

ANNEXURE A**PROJECT TECHNICAL SPECIFICATION****1. GENERAL**

This part of the specification deals with the main items of material and equipment which it will be the Contractor's responsibility to supply and install in accordance with this document and the drawings.

Sufficient information is provided in this document and on the drawings to enable the Tenderer to accurately price the work. Tenderers must allow for all items, whether specified in detail or not, required to complete the installation in a neat and workmanlike manner.

This specification specifies requirements and gives recommendations for material specifications, installation practices, testing requirements and project deliverables for the design, supply, installation and commissioning of the **Inergen gas suppression system** installed inside the various areas that form part of the Scope of Works.

2. GAS SUPPRESSION SYSTEM

The Clean Agent Fire Extinguishing System will be an engineered system utilizing a fixed nozzle agent distribution network it will be designed and installed in accordance with the SANS/ISO 14520 Code of Practice, and the Engineer's specification, whichever is more stringent. A full 300 bar INERGEN (IG541) system, shall be used. Cylinder capacity shall be 80L at 300bar.

Approval shall be European approved in, TPED2010/35 EU and one other internationally recognized approval as listed in SANS347 and PER"

Cylinder valves shall comply with ADR/ISO10297 (previously EN849) Annex A "Valve impact test", and if the cylinder discharge valve is fitted directly on cylinder, also compliance testing and certification to ISO17871"Quick release cylinder valves"

Performance Approval authority is (UL) standard 2127

The system shall be actuated by detection and control equipment for automatic system operation along with providing local and remote manual operation as required. Work under this portion of the contract consists of the supply, detail design, delivery and installation of an automated gas flooding fire suppression system, complete with all pipe work, valves, nozzles, signage, and discharge control units.

The complete aspirating smoke detection system will also for part of this contract.

3. TECHNICAL REQUIREMENTS

The gas system shall consist of total storage banks and be capable of totally flooding the protected areas to a design concentration applicable to the gas offered at an ambient temperature of 21°C A minimum gas design concentration of 39.9% is required. A room oxygen concentration of maximum 14% (minimum 11%) shall be maintained for a period of not less than ten minutes after the gas discharge, Discharge times will be those as specified in the SANS/ISO 14520-15 Code of Practice, alternatively to those concentrations in compliance with the products listings.

The system design shall be based on the following criteria:
Indoor temperature (anticipated design) 21°C

A complete system, each individual component, design manual and design software approval shall be provided on the total inert gas installation shall be from one manufacturer.

The detailed design shall form part of an approved, integrated design, manufacture and testing process in compliance with the regulation. The design of the fire protection layout shall be done as part of an ISO9001 certified design program.

4. **MATERIALS**

Only equipment and components specifically designed for the proposed use may be used. Proof of such compliance shall be provided for each item, and in the case of the gaseous extinguishing system, the software, each component and the system as a whole.

Relevant national design code is ASME B31.

5. **WORKING DOCUMENTS**

The contractor shall be responsible for producing the following working documents, which shall include the following items:

- (a) drawings, to an indicated scale of extinguishant distribution system, including containers, location of containers, piping and nozzles, valves and pressure _ reducing devices, orifice unions and pipe hanger spacing;
- (b) Enclosure cross-section, full height or schematic diagram, including raised access floor and suspended ceiling;
- (c) Extinguishing concentration, design concentration and maximum concentration;
- (d) Specification of containers used, including capacity, storage pressure and mass including extinguishant;
- (e) Description of nozzle(s) used, including inlet size, orifice port configuration, and orifice size/code and orifice size of pressure -reducing devices, if applicable.
- (f) description and suppliers of pipes, valves and fittings used, including material specifications, grade and pressure rating, mill certificates and batch test reports,
- (g) Equipment schedule or bill of materials for each piece of equipment or device, showing device name, manufacturer, model or part number, quantity and description.
- (h) Isometric view of extinguishant distribution system, showing the length and diameter of each pipe segment and node reference numbers relating to the flow calculations;
- (i) Enclosure pressurization and venting calculations;
- (j) Description of fire detection, actuation and control systems; and
- (k) Installation, testing and commissioning instructions and trouble analysis guide and details of all safety protection devices, where applicable.

6. **CYLINDERS**

Cylinders shall be designed to hold the specific extinguishant. Cylinders shall not be charged to a full density greater than specified in that part of ISO 14520:15 relating to the specific extinguishant. Cylinders shall be designed to suit the working pressure of the gas offered. Design pressure shall be at least 1.5 times the working pressure or relevant to an accepted manufacturing standard to be supplied with (COC) from SANAS approved (AIA)

Cylinders and valve manifolds shall be tested hydraulically to the highest pressure of that specified by SANS ISO 14520, or manufacturer, or 450 bar test pressure and be substantiated by a relevant test certificate. All cylinders will be supplied with a pressure relief valve as per manufacturer accepted Standards and approval or in accordance with SANS 347 specification.

The cylinders used in these systems shall be designed to meet the requirements of relevant national standards and be TPED approved, particularly the Pressure Equipment Regulations (PER) under the Occupational Health and Safety Act (Act 85 of 1993). The Contractor shall provide written proof of compliance with such design code by the manufacturer or importer Furthermore; the Contractor shall submit certificates for each and every storage cylinder before bringing them onto site. Where no certificates have been issued, the Contractor shall submit a list of cylinders, including manufacturer, serial number and standard together with a (SANAS) approved (AIA) Certificate of conformance (COC).

The container valve assembly should be fitted with a pressure relief device complying with the appropriate national standards and be approved to TPED standard for transportable pressure vessels.

All storage cylinders shall be supplied new, and all cylinders forming part the installation shall be of interchangeable without any modification whatsoever.

Cylinder shipping shall be in accordance with the TPED code of the cylinders.

Storage cylinders shall be shipped fully charged, and with an approved protective cap over the cylinder valve. Protective caps shall be removed only once cylinders have been finally bracketed into position. All protective caps shall be mounted on a traceable tag cap rack next to the cylinder bank.

Storage cylinders shall be installed in banks in accordance with the manufacturer's specifications and SABS ISO 14520 Code of Practice. All cylinders shall be securely positioned by means of a rigid bracketing assembly, which eliminates any lateral movement of cylinders.

7. **CONTENTS INDICATION**

Each cylinder must be electrically individually monitored for pressure leaks on cylinder bank. Cylinder gauge must indicate pressure in kPA or Bar. The pressure monitoring of the cylinder will be connected to the main control panel and indicate fault alarm if any cylinder leaks on the cylinder bank.

8. **CONTAINER ARRANGEMENT**

Arrangements shall be made for container and valve assemblies and accessories to be accessible for inspection, testing and other maintenance when required. Cylinder Discharge valve shall be able to be removed from system for service or repair without removing the entire cylinder from the site.

Each cylinder is to be fitted with an approved TPED hand wheel valve. Containers shall be adequately mounted and suitably supported according to the systems installation manual so as to provide for convenient individual servicing of the container and its contents. Containers shall be suitably supported, each with two suitable clamps, each from a rigidly fixed uni-strut.

Containers shall be supported on a steel stand designed to take all containers in a manifold group. Supports shall be level with the false floor and manufactured from steel sections welded and painted black, and solidly bolted to the wall, after being adjusted for correct floor level.

Storage containers shall not be located where they will be subjected to severe weather conditions or to potential damage due to mechanical, chemical or other causes. Where potentially damaging exposure or unauthorized interference is likely a suitable enclosure or guards shall be provided by the contractor.

Different sized storage containers connected to a common manifold may not be used for Non-liquefied gas containers.

9. **MANIFOLDS**

Manifolds manufactured by the Inert Gas Agent equipment manufacturer shall be Certified to an approved requirement listed in the PER or SANS347.

Flexible connection hoses shall consist of flexible, steel reinforced hose, with swaged on threaded connectors on either end, and shall incorporate a check valve to prevent agent loss in case of a discharge with any cylinder disconnected from the hose for any reason. These hoses shall have at least the same pressure handling capability as the manifolds.

10. **MANUAL AND ELECTRONIC SOLENOID ACTUATION VALVES**

At each bank, an electrical solenoid-controlled actuator or detonator type) shall Automatically release the gas on receipt of the appropriate fire alarm signal or manually operated.

11. **SELECTOR VALVES (SV)**

Selector valve are to distribute the Gas from the main bank into the required risk, (SV) are to be operated Pneumatically, Electrically or Manually. All equipment to ensure the operation of SV valves is to be provided.

(PE) Approval CE1116
Performance authority approval UL
Working Pressure WP 400bar

12. **PIPEWORK DISTRIBUTION**

Pipe work and fittings shall comply with appropriate local requirements and be in compliance of the local (PER) and SANS 347, Installer of the equipment must provide the relevant design code used to conform to the requirement. Pipe system is to be designed to conform to Category 1 SANS 347.

Installer or subcontractors shall have a current approval for document control accepted by a relevant inspection authority. I.e. SABS ISO9001.

Pipe system shall be non-combustible and able to withstand the expected pressures and temperatures without damage, where the manufacturer's listings require more stringent specifications in accordance with equipment's listing these shall be followed.

Before final assembly, pipe and fittings shall be inspected visually to ensure they are clean and free of burrs and rust, and that no foreign matter is inside and the full bore is clear After assembly, the system shall be thoroughly blown through with dry air or Nitrogen.

Over pressure relief devices shall be designed to operate at a pressure not greater than the test pressure of the pipe work, or as required by the manufacturer. Pressure relief devices, which can include a selector valve assembly, should be fitted so that the discharge, in the event of operation, will not injure or endanger personnel and, if necessary, so that the discharge is piped to an area where it will not become a hazard to personnel'.

In the systems using pressure operated container valves, automatic means shall be provided to vent any container leakage that build up pressure in the pilot system and cause unwanted opening of the container valve. The means of pressure venting shall not prevent operation of the container valve.

The pipe system shall be provided with the component manufacture pressure switch just upstream of the orifice union before any other take-off to provide a potential-free output signal to the main fire alarm system to monitor and report on a gas discharge.

13. **PIPING MATERIALS**

Piping shall be of non-combustible material having physical and chemical characteristics such that its integrity under stress can be predicated with reliability 'Only seamless Carbon-steel schedule piping shall be used., The pressure handling capabilities shall be the maximum developed pressure plus 50% at a maximum storage temperature of not less than 50°C, If higher operating temperatures are approved for a given system, the design pressure shall be adjusted to the developed pressure plus 50% at maximum temperature In performing this calculation, all joint factors and threading, grooving or welding allowances shall be taken into account.

Where a static pressure-reducing device is used in a non-liquefied gas system, the maximum working pressure plus 50% in the distribution pipe work downstream of the device shall be used in the verification of the downstream pipe wall thickness; all pipes shall be sleeved where penetrating separating elements Sleeves shall be properly sealed after the pipe installation. The following table provides schedule information for the pipe system:

Flexible tubing or hoses (including connections) shall be of approved materials in accordance with the system's listings and or manufacturer's recommendations and shall be suitable for service at the anticipated extinguishant pressure and maximum and minimum temperatures expected during normal and discharge conditions.

Notwithstanding the requirements of IS014520 the expected working pressures for Inert Systems shall be in accordance with NFPA2001.

Minimum Design Working Pressure for Inert Gas Clean Agent System Piping.

Pressure Criteria

Minimum Rim feed pressure XXS pipe 300 Bar WP

Minimum Area pipe pressure after (SV) 100 Bar WP

MAXIMUM ALLOWABLE PIPE SIZE DN100mm

Minimum Design Pressure at (21 °C) to be used.

Maximum Design Pressure at (50 °C) to be used.

All pipe ends shall be reamed clean of any burrs before assembly. Contractors shall physically check the inner diametric tolerance of particularly smaller pipe sizes for conformity with the prescribed specification.

Contractors are advised to blow through all distribution pipe work and nozzles to ensure that no blockages exist, prior to performing the full discharge test

13. **FITTINGS**

Fittings shall be classified in accordance to the relevant Design Code maximum downstream pressure at 50°C when filled to the maximum allowable fill density for the extinguishant being used, For systems that use a pressure-reducing device in the distribution piping, the fittings downstream of the device (orifice) shall have a minimum rated working pressure at 150% of the maximum anticipated pressure in the downstream piping.

Pipe and fitting Classifications
 Flanges Rim Feed Class 2500lbs
 Threaded Rim Feed Class 6000lbs
 Flanges After SV 600lbs
 Threaded After SV 3000lbs

- Cast iron fittings shall not be used,
- Welding and brazing alloys shall have a melting point above 500°C,
- Welding shall be performed in accordance with relevant national standards,
- Where copper, stainless steel, or other suitable tubing is joined with compression fittings, the manufacturer's pressure/temperature ratings of the fittings shall not be exceeded and care shall be taken to ensure the integrity of the assembly.
- All manifolds shall remain unpainted.

15. **IDENTIFICATION**

Identification colours shall be approved by the Engineer. Identification shall be neat and legible and shall be applied after completion of final finishes. All gas piping shall be provided with Agent identification stickers neatly applied to the pipes showing Agent and flow direction. Size and location shall be in accordance with SABS 0140 Identification of pipelines.

Each gas bank, Gas Control unit, and Interface shall be labeled with red lettering 50 mm high on a white background.

Labels shall be of non-corroding material, shall consist of red lettering with a minimum height of 50mm on a white non-glossy background. Labels shall be screwed into position, Each gas bank, Gas Control unit, and Interface shall be labeled.

16. **PIPE SUPPORTS**

Pipe supports shall be suitable for the expected temperature and shall be able to withstand the dynamic and static forces involved. Due allowance shall be made for the stresses induced in the pipe work by temperature variations. Adequate environmental protection shall be given to supports and associated steelwork,

Adequate support shall be provided for nozzles and their reactive forces such that in no case shall the distance from the last support be greater than as follows:

- a) <25mm pipe #100mm
- b) >25mm pipe #250mm

Movement of pipe work caused by temperature fluctuations arising from environment or the discharge of extinguishant may be considerable particularly over long lengths and should be considered in the support fixing methods. All pipe runs and system components shall be so located so as to maintain a minimum. Clearance of 200mm from electrical conduiting or equipment, unless greater clearance is indicated in the Supplementary Specification or on Tender drawings.

Where equipment is to be bolted down on concrete plinths, anchor studs shall preferably be cast into concrete bases. In such instances, the thread of the anchor studs shall be suitably protected to readily facilitate repeated disassembly of fixing assemblies.

Where equipment is to be fixed to concrete or brickwork surfaces, and where building or casting in is not feasible or desirable, fixing shall be by means of approved expansion type anchor bolts. Due care shall be taken to ensure adequate penetration of any expansion bolt, to eliminate surface damage. Pipes penetrating walls shall be sleeved.

All pipelines shall be firmly bracketed to walls and ceilings to the satisfaction of the Engineer any piping system shall be securely supported with due allowance for expansion and contraction and shall not be subject to possible damage.

The Contractor shall supply all bolts, fasteners, fittings, braces, supports, packing, gaskets, etc. necessary for assembly all equipment supplied by him. All such items required for assembly shall be supplied by the manufacturer of the Clean Agent equipment, or alternatively approved by the manufacturer.

Assembly of equipment shall be done in accordance with the requirements of the Clean Agent equipment manufacturer. Assemblies shall be neat and in accordance with the Client's and Engineer's requirements regarding quality of workmanship.

Typical pipe supports are made of RSA sections welded to steel plate and bolted to the structure these are to be manufactured as shown on the tender drawings. Threaded rod hangers shall under no circumstances be acceptable.

17. **VALVES**

Control valves must be able to be removed from the system cylinder for service or replacement without removing cylinder from site or decanting content. Valves are to be approved in accordance with EN12094.

18. **NOZZLES**

Nozzles, including nozzles directly attached to containers, shall be as supplied by the certified manufacturer of the Clean Agent equipment, and shall be of adequate strength for use with the expected working pressures, able to resist normal mechanical damage; and constructed to withstand expected temperatures with deformation.

All discharge nozzle orifices shall be pre-drilled by the certified manufacturer of the Clean Agent equipment, and the equivalent single orifice size clearly and indelibly stamped on the nozzle body, regardless of shape and number of orifices This equivalent size shall refer to the size of standard single orifice type with rounded entry and a coefficient of discharge of not less than 0.98, having the same flow rate as the nozzle in question. No Contractor or any other party shall under any circumstances be allowed to modify in any way any pre-drilled nozzle orifice, unless written approval from Fire-Eater has been provided.

Where possible, a minimum of two nozzles shall be provided in every protected space, or any part of subdivision separated from the main part of the protected space by any physical barrier, such as access flooring or ceiling. Single nozzles shall only be used in spaces too small to accommodate two nozzles where single nozzles are installed, blind elbows shall be fitted.

All discharge nozzles shall be located to achieve the best results and shall be selected and so positioned that the discharge will not splash flammable liquids or create dust clouds that might spread a fire, create an explosion, or otherwise adversely affect the contents of the protected space. Nozzles vary in design and discharge characteristics and shall be selected on the basis of their suitability for the use intended.

Where clogging by foreign materials is possible, the discharge nozzles shall be provided with frangible discs or blow-out caps. These devices shall provide an unobstructed opening upon system operation and shall be designed and arranged so they will not injure personnel Nozzles shall be suitable for the intended use and shall be approved for discharge characteristics, including area coverage and height limitations.

Nozzle discharge orifice inserts shall be of corrosion-resistant material and nozzles shall be brass with male threaded connections to ANSI 81 20.1, and compatible with the pipe threaded being used.

The Contractor shall individually ensure that the thread on each and every nozzle matches pipe thread before installation commences.

19. **NOZZLES IN CEILING TILES**

In order to minimize the possibility of lifting or displacement of lightweight ceiling tiles, precautions shall be taken to securely anchor tiles for a minimum distance of 15m from each discharge nozzle. Deflector shields shall be installed on all ceiling mounted nozzles.

20. **MARKING**

Discharge nozzles shall be permanently marked to identify the manufacturer and size of the orifice.