

# DESIGN MANUAL

FOR

## ***NN100***

# FIRE EXTINGUISHING SYSTEM



***NOHMI***  
**koatsu**



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## Chapter 1    **INTRODUCTION**

### 1. General

For long years **HALON 1211** and **HALON 1301** has been mainly used as the fire extinguishing system agent for many facilities, electrical rooms, computer rooms etc, as clean agent for fire protection.

However, in view of environmental conservation, production of these **HALONs** were banned at the end of 1993 according to Montreal Protocol signed in 1987. Because **HALONs** consist of bromine and chlorine which deplete earth ozone layer, in other words, they have higher **ODP** (Ozone Depletion Potential).

Main extinguishing mechanism of **HALONs** is suppressing fire by thermal reaction. Recently several agents (**Halocarbon** and others like FM200) have been developed and used as alternatives for **HALONs**.

Recently it is found that they cause another environmental disruption, that is, **GWP** (Global Warming Potential).

Those agents have higher **GWP** and longer life.

## 2. **NN100 system**

**NOHMI** has studied the fire extinguishing mechanism with HALON alternative which is the earth safe material, for long years.

As the results of this study, **NOHMI** has developed the **NN100 system**. **NN100 system** and **NN100** are **NOHMI's product names**.

**NN100** uses pure nitrogen gas as clean agent.

It is natural gas in the air, hence ODP and GWP are 0 (zero), but its life is eternal.

**NN100** has the following advantages.

2.1 **NN100** reduces oxygen concentration level to extinguish fire.

This method is old, but it has recorded successful results.

2.2 **Nitrogen agent** of **NN100** has no environmental disruption factors.

Its ODP and GWP are 0 (zero) because it is real natural gas.

2.3 **NN100** is completely clean, volatile and electrically non-conductive.

2.4 **NN100** is available anywhere. All halocarbon agents and other inert gas agents are licensed factory product.

2.5 **NOHMI** considers that **NN100** is the cheapest material.

2.6 **NN100** gives good visibility.

Because **NN100** is the transparent gaseous agent and it does not produce any fog at discharge.

### 3. International Authorization

The pure nitrogen gas extinguishing system has been listed in **NFPA 2001 Standard on Clean Agent Fire Extinguishing Systems 2000 Edition** as **IG-100**.

**IG-100** is the number of nitrogen inert gas specified in **ISO Standard 14520-13**.

**NN100 system** complies with **NFPA 2001** and **ISO Standard 14520-13** accordingly.

**NFPA 2001** lists **IG-100** as the fire extinguishing system for **Total Flooding Application** only. **IG-100** system can not be used for **Local Application**.



#### 4. Human Safety

As the results of field examinations, NOHMI has selected oxygen concentration reduction range for fire extinguishing between 10% and 12.5%. It is specified in **NFPA 2001** and recommended by **EPA** (US Environmental Protection Agency) as follows,

[ **EPA extraction** ]

**Oxygen  
Concentration  
(%)**

**Restriction conditions**

12 or more	It may take longer than one (1) minute to egress the area.
10 - 12	It shall be within one (1) minute to egress the area.
Below 10	Normally unoccupied area and it shall be within 30 seconds to egress the area.

[ **NFPA 2001** ]

**Oxygen  
Concentration  
(%)**

**Restriction conditions**

12 or more	It may take no longer than 5 minutes to egress the area.
10 - 12	It may take no longer than 3 minutes to egress the area.
10 - 8	Normally unoccupied area and it shall be within 30 seconds to egress the area
Below 8	Only unoccupied area where personnel are not exposed to such oxygen depletion.

## 5. Unit of Measurement

**SI** metric units shall be used in this document and others documents relevant to **NN100**.

For users convenience the imperial units are also indicated for reference as possible.

## Chapter 2    **DESIGN MANUAL**

### 1. General

The **NN100** (**NOHMI's** product name) pure nitrogen fire extinguishing system is based on **NFPA 2001 "Standard on Clean Agent Fire Extinguishing Systems"** 2000 edition.

This manual describes how to design and calculate **NN100** for the system planner (called "the planner" hereafter). The planner shall be certified by **NOHMI** subject to **NOHMI's** training program.

**NN100** extinguishes a fire mainly by reduction of oxygen level.

**NN100** is suitable for "**Total Flooding System**" and not suitable for "Local Application System".

## 2. Calculation

The planner shall enter calculation values in a "NN100 AGENT CALCULATION SHEET" to show in Appendix – 9.

### 2.1 Room Volume Calculation

The planner shall check and measure a room(s), (called “the protected room” hereafter), to be protected by the system.

The protected room shall be enclosed by certain fireproof materials such as concrete, steel and so on.

The planner shall calculate the total volume [**Vat**] (m<sup>3</sup>) of the protected room that fire extinguishing agent is discharged at a time as follows,

La1	:	Protected room part 1	length	(m)
Wa1	:		width	(m)
Ha1	:		Height	(m)
Na1	:	Number of same room(s) as part 1		
La2	:	Protected room part 2	length	(m)
Wa2	:		width	(m)
Ha2	:		Height	(m)
Na2	:	Number of same room(s) as part 2		

|  
|  
|

[**Vat**] : Total volume of the protected room that fire extinguishing agent is discharged at a time (m<sup>3</sup>)

$$\mathbf{Vat\ (m^3) = (La1\ x\ Wa1\ x\ Ha1\ x\ Na1)} \\ \mathbf{+ (La2\ x\ Wa2\ x\ Ha2\ x\ Na2) + \dots\dots\dots}$$

Note) The fireproofed obstruction(s), like concrete column, can be subtracted from the volume.

## 2.2 Gas Volume Calculation

### 2.2.1 Gas Extinguishing Concentration

The planner shall define the combustible material in the room.

By referring to **Cup-burner Flame Extinguishing Concentration**, the planner shall select the **[Cb]** gas extinguishing concentration (%) figure.

### 2.2.2 Design Gas Concentration

The planner shall determine the **[Cm]** minimum design gas concentration (%) by the following procedure.

- A) **[Cb]** (%) is smaller than 31 (%) (n-Heptane Cup-burner Extinguishing Concentration)

$$[Cm] (\%) = 40.3 (\%)$$

- B) **[Cb]** (%) is larger than 31 (%)

$$[Cm] (\%) = [Cb] (\%) \times 1.3$$

Note) "1.3 " is a safety factor.

### 2.2.3 Flooding Factor

By referring to **Appendix - 3 “Flooding Factors”**, the planner shall calculate the **[Fc]** ( $\text{m}^3 / \text{m}^3$ ) flooding factor in connection of the **[T]** ( $^{\circ}\text{C}$ ) temperature in the protected room and the **[Cm]** (%) minimum design gas concentration.

### 2.2.4 Required Gas Volume

The planner shall calculate the **[Vr]** ( $\text{m}^3$ ) required gas volume as follows,

**[Vat]** : Total volume of the protected room ( $\text{m}^3$ )

**[Fc]** : Flooding factor ( $\text{m}^3 / \text{m}^3$ )

**[Vr]** : Required gas volume ( $\text{m}^3$ )

$$\mathbf{Vr\ (m^3) = Vat\ (m^3) \times Fc\ (m^3 / m^3)}$$

### 2.2.5 Calculated Gas Volume

The planner shall calculate the [**Nc**] numbers of gas cylinder(s), and then, finalize the actual discharge gas volume as follows,

[**Vr**] : Required gas volume (m<sup>3</sup>)

[**Nc**] : Number of gas cylinder(s)

[**VL**] : Maximum volume per one cylinder

**20.3 m<sup>3</sup> / one cylinder**

**Nc = Vr (m<sup>3</sup>) / VL (m<sup>3</sup>)** (Round up)

[**Vz**] : Calculated gas volume (m<sup>3</sup>)

**Vz (m<sup>3</sup>) = Nc x 20.3 (m<sup>3</sup> / one cylinder)**

## 2.3 Human Safety Check

According to NFPA and EPA, the oxygen concentration level must be maintained within the range from 10% to 12.5% for human safety when the agent is discharged.

The planner shall check it as follows,

[**Vat**] : Total volume of the protected room (m<sup>3</sup>)  
 [**Vz**] : Calculated gas volume (m<sup>3</sup>)  
 [**Cz**] : Calculated gas concentration (%)

$$\mathbf{Cz} \text{ (\%)} = \{ 1 - \exp ( - \mathbf{Vz} \text{ (m}^3\text{)} / \mathbf{Vat} \text{ (m}^3\text{)} ) \} \times 100$$

[**O<sub>2</sub>**] : Oxygen concentration level (%)

$$\mathbf{O_2} \text{ (\%)} = 21 \times (1 - \mathbf{Cz} \text{ (\%)} / 100)$$

$$10.0 \leq \mathbf{O_2} \leq 12.5 \text{ (\%)}$$



## 2.4 Nozzle and Piping Arrangement

### 2.4.1 Main Piping Selection

The planner shall estimate the length of main piping from a piping arrangement sketch.

By referring to **Appendix - 4 “NN100 Flow Rate on Main Pipe”**, the planner shall select a main piping size(s) from the length of the main piping and the **[Fm]** flow rate.

The flow rate shall be calculated as follows,

**[Vr]** : Required gas volume (m<sup>3</sup>)

**[Fm]** : Flow rate on main pipe

$$\mathbf{Fm} \text{ (m}^3 \text{ / min)} = \mathbf{Vr} \text{ (m}^3 \text{)} / \mathbf{1.0} \text{ (min)}$$

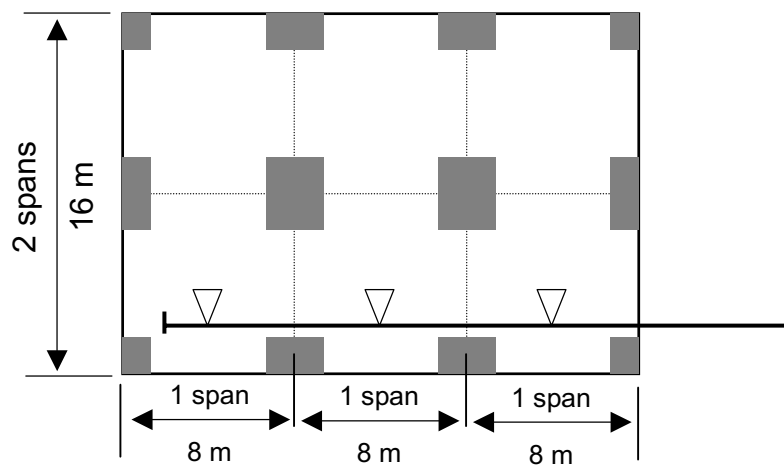
#### 2.4.2 Discharge Nozzle Arrangement

The planner shall design the arrangement of discharge nozzle(s) in consideration of equipment and room layout, evacuation route, maintenance and so on. The following three types discharge nozzles are available for **NN100** system.

##### A) Models SA and SB

These discharge nozzles are the type to discharge the agent from the wall side. **Model SB** has the small nominal size **10** and **Model SA** has the nominal size **20 or over**. One discharge nozzle can cover 1 span (approx.8 m) by 2 spans (approx.16 m) area and the height up to approx.8 m.

An additional discharge nozzle shall be provided wherever the room height exceeds 8 m.



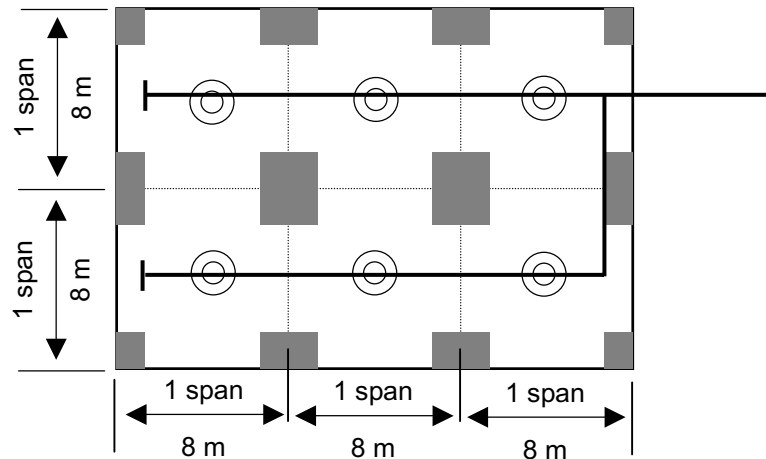
B) Model PN

This discharge nozzle is the type to discharge the agent from the top with the horizontal 360° radial distribution pattern.

It can be changed to the horizontal 180° radial distribution pattern with a deflector. In addition, flush and surface (with attachment) types are available.

One discharge nozzle can cover 1 span (approx.8 m) by 1 span (approx.8 m) area and the height up to approx.8 m.

An additional discharge nozzle shall be provided wherever the room height exceeds 8 m.



By referring to **Appendix - 5 “NN100 Flow Rate on Branch Pipe”** and **Appendix - 6 “Maximum Flow Rate of Discharge Nozzle”**, the planner shall design the size and the number of discharge nozzle(s) and adjacent branch pipe size.

## Chapter 3    **SYSTEM DESCRIPTION**

### 1. General

**NOHMI** offers and proposes the NN100 fire extinguishing system using **nitrogen gas** which is the **clean agent** for the environment on the earth, and this manual includes the details on its physical properties, specification, usage and safety aspects.

## 2. NN100 System Components

### 2.1 Nitrogen Gas

The agent used in **NN100 system** is nitrogen gas that exists at a rate of about 80 % in the atmosphere. It is a colorless, odorless, electrically non-conductive.

**NN100** extinguishes a fire by mainly reducing the oxygen level.

#### 2.1.1 Nitrogen Gas Specification

N<sub>2</sub> gas specification and agent characteristics shall comply with the standard of NFPA 2001, and the details are as shown the **Appendix - 1 and 2**.

#### 2.1.2 Storage Cylinders

**The storage cylinders** used in the system shall be designed to meet the requirements of **NN100 system**, which is made of seamless steel in accordance with the Japanese regulation.

N<sub>2</sub> gas agent supply shall be stored in the storage cylinders, and three (3) kinds of type are available for the system.

### 2.2 Cylinder Unit

(Refer to Dwg. Nos. 1017U820A, 1017U821A, 1017U822A, 1017U823A, 1017U824A and 1017U825A)

**The cylinder unit** is a supply source of the N<sub>2</sub> gas agent and it consists of N<sub>2</sub> storage cylinders, a N<sub>2</sub> pilot cylinder with releaser, pressure gauges, loop pipes (connection pipe between outlet of cylinder valve and manifold pipe), control tubes, a non-return valve(s), a manifold pipe(s), a stanchion(s) and accessories.

### 2.2.1 Storage Cylinders

(Refer to Dwg. No. 217CA40B)

**The storage cylinder** is filled with **N<sub>2</sub> gas clean agent** up to **20.3 m<sup>3</sup>** at 20°C (68°F). This cylinder has an internal volume of **83 liter** and is made of **seamless steel**.

The storage cylinder is equipped with the cylinder valve Model PC30[ ] that is capable of quickly discharging the agent.

This cylinder valve can release the N<sub>2</sub> gas agent with 10.8 MPa(110 kgf/cm<sup>2</sup>) or less, at 40 °C (104°F).

Volume of N<sub>2</sub> gas agent filled in each cylinder shall be recorded in the seal affixed on each cylinder for maintenance purpose.

### 2.2.2 Pilot Cylinder (Refer to Dwg. No. 1037C801A & 217CA35B)

**The pilot cylinder** has an internal volume of **82.5-liter** and is filled with **N<sub>2</sub> gas** to **8.2 m<sup>3</sup>** at 20 °C (68 °F) and other pilot cylinder has an internal volume of **5-liter** and is filled with **N<sub>2</sub> gas** to **0.5 m<sup>3</sup>** at 20 °C (68 °F).

**The pilot cylinder** is made of **seamless steel**.

The pilot cylinder is a device to operate the N<sub>2</sub> storage cylinders. This operation includes opening each cylinder valve with N<sub>2</sub> storage cylinder and can release the N<sub>2</sub> gas agent with 10.8 MPa (110 kgf/cm<sup>2</sup>) or less, at 40 °C (104°F).

Up to **175 N<sub>2</sub> storage cylinders** can be released with **one 82.5-liter pilot cylinder**, and up to **10 N<sub>2</sub> storage cylinders** can be released with **one 5-liter pilot cylinder**.

Volume of N<sub>2</sub> gas agent filled in each cylinder shall be recorded in the seal affixed on each cylinder for maintenance purpose.

## 2.3 Actuating Cylinder (Refer to Dwg. Nos.217CA16A)

The actuating cylinder is filled with **1 kg / 2.1 liter of CO<sub>2</sub> gas as the actuating gas** in the system, and is made of **seamless steel**.

**CO<sub>2</sub> gas** shall be used for the actuating gas of the system in accordance with **the Japanese standard**.

The actuating cylinder is a device to operate the corresponding selector valve, the line control valves and the pilot cylinder of the system.

The amount of CO<sub>2</sub> gas filled in the cylinder shall be recorded as the stamp of the surface of the cylinder for maintenance purpose.

### 2.3.1 Actuating Cylinder Valve (Refer to Dwg.Nos.217VA06A)

The actuating cylinder valve Model PH5C is designed for rapidly discharging the actuating gas into the control tubing line.

This valve shall be operated by the cylinder valve solenoid in the actuating cylinder cabinet.

### 2.3.2 Cylinder Valve Solenoid (Refer to Dwg.No.217EG01B)

The cylinder valve solenoid Model R65M14 is intended for releasing the actuating cylinder valve and it is fitted to the actuating cylinder valve.

The cylinder valve solenoid can be operated either by automatic operation (by electric signal from control panel) or by manual operation.

Note) The cylinder valve solenoid Model R65M10-N (Dwg.No.1037E802A) is intended for releasing the pilot cylinder valve directly and it is fitted to the pilot cylinder valve, when the system doesn't use selector valves. The actuating cylinder is needless.

## **2.4 Selector Valves**

Selector valve (Refer to Dwg.No.1010V604A,1010V605A and 1010V606A)

The selector valve is intended for use when storage cylinder unit is common with two or more hazards.

The selector valve shall be designed for the system for which some types are available, and each type can be selected according to the best suited for installation in the system.

The selector valve shall be provided with a piston releaser which can be opened by gas pressure of the actuating cylinder or manually.

## **2.5 Line Control Valves**

Line control valve : Model LCV4A (Refer to Dwg. No.217VC21A)

The line control valve is intended for use when one N<sub>2</sub> pilot cylinder is common and required number of N<sub>2</sub> storage cylinders differs in hazards.

The line control valve controls the flow of CO<sub>2</sub> actuating gas and N<sub>2</sub> pilot gas on the same control line.

The line control valve is used for opening the corresponding cylinder valve(s) with N<sub>2</sub> storage cylinder by pilot gas pressure in the system.



## **2.6 Field Devices**

### **2.6.1 Discharge Nozzles**

(Refer to Dwg. Nos.217NA01A, 217NA18A and 217NA04A)

The discharge nozzle shall be designed to discharge the uniform concentration of the extinguishing agent into the protected room.

Three (3) basic types of discharge nozzles are available, which can be selected according to the installation location.

The PN type discharge nozzle (refer to Dwg. No.217NA18A) that is mounted on surface or flush of the ceiling has a deflector producing a horizontal and / or a radial distribution pattern.

The SA or SB type (refer to Dwg. No.217NA01A or 217NA04A) that is mounted on the wall has a horn and the agent is discharged from the orifice to be directed in the horizontal direction.

### **2.6.2 Control Box (Local Release Box)      (Refer to Dwg. No. 210EK77A)**

The control box (local release box) shall be designed to actuate the system manually and installed to the outside near the main door of the protected facilities.

2.6.3 Discharge Indicator (Refer to Dwg. No. 217EE30A)

The discharge indicator shall be designed to display the message to personnel and installed above the entrance of the protected facilities. It shall be operated by an alarm signal from the control panel and its operation shall continue after the agent is discharged into the protected room.

And also, the message shall be indicated in red on the indicator to keep off the protected room when the agent is discharged into the room.

2.6.4 Warning Speaker (Refer to Dwg.Nos.217EF16A and 217EF04A)

Audible pre-discharge alarm shall be provided in the protected room to give a positive warning of impending discharge.

Operation of the warning speaker shall continue after agent discharge until an action has been taken to acknowledge the alarm and you proceed with the necessary action.

2.6.5 Safety Vent (Refer to Dwg. No. 217VC18A)

The safety vent shall be designed for protecting the piping and equipment from damage by relieving the agent remaining in the piping when its pressure rises abnormally.

The safety vent shall be installed on the piping between the N<sub>2</sub> cylinder manifold and the selector valve.

The safety vent is of a rupture disc type and operated at about 14.7 MPa.

## 2.6.6 Pressure Relief Damper

The pressure relief damper shall be designed to operate to prevent the inside of properties such as glass windows, door, etc. from being broken when the pressure rises in the hazard room by discharge of N<sub>2</sub> extinguishing agent.

The area of the pressure relief damper is calculated from following formula.

- [A] : Calculated area of Pressure relief damper (cm<sup>2</sup>)  
 [Q] : Maximum flow rate (= 1.6 x Design Flow rate) (m<sup>3</sup> / min)  
 [P] : Allowable strength of enclosure (Pa)  
 [dP] : Pressure drop in Duct line (Pa)

$$A = 134 \times Q / (P - dP)^{1/2}$$

General construction practices provide the guide in the flowing table for considering the normal strength and allowable pressures of average enclosures.

Construction apparatus	Allowable strength(Pa)
Concrete wall, Steel door, Wired sheet glass, etc.	2000
Double ceiling board, etc.	800
Fire shutter, etc.	600

## **2.7 Detectors and Control Panel**

### **2.7.1 Detectors**

#### **1) Smoke Detector** (Refer to Dwg. No. FDK6879e)

The smoke detector detects combustion products (smoke) generated by fire and transmits an alarm signal to the control panel. The photoelectric smoke detector can detect a fire in an earlier stage than a heat detector. Generally, the smoke detector shall be installed in the protected room.

#### **2) Heat Detector** (Refer to Dwg. No. FDL6763E)

The fixed temperature type heat detector is used for the protected room and it closes the alarm contacts when the ambient temperature has reached to the predetermined level as a result of a fire.

The detector is automatically self-restoring after operation, and transmits an alarm signal to the control panel.

### **2.7.2 Control Panel** (Refer to Dwg. No. 217EN41A)

**NOHMI** has designed the control panel which can provide centralized monitoring and control of various fire protection equipment.

On receiving a fire signal from smoke and / or heat detectors or a local release box, the control panel gives visual alarms indicating the alarm point and the audible alarms sound. It also contains a battery with charger having the capacity to maintain the system for one hour in supervision and one hour in actuation conditions.

## 2.8 Auxiliary

### 2.8.1 Piping

**The steel pipe** and its **joints** shall conform to the Japanese Standard, ASTM or ANSI standard, schedule 80 or equivalent.

The piping shall be installed in accordance with a good commercial practice.

With regard to the route of the piping, if any deviation to the design drawings should occur, advance arrangement with the designer is necessary.

If the route of the piping is changed, flow calculation shall be carried out once again.

The piping system shall be securely supported at a proper interval so as to withstand any deflection of the piping during discharge.

### 2.8.2 Wiring

**Wires and cables** shall be used in accordance with international authorities or local regulation. However, the internal wiring of the equipment shall be in accordance with the Japanese standard.

The wiring shall be installed in the protected facilities along a good route and in accordance with commercial practice.

Also, if the wiring route of the design drawing is changed, advance arrangement with the designer is necessary.

### **3. Actuation Sequence**

The system has the following three actuation sequences.

#### **3.1 Automatic**

The automatic sequence is fully automatic with the dual detection system as shown in **Fig. 1**.

#### **3.2 Manual**

The manual sequence is operated by turning the auto-manual changeover switch to manual position and by pushing the discharge switch in the control box located near the exit door as shown in **Fig. 2**.

#### **3.3 Manual (At Power Failure)**

The manual (at power failure) sequence is operated by pulling up a knob located on the cylinder valve solenoid as shown in **Fig. 3**.

Fig. 1 Automatic Operation

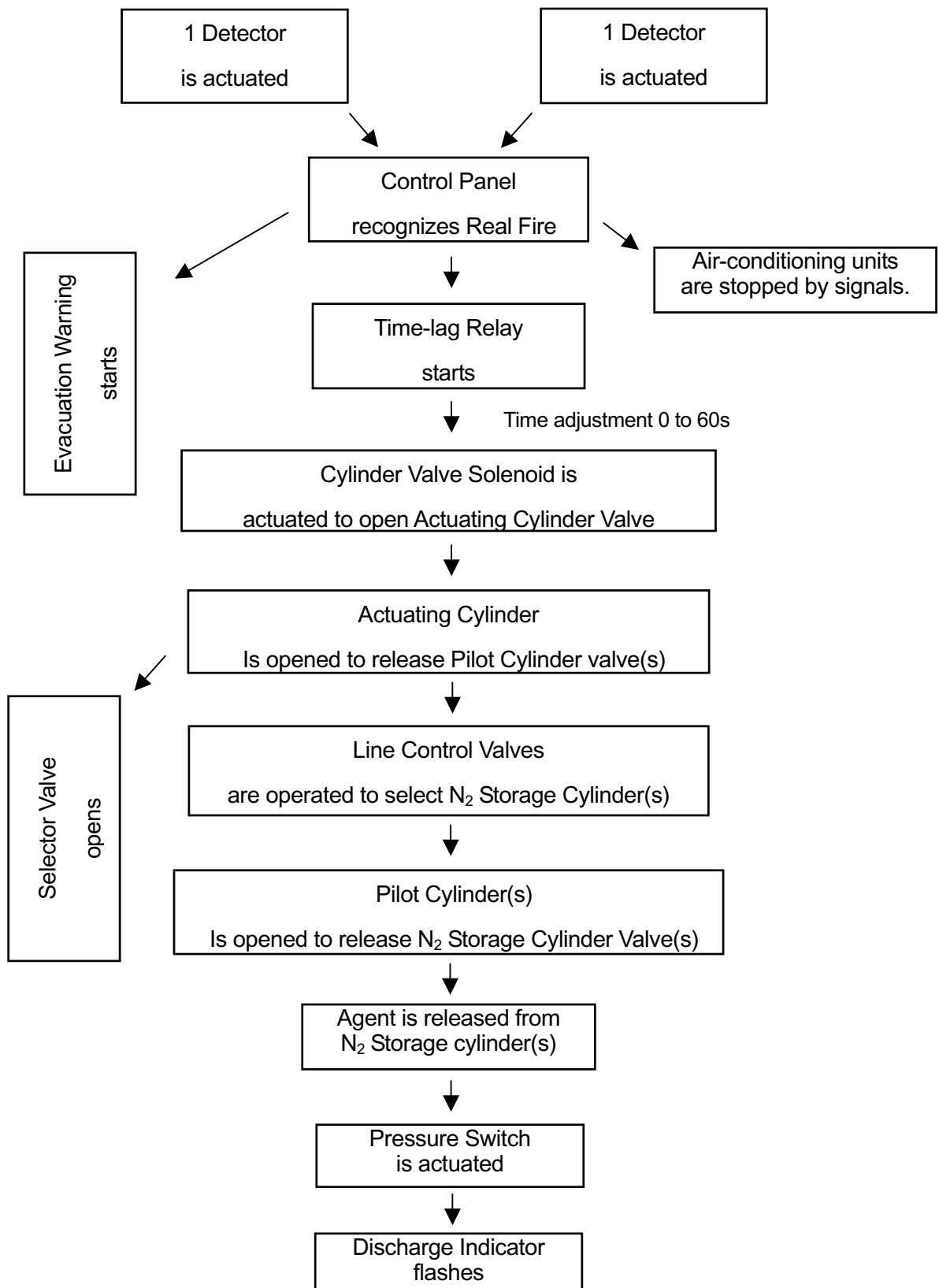


Fig. 2 Manual Operation

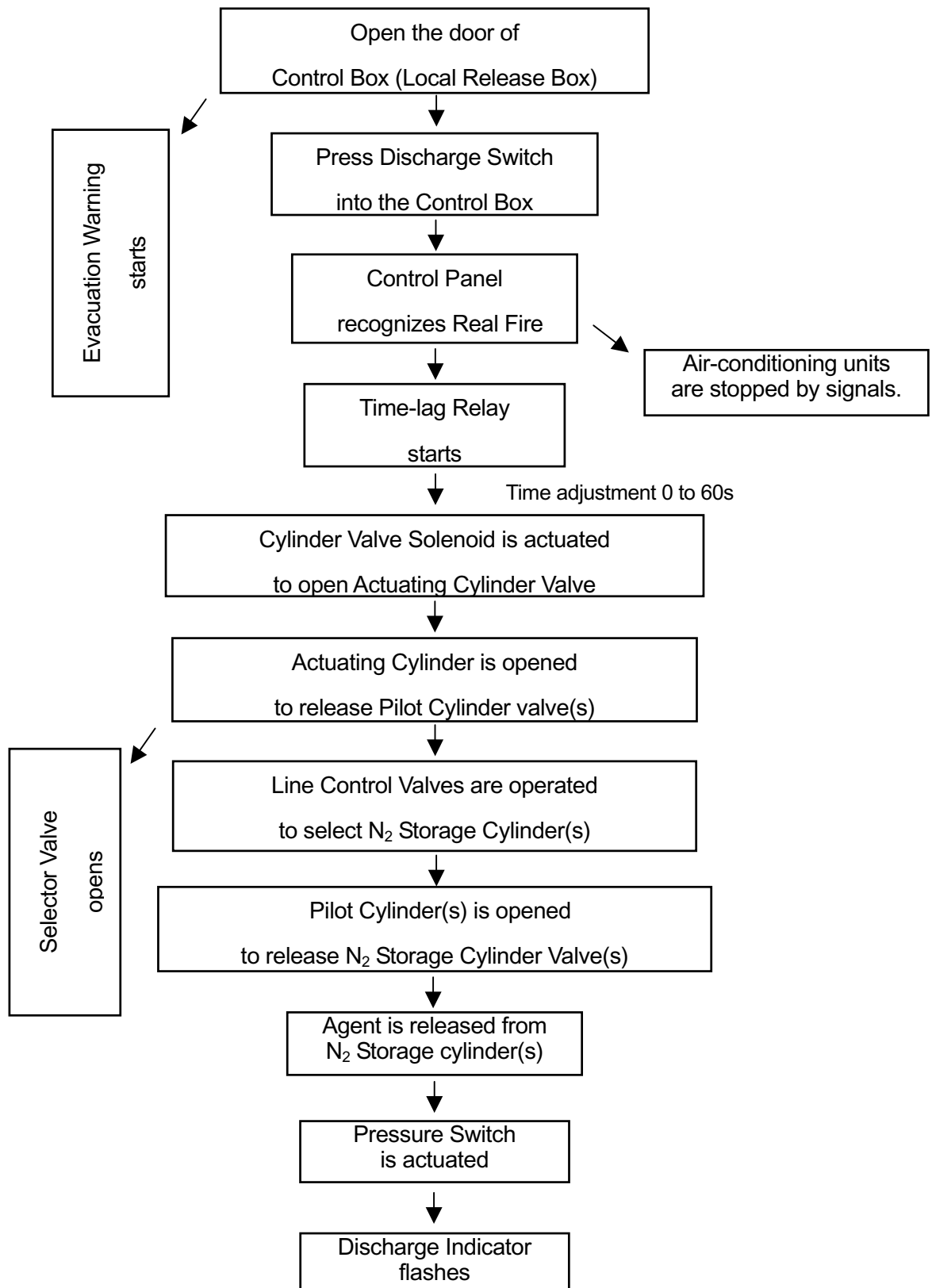
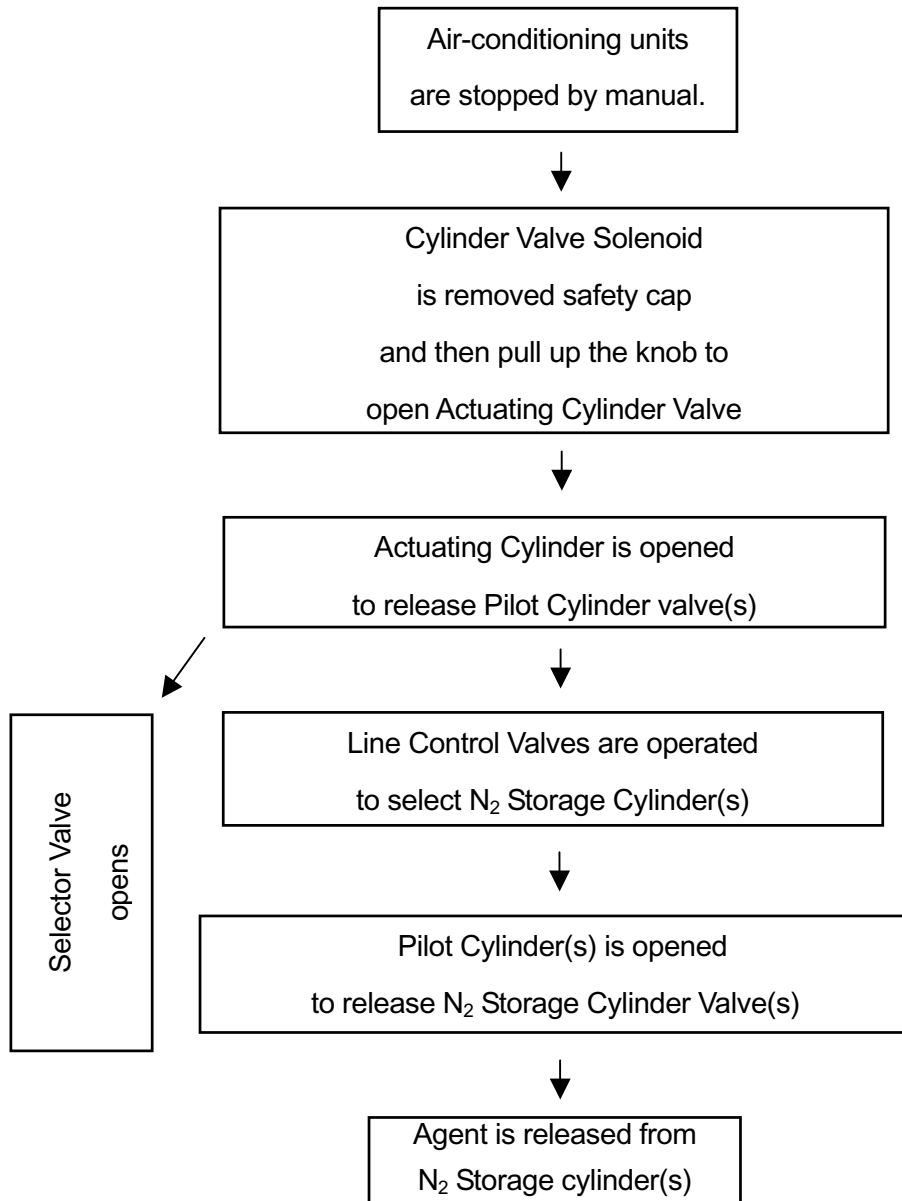




Fig. 3 Manual Operation (at power failure)



## CHARACTERISTICS

Description	Characteristics	Remarks
Chemical name	Nitrogen	
Chemical formula	N <sub>2</sub>	
Molecular weight	28.02	
Boiling point	- 195.8 °C	Note 1
Freezing point	- 210.0 °C	
Specific volume of Superheated vapor	0.858 m <sup>3</sup> /kg	Note 1 Note 2

- Notes
1. At 1.013 bar (absolute)
  2. At 20 °C (68 °F)

**SPECIFICATION**

Description	Specification	Remarks
Chemical name	Nitrogen	
ISO No.	IG - 100	
Purity	99.6 (V)%	Minimum
Moisture	0.005 (W)%	Maximum
Oxygen	0.1 (V)%	Maximum
Color Smell	None	

### **[Fc] FLOODING FACTORS**

[T] Temperature (°C)	[Cm] Minimum Design Concentration (V)%		
	40.3	44	48
- 20	0.60	0.67	0.76
- 15	0.59	0.66	0.74
- 10	0.58	0.65	0.73
- 5	0.57	0.63	0.71
0	0.56	0.62	0.70
5	0.55	0.61	0.69
10	0.54	0.60	0.68
15	0.53	0.59	0.67
20	0.52	0.58	0.65
25	0.51	0.57	0.64
30	0.50	0.56	0.63
35	0.49	0.55	0.62
40	0.49	0.54	0.61

**[Fm] NN100 FLOW RATE  
ON  
MAIN PIPE**

Nominal Size Metric (Inch)	Main Pipe Length (m)						
	to 25	to 50	to 75	to 100	to 125	to 150	to 200
25A (1")	110	80	60	50	35	20	--
32A (1-1/4")	195	160	125	100	80	60	--
40A (1-1/2")	270	220	180	150	120	95	--
50A (2")	445	390	320	275	230	190	--
65A (2-1/2")	770	640	560	470	380	320	270
80A (3")	1270	1050	910	770	680	600	520
100A (4")	2170	1850	1570	1370	1170	1010	860
125A (5")	3580	3070	2730	2380	2110	1810	1500
150A (6")	4920	4330	3820	3360	2970	2660	2250

(m<sup>3</sup> / min)

**[Fm] NN100 FLOW RATE  
 ON  
BRANCH PIPE**

Nominal Size		Flow Rate (m <sup>3</sup> / min)
Metric	(Inch)	
20A	(3/4")	20
25A	(1")	40
32A	(1-1/4")	70
40A	(1-1/2")	125
50A	(2")	210
65A	(2-1/2")	390
80A	(3")	580
100A	(4")	960
125A	(5")	1700

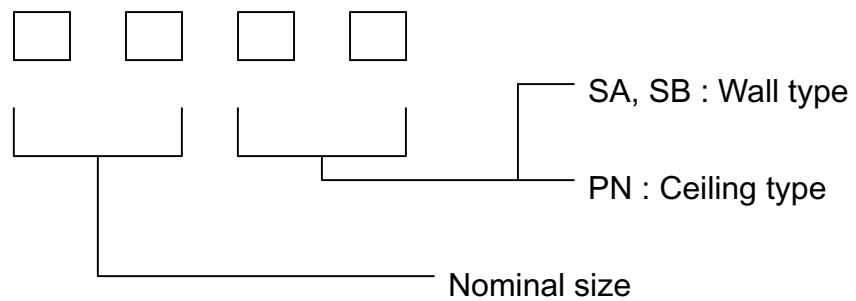
**MAXIMUM FLOW RATE  
OF  
DISCHARGE NOZZLE**

Discharge Nozzle Model Nos.		Maximum Flow Rate (m <sup>3</sup> / min)
Nominal Size	Suffix	
10	SB	15
20	SA	40
	PN	30
25	SA	70
	PN	60
32	SA	125
	PN	90
40	SA	180
	PN	125

**MAXIMUM FLOW RATE  
OF  
DISCHARGE NOZZLE**

(Cont'd)

(Discharge nozzle model numbering)



Example : 4 0 S A



## PACKAGED TYPE NN100 FIRE EXTINGUISHING SYSTEM

The packaged type NN100 fire extinguishing system consists the following (3) three type assembly units.

And usually, the system is installed in the hazard.

1. Type **A** package

Type **A** package includes

One N<sub>2</sub> 83-liter storage cylinder

One N<sub>2</sub> 5-liter pilot cylinder with cylinder valve actuator and

One set of control units

One N<sub>2</sub> 5-liter pilot cylinder can release twelve (12) N<sub>2</sub> 83-liter storage cylinders as maximum.

2. Type **B** package

Type **B** package includes One N<sub>2</sub> 83-liter storage cylinder only.

Type **B** package can be combined with Type **A** package or Type **C** package.

3. Type **C** package

Type **C** package includes

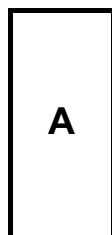
One N<sub>2</sub> 83-liter storage cylinder and

One N<sub>2</sub> 5-liter pilot cylinder with supporting releaser (PH - type)

Combination formations are as follows,

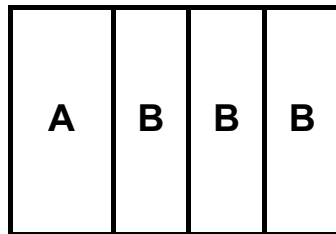
( Type **A** package only )

(Refer to Dwg.No.217HD32A)

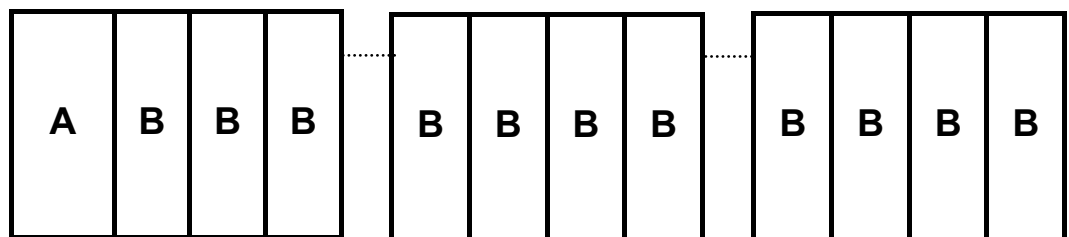


( From 2 to 4 N<sub>2</sub> 83-liter cylinders )

(Refer to Dwg.Nos.217HD32A and 217HD33A)

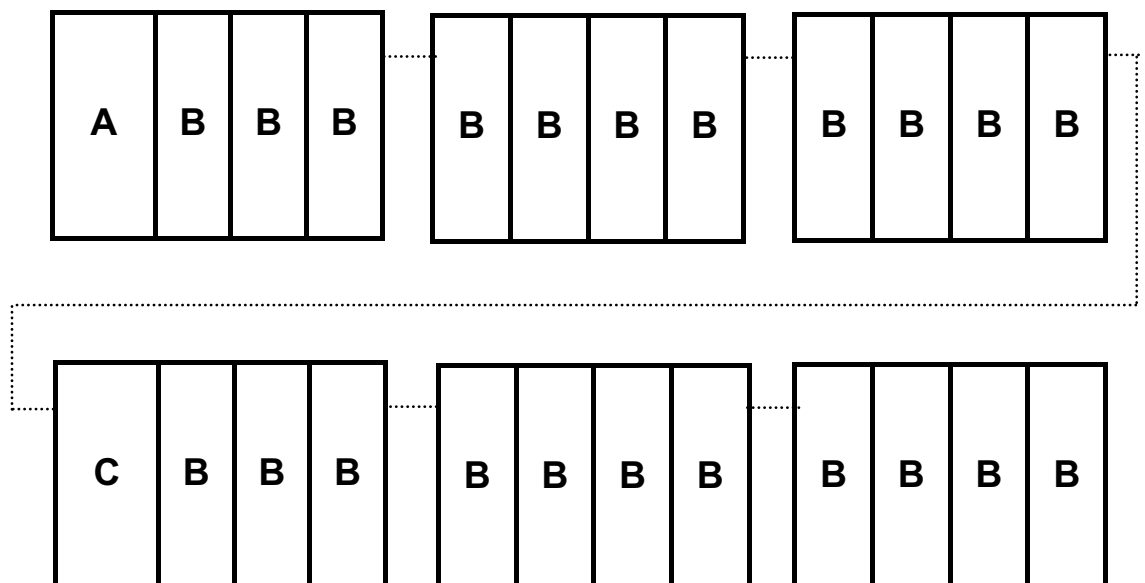


( Up to 12 N<sub>2</sub> 83-liter cylinders )



( Over 12 N<sub>2</sub> 83-liter cylinders )

(Refer to Dwg. Nos.217HD32A , 217HD33A  
and 217HD34A)



## CONCENTRATION

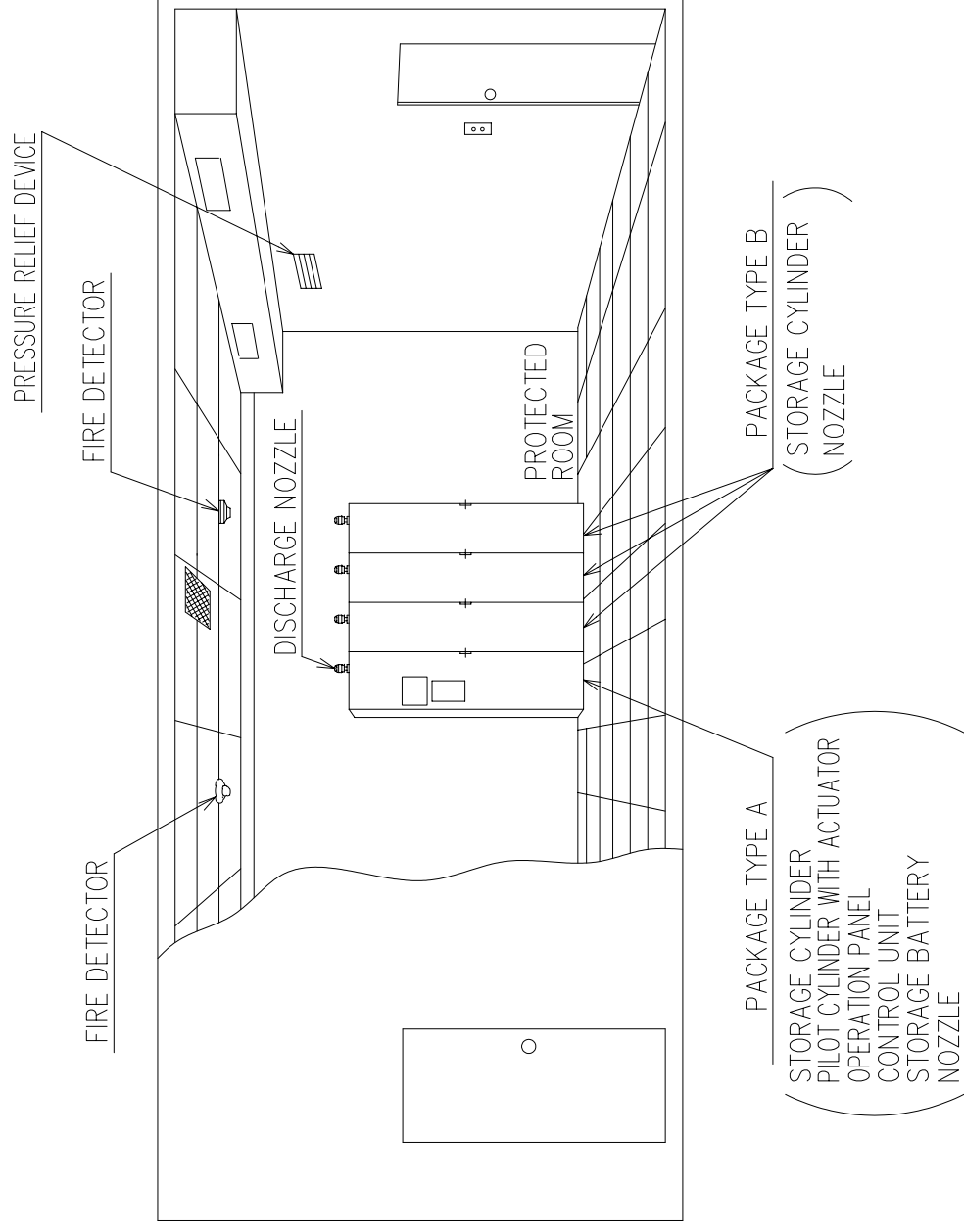
### AGENT - OXGEN

Concentration (%)	
Agent	Oxygen
40.3	12.5
41.0	12.4
43.0	12.0
45.0	11.6
47.0	11.1
49.0	10.7
51.0	10.3
52.3	10.0

## NN100 AGENT CALCULATION SHEET

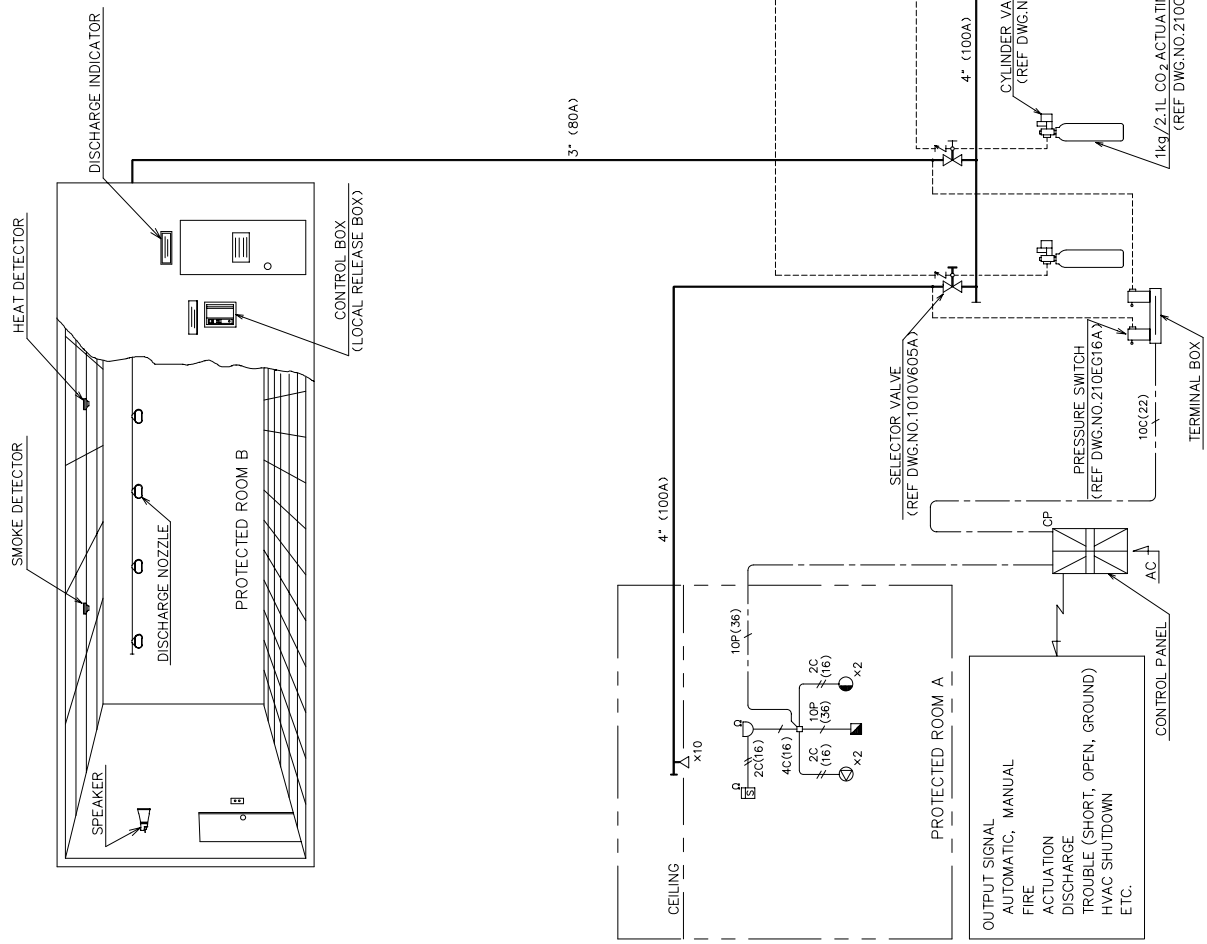
( / )

Date	- -	Subject				Approved	Checked	Written
JOB								
No.								
Protected Room Number								
Protected Room Name								
①	Area of Floor (m <sup>2</sup> )							
②	Volume (m <sup>3</sup> )							
③	Flooding Factor (m <sup>3</sup> /m <sup>3</sup> )							
④	N <sub>2</sub> Volume (m <sup>3</sup> ) ② x ③							
⑤	Discharge Time (min)							
⑥	Minimum Flow Rate (m <sup>3</sup> /min) ④ / ⑤							
⑦	Design Flow Rate (m <sup>3</sup> /min) ⑫ x ⑪							
⑧	Number of Cylinders (20.3m <sup>3</sup> /83L)							
⑨	Main Pipe Size (A)							
Nozzle	⑩ Model							
	⑪ Numbers							
	⑫ Flow Rate for each Nozzle (m <sup>3</sup> /min) ⑥ / ⑪							
⑬	N <sub>2</sub> Concentration (%)							
⑭	O <sub>2</sub> Concentration (%)							
⑮	Allowable Strength of Protected Room (Pa)							
⑯	Length of Duct (m)							
⑰	Area of Pressure Relief Opening (cm <sup>2</sup> )							
The Formula of the Pressure Relief Opening		$A = 134 \times \textcircled{7} \times 1.6 \times 1 / \sqrt{P\text{-delta } P} \quad (\text{cm}^2)$						
The Formula of the N <sub>2</sub> Concentration		$C (\%) = \{ 1 - \exp \textcircled{8} \times W \times 1 / \textcircled{2} \} \times 100 \quad W:20.3(\text{m}^3)$						
The Formula of the O <sub>2</sub> Concentration		$C (\%) = \{ 1 - \textcircled{13} / 100 \} \times 21$						



**PACKAGED TYPE  
NN100 FIRE EXTINGUISHING SYSTEM**

SYMBOL	DESCRIPTION	REMARKS	REF DWG. NO.
CN	N <sub>2</sub> STORAGE CYLINDER	20.3m <sup>3</sup> /83L (SEAMLESS STEEL CYLINDER)	217CA40B
CA	N <sub>2</sub> PILOT CYLINDER	8.2m <sup>3</sup> /82.5L (SEAMLESS STEEL CYLINDER)	1037C801A
△	DISCHARGE NOZZLE		217NA01A 217NA18A
CP	CONTROL PANEL	WITH ANNOUNCEMENT UNIT & STORAGE BATTERY UNIT	—
■	CONTROL BOX (LOCAL RELEASE BOX)	WITH AUTO-MANUAL CHANGEOVER SWITCH	210EK77A
○	DISCHARGE INDICATOR		217EE30A
⊙	SPEAKER	SOUND, VOICE ANNOUNCEMENT	217EF16A
∪	HEAT DETECTOR	FIXED TEMPERATURE TYPE	FDL6763E
⊞	SMOKE DETECTOR	PHOTOELECTRIC TYPE	FDK6708e
Ω	END LINE RESISTANCE	10KΩ 1/2W	—
—	PIPING	STPG370 Sch80	—
----	PNEUMATIC CONTROL TUBING	COPPER TUBE OD 6×11.0	—
---	WIRING	HEAT-PROOF TYPE	—
— —	NON-RETURN VALVE		217VC01A
— — —	RELIEF VALVE		217VC03A
⌒	φ4 LINE CONTROL VALVE		217VC21A



NN100 FIRE EXTINGUISHING SYSTEM

TYPICAL PIPING DIAGRAM