**INERGEN® Gaseous Fire Extinguishing System**

System specification

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## 1.0 GENERAL

The INERGEN Extinguishing System comprises of the following:

- Extinguishing Agent
- Storage Cylinder or Cylinders Bank
- Quick opening valve
- Pressure gauges
- Control (actuation) line
- High pressure connection hose
- Manifold with non return valves
- Pressure Reducing Unit
- Distribution piping
- Discharge nozzle

Above equipment is so connected as to perform as one complete and functionally safe fire extinguishing system.

This extinguishing system conforms to the VdS Guidelines on Gaseous Fire Extinguishing System and the extinguishing agent complies to the NFPA 2001 – Standards on Clean Agent Fire Extinguishing Systems.
The system as well as all individual parts are VdS Approved and tested to EN 12094.
This INERGEN Fire Extinguishing System is known as IG 541 in NFPA 2001 and also as IG 52.40.08 in German Standards.

## 2.0 PRODUCT DESCRIPTION

INERGEN® is an environmental friendly fire extinguishing gas, blend from naturally existing atmospheric gasses i.e. Nitrogen, Argon and CO2 . This gas is non ozone depleting, non global warming, electrically non conductive and non – corrosive.

The INERGEN® Gaseous Fire Extinguishing System is an engineered system designed for total flooding extinguishing system. When properly designed, it is effective on class A, B and C fires by lowering the oxygen content below the level that supports combustion and at the same time human life is sustained. Some typical applications are:

- computers rooms
- record storage
- telecommunication equipment
- process equipment
- all normally occupied or unoccupied electronic areas where equipment is either very sensitive or irreplaceable
- electrical switchgear rooms

INERGEN® has also been tested by FMRC for inerting capability and the results have shown that INERGEN® is capable of inerting propane / air and the methane / air mixtures at INERGEN® concentrations between 40 % and 50 %.

## 3.0 AVAILABILITY

INERGEN® is available from manufactures and their authorized dealers.

## 4.0 INSTALLATION

All system components must be installed by trained personnel according to regulations and guidelines given by the manufacturer.

## 5.0 SYSTEM ACTUATION

For the system energization the Pilot Cylinder provided with an electrical actuator properly mounted on the Quick Release Valve. When an actuation signal is given by the Control Panel to the electrical actuator, the actuator mechanically opens the Quick Release Valve and the INERGEN® is released. The valves of the slave cylinders open by pneumatic actuators using a proper pneumatic control line and pneumatic release piston.
The cylinders are secured against reaction when the INERGEN® is discharged. They can easily removed from the mounting to permit complete testing and actuation of the release and trip mechanism during inspection, without discharging the agent.
Notes :

1. The 200 Bar systems need independent pilot cylinder 27 lt/200bar for 21- 40 cylinder bank
   80 lt/200bar for 41-250 cylinder bank
2. The 300 Bar systems need independent pilot cylinder 8 lt/200bar for 2- 40 cylinder bank
   27 lt/200bar for 41-100 cylinder bank
   80 lt/200bar for101-250 cylinder bank

**Indicative system: TOTAL WALTHER 200/300 Bar Systems**

## 6.0 TECHNICAL SPECIFICATIONS

### 6.1 Inergen constitution

The INERGEN® supplied complies to NFPA 2001 and have purity as following:

- N2 52 ± 5 %
- Ar 40 ± 5 %
- $CO_2$ 8 ± 5 %
- Water content max 0.005 % by weight

The gas is stored at 200 or 300 bar at 15° C

### 6.2 Storage Cylinders

The INERGEN® is stored in rechargeable cylinders, constructed, tested and marked in accordance with Directive 84/525/CEE and DOT 3AA and has inspection certificates from TUV-D, Stoomweeren (Holland), SDM (France), Aspagar (Belgium) or any other equivalent Inspection Organisation.

Technical Data:

| | **200 Bar** | **300 Bar** |
|---|---|---|
| Test Pressure: | 300 Bar | 450 Bar |
| Storage Pressure: | 200 Bar | 300 Bar |
| Nominal Capacity: | 80LT/16,8Nm$^3$ or 23,6 kg<br>67LT/14,1Nm$^3$ or 19,7 kg<br>40LT/ 8,4Nm$^3$ or 11,8 kg<br>27LT/ 5,6Nm$^3$ or 7,9 kg | 80LT/23,6,Nm$^3$ or 35,5 kg |

## 6.3 Storage Cylinders

Each Cylinder is provided with a valve for the automatic operation which can be activated electrically, pneumatically or manually. It is delivered also with a pressure measuring and analyzing nozzle and a safety bursting disc which will operate in case of overpressurization.

Technical Data

| | **200 Bar** | **300 Bar** |
|---|---|---|
| Nominal Diameter | :12mm | 12mm |
| Working Pressure | :200 bar/15$^{o}$C | 350 bar/15°C |
| Overpreassure release | :270 bar | 420 bar |
| Min control pressure | :100 bar | 120 bar |
| Max working pressure | :240 bar | 360 bar |
| Material | | |
| Body | :Brass | Brass |

For the 300 Bar systems an orifice pressure reducing unit is installed at the outlet of each quick release valve to reduce the pressure from 300 bar to 200 bar.

## 6.4 Pressure gauge

Every cylinder is provided with a pressure gauge (range from 0 to 300 bar for 200 bar systems or 0-400 bar for 300 bar systems) which is connected at the special testing nozzle of the cylinder's quick release valve.
The gauge connection and disconnection does not cause any INERGEN® leakage.

## 6.5 Actuation

The release of the INERGEN agent from the storage is done by actuating the quick release valve using an electromechanical actuator which operates at 24 Vdc. Where multiple cylinder installation is used, the pilot cylinder's valve opens by the use of an electromechanical actuator while the valves of the slave cylinders open by agent pressure from pilot cylinder using a pneumatic control line and pneumatic release piston.

Technical Data

| | | |
|---|---|---|
| Electrical actuator | | |
| Operating Voltage | :24 VDC | |
| Power consumption | :15 W | |
| Protection Standard | :IP 65 | |
| Materials: | :Body – Red bronze | |
| | Plastic coated Stainless Steel | |
| | | |
| Pneumatic Actuator (attached on the Quick Release Valve) | | |
| Minimum working pressure: | 100 Bar | 150 Bar |
| Material | : Bronze | Bronze |

## 6.6 High pressure connection hose

All cylinders are connected to manifold using a flexible hose with the following specifications :

Technical Data

| | **200 Bar** | **300 Bar** |
|---|---|---|
| Nominal diameter | : 10 mm | 12 mm |
| Max operating pressure | :240 bar | 360 bar |
| Test pressure | :480 bar | 700 bar |
| Material | :Thermoplastics Galvanized Steel | |

## 6.7 Manifold with non return valves

If more than one cylinders are used, these are connected with flexible hoses within a common manifold via non return valves. With that design it is possible to remove one cylinder without the system interruption. The manifold is provided with non return valves. Its nominal diameter is DN 50 and can be connected up to 6 or 9 cylinders. When the non return valves are not used they are protected with special plugs.

Technical Data

| | | |
|---|---|---|
| Maximum operating pressure | : | 240 bar |
| Test pressure | : | 320 bar |
| Material: | | |
| Manifold | : | Galvanized Steel |
| Non return valves | : | Brass |

## 6.8 Pressure reducing unit

The pressure reduction device acts as a flow restriction to reduce the INERGEN® storage pressure from 200 bar to 60 bar or lower in the distribution piping. It is installed between the INERGEN® manifold and the nozzle pipework and it is of flanged type.

Technical Data

| | | |
|---|---|---|
| Nominal Diameter | : | DN 50 or DN 80 |
| Diameter of reduction flow hole | : | 3 – 35 mm / DN 50 |
| | | 20 – 56 mm / DN 80 |

Material: Galvanized steel, bronze

6.8.1 Single Cylinder Pressure Reducer System
Diameter of reduction flow hole: 1 – 6 mm
Material: Galvanized steel, bronze

## 6.9 Piping

All the pipe - network shall conform at least to the following requirements :

From the Cylinders up to the pressure reduction device

| | | |
|---|---|---|
| Max working pressure | : | 240 bar |
| Test pressure | : | 320 bar |
| Standarization | : | DIN 2448/17175 |
| Material | : | st 35.8-III |

From the pressure reduction device up to nozzles

| | | |
|---|---|---|
| Max working pressure | : | 60 bar |
| Test pressure | : | 80 bar |
| Standarization | : | Φ 15-50mm DIN 2458/1626/st 37.0 |
| | | Φ>DN 50 DIN 2448/17175/st 37.0 |
| Material | : | st 37.0 killed |

**All fittings will conform at least to the following requirements :**

From the Cylinders up to the pressure reduction device

| | | |
|---|---|---|
| Max working pressure | : | 240 bar |
| Test pressure | : | 320 bar |
| Standarization | : | ANSI B 16.11 |
| Material | : | A105/AstM (C21) |

From the pressure reduction device up to nozzles

| | | |
|---|---|---|
| Max working pressure | : | 60 bar |
| Test pressure | : | 80 bar |
| Standarization | : | GTW/DIN 2950 |
| Material | : | GTW 40-05 |

## 6.10 Discharge Nozzle

The selection and placement of the nozzles are such that the design concentration of oxygen and $CO_2$ concentrations can be achieved in all parts of the enclosure.

Technical Data

| | |
|---|---|
| Nominal diameter | :½" or 1" |
| Application | :Total flooding |
| Material | :Bronze |
| Maximum Coverage | :30 $m^2$ up to 5 m room height. |

The nozzle's openings size depends upon the working pressure and the design concentration.

The openings size for the two nozzle's types are:

½ in: 3-13 mm
1 in: 11-20 mm

Discharge nozzles are permanently marked with the diameter of the openings (orifice size).

## 7.0 PIPE SIZING

The following matrix helps for a rough selection of the distribution network or for existing network's sizing checks.

Qg : Specific flow rate in $Nm^3$ /min
DN: Nominal diameter in mm

| Qg | DN |
|---|---|
| 14 | 15 |
| 24,5 | 20 |
| 45,5 | 25 |
| 87,5 | 32 |
| 119 | 40 |
| 216 | 50 |
| 398 | 65 |
| 698 | 80 |

## 8.0 PRESSURE RELIEF

For exceptionally tight enclosures, where venting of an enclosure maybe necessary to relief pressure built up due to the discharge of large quantities of INERGEN, the minimum area necessary for free venting is determined from the following equations :

$$A = \frac{Q}{\sqrt{\Delta P \times V_{HOM}}} \times C_2$$

Where :

A = the opening in $m^2$

Q= flow of INERGEN® in $Nm^3$/sec

ΔP= maximum pressure increase in Pascal (1 mbar = 100 Pa)

V HOM = specific gravity of the homogeneous air / INERGEN® mixture (0,77 is a good average);

C2 = coefficient of resistance of opening, usually in the range 0,25 to 1,25. It can conveniently be equated to 1 in the case of typical louvered opening without the need for additional venting

Note :

1. Appropriate pressure relief depends on the INERGEN® discharge rate and enclosure strength.
2. Where venting is required, it should be sited as high as possible in the enclosure.
3. In many instances, particularly where harzardous materials are involved, relief openings often provide adequate venting.
4. Typical enclosure strenghts are as follows:
   Lightweight construction :1,2 Mpa
   Standard construction :2,4 Mpa
   Heavy construction :4.8 Mpa

## 9.0 PROTECTED AREA REQUIREMENTS

The area to be protected must be an enclosed area with minimal openings during INERGEN® discharge. Openings such as air conditioning louvres, cable trunks and ventilation fans shall be shut before INERGEN® discharge. In the case where this is not possible, extra INERGEN® gas is to be discharged to compensate any leakage. Any modification to the protected area, which involves additional or removal of large solid objects will cause the system to malfunction. If that is unavoidable, inform the INERGEN® dealer to make the appropriate system modification if possible.