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DP&T-SRGE	**TITLE:** **FLARE GAS RECOVERY SYSTEM – RELIEF SYSTEM**		NP-1
			ESUP

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SUMMARY

1 INTRODUCTION

1.1 Object

1.1.1 This specification describes the minimum requirements for the automation, instrumentation and control of the Flare Gas Recovery System - Relief System, to be installed at the UNIT.

1.1.2 This specification also describes:

- Interface with each system to be connected to Flare Gas Recovery System Relief Panel (PN-5412001);
- Integration aspects regarding each Package type.

1.2 Definitions

1.2.1 Refer to I-ET-3010.00-1200-940-P4X-002 - GENERAL TECHNICAL TERMS.

1.3 Abbreviations, Acronyms and Initialisms

AEPR	Automation & Electrical Panels Room
BPV	Buckling Pin Valve
CCR	Central Control Room (located in the Hull Accommodation)
CSS	Control and Safety System
FAT	Factory Acceptance Test
HFT	Hardware Fault Tolerance
HMI	Human-Machine Interface
HP	High Pressure
I/O	Input/Output
IP	Ingress Protection Ratings
LOPA	Layer of Protection Analysis
LP	Low Pressure
MTTF	Mean Time to Failure
PES	Programmable Electronic System
PCS	Process Control System
PFD	Probability of Failure on Demand
PLC	Programmable Logic Controller
PSD	Process Shutdown System
QOV	Quick Opening Valve
RRF	Risk Reduction Factor
SAT	Site Acceptance Test
SIF	Safety Integrity Function
SIL	Safety Integrity Level
SIT	Site Integration Test
SOS	Supervision and Operation System
SRS	Safety Requirements Specification
UAM	Unit Alarm Malfunction
UAS	Unit Alarm Shutdown

2 REFERENCE DOCUMENTS, CODES AND STANDARDS

2.1 External References

2.1.1 International Codes, Recommended Practices and Standards

API - AMERICAN PETROLEUM INSTITUTE

API	RP 14C	ANALYSIS, DESIGN, INSTALLATION AND TESTING OF SAFETY SYSTEMS FOR OFFSHORE PRODUCTION FACILITIES

IEC - INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC	60331	TESTS FOR ELECTRIC CABLES UNDER FIRE CONDITIONS
IEC	61508	FUNCTIONAL SAFETY OF ELECTRICAL/ELECTRONIC/PROGRAMMABLE ELECTRONIC SAFETY-RELATED SYSTEMS
IEC	61511	FUNCTIONAL SAFETY – SAFETY INSTRUMENTED SYSTEMS FOR THE PROCESS INDUSTRY SECTOR
IEC	61892-4	MOBILE AND FIXED OFFSHORE UNITS - ELECTRICAL INSTALLATIONS - PART 4: CABLES
IEC	62337	COMMISSIONING OF ELECTRICAL, INSTRUMENTATION AND CONTROL SYSTEMS IN THE PROCESS INDUSTRY – SPECIFIC PHASES AND MILESTONES
IEC	62381	AUTOMATION SYSTEMS IN THE PROCESS INDUSTRY- FACTORY ACCEPTANCE TEST (FAT), SITE ACCEPTANCE TEST (SAT) AND SITE INTEGRATION TEST (SIT)

2.1.2 Classification Society

The detailed design shall be submitted to approval by Classification Society. The design and installation shall take into account their requirements and comments.

2.2 Internal References

2.2.1 Project Documents

I-DE-3010.1M-5412-944-P4X-001	HIGH PRESSURE FLARE K.O. DRUM
I-DE-3010.1M-5412-944-P4X-002	LOW PRESSURE FLARE K.O. DRUM
I-DE-3010.1M-5412-944-P4X-003	HIGH/LOW PRESSURE FLARE
I-DE-3010.1M-5412-944-P4X-004	FLARE GAS RECOVERY SYSTEM
I-DE-3010.1M-5412-944-P4X-005	HIGH PRESSURE FLARE COLLECTING SYSTEM
I-DE-3010.1M-5412-944-P4X-006	LOW PRESSURE FLARE COLLECTING SYSTEM
I-ET-3010.00-1200-800-P4X-002	AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS
I-ET-3010.1M-1200-800-P4X-014	AUTOMATION INTERFACE OF PACKAGE UNITS

I-ET-3010.00-5140-700-P4X-002	SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS
I-ET-3010.00-5140-700-P4X-003	ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS
I-ET-3010.1M-5412-320-P4X-001	FLARE GAS RECOVERY COMPRESSION UNIT
I-RL-3010.1M-1200-940-P4X-001	GENERAL SPECIFICATION FOR AVAILABLE UTILITIES
I-RL-3010.1M-5412-983-P4X-001	SIL /LOPA STUDY REPORT

3 ENVIRONMENTAL AND OPERATION CONDITIONS

3.1 General

3.1.1 All equipment, panels and instrumentation devices shall be suitable for the environmental and operating conditions described in I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS.

3.1.2 All equipment, panels and instrumentation devices shall be designed to operate properly under wave motions in accordance with Classification Society.

3.1.3 Regarding electromagnetic and radiofrequency issues, all equipment and panels shall be designed to operate properly and in accordance with IEC applicable standards and Classification Society requirements.

4 TECHNICAL REQUIREMENTS

4.1 Functional Description

4.1.1 The Flare Gas Recovery System Relief Panel (PN-5412001) shall be responsible for the proper and safe operation of the QOVs actuation, valves in charge of HP/LP gas flow rate relieving. This system shall be interconnected to the other package panels in charge of the Flare Ignition & Monitoring Panel (PN-TA-5412001-01), to Flare Gas Recovery System Compression Unit Panel (PN-UC-5412001) and it shall be interconnected to Topsides PLCs.

4.1.2 The HP flare header shall operate in a pressure range defined by the following:

(i) the normal pressure level sets the relieving of its gas flow rate to Flare Gas Recovery Compression Unit,

(ii) the high pressure level sets the opening of the HP QOVs to the HP Flare, closing connection to the Flare Gas Recovery Compression Unit.

4.1.3 The LP flare header shall operate in a pressure range defined by the following:

(iii) the normal pressure level sets the starting of the pressure recovering equipment (compressor etc.) which recovers the LP gas from the LP flare header to the inlet of the second stage vapor recuperation system,

(iv) the high pressure level sets the opening of the LP QOV to the LP Flare and the closing of the connection to Flare Gas Recovery Compression Unit,

4.1.4 All these 4 (four) pressure levels shall be selected for proper and safe running of the flare gas system.

4.1.5 QOVs shall be installed in the flare main header in a downstream position of the HP and LP flare knock-out drums. Each QOV shall have BPVs protection in a bypass line. If the main QOV from each header is bypassed and the bypass valve is aligned, the BPVs shall still remain aligned. The blockage (only for maintenance) shall be made by full bore ball valves, installed upstream and downstream of the QOVs. The QOV valves shall move from close to fully open in less than 3 (three) seconds (to be confirmed during detailed engineering design phase).

4.1.6 Pressure transmitters (PIT-5412002-1, PIT-5412002-2 & PIT-5412002-3) shall be connected to Flare Gas Recovery System Relief Panel (PN-5412001) in order to monitor the HP flare header (2oo3 configuration). Flare Gas Recovery System Relief Panel (PN-5412001) sets the opening of the QOVs (XV-5412004/017) to the associated HP Flare, according process conditions, and requests a start this flare ignition to Flare Ignition & Monitoring Panel (PN-TA-5412001-01).

4.1.7 Pressure transmitters (PIT-5412007-1, PIT-5412007-2 & PIT-5412007-3) shall be connected to Flare Gas Recovery System Relief Panel (PN-5412001) in order to monitor the LP flare header (2oo3 configuration). Flare Gas Recovery System Relief Panel (PN-5412001) sets the opening of the QOV (XV-5412010) to the LP Flare, according process conditions, and requests a start this flare ignition to Flare Ignition & Monitoring Panel (PN-TA-5412001-01).

4.1.8 Flare Gas Recovery System – Relief System package classification shall be in accordance with I-ET-3010.1M-1200-800-P4X-014 – AUTOMATION INTERFACE OF PACKAGE UNITS. Package requirements shall be according to I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS. All parameters data shall be available for monitoring from HMI at CCR.

4.1.9 In addition to the signals requested by I-ET-3010.1M-1200-800-P4X-014 – AUTOMATION INTERFACE OF PACKAGE UNITS, which describe the interface between CSS and the FGRS panels, the following electrical signals shall be provided for interconnecting control/safety panels among themselves, at least:

- **Ignition System Loading –** hardwired signal with line monitoring from Flare Gas Recovery System Relief Panel – PN-5412001 (digital output – DO) to Flare Ignition & Monitoring Panel – PN-TA-5412001-01 (solenoid valve from sparking pellets type ignition system, energize to open), in order to activate the indexing cylinder and to rotate the magazine one step for loading of ignition pellet prior to opening of launching valve;

- **Ignition Pellet Launching –** hardwired signal with line monitoring from Flare Gas Recovery System Relief Panel – PN-5412001 (digital output – DO) to Flare Ignition & Monitoring Panel – PN-TA-5412001-01 (solenoid valve from sparking pellets type ignition system, energize to open), in order to open the launching valve;
- **Start Continuous Electric Sparking Type Ignition** – fail-safe hardwired signal from Flare Gas Recovery System Relief Panel – PN-5412001 (digital output – DO) to Flare Ignition & Monitoring Panel – PN-TA-5412001-01 (digital input – DI), in order to activate the continuous electric sparking type ignition system;
- **Flare Ignition Status** – fail-safe hardwired signal from Flare Ignition & Monitoring Panel – PN-TA-5412001-01 (digital output - DO) to Flare Gas Recovery System Relief Panel– PN-5412001(digital input - DI);
- **LP QOV opening** – fail-safe hardwired signal from Flare Gas Recovery System Relief Panel - PN-5412001 (digital output – DO) to Flare Gas Recovery Compression Unit Panel – PN-UC-5412001 (digital input – DI), in order to notify the compressor that the LP QOV has already been requested to open. Required actions from compressor side are not defined in this specification, but if it is required, they shall be taken into account.
- **HP QOVs opening** – fail-safe hardwired signal from Flare Gas Recovery System Relief Panel – PN-5412001 (digital output – DO) to Flare Gas Recovery Compression Unit Panel – PN-UC-5412001 (digital input – DI), in order to notify the compressor that the HP QOV has already been requested to open. Required actions from compressor side are not defined in this specification, but if it is required, they shall be taken into account.
- **UC-5412001 Shutdown** – fail-safe hardwired signal from Flare Gas Recovery Compression Unit Panel – PN-UC-5412001 (digital output – DO) to Flare Gas Recovery System Relief Panel – PN-5412001 (digital input – DI). This signal shall request LP & HP QOVs opening and flare ignition;

Note: All signals described above shall be confirmed during Detailed Engineering phase.

4.1.10 The following instruments shall be connected to Flare Gas Recovery System Relief Panel (PN-5412001):

- Pressure transmitters:
  - PIT-5412002-1, PIT-5412002-2 & PIT-5412002-3;
  - PIT-5412007-1, PIT-5412007-2 & PIT-5412007-3;
- QOVs with their respective limit switches (ZSL and ZSH) and solenoid valves (XY):
  - XV-5412004/017 with 04 solenoid valves (each): 1st one connected to PN-5412001; 2nd one connected to CSS – PSD; 3rd connected to PN-UC-5412001;
  - XV-5412010 with 03 solenoid valves: 1st one connected to PN-5412001; 2nd one connected to CSS – PSD; 3rd connected to PN-UC-5412001;
- BPVs with their respective limit switches (ZSL and ZSH):
  - PSE-5412003-1;
  - PSE-5412003-2;
  - PSE-5412008.

4.1.11 All safety functions shall be implemented taking into account the interconnections among the control/safety panels and the design documentation. All safety function to be implemented shall be approved by PURCHASER.

4.2 Minimum Safety Requirements

4.2.1 The whole loops (SIFs) shall comply with the safety instrumented level and the risk reduction factor (RRF) required by safety analysis, according to IEC-61508/61511.

4.2.2 Safety requirements shall apply to the Flare Gas Recovery System Relief Panel (PN-5412001) as indicated below:

- Safety sensors (initiators);
- Logic solver, including I/O cards, network, power supply and processors;
- Application program;
- All final elements, e.g., QOV/actuator sets, with respective solenoid control cabinets, if applicable, valve(s)/actuators between LP Flare header and HP Flare header;
- All appurtenances necessary to build the system.

4.2.3 SIL 3, stated in this technical specification shall be confirmed/updated during Detailed Engineering Design Phase, according to safety analysis (Layer of Protection Analysis – LOPA). All documentation in order to certify that SIL required by safety analysis were achieved shall be presented. The SRS shall include all SIF's.

4.2.4 Flare Ignition & Monitoring Panel (PN-TA-5412001-01) will be activated in a proper time and in coordination with QOVs actuations. Ignition will be assured even in the case of QOV back-up actuation (BPV).

Note: Each QOV back-up (Buckling Pin Valve) shall be taken into account as an independent layer of protection with high reliability and shall comply with PFD equal to 10^{-2}. For the two buckling pin valves installed, the value of 10^{-3} shall be considered as the PFD of the BPV set (two buckling pin valves).

4.2.5 Flare Gas Recovery System shall be fail-safe. During operation, power supply failures shall be investigated to guarantee the personnel safety, environment protection, and safety of process operating conditions and equipment.

NOTES:

1. It shall be presented a detailed study containing all the relief scenarios (from PSVs, BDVs and PVs) for the flare system, including the dynamics of the total system.

2. Process design calculations shall be undertaken by during Detailed Engineering Design phase in order to define the Flare Gas Recovery System response times that are sufficiently short to prevent unacceptable process conditions. Flare Gas Recovery System response times shall be defined in that phase and shall be taken into account for selection of the QOV valves.

3. An alternative in order to achieve the safety integrity level required for the whole system may be proposed, subjected to PURCHASER evaluation and approval during bidding process.

4.3 Logic Solver Main Requirements

4.3.1 In order to guarantee SIL 3 reliability, an independent safety programmable electronic system (safety PES) shall be supplied, also designed and installed in compliance with safety integrity level SIL 3 requirements. The safety PES will be part of Flare Gas Recovery System Relief Panel (PN-5412001).

4.3.2 Logic Solver shall consist of:

- Redundant CPUs (processors) with suitable hardware features for functional safety, a suitable operating system and embedded functions for failures control, communication boards, I/O boards, memory boards, power suppliers, racks, etc.;
- Library with approved safety function blocks;
- Suitable configuration tool for SIF parameters;
- Tool to confirm that the download application software is identical to the source application software;
- Safety users' manual describing instructions on how to use the actual equipment in order to build safety applications that comply with IEC 61508.

4.3.3 The Logic Solver shall be designed in compliance with safety integrity level SIL 3 requirements, in accordance with IEC 61508.

4.3.4 In order to obtain both characteristics of high availability and high reliability (safety), redundant controllers shall be the core of Flare Gas Recovery System Relief Panel (PN-5412001).

4.3.5 Safety PES SIL 3 certification is mandatory and preference shall be given to equipment assessed by an independent organization that has been approved by Brazilian accreditation body (INMETRO) or the equipment is certified by TÜV, Exida or similar.

4.3.6 It shall be supplied all Safety PES hardware, application software, programming, configuration, cabinets, wiring, parts and materials for a fully functional system, whether or not specifically itemized in this specification. A fully functional system in this specification also includes a fully functional, programmed and configured Safety PES interface available for communication to CSS. The interface with CSS shall be kept to the minimum necessary for CSS safety actions execution.

4.3.7 The Safety PES shall be able to communicate with CSS, without impact on the Safety PES logics.

4.3.8 Safety PES shall include hardware and software diagnostic facilities. Logic voted inputs and/or redundant outputs may be used in order to achieve SIL 3 reliability. Safety PES for SIL 3 applications shall demonstrate a minimum safe failure fraction of 90%.

4.3.9 Only certified software and hardware versions shall be used. New versions or versions for bugs' correction, which are directly related to the system safety or availability, shall only be implemented after proper certification.

4.3.10 Each analog input channel shall have resources for detecting signal failure when exceeds the 4-20mA range. It shall be used distinct modules to connect the redundant initiators and/or actuators.

4.3.11 The components of Safety PES shall be provided with built-in redundancy or fault tolerance so that a single card failure shall not cause a loss on Flare Gas Recovery System functionality.

4.3.12 Component parts of the Safety PES shall be arranged such that a loss of signal or power causes a safe failure.

4.3.13 The signals that shall be sent to CSS through network are described in I-ET-3010.1M-1200-800-P4X-014 – AUTOMATION INTERFACE OF PACKAGE UNITS

4.3.14 For development of application software the activities shall comprise:

- Application software specification;
- Cause & effect diagram;
- Individual safety function specification;
- Descriptions;
- Associated tag list;
- Logic specification;
- Timing requirements;
- Safety response times;
- Logic delay times;
- Safety thresholds and limits;
- Bypasses requirements;
- Alarms, logs and events treatment specification.

4.3.15 Application software Uploading/downloading shall be verified and documented.

4.3.16 All bypasses, overrides and inhibits of a Flare Gas Recovery System shall be alarmed/notified to the operators in the CCR HMIs. All Flare Gas Recovery System override facilities shall be carefully considered taking into account:

- The need for restricted access, e.g. password protection;
- Facilities for automatic recording of any overrides/bypasses;
- Definition of an upper limit for allowed override time to ensure that no overrides be forgotten.

4.3.17 All safety functionalities referring to logic solver failures shall be part of the system. In case of fail detection, it shall be alarmed in CSS HMI.

4.3.18 In order to minimize common cause failures (CCF), the Flare Gas Recovery System hardware and software shall be designed to operate independently from the initiating causes identified during the hazard analysis.

4.3.19 In order to improve the Flare Gas Recovery System availability, its devices shall have self-diagnosis features to detect on-line failures. Input signals line monitoring and partial stroke test routine shall be available.

4.3.20 Flare Gas Recovery System Relief Panel (PN-5412001) shall be installed indoor, in air-conditioned area, at AEPR.

4.4 Safety Requirements Specification

4.4.1 During the Detailed Engineering Design phase, a SRS shall be generated. The SRS shall define the technical requirements needed to SIF implementation, in order to guarantee tolerance against spurious fails and SIL reliability required in safety analysis.

4.4.2 The SRS shall include the following information:

- Process description and summary of the documented hazard scenarios generated from the hazard analysis process;
- Descriptions of functions performed by the SIF;
- SIL calculations for each SIF;
- Related process measurements with their normal operating ranges and applicable trips points;
- Safe state of the process for each identified SIF;
- Response time requirements for each SIF to bring the process to safe state;
- Requirements for overrides, inhibits and manual shutdowns, including how they will be reseted;
- Considerations for process common cause failures such as corrosion, plugging, power supply etc;
- Special start-up requirements and Flare Gas Recovery System restart considerations;
- Interfaces to CSS – PSD;
- Requirements for proof test interval;
- Required testing frequencies, PFD and spurious MTTF.

4.4.3 Safety integrity data for all devices shall be informed.

4.4.4 SIL evaluation/assessment/rating of the Flare Gas Recovery System shall include all fundamental components of the system as mentioned above. All documentation in order to certify that SIL requirements were achieved shall be presented.

4.4.5 Any component associated with Flare Gas Recovery System that could influence or prevent the system from performing its primary function shall be included in the SIL evaluation/assessment.

4.4.6 Safety integrity data/Reliability data for each component is required to perform the SIL evaluation and determine the overall system rating.

4.5 Instrumentation minimum requirements

4.5.1 Main characteristics of QOV: pneumatic actuator, fail open and equipped with 2 (two) limit switches (open and close). It shall open in a time not superior to 3 (three) seconds (to be confirmed during Detailed Engineering Design phase). LP QOVs and HP QOVs shall open according to item 4.1.

4.5.2 In order to meet SIL requirements, it shall be demonstrated that each QOV (including solenoid valve and actuator) and each pressure transmitter is suitable for use in the safety instrumented functions taking into account the requirements defined in IEC 61508/61511, including Minimum Hardware Fault Tolerance of final elements. Technical data of valve manufacturer and safety certificate issued by a recognized entity, such as TÜV, Exida or similar, related to QOVs` reliability, failure data, and similar shall be presented in order to proof the adequacy of the specified QOV for the safety application.

4.5.3 Buckling pin devices (similar to safety relief valves) shall not be taken into account as a Hardware Fault Tolerance for the QOVs.

4.5.4 For HP Flare, which is part of a SIL-3 SIF, the required HFT is 1, which means that the whole SIF shall have redundancy. This means that, even if SIL-3 is achievable with only one QOV, there shall be foreseen 2 QOVs, in order to achieve the required HFT.

4.5.5 Actuators shall be properly sized to operate the valve under the maximum specified operating conditions. Actuator configuration and selection shall be such that the actuator is suitable to be applied in the SIL loop as defined.

4.5.6 Safety transmitters (initiators) shall have failure diagnosis features and be dedicated to Flare Gas Recovery System duty only and, therefore, separated and independent from other field devices.

4.5.7 Minimum requirements for design, manufacturing, installation and tests of the instrumentation cables shall be in accordance with Classification Society rules.

4.5.8 Instrumentation cables shall follow IEC 61892-4.

4.5.9 All cabling associated with the fire and gas system shall be suitably protected against mechanical damage/hazardous events and consideration shall be given to diverse routing to minimize the possibility of loss of system capability due to cable damage arising from fire or other physical causes. All cables shall be fire resistant in accordance with IEC 60331.

4.6 SIL / LOPA STUDY

4.6.1 Taking into account the safety-related aspects of the Flare Gas Recovery System comprised of Flare Gas Recovery System Relief Panel (PN-5412001), Flare Ignition & Monitoring Panel – PN-TA-5412001-01 and Flare Gas Recovery Compression Unit Panel – PN-UC-5412001, and the technical need to properly integrate the FGRS, the detailed engineering design shall guarantee that the overall required risk reduction factor (RRF) determined by the Safety Analysis (I-RL-3010.1M-5412-983-P4X-001 – SIL / LOPA STUDY REPORT) can be achieved.

4.6.2 During that Safety Analysis, the safety instrumented function related to HP flare was classified as SIL 3, taking into account the existence of two mechanical independent protection layers (IPLs), that is, two buckling pin valves (BPVs) providing a PFD = 10-3 (RRF = 1,000) as a whole. The FGRS HP flare overall RRF (mechanical IPLs plus SIF), that is, two BPVs plus this SIF, was determined as 6,000,000.

4.6.3 During the detailed engineering design, it shall be developed the Safety Requirement Specification (SRS) bearing in mind that the RRF associated to each SIF shall be demonstrated, and moreover, it shall be proofed that RRF of the SIF related to HP flare shall be, as minimum, 6,000.

4.6.4 Regarding the safety instrumented function 04 related to LP flare, this SIF was rated as SIL 0 (unclassified), according Safety Analysis (I-RL-3010.1M-5412-983-P4X-001 – SIL / LOPA STUDY REPORT) due to required RRF is equal to 2.

Safety integrity level (SIL)	Average probability of a dangerous failure on demand of the safety function (PFD_{avg})
4	$\geq 10^{-5}$ to $< 10^{-4}$
3	$\geq 10^{-4}$ to $< 10^{-3}$
2	$\geq 10^{-3}$ to $< 10^{-2}$
1	$\geq 10^{-2}$ to $< 10^{-1}$

Table 1 – Safety integrity levels – target failure measures for a safety function operating in low demand mode of operation

4.6.5 Aiming reduction on capex, improving maintenance and arrangement aspects and keeping the overall RRF (mechanical IPL and SIF) required for this scenario, it was decided to remove one buckling pin valve (keeping one BPV) and to implement this SIF as SIL 1 rated.

4.7 Requirements for Electric Systems an,d Power Supply

4.7.1 Flare Gas Recovery System Relief Panel (PN-5412001) shall convert and distribute the different power supplies inside the panel, including where necessary a stabilized power supply unit for cabinet internal distribution of the 24 Vdc. See I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS. Electrical material and equipment shall comply with I-ET-3010.1M-5140-700-P4X-002 – SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS.

5 MANUFACTURING, DELIVERY AND OPERATION

5.1 Tests

5.1.1 All the required tests associated to the package automation, control and instrumentation of the package as a whole shall be performed, including FATs and SAT. FAT, SAT and SIT shall take into account IEC 62381, IEC 62337 and Classification Society rules.

5.1.2 Prior to execution, it shall be submitted for PURCHASER approval the planning and test procedures for each FAT (compressor, ignition system, Flare Gas Recovery System and the package as a whole) as well as for SAT.

5.1.3 Testing, performance validation, verification and commissioning activities shall demonstrate that the Safety Requirement Specification designed for the Flare Gas Recovery System has been reached. This test shall be witnessed by a recognized entity, such as TÜV, Exida or similar. This entity shall issue a certificate testing the requirements on Safety Requirement Specification and the required SIL.

5.1.4 Flare Gas Recovery System shall be fully tested in specific period of time (proof test interval) in order to detect and correct dangerous failures so as to maintain the required performance and the required PFD.

5.1.5 A detailed maintenance/inspection plan to be executed during unit lifetime in order to keep the SIL reliability shall be presented.

5.1.6 There shall be documented test procedures to verify the whole Flare Gas Recovery System, including the initiators and final elements.

5.1.7 Any component of hardware or software failed during a test shall be re-tested as necessary to prove rectification has been completed satisfactorily.

5.1.8 The devices shall have self-diagnosis features to detect on-line failures. Input signals line monitoring and partial stroke test routine shall be available.

5.2 Spare Parts

5.2.1 It shall be provided a suggested list with components subject to be supplied in spare parts. The components will be chosen during Detailing Engineering Design Phase.

5.3 Warranty

5.3.1 This supply shall guarantee for all Flare Gas Recovery System components, even for equipment or devices furnished by others, up to 24 (twenty four) months from delivery or for 12 (twelve) months operation.

5.3.2 This warranty shall cover fabrication or installation problems, as well as any service included in the scope of supply.

5.3.3 This supply shall guarantee the supply of spare parts of the Flare Gas Recovery System Relief Panel, at least, for up to 10 (ten) years after the acceptance test date, and technical assistance at installation site performed by qualified and certified maintenance staff, when requested.

5.3.4 During guarantee period, any defective device shall be changed for a new one, within 1 (one) week, after the problem report.

5.4 Packing Requirements

5.4.1 On completion of testing at factory all equipment shall be prepared for shipment and storage.

5.4.2 Equipment supplied loose shall be packed and crated for transport. In addition, if some electronic equipment is susceptible to transport damage, it shall be removed from the panel for separate packing and crating.