-latching	
11	Supervisory Notification	LED and tone-alert only, or with: NAC 2 also on; Aux Relay 3 also on; or both NAC 2 and Aux Relay 3 also on	

OPERATOR PANEL FUNCTION REFERENCE



RELEASE CONTROL SYSTEM REQUIREMENTS

1. Solenoid valves are connected as 2-wire, Class B notification/releasing circuits **with only one 24 VDC solenoid valve per circuit** (or two, 12 VDC solenoids in series if applicable) to ensure supervision.
2. Coil Supervision Module, Part No. 430687, must be wired electrically before the solenoid valve and located in the solenoid valve wiring junction box.
3. For FM Approved Deluge and Preaction Sprinkler operation, initiating device circuits must be Class A, wired to Listed/Approved devices.
4. Power supply loading and wiring distances must be per Installation, Programming, and Operating Instructions, Part No. 430545.
5. For FM Approved Deluge and Preaction Sprinkler Systems, battery standby capacity must be a minimum of 90 hours with 10 minutes of alarm.
6. For FM Approved Automatic Extinguishing Release, battery standby must be a minimum of 24 hours with 5 minutes of alarm.
7. Battery standby must be selected for a minimum voltage of 23 VDC to ensure proper valve operation.
8. Maintenance Switch, Part No. 433936 or 433937, are required to allow the system to be tested or serviced.
9. For FM Approved Deluge and Preaction Sprinkler operation, the specified compatible Automatic Water Control Valves must be used.
10. For UL Listed and FM Approved Automatic Extinguishing Release, solenoid valves must be electrically compatible.
11. Abort Switch, Part No. 433940, is available when abort operation is required. When used, wire on Special Purpose Monitoring Circuits (SPMs) as Class A or B, the same as required for other initiating devices.
12. Manual Release Stations are used for direct activation of the release solenoids with the appropriate time delay implemented by the fire alarm control panel.

LISTINGS AND APPROVALS

- UL Listed: S4935
- FM Approved: J.I.3012391
- CSFM: 7165-0595:113
- MEA (NYC): 49-03-E

EXPANSION MODULES AND ACCESSORIES

Auxiliary Relay Module, Part No. 430529. Four relays per module are available as required. Dual hazard applications will require two modules for auxiliary relay operation. Each relay module has a manual disconnect switch that controls relays 2 through 4 (Trouble Relay is not controlled). Relay outputs are required to be connected to 15 A maximum circuit breaker.

Operation is per the following actions:

Relay 1 activates on any **trouble** associated with its hazard

Relay 2 activates on any **alarm** associated with its hazard

Relay 3 activates for pressure switch as required per application or actuates with second zone for cross-zoned systems (hazard specific)

Relay 4 activates when the hazard specific RAC activates

Dual Circuit Class A Adapter Module, Part No. 430531. This module converts two Class B circuits to Class A operation. It consumes no additional current and is compatible with IDCs, SPMs, and NACs. Up to four modules may be mounted within the AUTOPULSE Z-10 cabinet.

Maintenance Switch. Proper service of release appliance circuits requires the ability to securely disconnect the release circuit during installation and maintenance. Maintenance switches are controlled by keyswitch and initiate a supervisory condition when in disconnect/disable position. Models with lamp are on a double-gang plate and are powered from separate 24 VDC wiring. Mounting is on stainless steel plates and models are available as either surface or flush mount (see drawing below).

Maintenance switches, one per RAC, are required per NFPA 72, the National Fire Alarm Code, to allow the system to be tested or serviced without actuating the fire suppression systems. Their use may not be allowed in some jurisdictions; always confirm local requirements. When used, maintenance switches are required to ensure that operation initiates a supervisory condition.

006549

Maintenance Switch

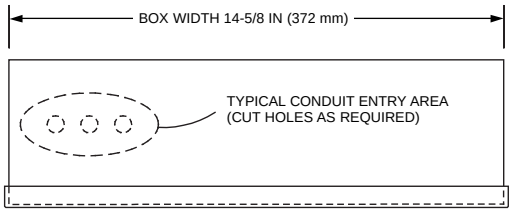
Abort Switch. For manual abort requests, these abort switches are available with or without a built-in 1.2 kΩ, 1 W resistor and are mounted on single-gang stainless steel plates. Abort switches are connected to the SPM inputs per system requirements.

Activity abort occurs while the switch is pushed and continues after releasing the switch for the selected Abort Release Time Delay (see drawing below).

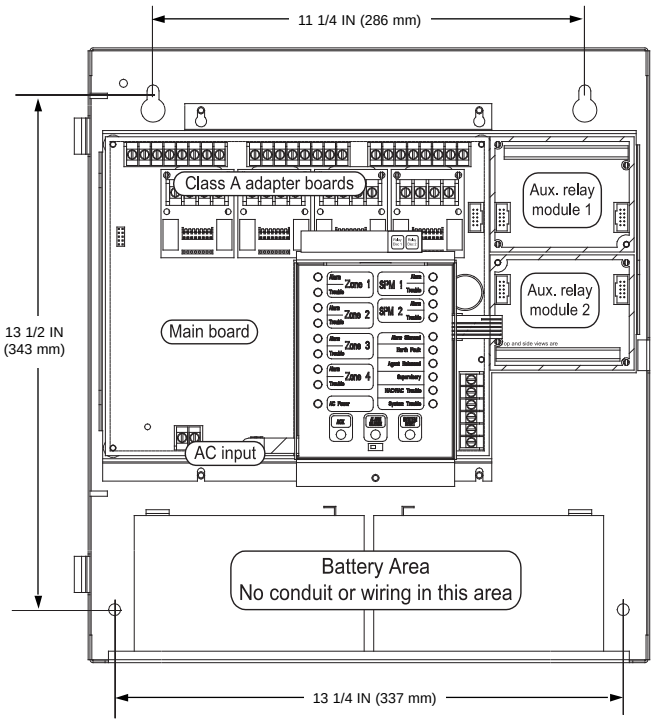
006550

Abort Switch

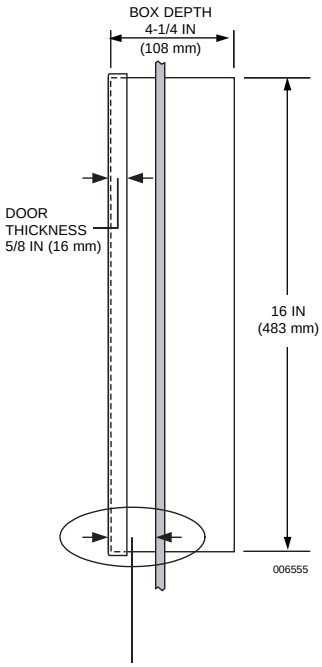
MOUNTING REFERENCE INFORMATION



(TOP AND SIDE VIEWS ARE SHOWN WITH DOOR INSTALLED)



(FRONT VIEW MODULE PLACEMENT REFERENCE SHOWING MOUNTING HOLE DIMENSIONS, OPTIONAL CLASS A ADAPTER MODULES, AND OPTIONAL RELAY MODULES)



NOTE: FOR SEMI-FLUSH MOUNTING, CABINET MUST EXTEND 1-1/2 IN (38 mm) MINIMUM FROM WALL SURFACE

NOTE: A SYSTEM GROUND MUST BE PROVIDED FOR EARTH DETECTION AND TRANSIENT PROTECTION DEVICES. THIS CONNECTION SHALL BE MADE TO AN APPROVED, DEDICATED EARTH CONNECTION PER NFPA 70, ARTICLE 250, AND NFPA 780.

ORDERING INFORMATION

Part No.	Description
430525	AUTOPULSE Z-10 FACP, 120/240 VAC

NOTE: Proper operation of release control systems requires that the system design, installation, and maintenance be performed correctly and in accordance with all applicable local and national codes, and equipment manufacturer's instructions. No liability for total system operation is assumed or implied.

Ansul Incorporated
Marinette, WI 54143-2542
715-735-7411
www.ansul.com

AUTOPULSE® IQ-318
INTELLIGENT ADDRESSABLE FIRE ALARM SYSTEM
Data/Specifications

ANSUL®

GENERAL

The AUTOPULSE® IQ-318 intelligent Fire Alarm Control Panel is part of the AUTOPULSE Series of Fire Alarm Controls from ANSUL®.

Designed with modularity and for ease of system planning, the AUTOPULSE IQ-318 can be configured with just a few devices for small building applications, or for a large campus or high-rise application. Simply add additional peripheral equipment to suit the application.

FEATURES

- Listed to UL Standard 864, 9th edition.
- One isolated intelligent Signaling Line Circuit (SLC) Style 4, 6 or 7.
- Up to 159 detectors (any mix of ion, photo, thermal, or multi-sensor) and 159 modules (NO manual stations, two wire smoke, notification, or relay). 318 devices maximum.
- Standard 80-character display.
- 6.0 amp power supply with four Class A/B built-in Notification Appliance Circuits (NAC). Selectable System Sensor, Wheelock, or Gentex strobe synchronization.
- Built-in Alarm, Trouble, and Supervisory relays.
- VeriFire® Tools offline program option. Sort Maintenance Reports by compensation value (dirty detector), peak alarm value, or address.
- Autoprogramming and Walk Test reports.
- Optional universal 318-point DACT.
- 80-character remote annunciators (up to 32).
- EIA-485 annunciators, including custom graphics.
- Printer interface (80-column and 40-column printers).
- History file with 800-event capacity in nonvolatile memory, plus separate 200-event alarm-only file.
- Alarm Verification selection per point, with tally.
- Autoprogramming and Walk Test reports.
- Positive Alarm Sequence (PAS) Presignal.
- Silence inhibit and Auto Silence timer options.
- March time / temporal / California two-stage coding / strobe synchronization.
- Field-programmable on panel or on PC, with VeriFire Tools program check, compare, simulate.
- Full QWERTY keypad.
- Charger for up to 90 hours of standby power.
- Non-alarm points for lower priority functions.
- Remote ACK/Signal Silence/System Reset/Drill via monitor modules.
- Automatic time control functions, with holiday exceptions.
- Surface Mount Technology (SMT) electronics.
- Extensive, built-in transient protection.
- Powerful Boolean logic equations.

- **FlashScan® intelligent features:**
  - Poll 318 devices in less than two seconds.
  - Activate up to 159 outputs in less than five seconds.
  - Multicolor LEDs blink device address during Walk Test.
  - Fully digital, high-precision protocol (U.S. Patent 5,539,389).
  - Manual sensitivity adjustment — nine levels.
  - Pre-alarm ONYX intelligent sensing — nine levels.
  - Day/Night automatic sensitivity adjustment.
  - Sensitivity windows:

007704

Ion – 0.5 to 2.5%/foot obscuration.
Photo – 0.5 to 2.35%/foot obscuration.
Laser (VIEW®) – 0.02 to 2.0%/foot obscuration.
Acclimate Plus™ – 0.5 to 4.0%/foot obscuration.
HARSH™ – 0.5 to 2.35%/foot obscuration.

  - Drift compensation (U.S. Patent 5,764,142).
  - Degraded mode — in the unlikely event that the CPU-318 microprocessor fails, FlashScan detectors revert to degraded operation and can activate the CPU-318 NAC circuits and alarm relay. Each of the four built-in panel circuits includes a Disable/Enable switch for this feature.
  - Multi-detector algorithm involves nearby detectors in alarm decision (U.S. Patent 5,627,515).
  - Automatic detector sensitivity testing.
  - Maintenance alert (two levels).
  - Self-optimizing pre-alarm.

- **VIEW (Very Intelligent Early Warning) smoke detection technology:**
  - Revolutionary spot laser design.
  - Advanced intelligent sensing algorithms differentiate between smoke and non-smoke signals (U.S. Patent 5,831,524).
  - Addressable operation pinpoints the fire location.
  - No moving parts to fail or filters to change.
  - Early warning performance comparable to the best aspiration systems at a fraction of the lifetime cost.

- **Acclimate Plus low-profile intelligent multi-sensor:**
  - Detector automatically adjusts sensitivity levels without operator intervention or programming. Sensitivity increases with heat.
  - Microprocessor-based technology; combination photo and thermal technology.
  - FlashScan or classic mode compatible with NFS2-636, NFS-318.
  - Low-temperature warning signal at 40 °F ± 5 °F (4.44 °C ± 2.77 °C).

- **HARSH Hostile-Area Smoke Head:**
  - Provides early warning of smoke detection in environment where traditional smoke detectors are not practical.
  - The detector's filters remove particulates down to 30 microns in size.
  - Intake fan draws air into photo chamber, while airborne particles and water mist are removed.
  - Requires auxiliary 24 VDC from system or remote power supply.

FEATURES (Continued)

- **Releasing features:**
  - Ten independent hazards
  - Sophisticated cross-zone (three options)
  - Delay timer and Discharge timers (adjustable)
  - Abort (four options)
  - Low Pressure CO_2 Listed
- **High-efficiency offline switching 3.0 amp power supply (6.0 A in alarm):**
  - 120 or 220/240 VAC
  - Displays battery current/voltage on panel (with display)

FLASHSCAN EXCLUSIVE NEW WORLD-LEADING DETECTOR PROTOCOL

At the heart of the AUTOPULSE IQ-318 is a set of detection devices and device protocol — FlashScan (U.S. Patent 5,539,389). Flash-Scan is an all-digital protocol that gives superior precision and high noise immunity.

In addition to providing quick identification of an active input device, this new protocol can also activate many output devices in a fraction of the time required by competitive protocols.

This high speed also allows the AUTOPULSE IQ-318 to have the largest device per loop capacity in the industry – 318 points – yet every input and output device is sampled in less than two seconds. The microprocessor-based FlashScan detectors have bicolor LEDs that can be coded to provide diagnostic information, such as device address during Walk Test.

INTELLIGENT SENSING

Intelligent sensing is a set of software algorithms that provides the AUTOPULSE IQ-318 with industry-leading smoke detection capability. These complex algorithms require many calculations on each reading of each detector, and are made possible by the very high-speed microcomputer used by the AUTOPULSE IQ-318.

Drift Compensation and Smoothing: Drift compensation allows the detector to retain its original ability to detect actual smoke, and resist false alarms, even as dirt accumulates. It reduces maintenance requirements by allowing the system to automatically perform the periodic sensitivity measurements required by NFPA 72. Smoothing filters are also provided by software to remove transient noise signals, such as those caused by electrical interference.

Maintenance Warnings: When the drift compensation performed for a detector reaches a certain level, the performance of the detector may be compromised, and special warnings are given. There are three warning levels: (1) Low Chamber value, usually indicative of a hardware problem in the detector; (2) Maintenance Alert, indicative of dust accumulation that is near but below the allowed limit; (3) Maintenance Urgent, indicative of dust accumulation above the allowed limit.

Sensitivity Adjust: Nine sensitivity levels are provided for alarm detection. These levels can be set manually, or can change automatically between day and night. Nine levels of pre-alarm sensitivity can also be selected, based on predetermined levels of alarm. Pre-alarm operation can be latching or self-restoring, and can be used to activate special control functions.

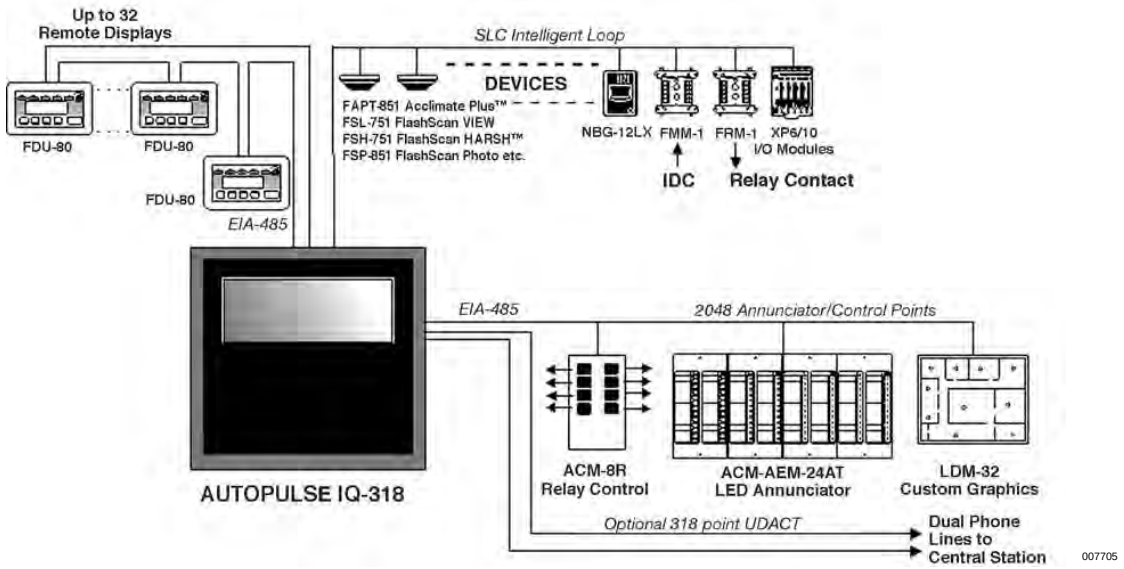
Self-Optimizing Pre-Alarm: Each detector may be set for "Self-Optimizing" pre-alarm. In this special mode, the detector "learns" its normal environment, measuring the peak analog readings over a long period of time, and setting the pre-alarm level just above these normal peaks.

Cooperating Multi-Detector Sensing: A patented feature of intelligent sensing is the ability of a smoke sensor to consider readings from nearby sensors in making alarm or pre-alarm decisions. Without statistical sacrifice in the ability to resist false alarms, it allows a sensor to increase its sensitivity to actual smoke by a factor of almost two to one.

FIELD PROGRAMMING OPTIONS

Autoprogram is a timesaving feature of the AUTOPULSE IQ-318. It is a special software routine that allows the AUTOPULSE IQ-318 to "learn" what devices are physically connected and automatically load them in the program with default values for all parameters. Requiring less than one minute to run, this routine allows the user to have almost immediate fire protection in a new installation, even if only a portion of the detectors are installed.

Keypad Program Edit (with KDM-R2): The AUTOPULSE IQ-318, like all intelligent panels, has the exclusive feature of program creation and editing capability from the front panel keypad, **while continuing to provide fire protection.** The architecture of the AUTOPULSE IQ-318 software is such that each point entry carries its own program, including control-by-event links to other points. This allows the program to be entered with independent per-point segments, while the AUTOPULSE IQ-318 simultaneously monitors other (already installed) points for alarm conditions.

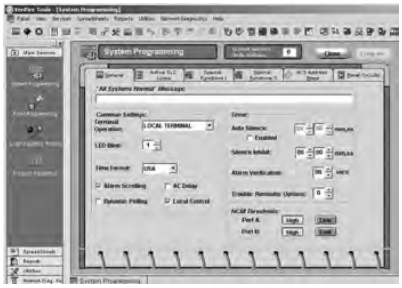


VeriFire Tools is an offline programming and test utility that can greatly reduce installation programming time, and increase confidence in the site-specific software. It is Windows®-based and provides technologically advanced capabilities to aid the installer. The installer may create the entire program for the AUTOPULSE IQ-318 in the comfort of the office, test it, store a backup file, then bring it to the site and download from a laptop into the panel.

```
AUTOPROGRAM    PLEASE WAIT
```

```
L1:80 DETS, 15 MODS
BELLS: 04
```

Autoprogram Function



VeriFire™ Tools System Programming Screen

007187

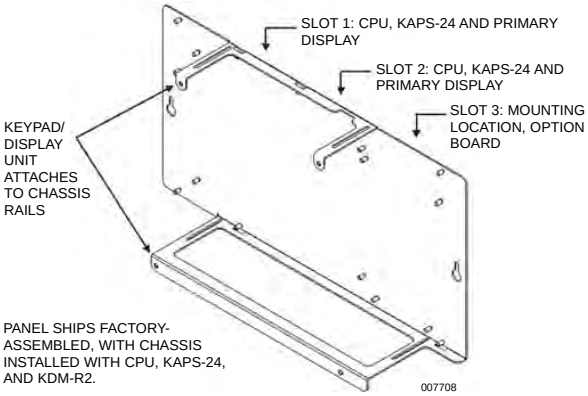
PLACEMENT OF EQUIPMENT IN CHASSIS AND CABINET

The following guidelines outline the AUTOPULSE IQ-318's flexible system design.

Wiring: When designing the cabinet layout, consider separation of power-limited and non-power-limited wiring as discussed in the AUTOPULSE IQ-318 Installation Manual.

It is critical that all mounting holes of the AUTOPULSE IQ-318 are secured with a screw or standoff to ensure continuity of Earth Ground.

Equipment Placement in AUTOPULSE IQ-318 Chassis



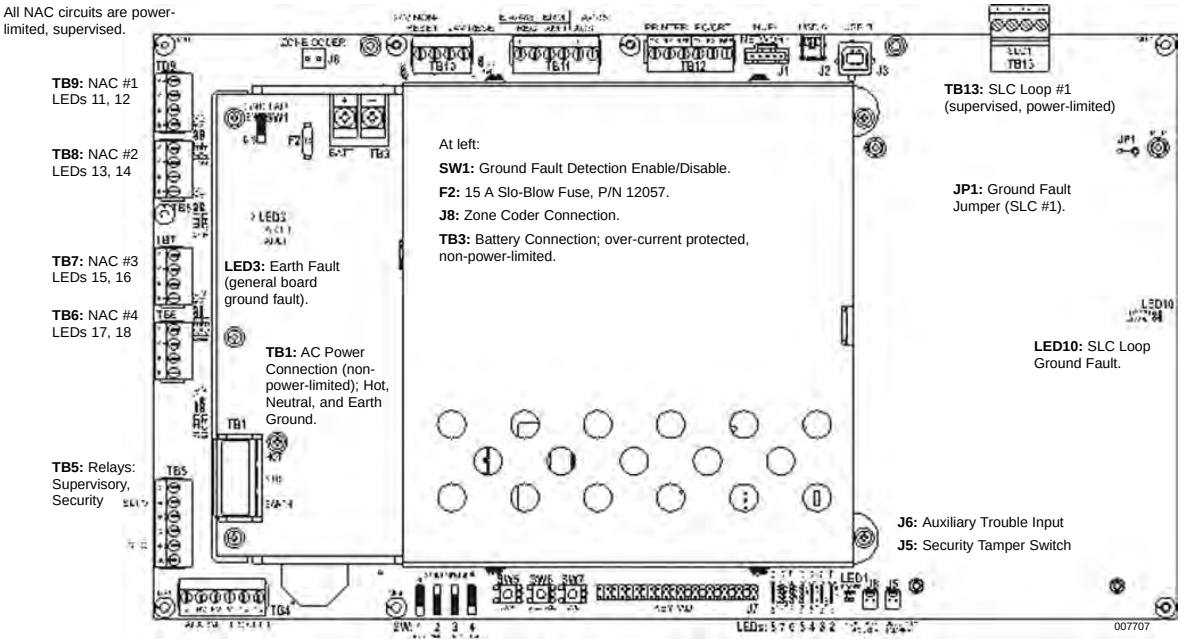
007708

CPU2-318 Board Diagram

TB10: DC Power (24 VDC, power-limited); Non-Resettable, Resettable.
TB11: EIA-485 Connection (supervised); Terminal Mode, ACS Mode.
TB12: EIA-232 Connection; Printer, PC/Terminal (CRT).

J1: Network/Service Connection (NUP), power-limited, supervised.
J2: USB A VeriFire Tools Connection.
J3: USB B VeriFire Tools Connection.

All NAC circuits are power-limited, supervised.



007707

TB4: Alarm Relay, Trouble Relay. Output relays; power-limited only if connected to a power-limited source.

SW1, SW2, SW3, SW4: Disable-Enable switches for Backup Alarm, NACs 1-4 respectively.

System switches, "No Keyboard Operation":
SW5 Acknowledge
SW6 Silence

SW7 Reset
J7 KDM-R2 Connection

LED1: Power On (AC or battery)
LED2: Signals Silenced
LED3: Point Disabled
LED4: System Trouble
LED5: Supervisory

LED6: Security
LED7: Pre-Alarm
LED8: Fire Alarm

KDM-R2 CONTROLS AND INDICATORS

Program Keypad: QWERTY type (keyboard layout).

12 LED Indicators: Power; Fire Alarm; Pre-Alarm; Security; Supervisory; System Trouble; Signals Silenced; Points Disabled; Control Active; Abort; Pre-Discharge; Discharge.

Membrane Switch Controls: Acknowledge/Scroll Display; Signal Silence; Drill; System Reset; Lamp Test.

LCD Display: 80 characters (2 x 40) with long-life LED backlight.

CONFIGURATION GUIDELINES

The AUTOPULSE IQ-318 system ships assembled; description and some options follow.

AUTOPULSE IQ-318: The standard, factory-assembled AUTOPULSE IQ-318 panel includes the following components: one CPU-318 control panel mounted on chassis (120 V operation – ships with grounding cable, battery interconnect cables, and document kit); one KAPS-24 integral power supply mounted to the CPU-318; one primary display KDM-R2 keypad/display; and one cabinet for surface or semi-flush mounting. Purchase batteries separately. One or two option boards may be mounted inside the AUTOPULSE IQ-318 cabinet; additional option boards can be utilized in remote cabinets.

AUTOPULSE IQ-318C: Same as AUTOPULSE IQ-318 above, but with ULC listing.

AUTOPULSE IQ-318E: Same as AUTOPULSE IQ-318 above, but with 240 V operation.

BMP-1: Blank module for unused module positions.

TR-318: Trim ring for the AUTOPULSE IQ-318 cabinet.

OPTION MODULES

FCPS-24S6/-24S8: Remote six-amp and eight-amp power supplies with battery charger.

COMPATIBLE DEVICES, EIA-485 PORTS

ACM-24AT: ACS annunciator – up to 96 points of annunciation with Alarm or Active LED, Trouble LED, and switch per circuit. Active/Alarm LEDs can be programmed (by powered-up switch selection) by point to be red, green, or yellow; the Trouble LED is always yellow.

AEM-24AT: Same LED and switch capabilities as ACM-24AT, expands the ACM-24AT to 48, 72, or 96 points.

ACM-48A: ACS annunciator – up to 96 points of annunciation with Alarm or Active LED per circuit. Active/Alarm LEDs can be programmed (by powered-up switch selection) in groups of 24 to be red, green, or yellow. Expandable to 96 points with one AEM-48A.

AEM-48A: Same LED capabilities as ACM-48A, expands the ACM-48A to 96 points.

TM-4: Transmitter Module. Includes three reverse-polarity circuits and one municipal box circuit; mount on AUTOPULSE IQ-318 chassis or remotely.

FDU-80: Remote LCD display, 80 characters, with LEDs.

LDM: Lamp Driver Modules LDM-32, LDM-E32, and LDMR32; remote custom driver modules.

ACM-8R: Remote Relay Module with eight Form-C contacts. Can be located up to 6,000 ft (1828.8 m) from panel on four wires.

UDACT: Universal Digital Alarm Communicator Transmitter, 636 channel.

COMPATIBLE INTELLIGENT DEVICES

FSI-851: Low-profile FlashScan ionization detector, will replace FSI-751.

FSI-751: Low-profile FlashScan ionization detector.

FSP-851: Low-profile FlashScan photoelectric detector, will replace FSP-751.

FSP-751: Low-profile FlashScan photoelectric detector.

FSP-851T: Low-profile FlashScan photoelectric detector with 135 °F (57 °C) thermal, will replace FSP-751T.

FSP-751T: Low-profile FlashScan photoelectric detector with 135 °F (57 °C) thermal.

FST-851: FlashScan thermal detector 135 °F (57 °C), will replace FST-751.

FST-751: FlashScan thermal detector 135 °F (57 °C).

FST-851R: FlashScan thermal detector 135 °F (57 °C) with rate-of-rise, will replace FST-751R.

FST-751R: FlashScan thermal detector 135 °F (57 °C) with rate-of-rise.

FST-851H: FlashScan 190 °F (88 °C) high-temperature thermal detector.

FSD-751P: FlashScan photo duct detector with housing.

FSD-751PL: Low-flow FlashScan photo duct detector with housing, will replace FSD-751P.

FSD-751RP: FlashScan photo duct detector with relay and housing.

FSD-751RPL: Low-flow FlashScan photo duct detector with relay and housing, will replace FSD-751RP.

FAPT-851: FlashScan Acclimate Plus low-profile multisensor detector, will replace FAPT-751.

FAPT-751: Acclimate Plus low-profile multisensor detector.

FSH-751: FlashScan HARSH Hostile Area Smoke Head.

FSL-751: FlashScan VIEW laser photo detector.

LPX-751: Low-profile VIEW laser photo detector.

B224RB: Low-profile relay base.

OPTION MODULES (Continued)

B224BI: Isolator base for low-profile detectors.

B710LP: Low-profile base. Standard U.S. style.

B501: European-style, 4 in. (10.16 cm) base.

B501BH: Sounder base, includes B501 base above.

FMM-1: FlashScan monitor module.

FDM-1: FlashScan dual monitor module.

FZM-1: FlashScan two-wire detector monitor module.

FMM-101: FlashScan miniature monitor module.

FCM-1: FlashScan NAC control module.

FRM-1: FlashScan relay module.

NBG-12LX: Manual fire alarm station, addressable.

ISO-X: Isolator module.

XP6-C: FlashScan six-circuit supervised control module.

XP6-MA: FlashScan six-zone interface module; connects intelligent alarm system to two-wire conventional detection zone.

XP6-R: FlashScan six-relay (Form-C) control module.

XP10-M: FlashScan ten-input monitor module.

OTHER OPTIONS

VeriFire-TCD: VeriFire Tools CD-ROM. Contains programming software. Includes local panel connection cable. Programming PC requires a serial port connection.

BAT Series: Batteries. AUTOPULSE IQ-318 utilizes two 12 volt, 18 to 200 AH batteries. This series of products replaces the previous PS Series.

NFS-LBB: Battery Box (required for batteries over 25 AH).

NFS-LBBR: Same as above, but red.

SYSTEM SPECIFICATIONS

System Capacity

Intelligent Signaling Line Circuits 1

Intelligent detectors 159

Addressable monitor/control modules 159

Programmable internal hardware and output circuits 4

Programmable software zones. 99

Special programming zones 14

LCD annunciators per CPU-318/-318E 32

ACS annunciators
per CPU-318/-318E . . . . . 32 addresses x 64 points

Specifications

- Primary input power, **CPU-318 board:** 120 VAC, 50/60 Hz, 3.0 A. **CPU-318E board:** 220/240 VAC, 50/60 Hz, 1.5 A.
- Total output 24 V power: 6.0 A in alarm.

Note: The power supply has a total of 6.0 A of available power. This is shared by all internal circuits.

- Standard notification circuits (4): 1.5 A each.
- Four-wire detector power: 1.25 A.
- Non-resettable regulated power outputs: 1.25 A each.
- Battery charger range: 18 AH – 200 AH. Use separate cabinet for batteries over 25 AH.
- Optional high-capacity (25 – 120 AH) battery charger: CHG-120.
- Float rate: 27.6 V.

Cabinet Specifications

AUTOPULSE IQ-318 cabinet dimensions:

BACKBOX, OUTSIDE: 18.240 in. (46.33 cm) height, 5.77 in. (14.656 cm) deep.

WITH DOOR: 18.870 in. (47.93 cm) wide x 18.469 in. (46.911 cm) high x 5.817 in. (14.775 cm) deep.

BACKBOX, INSIDE: 18.120 in. (46.025 cm) inner width, 5.175 in. (13.145 cm) inner depth.

Temperature and Humidity Ranges

This system meets NFPA requirements for operation at 32 – 120 °F (0 – 49 °C) and at a relative humidity 93% ± 2% RH (noncondensing) at 90 °F ± 3 °F (32 °C ± 2 °C). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 60 – 80 °F (15 – 27 °C).

STANDARDS

The AUTOPULSE IQ-318 complies with the following UL Standards and NFPA 72 Fire Alarm Systems requirements:

- UL 864, 9th Edition.
- UL 1076 (Burglary).
- LOCAL (Automatic, Manual, Waterflow and Sprinkler Supervisory).
- AUXILIARY (Automatic, Manual and Waterflow) (requires 4XTMF).
- REMOTE STATION (Automatic, Manual and Waterflow) (requires 4XTMF).
- PROPRIETARY (Automatic, Manual and Waterflow). Not applicable for FM.

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the basic AUTOPULSE IQ-318 control panel. In some cases, certain modules may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

The AUTOPULSE IQ-318 complies with UL Standards 864, 9th Edition (Fire). It is designed to meet NFPA 72 Local, Auxiliary, Remote Station, and Proprietary (not applicable for FM) Fire System Requirements.

UL Listed S4935
ULC S4935
MEA 128-07-E
FM . . . . . Pending
California State Fire Marshall . . . . . Pending

ORDERING INFORMATION

Part No.	Description
434957	AUTOPULSE IQ-318 FACP, 120 VAC
434958	AUTOPULSE IQ-318C FACP, 120 VAC (ULC)
434959	AUTOPULSE IQ-318E FACP, 240 VAC

ANSUL
by Tyco Fire Suppression & Building Products

AQUASONIC WATER-ATOMIZING FIRE SUPPRESSION SYSTEM

Data/Specifications

FEATURES

- FM Approved
- Effective suppression of Class B combustibles (i.e. flammable liquids, oils, greases, tars, oil-based paints, lacquers and flammable vapors)
- Environmentally safe
- Minimal water discharge
- Optimized protected volume with minimal piping and system discharge devices
- Flexible system piping and atomizer location
- Fully self-contained skid for volumes up to 9200 ft^3 (260 m^3)
- ASME/TPED Approved stainless steel water tank

APPLICATION

The AQUASONIC Water-Atomizing Fire Suppression System* utilizes water droplets as the suppression agent. These droplets can effectively be applied in total flooding fire suppression applications having a volume up to and including 36,727 ft^3 (1040 m^3). Applications include:

- Machinery Spaces
- Both Insulated and Non-Insulated Combustion Turbine Enclosures
- Generator Enclosures
- Flammable Liquid Storage

Note: Non-acceptable hazards include rack or palletized storage of flammable or combustible liquids.

PRINCIPLES OF OPERATION

The AQUASONIC system suppresses a Class B fire by causing one or more of the following reactions:

- Heat extraction from the fire as water is converted into vapor and the fuel is cooled
- Dilution of flammable vapors by the entrainment of water vapor
- Cooling of liquid hydrocarbon fuels below vaporization temperature

When a fire condition is detected in the protected hazard, the detection and control system will actuate the AQUASONIC system which contains nitrogen cylinders and a stainless steel water tank. The nitrogen storage cylinders provide pressure to drive the water to the system atomizers. When the system is operated, CV-98 valves on the nitrogen cylinders open and the gas pressure flows through pressure regulators which maintain the pressure at 125 psi (8.6 bar). This pressure drives the water through the opened water valve and to the system atomizers. The nitrogen discharge also provides the necessary pressure to create the water discharge plume.

Note: Water-atomizing systems shall not be used for direct application to materials that react with water to produce violent reactions or significant amounts of hazardous products. Such materials include but are not limited to the following:

- Reactive metals such as lithium, sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium
- Metal alkoxides, such as sodium methoxide
- Metal amides, such as sodium amide
- Carbides, such as calcium carbide
- Halides, such as benzoyl chloride and aluminum chloride
- Hydrides, such as lithium aluminum hydride
- Oxyhalides, such as phosphorus oxybromide
- Silanes, such as trichloromethylsilane
- Sulfides, such as phosphorus pentasulfide
- Cyanates, such as methylisocyanate

*Patent Pending

008245

008536

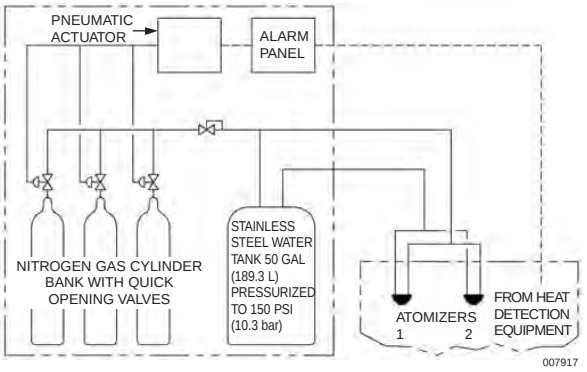
	DOT Skid	TPED Skid
Weight:	2550 lb (1156.7 kg)	1984 lb (900 kg)
Length:	64 in. (1.6 m)	59 in. (1.5 m)
Width:	35 in. (0.9 m)	31.5 in. (0.8 m)
Height:	78 in. (2.0 m)	90.5 in. (2.3 m)

DESCRIPTION

The AQUASONIC Water-Atomizing Fire Suppression System is a total flood system designed to protect Class B flammable liquid hazards in machinery spaces, both insulated and non-insulated combustion turbine enclosures, generator enclosures, and flammable liquid storage. The AQUASONIC system can protect a potential hazard with a volume up to 36,727 ft^3 (1040 m^3) with two atomizers that use low pressure, dual flow, advanced atomization technology to create a minimum 10-minute discharge plume of water droplets that are the optimum size to suppress a Class B fire. When sprayed within an enclosure, the AQUASONIC Atomizer spray pattern expands slightly and the water droplets are primarily distributed (circulated) around the space via the high velocity atomizing media discharge. As the high velocity discharge plume of water droplets approaches the floor, or other horizontal obstruction, a large majority of the plume is diverted laterally, as well as vertically upwards, to fill the spaces between the core spray patterns and above the atomizers. The circulation characteristics of the AQUASONIC Atomizer plume result in rapid, homogenous distribution of water droplets throughout the protected environment. The AQUASONIC system has been fire tested within compartmentalized areas and found effective for the suppression of a wide variety of exposed and shielded Class B hydrocarbon pool, spray, and gravity fires.

DESCRIPTION (Continued)

The system is capable of automatic detection and actuation and/or remote manual actuation.



The above figure provides a system schematic. The engineered AQUASONIC system provides a less complex alternative to high pressure water mist systems. It is primarily comprised of a pre-packaged AQUASONIC supply skid containing both compressed nitrogen and stored water which, upon actuation, automatically supply the necessary quantity of each to the AQUASONIC Atomizers.

A system installation and maintenance manual is available containing information on system components and procedures concerning design, operation, inspection, maintenance, and recharge.

The system is installed and serviced by authorized ANSUL distributors that are trained by the manufacturer.

COMPONENTS

AQUASONIC System – The AQUASONIC system consists of nitrogen cylinders used for pressurizing and expelling the system water supply. The cylinders also function as the nitrogen source to activate the system atomization technology. The cylinders are regulated to the correct pressure to allow the system to perform properly. Included on the AQUASONIC system is a 50 gal (189.3 L) ASME/TPED stainless steel tank used to store the system water supply. The AQUASONIC system contains the necessary valves, hoses, and manifolding. All skid components are rigidly mounted on a channel-iron base for easily positioning the assembly in the proper location. The complete AQUASONIC skid assembly is painted with a red, air dry enamel finish.

Note: Choice of ANSUL AUTOMAN® II-C Releasing Device (either standard or explosion/weather-proof) and appropriate mounting bracket must be ordered separately.

AUTOPULSE® Control System – The AUTOPULSE Control System is designed to monitor fixed fire hazards. The control system can automatically actuate the AQUASONIC system after receiving an input signal from one or more initiating devices, i.e. manual pull station or detector. The control system incorporates an internal power supply, on-line emergency batteries, and solid state electronics.

ANSUL AUTOMAN II-C Releasing Device – The ANSUL AUTOMAN II-C Releasing Device consists of a metal enclosure which contains a spring-loaded puncture pin release mechanism, an actuation cartridge, electrical circuitry, and an input/output terminal strip for making electrical connections. The ANSUL AUTOMAN II-C Releasing Device provides automatic pneumatic actuation of the AQUASONIC system. When wired to an AUTOPULSE Control System, it will provide supervised electric detection and release. The ANSUL AUTOMAN II-C Releasing Device also provides manual actuation using the strike button on the release enclosure or with optional remote manual cable pull station. When an AUTOPULSE Control System is used, manual actuation is accomplished using an electric manual pull station. The ANSUL AUTOMAN II-C Releasing Device requires an LT-10-R nitrogen cartridge for system actuation. Cartridge must be ordered separately. An explosion/weather-proof ANSUL AUTOMAN II-C Releasing Device is also available. Choice of ANSUL AUTOMAN II-C Releasing Device (either standard or explosion/weather-proof) and appropriate mounting bracket must be ordered separately.

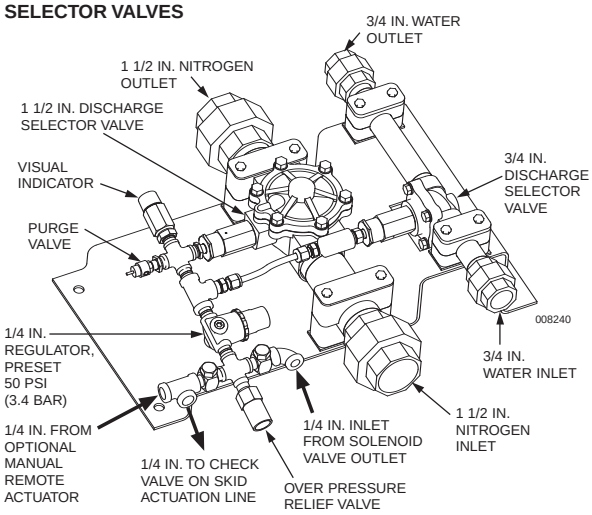
Remote Actuator (Optional) – The Remote Actuator is a device that allows for system actuation from a location either on or away from the AQUASONIC skid assembly.Two types of actuators are offered. One requires an LT-10-R nitrogen cartridge, and the other requires an LT-30-R nitrogen cartridge. When actuated, the cartridges will supply pressure to the CV-98 valves on the cylinder, allowing nitrogen to flow through the system. Cartridge must be ordered separately.

Selector Valve Assembly – The selector valve assembly consists of:

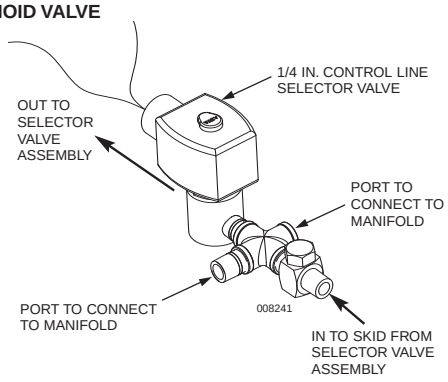
- A 3/4 in. pneumatically operated valve for water and 1 1/2 in. pneumatically operated valve for gas
- Brass inlet and outlet piping with union couplings
- Pressure inlet regulator set at 50 psi (3.4 bar)
- A poppet-style purge valve to allow means of relieving the actuation pressure
- An over pressure relief valve for the actuation line
- A solenoid valve for electric actuation of the selector valve

Selector valves are used when two or more hazard enclosures will be protected with a single supply or a single main and reserve system. They work by allowing the agent to be distributed to the hazard that requires suppression. Up to eight hazard enclosures may be protected by a single supply. Selector valves can be operated either pneumatically or electrically. For electrical operation, the included solenoid valve must be mounted onto the skid assembly. The solenoid valve directs actuation line pressure from the ANSUL AUTOMAN II-C Releasing Device to the appropriate selector valve. Selector valve assemblies may be used in conjunction with optional pneumatic remote actuators where required.

SELECTOR VALVES



SOLENOID VALVE



50 Gallon Stainless Steel Water Tank Assembly – The AQUASONIC system agent tank is a 50 gal (189.3 L) capacity stainless steel water tank featuring a 0.1875 in. (4.8 mm) thick ASME/TPED pressure vessel that is certified to 150 psi (10.3 bar). The tank features a 2 in. (5.1 cm) fill opening; the tank also has an outlet that is positioned for optimal flow, containing a Y strainer which will reduce the number of foreign particles in the water stream from reaching the atomizer(s). The tank is constructed from 304L stainless material to ensure rust-free performance.

- **Valve and Cylinder Assembly** – The AQUASONIC system contains multiple 3AA 3000 DOT rated 575 ft^3 (16.3 m^3) or EN1964-2 TPED 561 ft^3 (16.3 m^3) nitrogen cylinder assemblies. When the actuation pressure reaches the nitrogen actuation line to the cylinder assembly, the piston in the CV-98 valve forces the valve to the open position, allowing nitrogen to flow through the system.

  Regulator – The AQUASONIC system utilizes a factory-set regulator to allow the proper nitrogen pressure to discharge the water from the tank to the atomizer. It also utilizes an adjustable regulator, allowing the necessary nitrogen pressure to flow directly to the atomizer to activate its advanced atomization technology.

- **Atomizer** – The AQUASONIC Atomizer* utilizes advanced technology, combining separate feeds of compressed nitrogen gas and water to generate and uniformly distribute water droplets throughout a protected volume. Each atomizer is delivered pre-trimmed with the appropriate water flow control orifice, strainer, mounting plate, and dust cap in place. The water supply inlet is 1/2 in. NPT, and the nitrogen supply inlet is 1 in. NPT. The AQUASONIC Atomizer utilizes an in-line restricting orifice to generate the appropriate water flow.

  Note: When ordering an AQUASONIC system, the Atomizer Assembly must be specified.

007901

APPROVALS/STANDARDS

Applicable Standards – The AQUASONIC Water-Atomizing Fire Suppression System complies with NFPA 750 (2006) “Standard on Water Mist Fire Protection Systems.”

FM Approved

- CE Marked (TPED skid only)

INSTALLATIONS

All system components and accessories must be installed by personnel trained by the manufacturer. All installations must be performed according to guidelines stated in the manufacturer’s design, installation, operation, inspection, recharge, and maintenance manual and NFPA 750.

AVAILABILITY AND COST

Availability – AQUASONIC Water-Atomizing Fire Suppression Systems are sold and serviced though a network of independent distributors located in most states and many foreign countries.

Cost – Cost varies with type of system specified, size and design.

TECHNICAL SERVICES

- For information on the proper design and installation, contact a local authorized AQUASONIC System distributor. The ANSUL Technical Services Department is also available to answer design and installation questions.

*Patent Pending

tyco
Fire Suppression
& Building Products

www.ansul.com
One Stanton Street
Marinette, WI 54143-2542

+1-800-862-6785 (United States, Canada)
+44(0)1493-417600 (UK)
+1-715-735-7411 (International)

AQUASONIC™ WATER ATOMIZER

Data/Specifications

APPLICATION

- The AQUASONIC™ Water-Atomizing Fire Suppression System (patent pending) is a total flood system designed to protect Class B flammable liquid hazards in machinery spaces, both insulated and non-insulated combustion turbine enclosures, generator enclosures, and flammable liquid storage. The AQUASONIC system can protect a potential hazard with a free volume up to 9200 ft^3 (260 m^3) with two atomizers that use low pressure, dual flow, advanced atomization technology to create a minimum 10-minute discharge plume of water droplets that are the optimum size to suppress a Class B fire. The AQUASONIC system has been fire tested within compartmentalized areas and found effective for the suppression of a wide variety of exposed and shielded Class B hydrocarbon pool, spray, and gravity fires.

DESCRIPTION

- The AQUASONIC Atomizer utilizes advanced technology, combining separate feeds of compressed nitrogen gas and water to generate and uniformly distribute water droplets throughout a protected volume.

Each atomizer is delivered pre-trimmed with the appropriate water flow control orifice, strainer, mounting plate, and dust cap in place. The water supply inlet is 1/2 in. NPT, and the nitrogen supply inlet is 1 in. NPT. The AQUASONIC Atomizer utilizes an in-line restricting orifice to generate the appropriate water flow.

The total AQUASONIC Fire Suppression System, including the Atomizer, is FM approved. The total system requires two atomizers.

Spray Characteristics

When sprayed into the hazard, the AQUASONIC Atomizer creates a conical spray pattern which has a diameter of approximately 36 in. (0.9 m) at a distance of 72 in. (1.8 m) and greater from the atomizer.

When sprayed within an enclosure, the AQUASONIC Atomizer spray pattern expands slightly and the water droplets are primarily distributed (circulated) around the space via the high velocity atomizing media discharge. As the high velocity discharge plume of water droplets approaches the floor or other horizontal obstruction, a large majority of the plume is diverted laterally, as well as vertically upwards, to fill the spaces between the core spray patterns and above the atomizers. The circulation characteristics of the AQUASONIC Atomizer plume result in rapid, homogenous distribution of water droplets throughout the protected environment.

Dust Caps

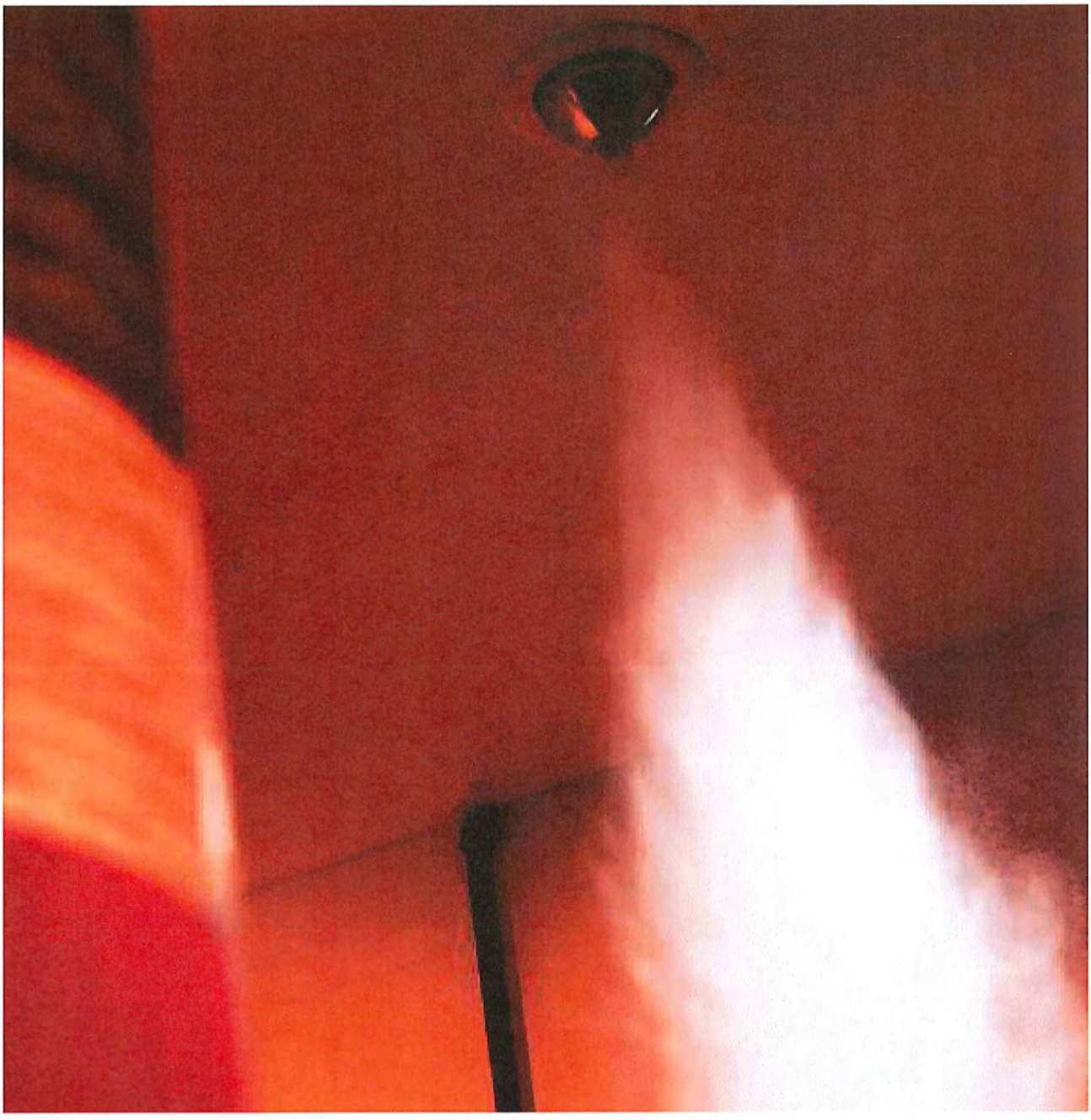
Although not required for all applications, each AQUASONIC Atomizer is provided with a Dust Cap to help keep air-borne debris from accumulating within the nozzle that could prevent proper operation.

007901

ORDERING INFORMATION

Part No.	Description	Shipping Weight
435877	Atomizer Shipping Assembly, Pressure Range 73-87 psi (5.0-6.0 bar)	19 lb (8.6 kg)
435878	Atomizer Shipping Assembly, Pressure Range 88-105 psi (6.1-7.2 bar)	19 lb (8.6 kg)
435879	Atomizer Shipping Assembly, Pressure Range 106-130 psi (7.3-8.9 bar)	19 lb (8.6 kg)
435880	Atomizer Shipping Assembly, Pressure Range 131-155 psi (9.0-10.7 bar)	19 lb (8.6 kg)

ANSUL | tyco Fire Suppression & Building Products
One Stanton Street
Marinette, WI 54143-2542
715-735-7411
www.ansul.com



FIRE PROTECTION, NATURALLY

AQUASONIC™ Water-Atomizing Fire Suppression System

ANSUL
by Tyco Fire Suppression & Building Products

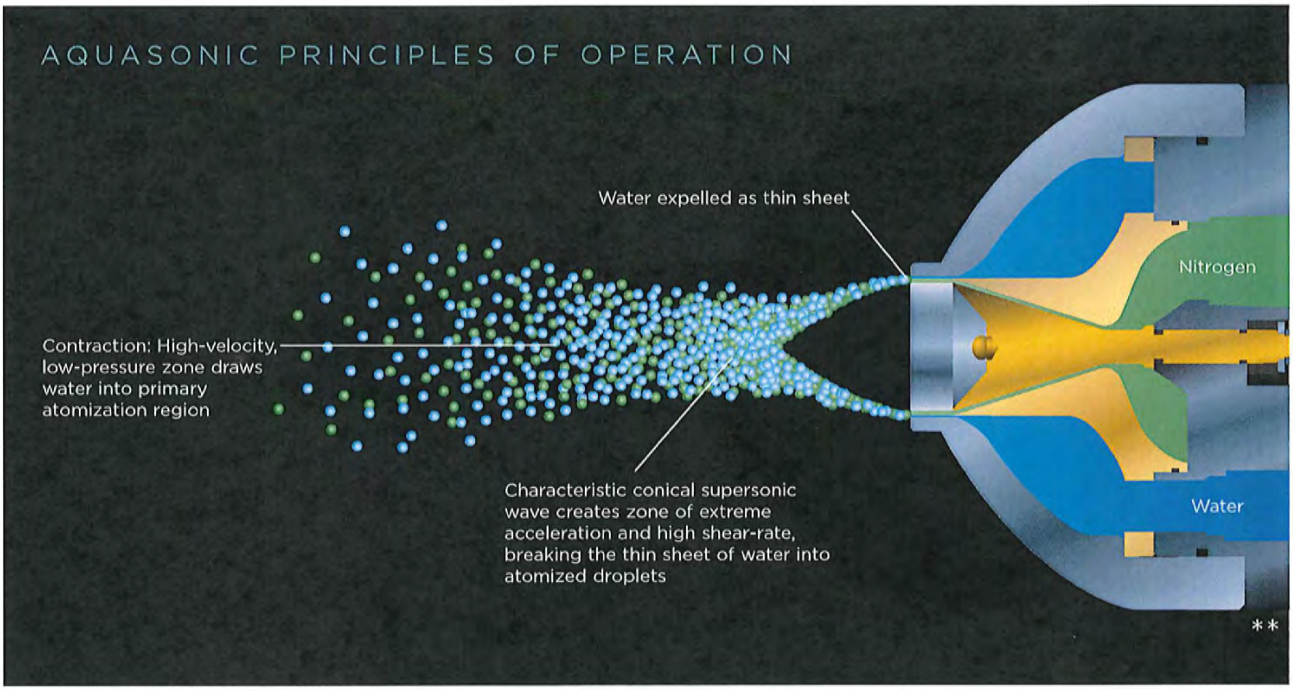
YOU'VE NEVER SEEN WATER DO THIS

Class B flammable liquid hazards can be protected by the total flooding abilities of the AQUASONIC system. Two supersonic atomizers create 1.5 trillion superfine water droplets per second, producing a combined surface area of 1302 ft² (121 m²) per second. This is equivalent to the surface of an Olympic-size soccer field in one minute. Plus, the atomizers propel the droplets at high velocity throughout the combustion zone.

PRINCIPLES OF OPERATION

The atomizer is the key to the effectiveness of the AQUASONIC system.* Supersonic technology generates a high-velocity, low-pressure zone that draws a thin sheet of water into a primary atomization region. A conical supersonic wave then creates a zone of extreme acceleration and high shear-rate, breaking the sheet into atomized droplets.

*This system should not be used for direct application to materials that react violently with water or produce hazardous products.



THIS SYSTEM HAS WHAT IT TAKES

The AQUASONIC atomizer features 100% machined stainless steel construction for superior strength, no internal moving parts for extreme dependability, and multiple mounting options for ease of installation. The AQUASONIC system is constructed of industry-recognized, proven ANSUL components including an ASME/TPED approved stainless steel water storage tank. Capable of automatic detection and actuation and/or remote manual actuation, the system is installed and serviced by authorized ANSUL distributors.

THE AQUASONIC FIRE SUPPRESSION SYSTEM IS:

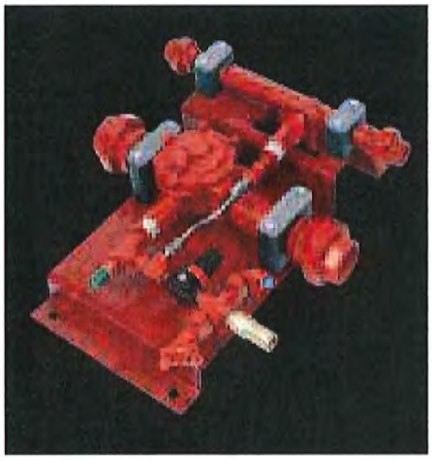
Fast — high-volume, high-velocity discharge quickly fills spaces
Smart — uses one-third the water of comparable high-pressure water mist systems
Lower Pressure — less than 10% of the pressure required of high-pressure water mist systems

A SMART ALTERNATIVE

Other fire suppression systems can't do what the AQUASONIC system does. Traditional CO_2 systems haven't proven to be people-friendly and single-fluid water mist systems may have reached the limits of their capabilities. The AQUASONIC system knocks down fires better and is safe for people and the environment.

FM APPROVED

The AQUASONIC system extinguished all fire scenarios in the FM Protocol 5560 including scenarios in which extinguishment was not required in order to pass. The AQUASONIC system is FM approved for spaces ranging from 4,591 to 36,727 cubic feet (130 to 1040 cubic meters).



THE AQUASONIC FIRE SUPPRESSION SYSTEM GIVES YOU OPTIONS

In terms of placement, the AQUASONIC system offers maximum flexibility.

- Atomizers can be mounted to ...

  The Ceiling — at heights from 9.8 to 26.3 feet (3.0 to 8.0 meters)

  The Walls — at heights from 6.7 to 16.4 feet (2.0 to 5.0 meters)
- Selector Valves — Electrical or mechanical options allow protection of multiple hazards using a single system.

IF ANYONE WAS GOING TO DEVELOP A NEW WAY TO USE WATER, IT WAS TYCO

Our innovators continue to lead the fire suppression industry with a full range of quality ANSUL solutions and specialized products backed by a worldwide network of factory-trained distributors — the largest and most qualified in the industry. The AQUASONIC Fire Suppression System is another exclusive innovation in the ANSUL fire protection line. Choose to protect people and assets with the brand you trust. ANSUL.

APPLICATIONS:

- MACHINERY AREAS
- INSULATED AND NON-INSULATED COMBUSTION TURBINE ENCLOSURES
- PUMP ROOMS
- GENERATORS
- TRANSFORMER VAULTS
- GEAR BOXES
- OIL PUMPS AND TANKS




A LOOK INSIDE THE INNOVATION

The ANSUL® AQUASONIC™ Water-Atomizing Fire Suppression System is a revolution in Class B fire protection. Compared to typical water mist systems, the AQUASONIC system produces a higher volume of smaller water droplets and projects them further. The high-performance fire suppression system is specifically engineered to cover a wide range of industrial, commercial, and institutional special hazard applications.

The AQUASONIC Fire Suppression System utilizes non-toxic and readily available extinguishing media (water and nitrogen). AQUASONIC twin-fluid technology is safe for people, environment friendly, and inexpensive to recharge. The dependable system has few moving parts and uses tested technology with decades of proven service. Plus, there's no need for enclosure integrity tests, because the AQUASONIC system has been tested and approved with the door open.

FM APPROVED ■ CE MARKED ■ ENVIRONMENTALLY SAFE ■ FULLY SELF-CONTAINED
MINIMAL WATER DISCHARGE ■ EFFECTIVE ON CLASS B FIRES
FLEXIBLE SYSTEM PIPING AND ATOMIZER LOCATION
OPTIMIZED, PROTECTED VOLUME WITH MINIMAL PIPING AND SYSTEM DISCHARGE DEVICES

tyco
Fire Suppression
& Building Products

One Stanton Street
Marinette, WI 54143-2542
USA

+1-800-862-6785 (United States, Canada)
+44 (0) 1493-417600 (UK)
+1-715-735-7411 (International)
www.ansul.com

 Form No. F-2008080-1

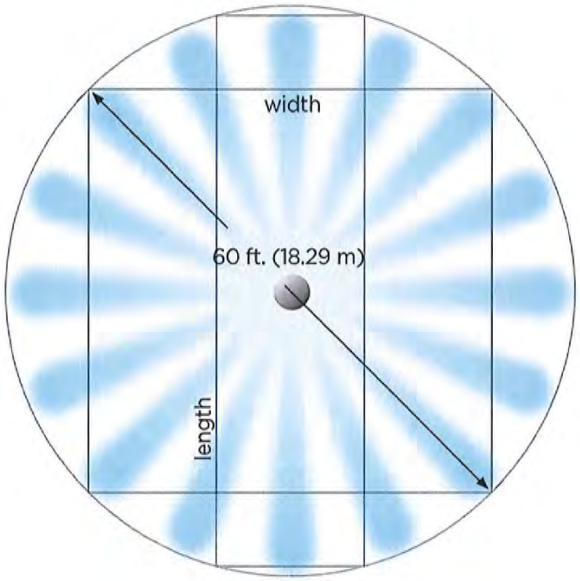
WHEN IT COMES TO PROTECTION, WE'RE GOING TO NEW LENGTHS

ANSUL
by Tyco Fire Suppression & Building Products

INTRODUCING ENHANCED SAPPHIRE SYSTEMS, NOW WITH GREATER AREA COVERAGE

You already know the value of the ANSUL SAPPHIRE Clean-Agent System with its unique fire suppression characteristics. Now the benefit to your business reaches even further.

Recent enhancements give your system one of the largest nozzle coverage areas of any UL/FM-approved 3M NOVEC™ 1230 system you can buy. That means a simpler system, with fewer nozzles and a smaller price tag.

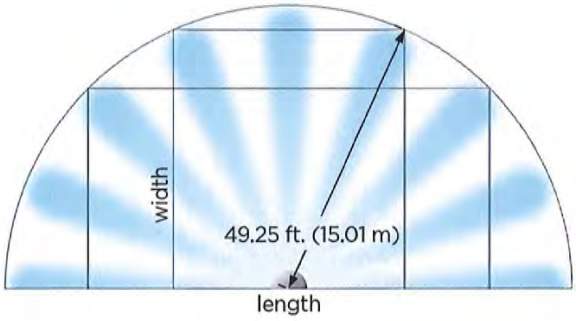


GOING THE DISTANCE TO SAFEGUARD YOUR ASSETS.

- 60 ft. (18.29 m) diameter: 30 ft. (9.14 m) radial distance per 360° nozzle.
- 49.25 ft. (15.01 m) radial distance per 180° nozzle.
- Maximum area coverage of 1,800-sq. ft. (167.2 m^2)

SAME GREAT SAPPHIRE PROTECTION — JUST MORE COVERAGE.

SAPPHIRE systems remain the most effective solution for the protection of electronics and other high-value assets. It's the ideal choice when looking for an effective, environment-friendly clean-agent. With the recent enhancements, you can now add "increased coverage" to the list.



tyco Fire Suppression & Building Products

One Stanton Street
Marinette, WI 54143-2542
USA

+1-800-862-6785 (United States, Canada)
+1-715-735-7411 (International)
www.ansul.com

Form No. F-2010237

VictaulicVortex™

fire suppression system

THE ONLY HYBRID NITROGEN-WATER FIRE SUPPRESSION SYSTEM WITH:

- Nearly zero wetting of protected areas; no need for costly clean up or equipment replacement
- Green design that is safe for the environment and personnel
- Quick system recharge; minimal facility downtime
- No need for assurance of tight room integrity

FM

Victaulic Vortex 1000 system FM Approved in compliance with the FM5580 - Hybrid (Water and Inert Gas) Fire Extinguishing Systems Standard

Victaulic®

Piping. Systems. Solutions.

www.victaulicvortex.com

Introducing the world's first

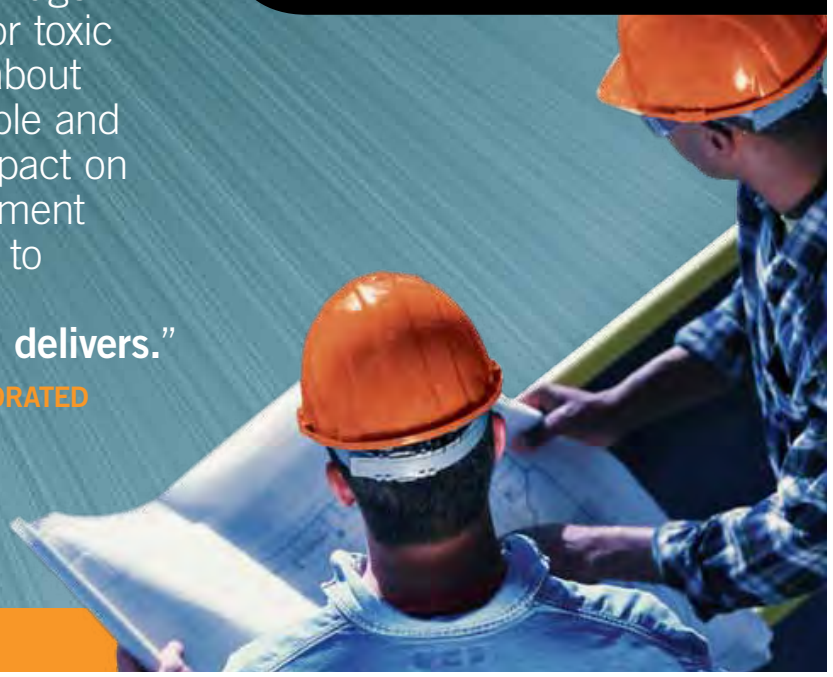
Until now,

"fire suppression" meant damaged equipment, lengthy and costly clean up, and lost productivity.

With Victaulic Vortex, experience a new standard of special hazard fire suppression, brought to you by Victaulic, the leader in innovation for the fire protection market.

"My clients were very impressed with the Vortex system when they saw the level of fire protection it provides without huge amounts of water or toxic chemicals. It's all about protecting the people and assets, minimal impact on the hazard environment and the fast return to normal operations. **The Vortex system delivers.**"

TOM EUSON, 3S INCORPORATED



VictaulicVortex™

THE VICTAULIC DIFFERENCE

The Victaulic Vortex fire suppression system is built on more than 80 years of Victaulic innovation and product development experience and provides the best capabilities of both water mist and inert gas systems.

Ease of design, minimal wetting and advanced fire suppression capabilities all give the Victaulic Vortex system the advantage over existing systems.

The homogeneous mixture of water droplets and nitrogen gas is propelled with enough energy to overcome the drag effect that has limited the effectiveness of traditional water mist systems.

The unique swirling pattern quickly fills the hazard space and attacks the fire, overcoming aerodynamic forces that typically decelerate and diffuse water droplets making them ineffective.

10vs1000 microns

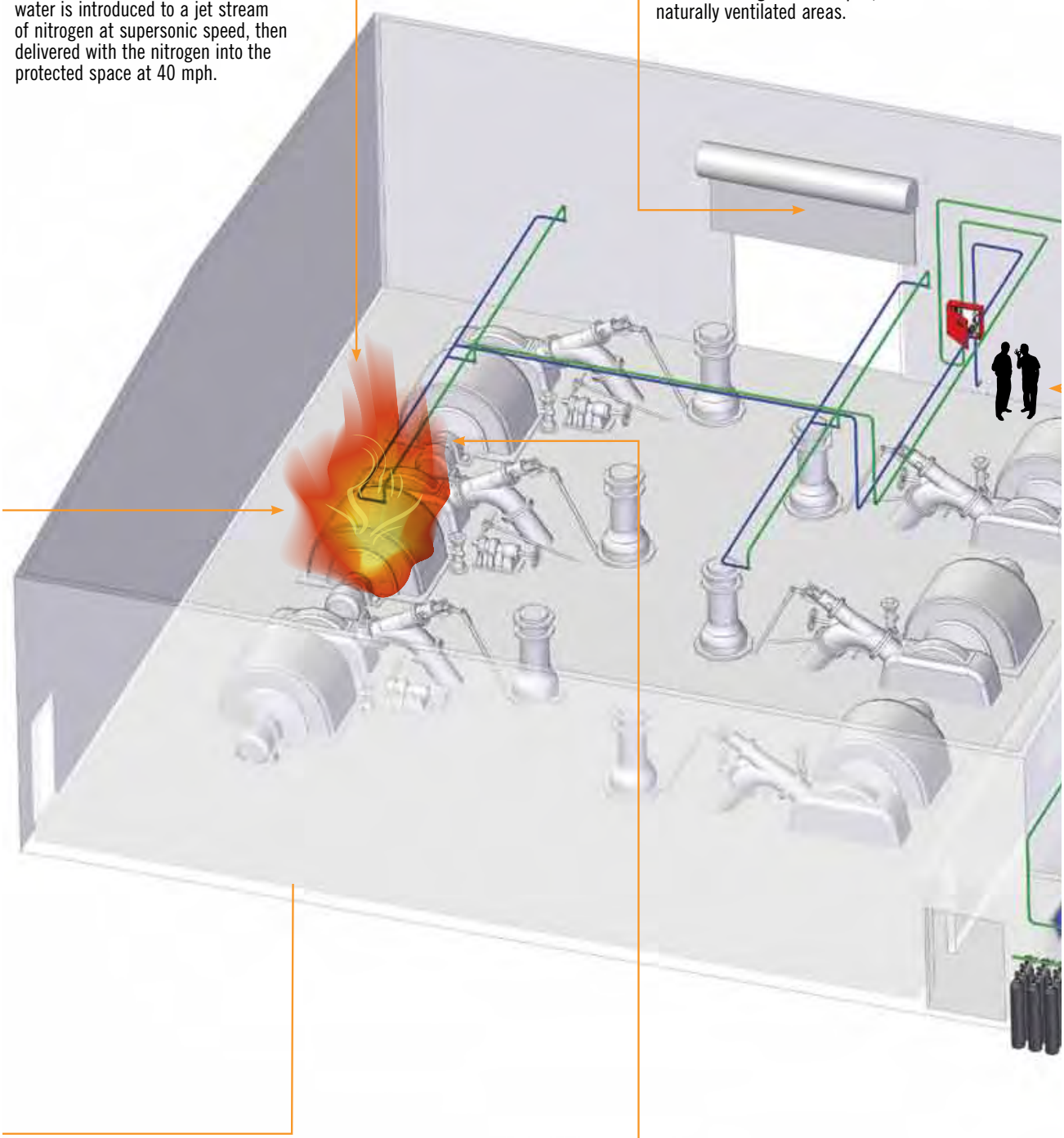
Water droplets are up to 100 times smaller than water particles delivered by a traditional water mist system, providing 50% improved heat absorption and total extinguishing.

Nearly zero water residue in protected areas means there is no water damage after the fire is extinguished.

40 mph

High velocity and low pressure creates a uniform blend of water and nitrogen; water is introduced to a jet stream of nitrogen at supersonic speed, then delivered with the nitrogen into the protected space at 40 mph.

Unlike other systems, maintaining room integrity is not essential; fires are extinguished in open, naturally ventilated areas.



124,000 cubic ft.

System is scalable from one zone of 124,000 ft^3 to broad networks of zones as large and as many as required.

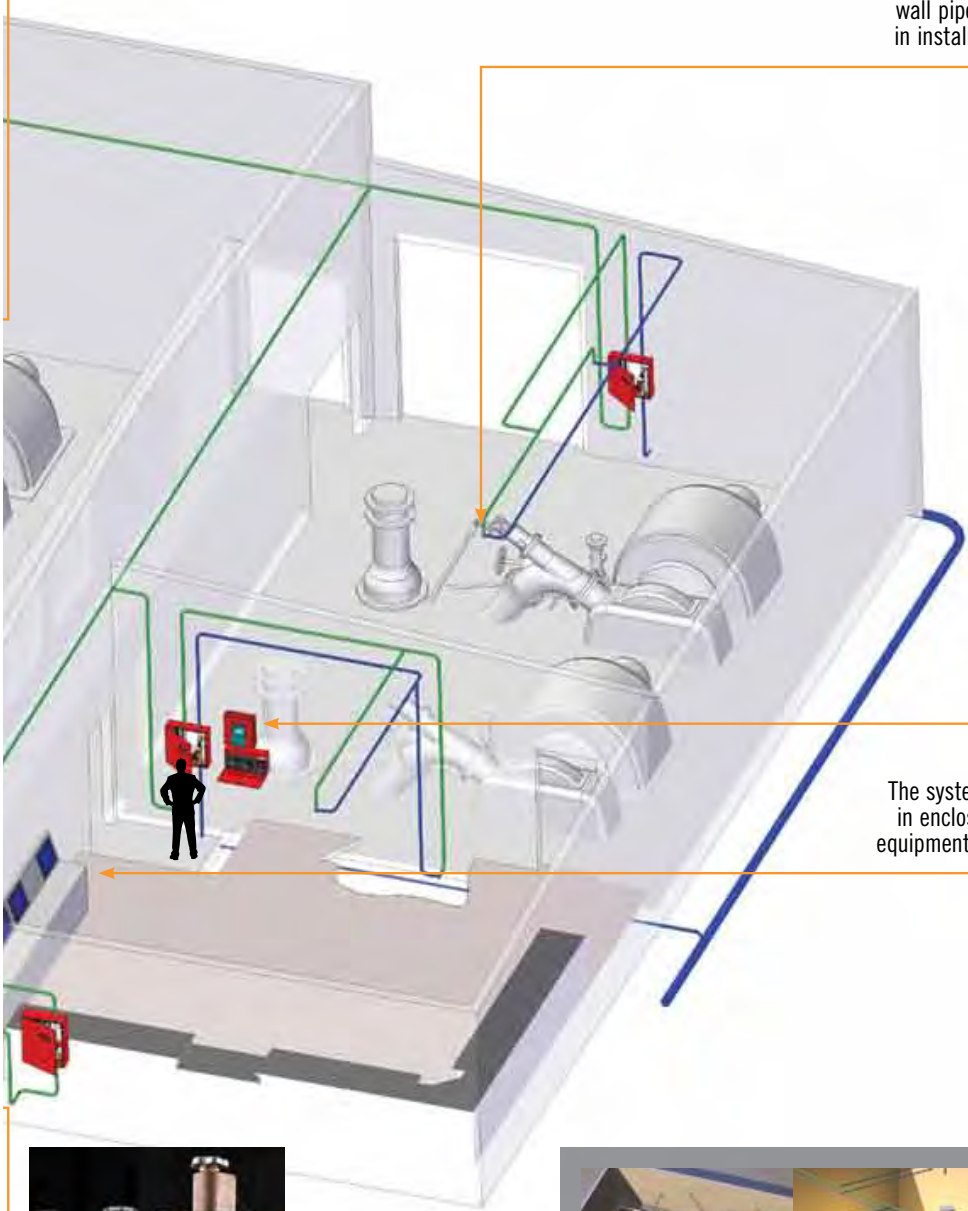
Zones can be centrally controlled yet independently activated for fire suppression only where required.

Made entirely of non-toxic agents — personnel are safe even during activation; reduction of oxygen in the space is at levels within safe breathing tolerances.

System activation is immediate when sensors detect smoke or heat — there is no delay in activation to evacuate personnel to avoid a toxic environment.

labor savings

Low system pressures — less than 25 psi of nitrogen and ~25 psi of water — permit lighter wall pipe providing direct savings in installation and material costs.



The system is compatible with facility fire protection systems providing greater design flexibility in both retrofit and new construction.

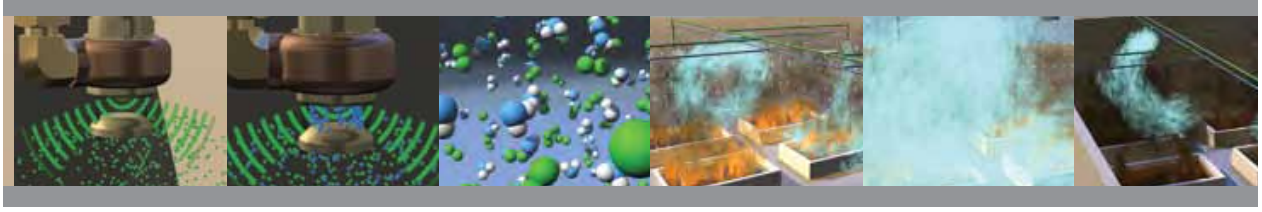
The system fully extinguishes fires in enclosed cabinets and isolated equipment within protected spaces.

System is recharged rapidly allowing for a return to working conditions almost immediately after a fire.

The Victaulic Vortex emi wing design. The supers velocity, producing shoc through the emitter.

2500 cubic ft.

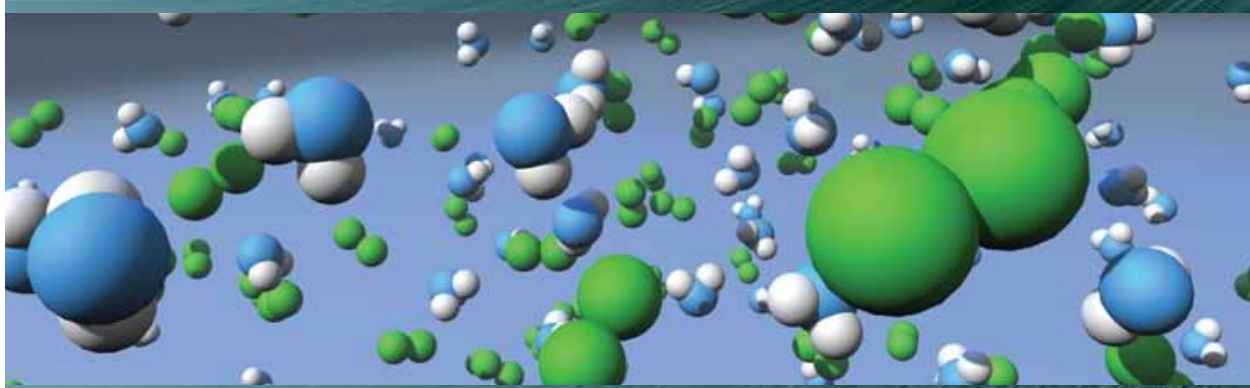
The system delivers as little as one gallon of water per emitter per minute; each emitter can protect up to 2,500 cubic ft.



nitter shape is based on supersonic aircraft rsonic nitrogen flow drops rapidly to subsonic ick waves that atomize the water injected

The water and nitrogen mixture is projected at high velocity and great distance in a vortex pattern, absorbing the heat and starving the fire of oxygen.

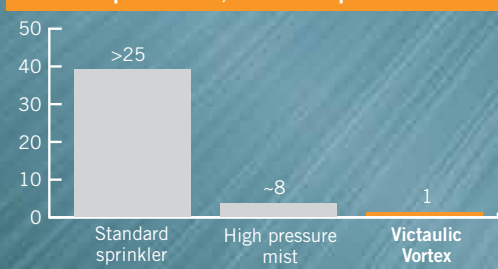
hybrid water/inert gas
fire suppression system



The average Victaulic Vortex droplet size is less than 10 microns, and the minimal amount of water released per emitter—as little as one gallon per minute— virtually eliminates any wetting in a space.

Traditional sprinklers typically release more than 25 gallons of water per minute per sprinkler, or 96% more than the Victaulic Vortex system. In addition, high-pressure water mist systems release approximately 8 gallons of water per nozzle per minute, or 88% more than the Victaulic Vortex system.

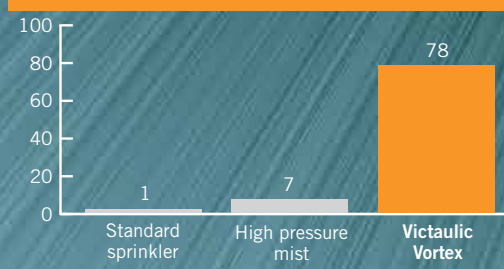
Relative amount of water required
GPM flow per emitter, nozzle or sprinkler



Unlike other combined agent systems, the Victaulic Vortex hybrid system utilizes both nitrogen and water as **complementary extinguishing agents.**

For smaller fires, the nitrogen is the primary extinguishing agent, reducing the oxygen level in the space to a breathable level, where combustion cannot be sustained.

Relative surface area of heat exposure
Square inches per minute, normalized Standard Sprinkler = 1



In larger fires, the water mist is more effective, cooling the fire by absorbing the heat and reducing the available oxygen. In fact, **the heat-absorbing water droplet surface area is 90 times greater than that of any standard sprinkler system,** providing maximum heat absorption efficiency.

Performance Analysis:

ENVIRONMENT IMPACT COMPARISON

Agent	
Victaulic Vortex Fire Suppression System	A hybrid system utilizing inert clean agent gas and water. The ~10 µ sized water droplets remove the heat in large fires and aid in the radiative and convective heat blocking. The nitrogen extinguishes small fires in large rooms in naturally ventilated environments.
Intermediate Pressure Water Mist and Sprinkler Systems	Larger size water droplets are used to soak the fuel source. Steam generated from the fire aids in the radiative and convective heat blocking. Large droplet size and momentum generally make these less efficient for shielded fires.
High Pressure Water Mist	Water extracts heat from the fire. Steam generated from the fire aids in the radiative and convective heat blocking. Momentum is generally lost within a short distance of the nozzle. More efficient for large fire extinguishment.
Inert Clean Agent Gases	Rely primarily on oxygen reduction. Limited thermal cooling and no reduction of radiative or convective heat transfer. Fuel is not cooled and re-ignition from hot objects is possible.
Halogenated Agents	Rely on flame temperature reduction due to the thermal characteristics of the agent or disruption of the combustion process. No reduction in radiative or convective heat transfer and the fuel is generally not cooled leading to possible re-ignition.

WATER CHARACTERISTICS COMPARISON

	FLOW, GPM PER EMITTER, NOZZLE OR SPRINKLER	DROP SIZE, µm	OPERATING PRESSURE, PSIG	VELOCITY
Agent				
Victaulic Vortex Fire Suppression System	<= 1	<10	25	High
Intermediate Pressure Water Mist	37	400 – 1000	350	High
High Pressure Water Mist	~ 8*	50 – 100	1500 – 2500	Low
Sprinkler Systems	>25	>1000	>20	Moderate
Inert Gases	N/A	N/A	2500	N/A
Halogenated Agents	N/A	N/A	360	N/A

*Dependent upon system design

REGULATORY INFORMATION

FM has Approved the Victaulic Vortex 1000 Fire Suppression System for the protection of combustion turbines, machinery spaces, and special hazard machinery spaces in enclosures with volumes not exceeding 127,525 ft^3/3600 m^3 and a maximum height of 24.6 ft/4.9 m.

The Victaulic Vortex system has been witnessed by Underwriter's Laboratory and **found to extinguish Class A polymeric and wood crib materials and Class B flammable liquid fires effectively in accordance with UL 2127.**

The EPA has provided a Significant New Alternatives Policy (SNAP) Approval for the Victaulic Vortex system, **listing the system as a hybrid inert gas, water-based system and an acceptable replacement for Halon 1301 in total flooding applications.**

The Victaulic Vortex system has **demonstrated the capability of extinguishing all fire scenarios of NFPA 750 and NFPA 2001** without needing to meet the extended discharge, room integrity (10 minute hold time) and delivery time (1 minute) requirements of NFPA 750 and NFPA 2001.

By only using the natural materials of water and nitrogen, the Victaulic Vortex system:

- is **not subject to specific government regulations** such as certificates of approval due to Ozone Depletion Potential (ODP).
- **does not require special processes for the replacement of proprietary agents** since the materials required for system recharging are readily available.

For more information, contact Victaulic at 1-877-9VORTEX or email: vortex@victaulic.com

WCAS-7RXGYC

PB-389
5309 REV C

Victaulic®
Piping. Systems. Solutions.

VictaulicVortex™

fire suppression system

For Data Center and Control Room Applications

- Nearly zero wetting
- No costly clean up or equipment replacement
- Sustainable design
- Quick system recharge, minimal downtime
- No need for assurance of tight room integrity

Victaulic®
Piping. Systems. Solutions.

The Victaulic Difference

"In mission critical applications like data rooms and server spaces, the ability to provide fast, dependable fire suppression without any appreciable water presence or toxic chemicals is fantastic. At Bluehost, we are all about innovative technology. We look for flexible systems that can accommodate our specific needs, both in protecting equipment and people, as well as getting back up and running fast after an event. The Victaulic Vortex system offers all that and more—green technology, minimal water presence, effortless clean-up, economical recharge, immediate activation, no need for room integrity—this system simply has it all."

–MATT HEATON, OWNER, BLUEHOST

As little as 0.26 GPM of water per emitter discharged.

100% green design.

Zero need for maintenance of room integrity.

The Victaulic Vortex Fire Suppression System is built on more than 85 years of Victaulic innovation and product development experience and provides the best capabilities of both water mist and inert gas systems.

The homogeneous mixture of water droplets and nitrogen gas is discharged with enough energy to overcome the drag effect that has limited the effectiveness of traditional water mist systems.

Fire suppression for data centers and control rooms

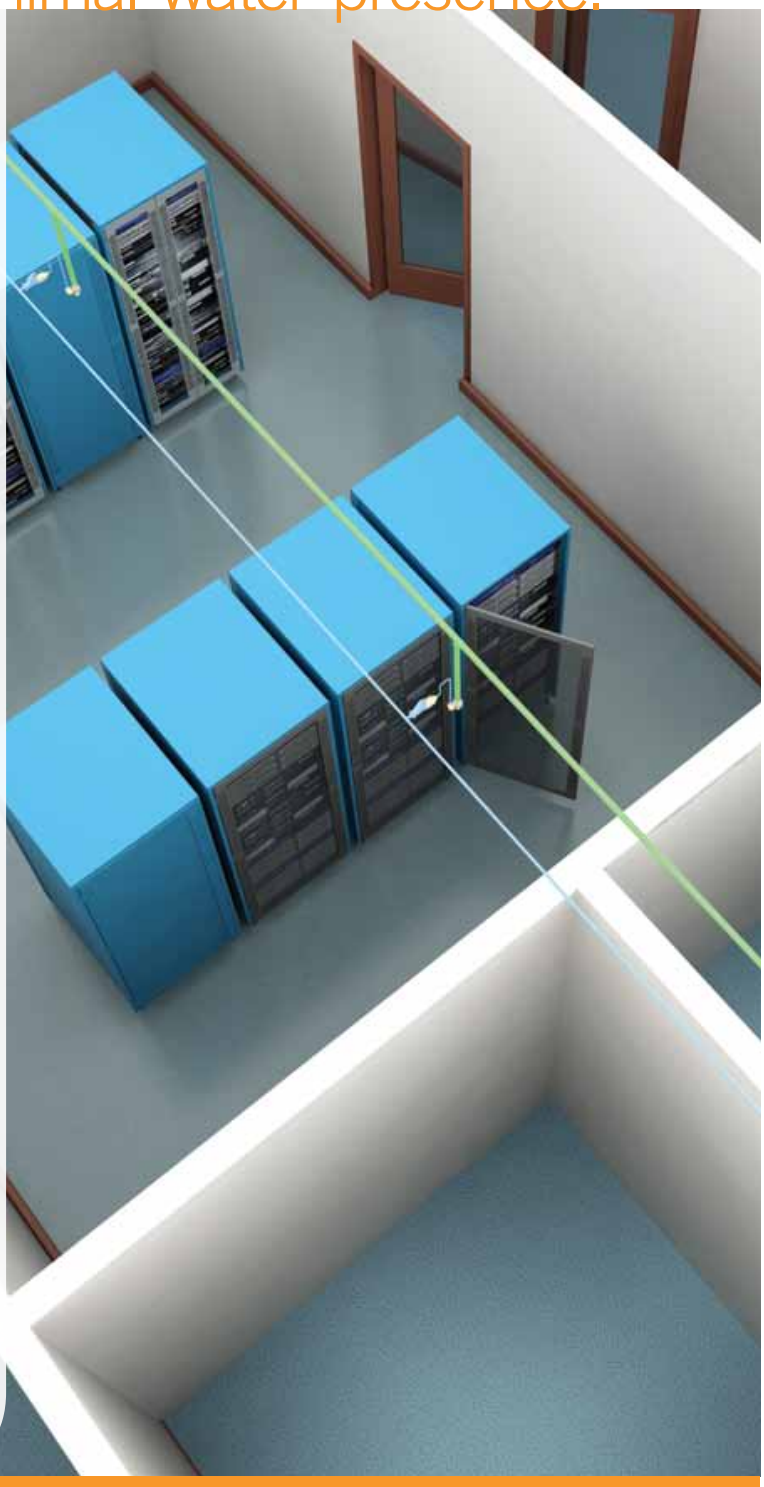
- Minimal water presence
- Simple, modular system design for easy installation and maintenance
- Easy portability for facility relocations or renovations

Active release system

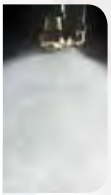
The Victaulic Vortex system utilizes an active release system to discharge nitrogen upon activation.

- Simple, low-maintenance piping
- Easy access to cylinders for refill and inspection
- Scalable, expandable design

Victaulic Vortex hybrid technology extinguishes via heat absorption and oxygen deprivation with minimal water presence.



¼ gallon



SPARSE WATER PRESENCE

As little as ¼ gallon of water per minute per emitter utilized to suppress fires.

ROOM INTEGRITY

Unlike other systems, maintaining room integrity is not essential; fires are extinguished in open, naturally ventilated areas.

SUB-FLOORS

Sub-floor spaces easily protected by scalable, zoned system design.

40 mph

EMITTER/DISCHARGE

High velocity and low pressure creates a uniform blend of water and nitrogen; water is introduced to a jet stream of nitrogen at supersonic speed, then delivered with the nitrogen into the protected space at 40 mph.

COMPATIBLE WITH SECURITY SYSTEM

The system is compatible with facility fire protection systems providing greater design flexibility in both retrofit and new construction.

ZONEABLE AND SCALABLE

System activation is immediate when sensors detect smoke or heat — there is no delay in activation to evacuate personnel to avoid a toxic environment.

nearly zero wetting

PROTECTION WITHIN ENCLOSURES

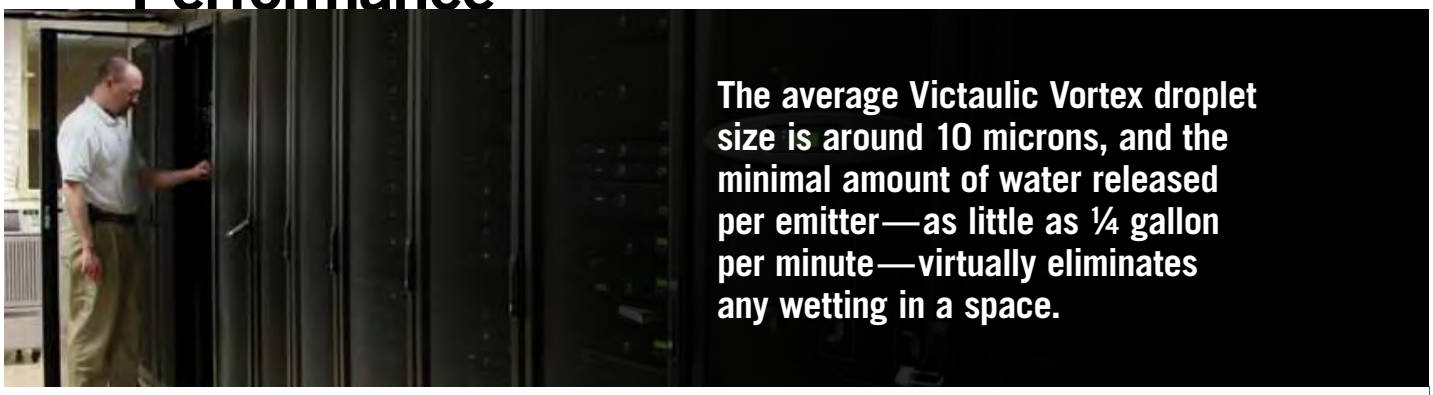
Even small, smoldering fires within racks are detected and extinguished with negligible water exposure for components or hardware.

sustainable design

100% GREEN DESIGN

Made entirely of non-toxic agents — personnel are safe even during activation; reduction of oxygen in the space is at levels within safe breathing tolerances.

Performance



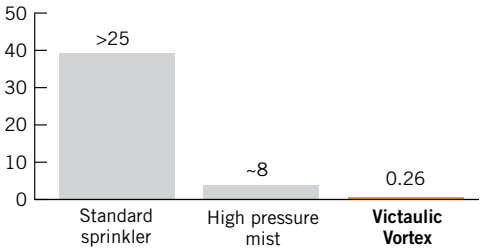
The average Victaulic Vortex droplet size is around 10 microns, and the minimal amount of water released per emitter—as little as ¼ gallon per minute—virtually eliminates any wetting in a space.

The system uses **97% less water** than high-pressure water mist systems. For example, a space the size of two football fields can be protected by a system that activates immediately to extinguish a high hazard fire with **around three gallons of water in less than four minutes.**

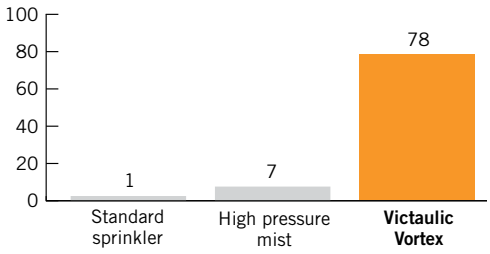
Unlike other combined agent systems, the Victaulic Vortex hybrid system utilizes both nitrogen and water as **complementary extinguishing agents.**

For smaller fires, the Victaulic Vortex system utilizes nitrogen as the primary extinguishing agent, reducing the oxygen level in the space to a breathable level, where combustion cannot be sustained.

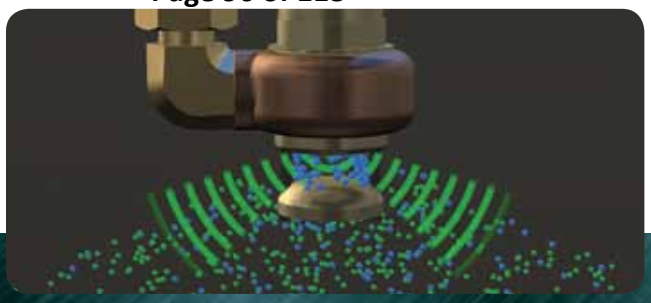
RELATIVE AMOUNT OF WATER REQUIRED
GPM FLOW PER EMITTER, NOZZLE OR SPRINKLER



RELATIVE SURFACE AREA OF HEAT EXPOSURE SQUARE INCHES
PER MINUTE, NORMALIZED STANDARD SPRINKLER = 1



In larger fires, the water mist is more effective, cooling the fire by absorbing the heat and reducing the available oxygen. In fact, the heat-absorbing water droplet surface area is **90 times greater** than that of any standard sprinkler system, providing maximum heat absorption efficiency.



PERFORMANCE ANALYSIS:

WATER CHARACTERISTICS COMPARISON

	FLOW, GPM PER EMITTER, NOZZLE OR SPRINKLER	DROP SIZE, µm	OPERATING PRESSURE, PSIG	VELOCITY
Agent				
Victaulic Vortex Fire Suppression System	0.26	<10	25	High
Intermediate Pressure Water Mist	3-5	400 – 1000	350	High
High Pressure Water Mist	~ 8*	50 – 100	1500 – 2500	Low
Sprinkler Systems	>25	>1000	>20 min	Moderate
Inert Gases	N/A	N/A	2500	N/A
Halogenated Agents	N/A	N/A	360	N/A

*Dependent upon system design

PERFORMANCE ANALYSIS:

ENVIRONMENT IMPACT COMPARISON

Agent	
Victaulic Vortex Fire Suppression System	A hybrid system utilizing inert clean agent gas and water. The ~10 µm sized water droplets remove the heat in large fires and aid in the radiative and convective heat blocking. The nitrogen extinguishes small fires in large rooms in naturally ventilated environments.
Intermediate Pressure Water Mist and Sprinkler Systems	Larger size water droplet are used to soak the fuel source. Steam generated from the fire aids in the radiative and convective heat blocking. Large droplet size and momentum generally make these less efficient for shielded fires.
High Pressure Water Mist	Water extracts heat from the fire. Steam generated from the fire aids in the radiative and convective heat blocking. Momentum is generally lost within a short distance of the nozzle. Most efficient for large fire extinguishment.
Inert Clean Agent Gases	Rely primarily on oxygen reduction. Limited thermal cooling and no reduction of radiative or convective heat transfer. Fuel is not cooled and re-ignition from hot objects is possible.
Halogenated Agents	Rely on flame temperature reduction due to the thermal characteristics of the agent or disruption of the combustion process. No reduction in radiative or convective heat transfer and the fuel is generally not cooled leading to possible reignition.

project brief

Zappos Data Center

LOUISVILLE, KENTUCKY, USA

TYPE OF FACILITY: DATA CENTER

When the Zappos Company needed a new fire suppression system to protect its data center in their Louisville, Kentucky facility, they turned to Midwest Fire Protection. Midwest chose to install the Victaulic Vortex Fire Suppression system, in order to avoid large amounts of water around the computer equipment as well as to fulfill a need to suppress fires out in the open, ventilated space and inside the electrical cabinets.

The environmentally-friendly Victaulic Vortex system was also desired by the Zappos Company for its zero emissions and absolute lack of toxic chemicals or agents. The project was completed in 2009.

ENGINEER/CONSULTANT

Meyer General Contracting, Inc.

project brief

Golden Ears Bridge

BRITISH COLUMBIA, CANADA

TYPE OF FACILITY: DATA CENTER

This data center facility, located approximately five miles from the Golden Ears Bridge, is operated by Transroute, Canada and supports the bridge's automated toll equipment. ASD Technologies selected the Victaulic Vortex™ Fire Suppression system because it can adequately suppress fires which may start inside computer rack cabinets with minimal water damage. Further, since the Victaulic Vortex system only deploys water and nitrogen, it is a 100% green system which was also a requirement for this project.

Another key Victaulic Vortex system benefit is its ability to be installed as a stand-alone system, operating independently of the fire safety systems for the surrounding building. The project was completed in 2010.

ENGINEER/CONSULTANT

Novota Group

PB-402 6423 REV B

Victaulic®
Piping. Systems. Solutions.

Appendix B

Vendor Budget Pricing

tyco
Fire Suppression
& Building Products

QUOTATION SHEET FOR:
ANSUL AUTOPULSE - CONVENTIONAL

DATE: **December 9, 2011**
JOB NAME: **Nain Office** (MaKKovik Similar)
CUSTOMER: **Hatch Mott, Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-9 AutoPulse Nain Office**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	LIST PRICE	EXTENSION
1	430525	AUTOPULSE Z-10 Control Unit, 120 VAC	$998.00	$998.00
1	430687	Coil Supervision Module (Release Circuit)	$30.20	$30.20
1	431196	Abort Supervision Module	$35.20	$35.20
1	430529	4-Pt Auxiliary Relay Module	$160.00	$160.00
2	430559	Photoelectric Detector, 2.8% ULI/ULC	$62.00	$124.00
2	430567	2 Wire Base w/LED Driver ULI/ULC	$10.30	$20.60
1	417693	BA1210 Battery, 12 V 12.0 AH (2 Batteries)	$324.00	$324.00
1	437028	KMS-6-42A Motorized Alarm Bell, 6" 24 VDC	$43.70	$43.70
1	438774	BBR- Surface Backbox for Alarm Bell	$13.65	$13.65
1	437034	MTWP-2475W-FR Horn/Strobe Light 75cd 24VDC, W.P.	$171.64	$171.64
1	437035	IOB-R Weatherproof or Surface Backbox for MT	$26.69	$26.69
		DETECTION EQUIPMENT TOTAL		$1,947.68
		DISCOUNT		*10.00%*
		DISCOUNT		
		DISCOUNTED PRICE		$1,752.91
		ENGINEERING CHARGES (not included)		
		TOTAL NET PRICE in US $		**$1,752.91**

Prices shown In U.S. Dollars and Subject to Ansul's Current Published Exchange Rate
Freight, Taxes and All Other Applicable Charges Not Included,
F.O.B. Marinette, WI and or Woodbridge, ON
Except for orders over $6,000 in which case Freight is Prepaid
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

tyco
Fire Suppression
& Building Products

QUOTATION SHEET FOR:
ANSUL AUTOPULSE - CONVENTIONAL

DATE: **December 8, 2011**
JOB NAME: **Williams Harbour Office**
CUSTOMER: **Hatch Mott, Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-8 AutoPulse Williams Harbour Office**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	LIST PRICE	EXTENSION
1	430525	AUTOPULSE Z-10 Control Unit, 120 VAC	$998.00	$998.00
1	430687	Coil Supervision Module (Release Circuit)	$30.20	$30.20
1	431196	Abort Supervision Module	$35.20	$35.20
1	430529	4-Pt Auxiliary Relay Module	$160.00	$160.00
2	430559	Photoelectric Detector, 2.8% ULI/ULC	$62.00	$124.00
2	430567	2 Wire Base w/LED Driver ULI/ULC	$10.30	$20.60
1	417693	BA1210 Battery, 12 V 12.0 AH (2 Batteries)	$324.00	$324.00
1	437028	KMS-6-42A Motorized Alarm Bell, 6" 24 VDC	$43.70	$43.70
1	438774	BBR- Surface Backbox for Alarm Bell	$13.65	$13.65
1	437034	MTWP-2475W-FR Horn/Strobe Light 75cd 24VDC, W.P.	$171.64	$171.64
1	437035	IOB-R Weatherproof or Surface Backbox for MT	$26.69	$26.69
		DETECTION EQUIPMENT TOTAL		$1,947.68
		DISCOUNT		*10.00%*
		DISCOUNT		
		DISCOUNTED PRICE		$1,752.91
		ENGINEERING CHARGES (not included)		
		TOTAL NET PRICE in US $		**$1,752.91**

Prices shown In U.S. Dollars and Subject to Ansul's Current Published Exchange Rate
Freight, Taxes and All Other Applicable Charges Not Included,
F.O.B. Marinette, WI and or Woodbridge, ON
Except for orders over $6,000 in which case Freight is Prepaid
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

08-Dec-11

QUOTATION 11-12-drd-Dec.-8-Nain Diesel Generator Room (MaKKovik similar)

Hatch Mott, Fredericton, Peter Macpherson

Note:Price amounts shown are in US$

Qty	PartNbr	Part Description	Weight	ListPrice	NetPrice	Total Net Price
16	437166	Cylinder, Nitrogen, 575 cu. ft. (DOT)	0	$ 2,216.00	$ 1,994.40	$ 31,910.40
16	427082	Flexible Discharge Bend for CV90 and CV98 (200 Bar)	0	$ 139.00	$ 125.10	$ 2,001.60
1	79640	Back Frame Assembly (4 cylinder)	0	$ 236.00	$ 236.00	$ 236.00
1	79642	Back Frame Assembly (6 cylinder)	0	$ 337.00	$ 303.30	$ 303.30
8	73257	Upright - Left Side, Right Side or Center	0	$ 103.00	$ 92.70	$ 741.60
6	73554	Bracket Foot, Right - single or Back to Back Row	0	$ 42.80	$ 38.52	$ 231.12
3	73555	Bracket Foot, Left - Double Row	0	$ 63.00	$ 56.70	$ 170.10
3	73556	Bracket Foot, Right - Double Row	0	$ 63.00	$ 56.70	$ 170.10
6	418503	Bolt and Nut, 27 in. (659 mm) (Double Row)	0	$ 19.30	$ 17.37	$ 104.22
6	73092	Cylinder Clamp - 3 Cylinders	0	$ 65.00	$ 58.50	$ 351.00
2	71682	Weigh Rail Support Double Row	0	$ 120.00	$ 108.00	$ 216.00
2	428949	Booster Actuator	0	$ 412.00	$ 370.80	$ 741.60
2	73327	Actuator, Electric, HF	0	$ 562.00	$ 505.80	$ 1,011.60
4	437340	50 Gal. (189 L) Water Tank Assembly	0	$ 5,720.00	$ 5,148.00	$ 20,592.00
4	72584	Nitrogen Hose	0	$ 153.00	$ 137.70	$ 550.80
1	437289	Regulator 600 SCFM (1000 N?m3/hour), 3 to 5 Atomizer	0	$ 5,720.00	$ 5,720.00	$ 5,720.00
2	472014	Victor Regulator, (125 PSI)	0	$ 587.00	$ 528.30	$ 1,056.60
6	435877	Atomizers Pressure Range, 73-84 psi (5.03-6.00 bar)	0	$ 3,640.00	$ 3,276.00	$ 19,656.00
						$ 85,764.04

08-Dec-11

QUOTATION 11-12-drd-Dec.-8-Natuashish Diesel Generator Room

Hatch Mott, Fredericton, Peter Macpherson

Note:Price amounts shown are in US$

Qty	PartNbr	Part Description	Weight	ListPrice	NetPrice	Total Net Price
30	437166	Cylinder, Nitrogen, 575 cu. ft. (DOT)	0	$ 2,216.00	$ 1,994.40	$ 59,832.00
30	427082	Flexible Discharge Bend for CV90 and CV98 (200 Bar)	0	$ 139.00	$ 125.10	$ 3,753.00
1	79639	Back Frame Assembly (3 cylinder)	0	$ 177.00	$ 159.30	$ 159.30
2	79642	Back Frame Assembly (6 cylinder)	0	$ 337.00	$ 303.30	$ 606.60
8	73257	Upright - Left Side, Right Side or Center	0	$ 103.00	$ 92.70	$ 741.60
6	73554	Bracket Foot, Right - single or Back to Back Row	0	$ 42.80	$ 38.52	$ 231.12
6	73555	Bracket Foot, Left - Double Row	0	$ 63.00	$ 56.70	$ 340.20
6	73556	Bracket Foot, Right - Double Row	0	$ 63.00	$ 56.70	$ 340.20
10	418503	Bolt and Nut, 27 in. (659 mm) (Double Row)	0	$ 19.30	$ 17.37	$ 173.70
10	73092	Cylinder Clamp - 3 Cylinders	0	$ 65.00	$ 58.50	$ 585.00
3	71682	Weigh Rail Support Double Row	0	$ 120.00	$ 108.00	$ 324.00
2	428949	Booster Actuator	0	$ 412.00	$ 370.80	$ 741.60
2	73327	Actuator, Electric, HF	0	$ 562.00	$ 505.80	$ 1,011.60
6	437340	50 Gal. (189 L) Water Tank Assembly	0	$ 5,720.00	$ 5,148.00	$ 30,888.00
1	437290	Regulator 1800 SCFM (3000 N?m3/hour), 6 to 15 Atomizer	0	$ 9,984.00	$ 8,985.60	$ 8,985.60
2	472014	Victor Regulator, (125 PSI)	0	$ 587.00	$ 528.30	$ 1,056.60
10	435877	Atomizers Pressure Range, 73-84 psi (5.03-6.00 bar)	0	$ 3,640.00	$ 3,276.00	$ 32,760.00
						$ 142,530.12

tyco
Fire Suppression
& Building Products

QUOTATION SHEET FOR:
ANSUL AUTOPULSE - CONVENTIONAL

DATE: **December 9, 2011**
JOB NAME: **Natuashish Electrical Battery Room**
CUSTOMER: **Hatch Mott, Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-9 AutoPulse Elec. Battery Room**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	LIST PRICE	EXTENSION
1	430525	AUTOPULSE Z-10 Control Unit, 120 VAC	$998.00	$998.00
1	430687	Coil Supervision Module (Release Circuit)	$30.20	$30.20
1	431196	Abort Supervision Module	$35.20	$35.20
1	430529	4-Pt Auxiliary Relay Module	$160.00	$160.00
2	430559	Photoelectric Detector, 2.8% ULI/ULC	$62.00	$124.00
2	430567	2 Wire Base w/LED Driver ULI/ULC	$10.30	$20.60
1	417693	BA1210 Battery, 12 V 12.0 AH (2 Batteries)	$324.00	$324.00
1	437028	KMS-6-42A Motorized Alarm Bell, 6" 24 VDC	$43.70	$43.70
1	438774	BBR- Surface Backbox for Alarm Bell	$13.65	$13.65
1	437034	MTWP-2475W-FR Horn/Strobe Light 75cd 24VDC, W.P.	$171.64	$171.64
1	437035	IOB-R Weatherproof or Surface Backbox for MT	$26.69	$26.69
		DETECTION EQUIPMENT TOTAL		$1,947.68
		DISCOUNT		*10.00%*
		DISCOUNT		
		DISCOUNTED PRICE		$1,752.91
		ENGINEERING CHARGES (not included)		
		TOTAL NET PRICE in US $		**$1,752.91**

Prices shown In U.S. Dollars and Subject to Ansul's Current Published Exchange Rate
Freight, Taxes and All Other Applicable Charges Not Included,
F.O.B. Marinette, WI and or Woodbridge, ON
Except for orders over $6,000 in which case Freight is Prepaid
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

tyco
Fire Suppression
& Building Products

QUOTATION SHEET FOR:
ANSUL AUTOPULSE - CONVENTIONAL

DATE: **December 9, 2011**
JOB NAME: **Natuashish Electrical Computerl Room**
CUSTOMER: **Hatch Mott, Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-9 AutoPulse Elec. Coputer Room**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	LIST PRICE	EXTENSION
1	430525	AUTOPULSE Z-10 Control Unit, 120 VAC	$998.00	$998.00
1	430687	Coil Supervision Module (Release Circuit)	$30.20	$30.20
1	431196	Abort Supervision Module	$35.20	$35.20
1	430529	4-Pt Auxiliary Relay Module	$160.00	$160.00
2	430559	Photoelectric Detector, 2.8% ULI/ULC	$62.00	$124.00
2	430567	2 Wire Base w/LED Driver ULI/ULC	$10.30	$20.60
1	417693	BA1210 Battery, 12 V 12.0 AH (2 Batteries)	$324.00	$324.00
1	437028	KMS-6-42A Motorized Alarm Bell, 6" 24 VDC	$43.70	$43.70
1	438774	BBR- Surface Backbox for Alarm Bell	$13.65	$13.65
1	437034	MTWP-2475W-FR Horn/Strobe Light 75cd 24VDC, W.P.	$171.64	$171.64
1	437035	IOB-R Weatherproof or Surface Backbox for MT	$26.69	$26.69
		DETECTION EQUIPMENT TOTAL		$1,947.68
		DISCOUNT		*10.00%*
		DISCOUNT		
		DISCOUNTED PRICE		$1,752.91
		ENGINEERING CHARGES (not included)		
		TOTAL NET PRICE in US $		**$1,752.91**

Prices shown In U.S. Dollars and Subject to Ansul's Current Published Exchange Rate
Freight, Taxes and All Other Applicable Charges Not Included,
F.O.B. Marinette, WI and or Woodbridge, ON
Except for orders over $6,000 in which case Freight is Prepaid
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

tyco
Fire Suppression
& Building Products

QUOTATION SHEET FOR:
ANSUL AUTOPULSE - CONVENTIONAL

DATE: **December 9, 2011**
JOB NAME: **Natuashish Electrical Control Room**
CUSTOMER: **Hatch Mott, Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-9 AutoPulse Elec. Control Room**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	LIST PRICE	EXTENSION
1	430525	AUTOPULSE Z-10 Control Unit, 120 VAC	$998.00	$998.00
1	430687	Coil Supervision Module (Release Circuit)	$30.20	$30.20
1	431196	Abort Supervision Module	$35.20	$35.20
1	430529	4-Pt Auxiliary Relay Module	$160.00	$160.00
3	430559	Photoelectric Detector, 2.8% ULI/ULC	$62.00	$186.00
3	430567	2 Wire Base w/LED Driver ULI/ULC	$10.30	$30.90
1	417693	BA1210 Battery, 12 V 12.0 AH (2 Batteries)	$324.00	$324.00
1	437028	KMS-6-42A Motorized Alarm Bell, 6" 24 VDC	$43.70	$43.70
1	438774	BBR- Surface Backbox for Alarm Bell	$13.65	$13.65
1	437034	MTWP-2475W-FR Horn/Strobe Light 75cd 24VDC, W.P.	$171.64	$171.64
1	437035	IOB-R Weatherproof or Surface Backbox for MT	$26.69	$26.69
		DETECTION EQUIPMENT TOTAL		$2,019.98
		DISCOUNT		*10.00%*
		DISCOUNT		
		DISCOUNTED PRICE		$1,817.98
		ENGINEERING CHARGES (not included)		
		TOTAL NET PRICE in US $		**$1,817.98**

Prices shown In U.S. Dollars and Subject to Ansul's Current Published Exchange Rate
Freight, Taxes and All Other Applicable Charges Not Included,
F.O.B. Marinette, WI and or Woodbridge, ON
Except for orders over $6,000 in which case Freight is Prepaid
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

tyco
Fire Suppression
& Building Products

QUOTATION SHEET FOR:
ANSUL AUTOPULSE - CONVENTIONAL

DATE: **December 9, 2011**
JOB NAME: **Natuashish Heat Exchanger Room**
CUSTOMER: **Hatch Mott, Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-9 AutoPulse Heat Exchanger Room**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	LIST PRICE	EXTENSION
1	430525	AUTOPULSE Z-10 Control Unit, 120 VAC	$998.00	$998.00
1	430687	Coil Supervision Module (Release Circuit)	$30.20	$30.20
1	431196	Abort Supervision Module	$35.20	$35.20
1	430529	4-Pt Auxiliary Relay Module	$160.00	$160.00
2	430559	Photoelectric Detector, 2.8% ULI/ULC	$62.00	$124.00
2	430567	2 Wire Base w/LED Driver ULI/ULC	$10.30	$20.60
1	417693	BA1210 Battery, 12 V 12.0 AH (2 Batteries)	$324.00	$324.00
1	437028	KMS-6-42A Motorized Alarm Bell, 6" 24 VDC	$43.70	$43.70
1	438774	BBR- Surface Backbox for Alarm Bell	$13.65	$13.65
1	437034	MTWP-2475W-FR Horn/Strobe Light 75cd 24VDC, W.P.	$171.64	$171.64
1	437035	IOB-R Weatherproof or Surface Backbox for MT	$26.69	$26.69
		DETECTION EQUIPMENT TOTAL		$1,947.68
		DISCOUNT		*10.00%*
		DISCOUNT		
		DISCOUNTED PRICE		$1,752.91
		ENGINEERING CHARGES (not included)		
		TOTAL NET PRICE in US $		**$1,752.91**

Prices shown In U.S. Dollars and Subject to Ansul's Current Published Exchange Rate
Freight, Taxes and All Other Applicable Charges Not Included,
F.O.B. Marinette, WI and or Woodbridge, ON
Except for orders over $6,000 in which case Freight is Prepaid
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

tyco *Fire Suppression & Building Products*

QUOTATION FOR:

ANSUL SAPPHIRE ENGINEERED SYSTEMS

DATE: **December 9, 2011**
JOB NAME: **Natuashish Electical Battery Room, 1,001 ft3**
CUSTOMER: **Hatch Mott Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-9 Sapphire- Computer Room**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	WEIGHT	LIST PRICE	EXTENSION
1	570634	90 lb Cylinder Assembly (42lb)	*57.5*	$ 1,630.00	$1,630.00
1	570085	Container Bracket, 20 - 90 lb Cylinder	*2*	$ 80.00	$80.00
1	570585	Cylinder Low Pressure Switch	*0.3*	$ 103.00	$103.00
1	570537	Solenoid Actuator, 24V DC (0.2 amps)	*2.5*	$ 497.00	$497.00
1	570549	Local Manual Actuator	*1*	$ 152.00	$152.00
1	415142	S. S. Actuation Hose, 32 in., 1/4in. MNPT x 7/16-20 Flare	*1*	$ 33.00	$33.00
1	032338	Male Actuation Connector 7/16-20 x 1/4 in. NPT	*0.1*	$ 3.10	$3.10
1	570342	Male Adapter 1/4 in. NPT x 1/4 in. BSPP	*0.1*	$ 17.70	$17.70
1	046250	Pressure Switch - DPST	*5.5*	$ 368.00	$368.00
1	570557	Single Tank Swivel Adaptor, 1 in. BSP to 1 in. FNPT	*1*	$ 21.70	$21.70
1	570604	Brass Nozzle 1 in. (25 mm) - 360 deg	*0.6*	$ 154.00	$154.00
1	570580	Entrance Warning Sign	*0.2*	$ 25.20	$25.20
1	570581	Exit Warning Sign	*0.2*	$ 30.00	$30.00
1	428655	Dual Action Pull Station SPST	*1*	$68.00	$68.00
1	428660	Surface Mount Back Box	*1*	$21.70	$21.70
1	076494	Abort Switch, Surface Mount	*2*	$143.00	$143.00
1	076498	Switch, Maintenance, Surface Mount	*2*	$261.00	$261.00
		NOVEC 1230 AGENT			
42	N/A	Factory Fill/Refill (per lb)	*42*	$30.24	$1,270.08
		SAPPHIRE EQUIPMENT TOTAL			$3,608.40
		DISCOUNT			*10.00%*
		DISCOUNT			
		NOVEC 1230 AGENT TOTAL			$1,270.08
		DISCOUNT			*50.00%*
		DISCOUNTED PRICE			$3,882.60
		TOTAL EQUIPMENT WEIGHT	*120.0 lbs*		
		ENGINEERING CHARGES (not included)			
		TOTAL NET PRICE in US $			**$3,882.60**

Prices, Shown In U.S. Dollars
Freight, Taxes and All Other Applicable Charges Not Included, F.O.B. MARINETTE
Except for orders over $2,500 in which case Freight is Prepaid
Price List Effective Date, June 2008
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

tyco *Fire Suppression & Building Products*

QUOTATION FOR:

ANSUL SAPPHIRE ENGINEERED SYSTEMS

DATE: **December 9, 2011**
JOB NAME: **Natuashish Electical Computer Room, 1,277 ft3**
CUSTOMER: **Hatch Mott Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-9 Sapphire- Computer Room**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	WEIGHT	LIST PRICE	EXTENSION
1	570634	90 lb Cylinder Assembly (54 lb)	*57.5*	$ 1,630.00	$1,630.00
1	570085	Container Bracket, 20 - 90 lb Cylinder	*2*	$ 80.00	$80.00
1	570585	Cylinder Low Pressure Switch	*0.3*	$ 103.00	$103.00
1	570537	Solenoid Actuator, 24V DC (0.2 amps)	*2.5*	$ 497.00	$497.00
1	570549	Local Manual Actuator	*1*	$ 152.00	$152.00
1	415142	S. S. Actuation Hose, 32 in., 1/4in. MNPT x 7/16-20 Flare	*1*	$ 33.00	$33.00
1	032338	Male Actuation Connector 7/16-20 x 1/4 in. NPT	*0.1*	$ 3.10	$3.10
1	570342	Male Adapter 1/4 in. NPT x 1/4 in. BSPP	*0.1*	$ 17.70	$17.70
1	046250	Pressure Switch - DPST	*5.5*	$ 368.00	$368.00
1	570557	Single Tank Swivel Adaptor, 1 in. BSP to 1 in. FNPT	*1*	$ 21.70	$21.70
1	570604	Brass Nozzle 1 in. (25 mm) - 360 deg	*0.6*	$ 154.00	$154.00
1	570580	Entrance Warning Sign	*0.2*	$ 25.20	$25.20
1	570581	Exit Warning Sign	*0.2*	$ 30.00	$30.00
1	428655	Dual Action Pull Station SPST	*1*	$68.00	$68.00
1	428660	Surface Mount Back Box	*1*	$21.70	$21.70
1	076494	Abort Switch, Surface Mount	*2*	$143.00	$143.00
1	076498	Switch, Maintenance, Surface Mount	*2*	$261.00	$261.00
		NOVEC 1230 AGENT			
54	N/A	Factory Fill/Refill (per lb)	*54*	$30.24	$1,632.96
		SAPPHIRE EQUIPMENT TOTAL			$3,608.40
		DISCOUNT			*10.00%*
		DISCOUNT			
		NOVEC 1230 AGENT TOTAL			$1,632.96
		DISCOUNT			*50.00%*
		DISCOUNTED PRICE			$4,064.04
		TOTAL EQUIPMENT WEIGHT	*132.0 lbs*		
		ENGINEERING CHARGES (not included)			
		TOTAL NET PRICE in US $			**$4,064.04**

Prices, Shown In U.S. Dollars
Freight, Taxes and All Other Applicable Charges Not Included, F.O.B. MARINETTE
Except for orders over $2,500 in which case Freight is Prepaid
Price List Effective Date, June 2008
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

tyco *Fire Suppression & Building Products*

QUOTATION FOR:

ANSUL SAPPHIRE ENGINEERED SYSTEMS

DATE: **December 9, 2011**
JOB NAME: **Natuashish Electical Control Room 6,855 ft3**
CUSTOMER: **Hatch Mott Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-9 Sapphire- Elec. Control Room**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	WEIGHT	LIST PRICE	EXTENSION
1	570652	390 lb Cylinder Assembly (286 lb)	*198*	$ 3,765.00	$3,765.00
1	570092	Container Bracket, 140 - 450 lb Cylinder	*2.5*	$ 89.50	$89.50
1	570278	Liquid Level Indicator (390 & 850 lb Cylinder)	*2.5*	$ 660.00	$660.00
1	570585	Cylinder Low Pressure Switch	*0.3*	$ 103.00	$103.00
1	570537	Solenoid Actuator, 24V DC (0.2 amps)	*2.5*	$ 497.00	$497.00
1	570549	Local Manual Actuator	*1*	$ 152.00	$152.00
1	415142	S. S. Actuation Hose, 32 in., 1/4in. MNPT x 7/16-20 Flare	*1*	$ 33.00	$33.00
1	032338	Male Actuation Connector 7/16-20 x 1/4 in. NPT	*0.1*	$ 3.10	$3.10
1	570342	Male Adapter 1/4 in. NPT x 1/4 in. BSPP	*0.1*	$ 17.70	$17.70
1	046250	Pressure Switch - DPST	*5.5*	$ 368.00	$368.00
1	570558	Single Tank Swivel Adaptor, 2 in. BSP to 2 in. FNPT	*2*	$ 61.00	$61.00
2	570606	Brass Nozzle 1 1/2 in. (40 mm) - 360 deg	*3.6*	$ 172.00	$344.00
1	570580	Entrance Warning Sign	*0.2*	$ 25.20	$25.20
1	570581	Exit Warning Sign	*0.2*	$ 30.00	$30.00
1	428655	Dual Action Pull Station SPST	*1*	$68.00	$68.00
1	428660	Surface Mount Back Box	*1*	$21.70	$21.70
1	076494	Abort Switch, Surface Mount	*2*	$143.00	$143.00
1	076498	Switch, Maintenance, Surface Mount	*2*	$261.00	$261.00
		NOVEC 1230 AGENT			
286	N/A	Factory Fill/Refill (per lb)	*286*	$30.24	$8,648.64
		SAPPHIRE EQUIPMENT TOTAL			$6,642.20
		DISCOUNT			*10.00%*
		DISCOUNT			
		NOVEC 1230 AGENT TOTAL			$8,648.64
		DISCOUNT			*50.00%*
		DISCOUNTED PRICE			$10,302.30
		TOTAL EQUIPMENT WEIGHT	*511.5 lbs*		
		ENGINEERING CHARGES (not included)			
		TOTAL NET PRICE in US $			**$10,302.30**

Prices, Shown In U.S. Dollars
Freight, Taxes and All Other Applicable Charges Not Included, F.O.B. MARINETTE
Except for orders over $2,500 in which case Freight is Prepaid
Price List Effective Date, June 2008
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

tyco *Fire Suppression & Building Products*

QUOTATION FOR:

ANSUL SAPPHIRE ENGINEERED SYSTEMS

DATE: **December 9, 2011**
JOB NAME: **Natuashish Heat Exchanger Room, 3,516 ft3**
CUSTOMER: **Hatch Mott Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-9 Sapphire- Computer Room**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	WEIGHT	LIST PRICE	EXTENSION
1	570651	280 lb Cylinder Assembly (147 lb)	*158*	$ 3,600.00	$3,600.00
1	570092	Container Bracket, 140 - 450 lb Cylinder	*2.5*	$ 89.50	$89.50
1	570277	Liquid Level Indicator (280 lb Cylinder)	*2.3*	$ 628.00	$628.00
1	570585	Cylinder Low Pressure Switch	*0.3*	$ 103.00	$103.00
1	570537	Solenoid Actuator, 24V DC (0.2 amps)	*2.5*	$ 497.00	$497.00
1	570549	Local Manual Actuator	*1*	$ 152.00	$152.00
1	415142	S. S. Actuation Hose, 32 in., 1/4in. MNPT x 7/16-20 Flare	*1*	$ 33.00	$33.00
1	032338	Male Actuation Connector 7/16-20 x 1/4 in. NPT	*0.1*	$ 3.10	$3.10
1	570342	Male Adapter 1/4 in. NPT x 1/4 in. BSPP	*0.1*	$ 17.70	$17.70
1	046250	Pressure Switch - DPST	*5.5*	$ 368.00	$368.00
1	570558	Single Tank Swivel Adaptor, 2 in. BSP to 2 in. FNPT	*2*	$ 61.00	$61.00
1	570607	Brass Nozzle 2 in. (50 mm) - 360 deg	*3.3*	$ 203.00	$203.00
1	570580	Entrance Warning Sign	*0.2*	$ 25.20	$25.20
1	570581	Exit Warning Sign	*0.2*	$ 30.00	$30.00
1	428655	Dual Action Pull Station SPST	*1*	$68.00	$68.00
1	428660	Surface Mount Back Box	*1*	$21.70	$21.70
1	076494	Abort Switch, Surface Mount	*2*	$143.00	$143.00
1	076498	Switch, Maintenance, Surface Mount	*2*	$261.00	$261.00
		NOVEC 1230 AGENT			
147	N/A	Factory Fill/Refill (per lb)	*147*	$30.24	$4,445.28
		SAPPHIRE EQUIPMENT TOTAL			$6,304.20
		DISCOUNT			*10.00%*
		DISCOUNT			
		NOVEC 1230 AGENT TOTAL			$4,445.28
		DISCOUNT			*50.00%*
		DISCOUNTED PRICE			$7,896.42
		TOTAL EQUIPMENT WEIGHT	*332.0 lbs*		
		ENGINEERING CHARGES (not included)			
		TOTAL NET PRICE in US $			**$7,896.42**

Prices, Shown In U.S. Dollars
Freight, Taxes and All Other Applicable Charges Not Included, F.O.B. MARINETTE
Except for orders over $2,500 in which case Freight is Prepaid
Price List Effective Date, June 2008
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

tyco *Fire Suppression & Building Products*

QUOTATION FOR:

ANSUL SAPPHIRE ENGINEERED SYSTEMS

DATE: **December 9, 2011**
JOB NAME: **Nian Office** (Makkovik Similar)
CUSTOMER: **Hatch Mott Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-9 Sapphire-Nain Office**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	WEIGHT	LIST PRICE	EXTENSION
1	570634	90 lb Cylinder Assembly (60lb)	*57.5*	$ 1,630.00	$1,630.00
1	570085	Container Bracket, 20 - 90 lb Cylinder	*2*	$ 80.00	$80.00
1	570585	Cylinder Low Pressure Switch	*0.3*	$ 103.00	$103.00
1	570537	Solenoid Actuator, 24V DC (0.2 amps)	*2.5*	$ 497.00	$497.00
1	570549	Local Manual Actuator	*1*	$ 152.00	$152.00
1	415142	S. S. Actuation Hose, 32 in., 1/4in. MNPT x 7/16-20 Flare	*1*	$ 33.00	$33.00
1	032338	Male Actuation Connector 7/16-20 x 1/4 in. NPT	*0.1*	$ 3.10	$3.10
1	570342	Male Adapter 1/4 in. NPT x 1/4 in. BSPP	*0.1*	$ 17.70	$17.70
1	046250	Pressure Switch - DPST	*5.5*	$ 368.00	$368.00
1	570557	Single Tank Swivel Adaptor, 1 in. BSP to 1 in. FNPT	*1*	$ 21.70	$21.70
1	570604	Brass Nozzle 1 in. (25 mm) - 360 deg	*0.6*	$ 154.00	$154.00
1	570580	Entrance Warning Sign	*0.2*	$ 25.20	$25.20
1	570581	Exit Warning Sign	*0.2*	$ 30.00	$30.00
1	428655	Dual Action Pull Station SPST	*1*	$68.00	$68.00
1	428660	Surface Mount Back Box	*1*	$21.70	$21.70
1	076494	Abort Switch, Surface Mount	*2*	$143.00	$143.00
1	076498	Switch, Maintenance, Surface Mount	*2*	$261.00	$261.00
		NOVEC 1230 AGENT			
60	N/A	Factory Fill/Refill (per lb)	*60*	$30.24	$1,814.40
		SAPPHIRE EQUIPMENT TOTAL			$3,608.40
		DISCOUNT			*10.00%*
		DISCOUNT			
		NOVEC 1230 AGENT TOTAL			$1,814.40
		DISCOUNT			*50.00%*
		DISCOUNTED PRICE			$4,154.76
		TOTAL EQUIPMENT WEIGHT	*138.0 lbs*		
		ENGINEERING CHARGES (not included)			
		TOTAL NET PRICE in US $			**$4,154.76**

Prices, Shown In U.S. Dollars
Freight, Taxes and All Other Applicable Charges Not Included, F.O.B. MARINETTE
Except for orders over $2,500 in which case Freight is Prepaid
Price List Effective Date, June 2008
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

tyco *Fire Suppression & Building Products*

QUOTATION FOR:

ANSUL SAPPHIRE ENGINEERED SYSTEMS

DATE: **December 8, 2011**
JOB NAME: **Williams Harbour Office Room, 1548 ft3**
CUSTOMER: **Hatch Mott Fredericton, Peter Macpherson**
REFERENCE: **11-12-DRD-Dec-8 Sapphire**

BILL OF MATERIALS

QTY	PART NO	PRODUCT DESCRIPTION	WEIGHT	LIST PRICE	EXTENSION
1	570634	90 lb Cylinder Assembly (65 lb)- Server Rm	*57.5*	$ 1,630.00	$1,630.00
1	570085	Container Bracket, 20 - 90 lb Cylinder	*2*	$ 80.00	$80.00
1	570585	Cylinder Low Pressure Switch	*0.3*	$ 103.00	$103.00
1	570537	Solenoid Actuator, 24V DC (0.2 amps)	*2.5*	$ 497.00	$497.00
1	570550	Pneumatic Actuator	*1*	$ 107.00	$107.00
1	570549	Local Manual Actuator	*1*	$ 152.00	$152.00
1	415142	S. S. Actuation Hose, 32 in., 1/4in. MNPT x 7/16-20 Flare	*1*	$ 33.00	$33.00
1	032338	Male Actuation Connector 7/16-20 x 1/4 in. NPT	*0.1*	$ 3.10	$3.10
1	570342	Male Adapter 1/4 in. NPT x 1/4 in. BSPP	*0.1*	$ 17.70	$17.70
1	046250	Pressure Switch - DPST	*5.5*	$ 368.00	$368.00
1	570557	Single Tank Swivel Adaptor, 1 in. BSP to 1 in. FNPT	*1*	$ 21.70	$21.70
1	570604	Brass Nozzle 1 in. (25 mm) - 360 deg	*0.6*	$ 154.00	$154.00
1	570580	Entrance Warning Sign	*0.2*	$ 25.20	$25.20
1	570581	Exit Warning Sign	*0.2*	$ 30.00	$30.00
1	428655	Dual Action Pull Station SPST	*1*	$68.00	$68.00
1	428660	Surface Mount Back Box	*1*	$21.70	$21.70
1	076494	Abort Switch, Surface Mount	*2*	$143.00	$143.00
1	076498	Switch, Maintenance, Surface Mount	*2*	$261.00	$261.00
		NOVEC 1230 AGENT			
65	N/A	Factory Fill/Refill (per lb)	*65*	$30.24	$1,965.60
		SAPPHIRE EQUIPMENT TOTAL			$3,715.40
		DISCOUNT			*10.00%*
		DISCOUNT			
		NOVEC 1230 AGENT TOTAL			$1,965.60
		DISCOUNT			*50.00%*
		DISCOUNTED PRICE			$4,326.66
		TOTAL EQUIPMENT WEIGHT	*144.0 lbs*		
		ENGINEERING CHARGES (not included)			
		TOTAL NET PRICE in US $			**$4,326.66**

Prices, Shown In U.S. Dollars
Freight, Taxes and All Other Applicable Charges Not Included, F.O.B. MARINETTE
Except for orders over $2,500 in which case Freight is Prepaid
Price List Effective Date, June 2008
QUOTE IS VALID FOR 60 DAYS and Subject to All Standard Terms and Conditions

08-Dec-11

Budgetary Quotation 11-12-DRD-Dec-08- Williams Harbour Diesel Plant

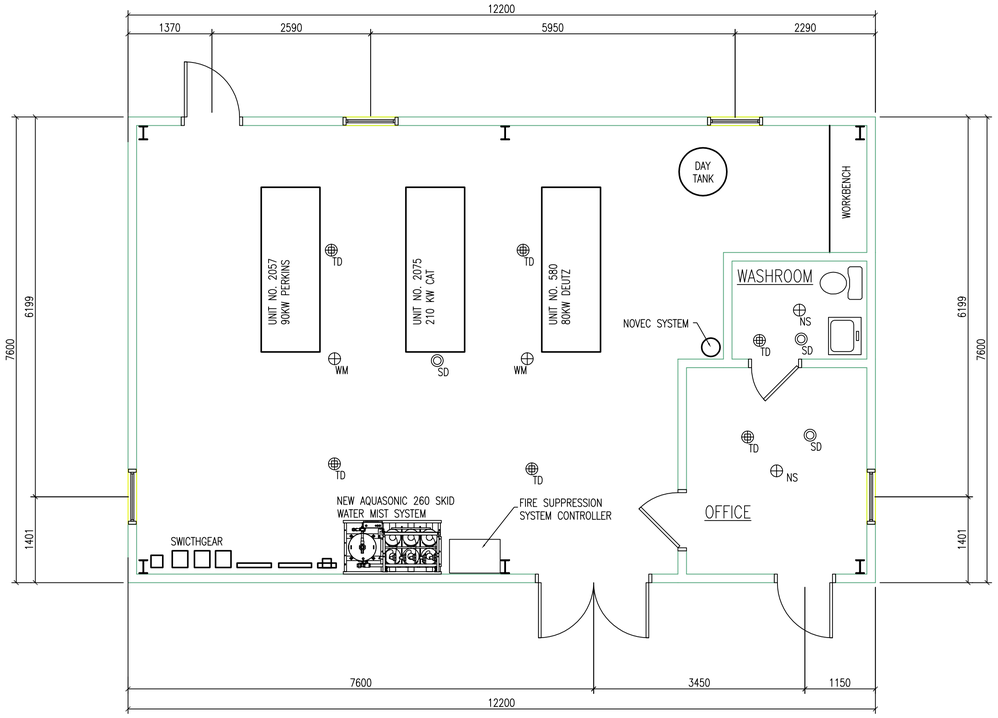
Hatch Mott McDonald, Fredericton
Peter Macpherson 506-450-4170
Diesel Generator Room Volume is approx. 235 M3

Note:Price amounts shown are in US$

Qty	PartNbr	Part Description	Weight	ListPrice	NetPrice	Total NetPrice
1	437665	AQUASONIC 260 Water Mist Supply Skid	0	$ 26,558.00	$ 23,902.20	$ 23,902.20
2	435877	Atomizer Pressure Range, 73-84 psi (5.03-6.00 bar)	0	$ 3,640.00	$ 3,276.00	$ 6,552.00
					Total	$ 30,454.20

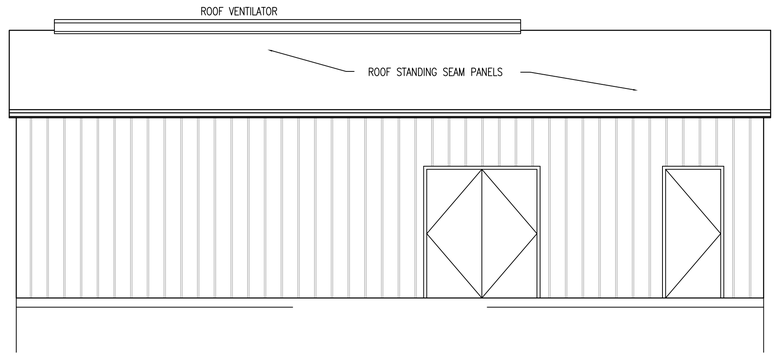
Appendix C

Preliminary Layout Drawings

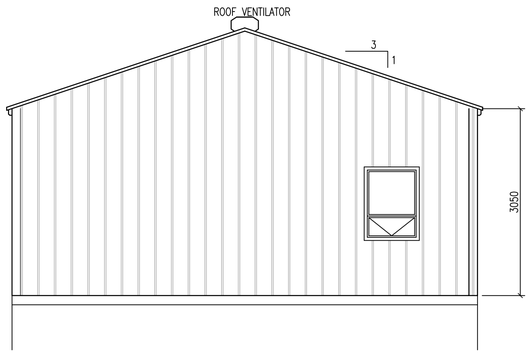


NOZZLE LEGEND	
SYMBOL	NOZZLE TYPE
NS	NOVEC SPRAY NOZZLE
WM	WATER MIST NOZZLE
SD	SMOKE DETECTOR
TD	THERMAL DETECTOR

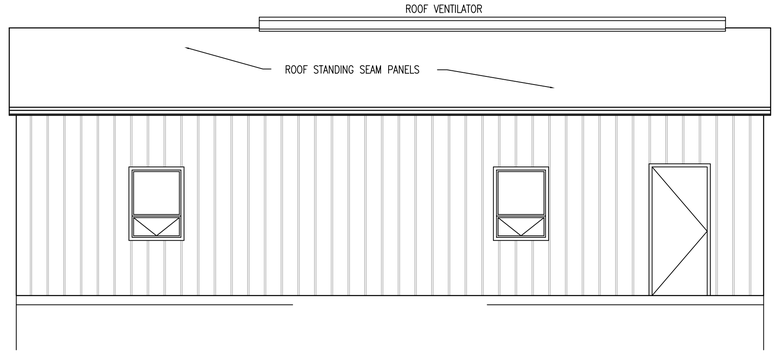
NOTE:
FINAL QTY. AND LOCATIONS OF ALL COMPONENTS TO BE DETERMINED DURING DETAIL ENGINEERING.



FRONT ELEVATION



SIDE ELEVATION



REAR ELEVATION

DWG.NO.	TITLE

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DWN.	DESIGN.	CHK.	APP'D
A	DEC.21,2011	ISSUED FOR REVIEW	RBGM	PM	CC	PM

REVISIONS

ELECT.	SCALE: 1:50
CIVIL	DESIGNED: PM
TRANS.	DRAWN: RBGM
MECH.	DATE: DEC.19.2011
P&C	CHECKED: CC
TELC.	APPROVED: PM

HATCH

HATCH PROJECT NO.
H340127

HATCH DRAWING NO.
H340127-A1-M-002

newfoundland labrador hydro
a nalcor energy company

Newfoundland and Labrador Hydro

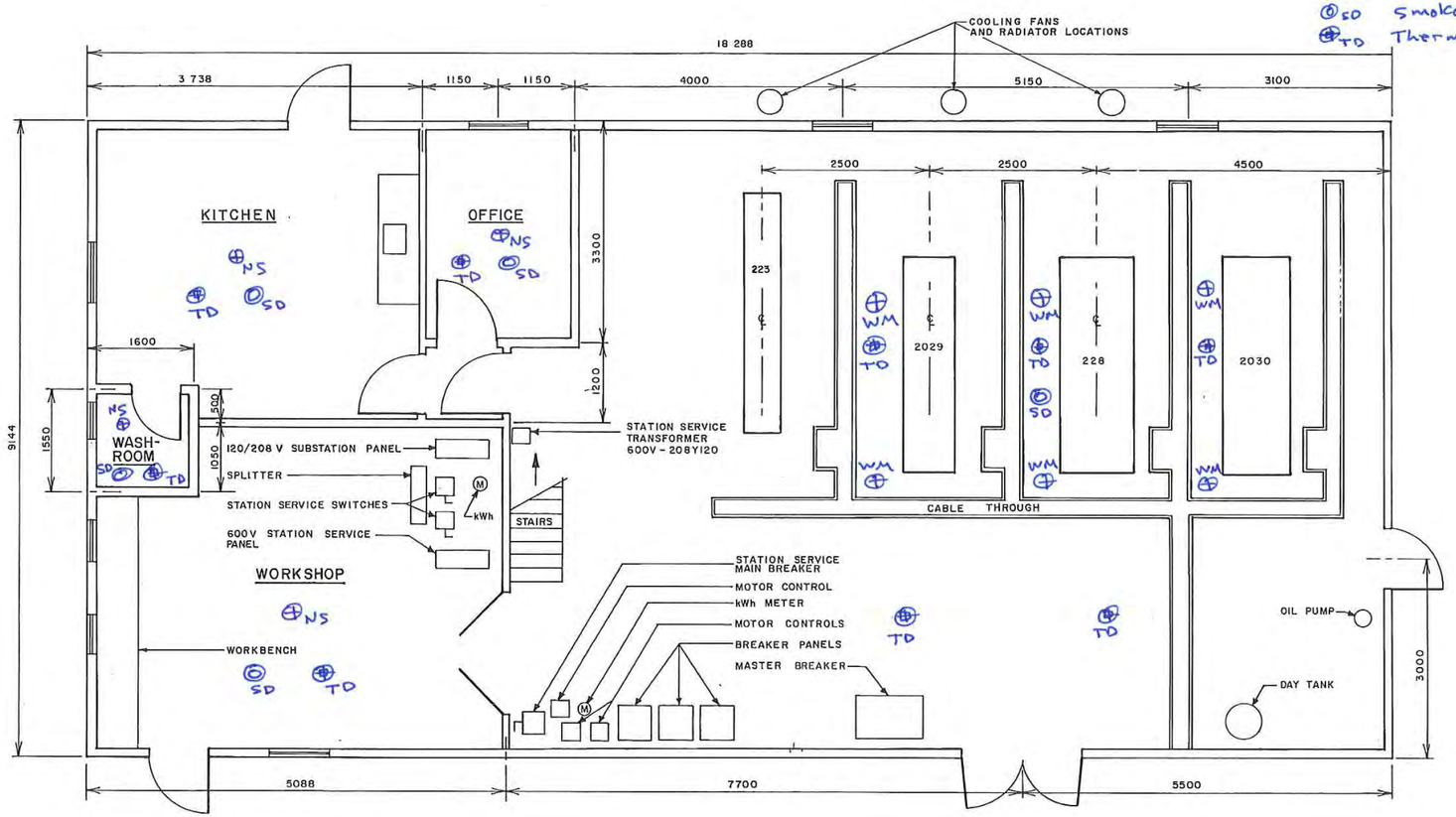
WILLIAM'S HARBOUR, NL
FLOOR PLAN & ELEVATIONS
FIRE SUPPRESSION STUDY

W.O. NO.	DWG. NO.	REV.
		A

PLOT SCALE = C.A.D.

645-03-27

NOZZLE LEGEND
NS Novec Spray
WM Water Mist
SD Smoke Detector
TD Thermal Detector



NOTE
1 ALL DIMENSIONS ARE GIVEN IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.

HYDRO — NEWFOUNDLAND AND LABRADOR HYDRO

MAKKOVIK DIESEL PLANT

PLANT INTERIOR LAYOUT

SCALE 1:50		DESIGNED		DRAWN K S C			
CHECKED		APPROVED		DATE 85-09-04			
W O No		DWG No A2-645-03-27		REV 1			

DWG No	TITLE
REFERENCE DRAWINGS	

No	DATE	DESCRIPTION	BY	CKD
1.	86-10-24	FIELD REVISIONS	G.E.M.	
REVISIONS				

ELECT	CIVIL	TRANS	MECH.
PASSED			

NOZZLE LEGEND	
SYMBOL	NOZZLE TYPE
NS	NOVEC SPRAY NOZZLE
WM	WATER MIST NOZZLE
SD	SMOKE DETECTOR
TD	THERMAL DETECTOR

NOTE:
FINAL QTY. AND LOCATIONS OF ALL COMPONENTS TO BE DETERMINED DURING DETAIL ENGINEERING.

HEAT EXCHANGER ROOM
CONSUMABLE STORAGE AREA
MAINTENANCE/ WORKSHOP
GENERATOR ROOM
LUNCHROOM
WR.
CORRIDOR
STORAGE
COMPUTER ROOM
BATTERY ROOM
SWITCH GEAR
ELECTRICAL / CONTROL ROOM
NOVEC SYSTEM
CONCRETE FOUNDATION FOR SUPPORT OF COMBUSTION EXHAUST FRAME (TYP.)
WATER MIST CYLINDERS
30 X NITROGEN
6 X WATER
FIRE SUPPRESSION SYSTEM CONTROLLER
EXPANDABLE ENDWALL
21793 (71'-6") (OUT. TO OUT. OF FOUNDATION)
5181 (17'-0")
5537 (18'-2")
5538 (18'-2")
16612 (54'-6") (OUT. TO OUT. OF FOUNDATION)
5252
5621
5718
5202
10132
540'-0"

		A	DEC.21,2011	ISSUED FOR REVIEW	RBGM	PM	CC	PM
DWG.NO.	TITLE	NO.	DATE	DESCRIPTION	DWN.	DESIGN.	CHK.	APP'D
REFERENCE DRAWINGS		REVISIONS						

HATCH

HATCH PROJECT NO. H340127

HATCH DRAWING NO. H340127-A1-M-003

newfoundland labrador hydro a nalcor energy company

Newfoundland and Labrador Hydro

ELECT.	SCALE:	1:50
CIVIL	DESIGNED:	PM
TRANS.	DRAWN:	RBGM
MECH.	DATE:	DEC.19,2011
P&C	CHECKED:	CC
TELC.	APPROVED:	PM

NATUASHISH
FLOOR PLAN FIRE SUPPRESSION STUDY

W.O. NO.

DWG. NO.

REV. A

PLOT SCALE =

C.A.D.

Suite E200, Bally Rou Place, 370 Torbay Rd.
St. John's, Newfoundland, Canada A1A 3W8
Tel (709) 754 6933 ◆ Fax (709) 754 2717