Besfa	Hellenic Gas Transmission System Ope 357-359 Messogion Av., GR 152 31 Halar Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	erator S.A. _I dri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-INS-	002	Rev. 1	Page 1 of 19



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ðesfa	Hellenic Gas Transmission System Operator S.A. 357-359 Messogion Av., GR 152 31 Halandri Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr		TECHNICAL SPECIFICATION
Doc No: DSF-SPC-IN	S-002	Rev. 1	Page 2 of 19

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Sesfa	Hellenic Gas Transmission System Operator S.A. 357-359 Messogion Av., GR 152 31 Halandri Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr		TECHNICAL SPECIFICATION
Doc No: DSF-SPC-INS-0	02	Rev. 1	Page 3 of 19

Table of Contents

RE	FERENCE DOCUMENTS	. 4
1.	SCOPE	. 6
2.	GENERAL	. 6
3.	DESIGN REQUIREMENTS	. 7
4.	SPECIFIC INSTRUMENT REQUIREMENTS	. 8
5.	INSPECTION AND CERTIFICATION	18
6.	COMPLIANCE WITH THE EU DIRECTIVES	19

ðesfa	Hellenic Gas Transmission System Operator S.A. 357-359 Messogion Av., GR 152 31 Halandri Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr		TECHNICAL SPECIFICATION
Doc No: DSF-SPC-IN	S-002	Rev. 1	Page 4 of 19

REFERENCE DOCUMENTS

- Job Spec. DSF-SPC-INS-003 [Instrumentation Symbols and Identification]
- Job Spec. DSF-SPC-QAC-005 [Shop inspection of Equipment and Materials for NGT Project]
- EU Directive 2014/35/EU LVD [Low Voltage Directive]
- 2014/34/EU ATEX [Equipment Explosive Atmospheres Directive]
- 2014/30/EU EMC [Electromagnetic Compatibility Directive]
- 2014/68/EU PED [Pressure Equipment Directive]
- 2014/32/EU MID [Measuring Instruments Directive]
- EN 837-1 [Pressure gauges - Part 1: Bourdon tube pressure gauges; dimensions, metrology, requirements and testing]
- EN 10272 [Stainless steel bars for pressure purposes]
- EN 60079-29-2 [Explosive atmospheres. Gas detectors. Selection, installation, use and maintenance of detectors for flammable gases and oxygen]
- EN 61158-3-1 [Industrial communication networks. Fieldbus specifications. Data-link layer service definition. Type 1 elements]
- EN 60068
 [Environmental testing]
- EN 60079-0 [Electrical apparatus for explosive gas atmospheres - Part 0: General requirements]
- EN 60079-1 [Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"]



- EN 60079-11
 [Explosive atmospheres Part 11: Equipment protection by intrinsic safety "i"]
- EN 60079-14 [Explosive atmospheres part 14: Electrical installations design, selection and erection]
- EN 60529
 [Degrees of protection provided by enclosures (IP code)]
- EN 60751 [Industrial platinum resistance thermometers and platinum temperature sensors (]
- EN 61000 series [Electromagnetic compatibility (EMC)]
- EN 61010-1 [Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements]
- EN 61158 [Industrial communication networks - Fieldbus specifications - Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series]
- EN 61508 [Functional safety of electrical/electronic/programmable electronic safety-related systems]
- EN 61779 [Electrical Apparatus for the Detection and Measurement of Flammable Gases]

All standards or codes mentioned in this specification are valid in their latest version or by the relative superseded edition.

δesfa	Hellenic Gas Transmission System Op 357-359 Messogion Av., GR 152 31 Hala Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	erator S.A. Indri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-II	NS-002	Rev. 1	Page 6 of 19

1. SCOPE

Instruments and controls are to be furnished in accordance with this Job Specification for pipeline, (including metering and regulating stations), as indicated on the Engineering Flow Diagrams and fulfilling Licensor's requirements as applicable.

Any conflict that may be encountered in applying the different technical documents shall be brought to Owner attention for the relevant clarification.

Unless otherwise specified, the following descending order of precedence among documents shall apply:

a. **EU DIRECTIVES**

- b. Material Requisition
- c. Project Specifications (including Licensor's specifications) attached to the Material Requisition itself.
- d. National Greek Codes, Standards, Regulations and Instructions.
- e. European Standards as appropriate.

2. GENERAL

2.1. FLOW DIAGRAM SYMBOLS AND INSTRUMENT IDENTIFICATION

Flow diagram symbols and identification (tag numbers) for instruments and controls shall be basically in accordance with **Job Specification DSF-SPC-INS-003.**

2.2. PACKAGE UNITS

- a. The instrumentation requirements, when packaged or licensed units are specified, shall conform to this specification wherever possible.
- b. Local control panels for package boilers, compressors, process heaters, or other units requiring such panels, shall preferably be furnished by the equipment Manufacturer/Vendor.

The panels with the instrumentation therein and the equipment which has to be controlled shall be tested as a unit, wherever possible.

2.3. UNITS

Metric. Pressure shall be expressed as gauge pressure.

2.4. LEGISLATION AND STANDARDS

EU Directives

<u>δesfa</u>	Hellenic Gas Transmission System Ope 357-359 Messogion Av., GR 152 31 Halar Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	e rator S.A. Indri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-INS-002		Rev. 1	Page 7 of 19

Relevant Standards

3. DESIGN REQUIREMENTS

3.1. GENERAL

All instrumentation shall be insensitive to shock or vibration effects normally encountered in pipeline installations.

3.1.1. TAGGING

An identification tag shall be attached to each piece of instrumentation equipment. The tags shall be of sturdy, stainless steel or other equally weather resistant material, permanently fastened to the piece of instrumentation equipment with stainless steel screws or pins.

3.1.2. PAINTING

Manufacturer's standard colours shall be used for all project instrumentation, including visible portions of instruments mounted on the control panel, unless otherwise specified.

3.1.3. ELECTRICAL EQUIPMENT AND ENCLOSURES

Field mounted or local panel mounted instrumentation, shall be suitable for use in a hazardous area and in accordance with its classification study. Outdoor installations of electronic instruments shall require a minimum mechanical protection of the order of IP 65.

As far as the electrical protection in hazardous areas is concerned, the applicable norm shall be the EU Directive 2014/34/EU ATEX. Reference is also made to EN 60079-0, EN 60079-1, and EN 60079-11.

Indoor control panels shall have a minimum mechanical protection of IP-52. Electronic instruments installed inside control panels shall have a minimum mechanical protection of IP-20. Indoor installations of electronic instruments, but not inside control panels, shall require a minimum mechanical protection IP-54.

3.1.4. TRANSMITTERS

- a. In general, transmitters shall be of the "SMART" type. Pressure transmitters, in particular, shall be of the force balance type or other negligible displacement type (i.e. capacitive or piezoresistive), except where such devices are not available for a specific measurement.
- b. Analog electronic signal transmission range shall be 4-20mA. Other than this range require Owner's Engineer approval.

Sesfa	Hellenic Gas Transmission System Ope 357-359 Messogion Av., GR 152 31 Halan Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	e rator S.A. dri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-INS-002		Rev. 1	Page 8 of 19

- c. Process variable indication shall be provided for each transmitter installed for control purpose and local controller. This indication shall be either direct reading, or the transmitter output in terms of the process variable.
- d. Transmitters shall comply with **EU Directives** as follows:
 - EU Directive 2014/34/EU ATEX
 - EU Directive 2014/68/EU PED
 - EU Directive 2014/30/EU EMC

Thus, transmitters shall comply with the European standards e.g. EN 61508, EN 60079-0, EN 60079-1, EN 60079-11, EN 60079-14, EN 60529, EN 61000 series.

3.1.5. TRANSMISSION SYSTEM

No process fluids of any type shall be piped into the control room. Transmission of the process variable shall be by means of electronic or electric type instruments. Pneumatic type instrumentation and signals may be used where dictated by the specific application requirements.

Transmission system shall comply with European Standards EN 61158-3-1 and EN 61158.

4. SPECIFIC INSTRUMENT REQUIREMENTS

4.1. TEMPERATURE INDICATORS (THERMOMETERS)

Thermometers shall be of the industrial bimetallic or mercury in steel or high-pressure nitrogen dial type suitable for thermo well mounting.

4.1.1. GENERAL

Thermometers directly mounted in thermo wells shall be fitted with an adjustable nipple for positioning.

Thermometers with remote indication shall be temperature compensated, and generally be insensitive to changes in the ambient temperature.

Thermometers shall have minimal response time and 1% repeatability. Pointers shall be adjustable.

4.1.2. HOUSINGS

Thermometer housings shall be waterproof and corrosion resistant and of a stainlesssteel construction. Dial nominal diameter to be 150 mm.

δesfa	Hellenic Gas Transmission System Op 357-359 Messogion Av., GR 152 31 Hala Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	erator S.A. ndri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-IN	IS-002	Rev. 1	Page 9 of 19

4.1.3. TESTING AND CERTIFICATION

All thermometers shall be function tested by the manufacturer and issued with a test certificate.

Certificates for thermometers with high accuracy shall include a calibration curve with traceability maintained via the thermometer serial number.

4.2. TEMPERATURE SWITCHES

Temperature switches for remote control or alarm purposes shall be conventional vapour filled or liquid expansion type.

The switches shall be part of intrinsically safe circuits. Temperature switches shall comply with **EU Directive 2014/34/EU ATEX**.

Gold plated and/or sealed contacts shall be used.

The temperature switches shall be generally insensitive to changes in the surrounding ambient temperature.

Temperature switches shall have response time less than 1 second and 1% repeatability.

4.2.1. REMOTE CONTROL OR ALARM SETPOINTS

The setpoints shall be adjustable over the entire temperature scale range specified.

Fixed switching differential shall be used.

4.2.2. TESTING AND CERTIFICATION

All temperature switches shall be function tested by the Manufacturer and issued with a test certificate.

4.3. TEMPERATURE TRANSMITTERS

The use of the "smart type" temperature transmitters is preferable.

Output shall be 4 to 20 mA directly proportional to the temperature.

Process variable indication for transmitter shall be as per 3.1.4c, unless otherwise specified.

Temperature transmitters shall be intrinsically safe.

Temperature transmitters shall comply with **EU Directives** as follows:

- EU Directive 2014/34/EU ATEX
- EU Directive 2014/30/EU EMC

They shall comply with European Standards EN 60079-14 and EN 61010-1.

δesfa	Hellenic Gas Transmission System Ope 357-359 Messogion Av., GR 152 31 Halan Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	e rator S.A. Idri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-INS-002		Rev. 1	Page 10 of 19

All temperature transmitters shall be function tested by the Manufacturer and issued with a test certificate inclusive of a calibration curve for the required span.

4.4. TEMPERATURE SENSORS

Temperature sensing elements shall be Resistance Temperature Detectors (RTD's) of the type Pt 100 for insertion in thermowells and shall be according to **EN 60751** standard. Thermocouples may be used only where dictated by the specific application requirements.

The elements shall be part of intrinsically safe circuits.

Temperature sensors shall comply with **EU Directives** as follows:

• EU Directive 2014/34/EU ATEX

• EU Directive 2014/32/EU MID

The RTD shall be connected to a resistance temperature converter by a 3-wire or 4-wire cable (4-wire configurations are preferable) making lead resistance adjustment unnecessary. The supply will be a constant DC. voltage and the output shall be a 4-20 mA measuring current.

4.4.1. EARTH TERMINAL

Required on resistance temperature converter.

4.4.2. TESTING AND CERTIFICATION

All temperature sensing elements shall be function tested by the Manufacturer and issued with a test certificate.

4.5. TEMPERATURE AND PRESSURE RECORDERS

Combined (dual channel Temperature and Pressure) mechanical strip recorders suitable for local mounting with "clockwork" spring constant speed chart drive shall be used for the M/R Stations.

Separate recording for each variable (temperature, pressure and differential pressure) by circular DN 300 chart recorders shall be used for the boarder measuring station. These recorders shall be suitable for local mounting with "clockwork" spring constant speed drive.

As an alternative to the separate three circular recorders a combined three pen circular chart recorder may be used provided that the observed accuracies are the same.

Also, electrical (battery) driven charts may be substituted for the above recorders provided they are certified officially for Intrinsically Safe operation in hazardous areas.

Sesfa	Hellenic Gas Transmission System Ope 357-359 Messogion Av., GR 152 31 Halar Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	e rator S.A. ndri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-IN	IS-002	Rev. 1	Page 11 of 19

4.5.1. TEMPERATURE SENSORS

The temperature sensors shall be of the mercury in steel (stainless) or high-pressure nitrogen flexible capillary tube type, suitable for mounting in a thermowell.

The sensor shall be temperature compensated and generally insensitive to changes in the surrounding ambient temperature.

Response time shall be 50% of span in less than 5 seconds. Permissible operating temperature range shall be as specified.

4.5.2. TEMPERATURE RECORDER

The temperature recorder shall have a measured accuracy better than \pm 0.25% of full scale.

4.5.3. PRESSURE MEASURING UNIT

Measuring element shall be hardened X2CrNiMo17-12-2 (**EN 10272**), unless process fluid requires the use of other materials.

The pressure measuring unit shall be suitable for operating within the specified range with a permissible overload in excess of 30% of specified range.

4.5.4. PRESSURE RECORDER

The pressure recorder shall have a measured accuracy better than 0.25% of full scale.

4.5.5. DIFFERENTIAL PRESSURE RECORDER

The differential pressure recorder shall have a measured accuracy better than 0.25% of full scale.

If option is available a mechanical flow integrator may be incorporated.

4.5.6. CHART WINDING CAPACITY

One (1) month minimum with a chart speed at 20 mm per hour for the strip chart recorders.

One (1) revolution per 24 hours for the circular chart recorders.

4.5.7. CHART WIDTH

100 mm minimum for the strip chart recorders DN 300, circular.

4.5.8. CHART SPEED

Adjustable between 5mm and 30mm per hour for the strip chart recorders.

δesfa	Hellenic Gas Transmission System Op 357-359 Messogion Av., GR 152 31 Hala Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	erator S.A. ndri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-IN	IS-002	Rev. 1	Page 12 of 19

4.5.9. INK RESERVOIR CAPACITY

Sufficient for one month continuous operation for the strip chart recorders less for the circular chart recorders.

4.5.10. TESTING AND CERTIFICATION

Each recorder shall be tested and calibrated by the Manufacturer and issued with a test certificate.

Traceability between the test certificate and recorders shall be maintained via the recorder serial number.

4.6. PRESSURE AND DIFFERENTIAL PRESSURE INDICATORS (PRESSURE GAUGES)

Pressure gauges shall comply with **EU Directives** as follows:

- EU Directive 2014/34/EU ATEX
- EU Directive 2014/68/EU PED
- EU Directive 2014/32/EU MID

Pressure gauges shall comply with the requirements of EN 837-1 and EN 60529.

4.6.1. GENERAL

Locally mounted pressure gauges shall be 160 mm nominal diameter. They shall use Bourdon tube (other types element may be used where Bourdon tube gauges are not applicable subject to Owner's Engineer approval) with "solid front" cases and blow-out backs or discs.

The pressure element shall be X2CrNiMo17-12-2 (EN 10272) stainless steel as a minimum.

Very low range gauges (draft gauges, absolute pressure gauges, etc.) for which X2CrNiMo17-12-2 (**EN 10272**) stainless steel is not available may utilize elements of other material (or type), if such material is compatible with the process fluid requirements.

Standard gauge connection size shall be 1/2" NPT.

Pressure Gauges shall be capable of withstanding a constant overload in excess of 10% of its range without effect to its accuracy, and an occasional overload of 30% of its range without bursting.

Differential pressure instruments shall withstand differential pressure equal to full line pressure without zero or calibration changes.

Sesfa	Hellenic Gas Transmission System Ope 357-359 Messogion Av., GR 152 31 Halar Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	e rator S.A. Idri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-INS-0	02	Rev. 1	Page 13 of 19

Pressure gauges shall have an accuracy class 1.

4.6.2. TYPE TEST

All pressure gauges shall have a type test approval certificate issued by a Notified Body.

4.6.3. TESTING AND CERTIFICATION

All pressure gauges shall be function tested by the Manufacturer and issued with a test certificate.

4.7. PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

Pressure and Differential Pressure Switches for remote control or alarm purposes shall be no touch inductive proximity switches.

Differential pressure instruments shall withstand differential pressure equal to full line pressure without zero or calibration changes.

The switches shall be part of an intrinsically safe circuit.

Pressure and differential pressure switches shall comply with **EU Directives** as follows:

- EU Directive 2014/34/EU ATEX
- EU Directive 2014/68/EU PED

4.7.1. REMOTE CONTROL OR ALARM SET POINTS

The set points shall be adjustable over the entire scale range specified. Fixed switching differential shall be used. Switching accuracy should be less than 0.5%. Switching hysteresis should be less than 1%.

4.7.2. Testing and Certification

All pressure and differential pressure switches shall be function tested by the Manufacturer and issued with a test certificate.

4.8. ELECTRONIC PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTERS

"Smart" type transmitters shall be used.

Transmitters shall be loop powered via 2-wire cables of an intrinsically safe circuit.

Analogue type output signal shall be 4-20mA directly proportional to the pressure/differential pressure.

Differential pressure transmitters shall withstand differential pressure equal to full line pressure without zero or calibration changes.

<u></u> Sesfa	Hellenic Gas Transmission System Ope 357-359 Messogion Av., GR 152 31 Halar Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	e rator S.A. Indri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-IN	S-002	Rev. 1	Page 14 of 19

Process variable indication for transmitter shall be as per **3.1.4c** unless otherwise specified.

Electronic pressure / differential pressure transmitters shall comply to **EU Directives** as follows:

- EU Directive 2014/34/EU ATEX
- EU Directive 2014/68/EU PED
- EU Directive 2014/32/EU MID
- EU Directive 2014/35/EU LVD

4.8.1. PRESSURE SENSOR

The sensor shall be separated from the process by a diaphragm with the pressure transmission between the diaphragm and sensor provided by silicone oil.

The sensor may be of the semi-conductor, strain gauge or capacitor type.

4.8.2. SPAN

Adjustable between 20 and 100% of the maximum scale range.

4.8.3. ZERO

Adjustable between - 20 and + 80% of the maximum span.

4.8.4. LOAD

Approximately 500 ohm at 24 volts d.c.

4.8.5. ACCURACY

Pressure transmitters: $\pm 0.1\%$ of span or better.

Differential pressure transmitter: ± 0.1% of span or better.

4.8.6. TEST AND CERTIFICATION

All transmitters shall be function tested by the Manufacturer and issued with a test certificate inclusive of a calibration curve for the required span.

Traceability between the certificate and the transmitter shall be maintained via the transmitter's serial number.

4.9. LIQUID LEVEL SWITCHES

Capacitance type liquid level alarm sensors.



4.9.1. GENERAL

Sensors shall have an accuracy better than + 20 mm of the actual liquid level.

Sensors to be mounted in outdoor locations shall be equipped with overvoltage protection.

Liquid level switches shall comply with EU Directives as follows:

• EU Directive 2014/34/EU ATEX

• EU Directive 2014/35/EU LVD

Liquid level switches shall comply with the requirements of EN 60068 and EN 60529.

4.9.2. SUPPLY AND SIGNAL

Power Supply and return alarm input signal shall be via a 2-wire cable. The signal circuit shall be intrinsically safe.

4.9.3. EARTH TERMINAL

Required.

4.9.4. TESTING AND CERTIFICATION

The liquid level alarm shall be function tested by the manufacturer and issued with a test certificate.

4.10. GAS DETECTION AND ALARM SYSTEM

Complete system designed, installed, tested and approved as specified, and to the extent required, by the Authorities, **EU Directive 2014/34/EU ATEX**, this specification and the requirements of **EN 60079-29-2** and **EN 61779**.

The configuration in principle is shown on this specification, unless it is specified in a different way in the relevant process and instrumentation diagrams.

4.10.1. SUPPLY AND SIGNAL LEVELS

Power supply shall be 24 VDC.

The signal circuit shall be analogue (4-20mA) and preferably intrinsically safe.

4.10.2. SYSTEM RANGE. SPAN AND ACCURACY

The whole system shall be operable over the range of 0-100% LEL at an accuracy to within + 2% of the operable range.

Sesfa	Hellenic Gas Transmission System Ope 357-359 Messogion Av., GR 152 31 Halan Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr	e rator S.A. dri	TECHNICAL SPECIFICATION
Doc No: DSF-SPC-INS-0	02	Rev. 1	Page 16 of 19

(LEL being approximately 5% volume in air for methane at 25°C and atmospheric pressure).

4.10.3. GAS DETECTORS

Gas detectors shall be of the type based on the catalytic combustion principle, with two elements (one sensing and one as reference) suitable for detecting explosive gases below the LEL (Lower Explosive Limit).

All gas detectors shall be fitted with a collecting cone to allow sensing at a very low % LEL (3-10% of LEL).

The gas detectors shall not be poisoned by gas concentrations over the LEL.

Detectors shall be of a 2-wire cable, 4-20 mA output transmitter type, and suitable for use in the hazardous area, according to its classification study.

Detectors and associated equipment shall be free from any maintenance requirements (recalibration, checks etc) for at least a period of one year after each calibration.

4.10.4. NUMBER OF DETECTORS

Final number and positioning of the detectors shall be Contractor's responsibility and shall be decided during detail engineering and according to room and process layout. The guidelines for installation given in **EN 60079-29-2** shall be considered.

As a minimum the following rules shall apply:

- One (1) detector per 25 m2 of the same room plus one additional detector per room.
- No less than two (2) detectors shall be installed in any room.
- Detectors shall be installed only in indoor areas.

4.10.5. GAS WARNING LIGHTS AND AUDIBLE ALARMS

On each external side of the building "yellow" gas warning flashing lights shall be positioned in a conspicuous way, but not visible from outside the fence perimeter.

Within a process, odorizer, analyzer and boiler room(s) "yellow" gas warning flashing lights, together with audible alarms shall be installed.

The audible alarms shall have a sound-level higher than the surrounding environmental noise. In a case of a process room shall be a min of 90 dBA.

4.10.6. GAS SYSTEM CONTROL EQUIPMENT

Two level detection modules for each gas detector inclusive of:

– Lamps for fault, alarm high and alarm high-high.



- Setpoint controls for alarm high and alarm high-high.
- Calibration facilities.
- Test alarm facilities.
- Reset pushbutton.
- Alarm relays for remote alarm, with potential-free SPOT contacts and necessary terminals, 24 V DC, 1 A. Relays normally energized.

On a single system failure there shall be no loss of more than one (1) detector signal.

Logic and signal repetition shall be designed as fail-safe.

The modules shall be suitable for mounting in a standard 50 cm rack within the station control panel, and have a minimum enclosure protection to IP 20.

4.10.7. TESTING

4.10.7.1. <u>GENERAL PROCEDURE FOR ADJUSTING THE GAS DETECTION</u> <u>SYSTEM</u>

Zero adjustment shall be executed in the detection module in the Station Control Panel (SCP).

Indicative alarm limits AAH=15% and AAHH=40% shall be set in the detection module in the SCP.

Disconnect protection cap on the detector.

Test gas 40% shall be applied to the detector by a flowrate of 1,7 l/min.

40% adjustment shall be executed in the detection module.

Test gas 15% shall be applied to the detector by a flowrate of 1,7 l/min.

Alarm indication in the SCP and the Gas Control Center (GCC) shall be controlled.

The visual warning flashing lights together with audible alarm's shall be controlled.

Timing function for automatically reset of audible alarms shall be controlled.

Test gas 40% shall be applied to the detector by a flowrate of 1,7 l/min.

Alarm indication in the SCP and the GCC shall be controlled.



Reactivation of the visual warning flashing lights together with audible alarms shall be controlled.

Automatically reset of audible alarms shall be controlled.

Test gas shall be removed from the detector.

After blow-off of the detector reconnect protection cap.

It shall be verified that the alarm indication in the SCP and GCC not disappears until the alarm is reset in SCP.

It shall be verified that the visual warning flashing lights are de-energized and the alarm indication in the GCC disappears.

Similar procedure (but with different settings) shall apply for the odorant detectors.

4.10.8. GAS DETECTORS (FOR ODORANT GAS)

Another detection method is required to detect probable leakage of the odorant gas in the atmosphere.

The odorant gas is tetrahydrothiophene (THT) C4H8S and a concentration of less than 15 parts per million of volume is desired to be readily detectable.

One odorant detector is to be installed in each odorization room and shall be part of the station flammable gases detection system.

The detection principle shall be based in one of the following methods: electrochemical cell-type, semiconductor (metal oxide) or infrared absorption method, depending also on the environmental conditions, (e.g. extreme levels of humidity), which may affect the lifetime of certain type of sensors (e.g. semiconductor type).

Alarm thresholds shall be those of LTEL or TLV.

In general, any odorant detection system shall have a malfunction alarm and be free from any maintenance requirements (recalibration, checks etc.) for at least a period one year after each calibration.

Contractor shall advise Client of type, model and manufacturer of the odorant gas detector to be installed prior to any commitments.

5. INSPECTION AND CERTIFICATION

Inspection will be performed by a third party independent inspection company to be appointed by the client.

Inspection requirements are defined in the following documents.

δesfa	Hellenic Gas Transmission System Operator S.A. 357-359 Messogion Av., GR 152 31 Halandri Tel.: 213 088 4000 Fax: 210 674 9504 Email: desfa@desfa.gr		TECHNICAL SPECIFICATION
Doc No: DSF-SPC-INS-	002	Rev. 1	Page 19 of 19

a. Material Requisition.

b. Job Specification DSF-SPC-QAC-005.

- c. Relevant project specifications.
- d. Inspection clauses of applicable codes.

Inspection procedures to be followed are detailed in Owner document "Inspections and Test Instructions for NGT Project".

6. COMPLIANCE WITH THE EU DIRECTIVES

Instrumentation that complies with the relevant European Directives shall be provided with:

- a. A physical CE marking and other information as required by the relevant directives.
- b. A declaration of conformity which lists all the directives with which the product complies.
- c. Any other information specified by the directive, e.g. user instructions.