



**HELLENIC GAS
TRANSMISSION
SYSTEM OPERATOR**

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**TECHNICAL JOB
SPECIFICATION**

F6

REVISION 1

DATE 22/09/2011

LIQUEFIED NATURAL GAS PLANTS

**DRY CHEMICAL EXTINGUISHING
SYSTEM FOR LNG STORAGE TANKS
RELIEF VALVES**

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QUALITY ASSURANCE PAGE

CHANGES LOG

- Para 4.7.5 deleted

REVISIONS LOG

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REFERENCE DOCUMENTS

ELOT EN 1473

[Installation and equipment for liquefied natural gas - Design of onshore installations]

ELOT EN 12065

[Installations and equipment for liquefied natural gas - Testing of foam concentrates designed for generation of medium and high expansion foam and of extinguishing powders used on liquefied natural gas fires]

ELOT EN 13480 Series

[Metallic industrial piping]

EU DIRECTIVES

LVD 2006/95/EC

[Harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits]

EMC 2004/108/EC

[Approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC EMC]

ATEX 94/9/EC

[Equipment and Protective Systems intended for use in Potentially Explosive Atmospheres]

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1.0 GENERAL

- 1.1 This specification covers the requirements for the supply of a fixed dry chemical extinguishing system for the atmospheric relief valves on the LNG Storage Tank.
- 1.2 In the event of ignition during venting, these extinguishers shall inject sodium bicarbonate base dry chemical fire fighting agent into the tail pipe of the affected relief valve. The number of atmospheric relief valves on each tank shall be determined by the CONTRACTOR.
- 1.3 The equipment associated with the extinguishing system shall be permanently mounted on the access / maintenance platform on top of each Storage Tank.
- 1.4 The extinguishing system shall be initiated automatically on high temperature and by remote manual start.
- 1.5 Nitrogen of good commercial grade, free of water and other contaminants shall be used as expellent gas.

2.0 SCOPE OF SUPPLY

- 2.1 The CONTRACTOR'S scope of supply shall include but not be limited to the following for each storage tank:
 - 2.1.1 Dual cylinder (primary and reserve), pre-pressurised dry chemical extinguishing packages, one for each relief valve which discharges to atmosphere.
 - 2.1.2 Design of control logic to be incorporated by the OWNER in the central control room.
 - 2.1.3 Dry chemical injection nozzles plus all miscellaneous mounting hardware.
 - 2.1.4 Dry chemical discharge piping.
 - 2.1.5 One nitrogen purge cylinder for each package.
 - 2.1.6 Mounting platform and anchor bolts.
 - 2.1.7 Heat detectors and support clips.
- 2.2 The Owner's scope of supply shall include the following:
 - 2.2.1 All control room mounted logic, alarms, and switches.
- 2.3 A diagrammatic arrangement of the dry chemical extinguishing system is shown in Appendix 1.

3.0 EU DIRECTIVES, EUROPEAN STANDARDS AND SPECIFICATIONS

3.1 Applicable standards and specifications shall include the following:

3.1.1 Dry chemical extinguishing systems: **ELOT EN 1473** and **ELOT EN 12065**.

3.1.2 Piping: **ELOT EN 13480**.

3.2 Applicable **EU Directives** shall include the following:

- **LVD 2006/95/EC** – "Harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits"
- **EMC 2004/108/EC** – "Approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC EMC"
- **ATEX 94/9/EC** – "Equipment and Protective Systems intended for use in Potentially Explosive Atmospheres"

4.0 DESIGN

4.1 ENCLOSURE

4.1.1 The CONTRACTOR shall provide one dual cylinder (primary and reserve), pre-pressurised dry chemical extinguisher package for each atmospheric relief valve.

4.1.2 In addition to the dual, pre-pressurised dry chemical extinguishers, each enclosure shall contain a nitrogen purge cylinder, pre-pressurised by the supplier. This cylinder shall be sized and piped by the CONTRACTOR in such a way as to purge all dry chemical lines (including the manifold connecting the two dry chemical containers) following completion of the discharge cycle. This cylinder shall be capable of local manual start. The recharge instructions shall define the necessity for line purging prior to declaring the system ready for further use.

4.1.3 The CONTRACTOR shall provide a watertight enclosure for housing each dual set of cylinders, dry chemical manifold, electric control heads, conduit box, pressure switches, nitrogen purge cylinder etc.

4.1.4 The enclosure shall be raised to prevent corrosion, with full length, front access doors. The doors shall be mounted on piano hinges.

4.1.5 The cylinders shall be mounted within the enclosure but shall be easily removable.

4.1.6 The cylinders shall be raised above the enclosure door.

4.1.7 The dry chemical outlet and conduit inlet shall extend a minimum 50 mm beyond the enclosure surfaces.

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4.2 DRY CHEMICAL CYLINDER

- 4.2.1 The appropriate cylinders shall be pre-pressurised and pre-charged with dry chemical agent.
- 4.2.2 Nitrogen shall be used as expellent gas.
- 4.2.3 Each dry chemical cylinder shall be capable of delivering the required quantity of dry chemical agent (sodium bicarbonate or equal) to its respective tail pipe. The CONTRACTOR shall define the actual agent capacity per cylinder. Any agent remaining in the cylinder after the discharge cycle is complete shall be ignored.
- 4.2.4 The two dry chemical cylinders within each enclosure shall be independent. They shall be labeled, and operate as "Primary" and "Reserve".
- 4.2.5 Each dry chemical cylinder shall be provided with its own electric control head, tying into a common conduit box. A pressure sensing switch shall be provided on each dry chemical cylinder.
- 4.2.6 The cylinders shall be designed, fabricated and tested in accordance with the applicable Industry Standards.
- 4.2.7 The cylinders shall be factory sealed to prevent the possibility of leakage.
- 4.2.8 Cylinder recharge fittings shall be to Greek industry standards.
- 4.2.9 The fill cap opening shall be of an adequate size for dry chemical agent recharging and inspection.
- 4.2.10 The fill cap shall be provided with a safety vent hole, capable of pressure venting with at least three threads engaged. The fill cap shall be gasketed.
- 4.2.11 A safety relief shall be provided on each cylinder.

4.3 CYLINDER DISCHARGE VALVE ASSEMBLY

- 4.3.1 The discharge valve assembly on each cylinder shall be provided with an integral pressure gauge, marked to show the operable pressure range.
- 4.3.2 The cylinder discharge valves shall be constructed of highly corrosion-resistant material throughout. All moving parts shall be of hardened stainless steel. All moving parts shall be internal within the valve assembly.

4.4 DISCHARGE NOZZLE

- 4.4.1 The CONTRACTOR shall define his actual design flow rate and corresponding nozzle inlet pressure.

4.4.2 The discharge nozzles shall be stainless steel and shall be specially designed as “Injection – type” nozzles for internal application as opposed to external application.

4.4.3 The CONTRACTOR shall submit a discharge nozzle performance curve, plotting inlet pressure versus flow rate.

4.5 DRY CHEMICAL DISCHARGE PIPING

4.5.1 The CONTRACTOR shall supply stainless steel sch. 40 dry chemical discharge pipe and fittings, for connecting each enclosure with its respective discharge nozzle.

4.5.2 The CONTRACTOR shall size this discharge piping, considering all two phase flow design parameters (e.g. Minimum powder velocity, design nozzle inlet pressure etc.). The CONTRACTOR taking into consideration ANNEX B, **ELOT EN 1473** shall submit the tables and curves which were used in his sizing of the discharge piping. The CONTRACTOR shall define the source of his data.

4.5.3 The CONTRACTOR shall advise how his system will prevent the depositing of dry chemical agent in the piping upon completion of the discharge cycle.

4.6 SYSTEM DESIGN

4.6.1 The following parameters shall be used in the system design:

4.6.1.1 LNG TANK

- Flow rate per relief valve = * M³/hr
- Molecular weight = 16 to 20
- Dry chemical flow rate per relief valve = * kg/hr
- Maximum extinguishing time = 10 seconds
- Minimum discharge time = 20 seconds.
- * Flow rate by Tank Contractor

4.6.2 The CONTRACTOR shall submit the equations, curves and data used in his system design. The CONTRACTOR shall define the source of his data and equations.

4.6.3 In the CONTRACTOR'S selection of his cylinder dry chemical agent capacity, he will consider that discharge shall continue for a minimum of 20 seconds and that the extinguishing time shall be achieved within a maximum of 10 seconds.

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4.7 INSTRUMENTATION AND CONTROLS

4.7.1 Instrumentation and control functions shall be designed for 24 volt, D.C.

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- 4.7.2 All CONTRACTOR supplied electrical accessory devices shall be explosion-proof, suitable for a Zone 1 area.
- 4.7.3 All alarm and trip contacts will be de-energized in the normal or standby mode.
- 4.7.4 The CONTRACTOR shall provide a control box for the relief valve dry chemical extinguishers. The enclosure shall be suitable for surface mounting in the control room.
- 4.7.5 As noted, the two cylinders located within each enclosure shall be designated and operate as "primary" and "reserve" respectively.
- 4.7.6 Each of the enclosures shall be functionally and physically separate and independent of the others. Each of the enclosures will be dedicated to a single tail pipe.
- 4.7.7 Each enclosure shall be separate from the others with respect to its detection, instrumentation and controls. For example, a fire in one tail pipe will be extinguished by only that single dual – cylinder enclosure dedicated to it; the other enclosures will remain in the standby condition.
- 4.7.8 The "primary" cylinder within each enclosure shall be on automatic start upon receipt of a High Temperature Detector (HTD) signal. Should the automatic actuation fail, the "primary" cylinder shall also be capable of remote manual start upon receipt of a signal from the main control room. The "reserve" cylinder within each enclosure shall be on remote manual start from the same location.
- 4.7.9 The CONTRACTOR shall provide the following isolated sustained contact closure signals for each of the enclosures.
 - 4.7.10.1 Contacts to indicate system "normal".
 - 4.7.10.2 Contacts to indicate low "primary" cylinder pressure.
 - 4.7.10.3 Contacts to indicate low "reserve" cylinder pressure.
 - 4.7.10.4 Control Head to discharge the "primary" cylinder (both automatically and remote manually).
 - 4.7.10.5 Control Head to discharge the "primary" cylinder (remote manually).
 - 4.7.10.6 Contacts to indicate the "primary" cylinder has been discharged.
 - 4.7.10.7 Contacts to indicate the "reserve" cylinder has been discharged.
 - 4.7.10.8 Sensors to indicate a tail pipe fire.
 - 4.7.10.9 Contacts to reset control system.
- 4.7.11 The Owner shall supply actuating sustained contacts and display functions as follows for

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each enclosure. All functions on the main control panel shall be grouped by enclosure (hence, relief valve designation).

- 4.7.11.1 System "normal" indicating light.
- 4.7.11.2 Low "primary" cylinder pressure indicating light.
- 4.7.11.3 Low "reserve" cylinder pressure indicating light.
- 4.7.11.4 Pushbutton to discharge "primary" cylinder.
- 4.7.11.5 Pushbutton to discharge "reserve" cylinder.
- 4.7.11.6 "Primary "cylinder discharged indicating light.
- 4.7.11.7 "Reserve "cylinder discharged indicating light.
- 4.7.11.8 "Fire detected" indicating light.
- 4.7.12 Instrumentation air is available at approximately 7 bar at ambient temperature.

5.0 SURFACE PREPARATION AND PAINTING

- 5.1 All surface preparation and painting shall be suitable for a marine environment.
- 5.2 Surface preparation and painting shall be in accordance with DESFA Project technical specifications for painting and protective coatings.

6.0 ADDITIONAL AND MISCELLANEOUS REQUIREMENTS

- 6.1 All nameplates exposed to the environment shall be engraved stainless steel.
- 6.2 Enclosure nameplates shall have, as a minimum, the following information:
 - 6.2.1 Hazard identification.
 - 6.2.2 Operating instructions.
 - 6.2.3 After use instructions.
 - 6.2.4 Recharge instructions.
 - 6.2.5 Maintenance instructions.
 - 6.2.6 Agent identification.
- 6.3 For personnel safety, once a cylinder has been discharged, a manual reset action at the manifold between the two cylinders must be performed. This feature shall prevent the recharged cylinder from auto-starting while it is being installed in the enclosure.

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- 6.4 The CONTRACTOR shall provide a moisture seal in each discharge line between the manifold and nozzle. The seal shall not hinder dry chemical discharge.