

**ELIGIBILITY CRITERIA FOR SUPPLY, ERECTION & COMMISSIONING OF COMPLETE REDUNDANT ADDRESSABLE FIRE DETECTION, ALARM & EXTINGUISHING CONTROL PLC SYSTEM FOR GAS TURBINE APPLICATION IN CPP & AMMONIA-II PLANT AT NFL VIJAIPUR**

SN	Conditions	Documents Required
1	<p>The bidders on its own or through its Original Equipment Manufacturer (OEM) should have experience of similar works at any Fertilizer/Petrochemical/Oil / Gas Industries/ Refineries/ Steel/ Power Plants/ Cement Industries / Continuous Process Industries in India during last 7-years ending last day of the month previous to which NIT has been issued.</p> <p>Similar work means “Supply, Erection and Commissioning of offered Redundant Addressable Fire Detection, Alarm &amp; Extinguishing Control PLC System for Gas Turbine Applications</p>	<p>1) OEM authorization Certificate specific to this tender (If bid is submitted by Dealer/Channel Partner to be submitted).</p> <p>2) Copies of Purchase order for similar items with full technical scope of work &amp; commercial details including work order value during the last seven years ending last day of the month previous to which NIT has been issued.</p>
2	<p>Completion Certificate with satisfactory performance</p>	<p>The bidders on its own or through its Original Equipment Manufacturer (OEM) should submit completion certificate with satisfactory performance against above PO indicating PO details, PO value, executed value and date of completion and should be issued by organization / end user where such ‘Redundant Addressable Fire detection, alarm &amp; extinguishing control PLC system for Gas turbine applications’ are installed.</p>
3	<p>The Average Annual financial turnover of the vendor during the last three years should be at least Rs. 37.50 Lakhs per annum for which bidder shall submit the certified copies of Audited Balance sheet/ P&amp;L for the last three financial years ending on 31.03.2023.</p>	<p>Bidder shall submit financial standing through Audited Balance sheet and Profit &amp; Loss account for the last three years (for the year 2020-21, 2021-22 &amp; 2022-23). In case the bidders do not fall under the ambit of statutory audit, and do not have audited annual reports/audited Balance sheet and Profit &amp; Loss statements, shall submit a statement certified by Statutory Auditor/practicing chartered accountant as documentary evidence in support thereof.</p>

**Note:**

- (i) In case completion certificate with satisfactory performance from concerned organization / end use is not available, bidder can submit self – certification for the same on their letter head mentioning name and address of the organization / end user, completion date, contact person name and contact details including e mail etc. Decision of acceptance of bid shall be final and binding to the vendor.
- (ii) All the required documents shall be self-attested by the bidder.



**TECHNICAL SPECIFICATIONS**  
**OF**  
**FIRE DETECTION AND ALARM SYSTEM (FAS)**  
**FOR GAS TURBINE APPLICATION**  
**IN CPP & AMM-II PLANT**  
**AT**  
**NFL VIJAIPUR**

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## 1.0 INTRODUCTION

National Fertilizers Limited, Vijaipur is having 3 Nos. Gas Turbine Generators (GTG-1, GTG-2, GTG-3) and 1 No. Gas Turbine driven Process Air Compressor (GT-PAC), with associated Heat Recovery Steam Generation (HRSG) unit running in cogeneration mode, as a part of its Captive Power Plant (CPP) to meet the Power and steam requirement of the whole complex. HRU-1 and HRU-2 are capable of generating 180 T/hr steam at 43 Kg/cm<sup>2</sup> each and HRU-3 is capable of generating 120 T/hr steam at 115 Kg/cm<sup>2</sup> with supplementary fuel firing.

GTG-1 and GTG-2 are of M/s General Electric design (Frame V), Model: PG 5361P, supplied by M/s ALSTHOM, France, with GE Speedtronic MARK-VIe and MARK-IV control system respectively.

GTG-3 (Model: PG5371(PA)) & GT-PAC (Type: M 5261-RA, Series-MS 5001) Gas Turbines are of M/s General Electric design (Frame V) with GE Speedtronic MARK-V and MARK-VIe control system respectively, supplied by M/s THOMASSEN INTERNATIONAL B.V. NETHERLAND.

The FAS systems of GTG-1 & GTG-2 are integrated in GE Speedtronic Mark-VIe and Mark- IV control system respectively. In GTG-3 & GT-PAC the FAS system is relay based control system with CO<sub>2</sub> based fire extinguishing system.

## 2.0 ENVIRONMENTAL CONDITIONS

The normal ambient temperature (0-60 Degree Celsius) and humidity conditions are 0-95% R.H.). Environmental temperature of the turbine compartment & accessories compartment where heat detectors are to be installed varies between 150 ~ 250 Degree Celsius.

## 3.0 OBJECTIVE FOR UPGRADATION

The FAS systems of GTG-1 & GTG-2 are integrated in existing GE Speedtronic Mark-VIe and Mark- IV control system respectively which is obsolete and not meeting NFPA Guidelines. In GTG-3 & GT-PAC the FAS system is relay-based control system with CO<sub>2</sub> fire extinguishing system. The Fire Detection and Alarm Systems are old relay-based system. These are installed since inception of the plant and these systems are very obsolete.

In view of above the upgradation of existing FAS of GTG-1,2,3 & GTPAC with latest and proven FAS PLC control system and field devices is to be done.

## 4.0 SCOPE OF SUPPLY

The bidders/vendors are required to submit the bid considering that the job shall be undertaken by them on turnkey basis for Supply, Erection and Commissioning of complete fire detection and alarm control system for 4 nos. of Gas Turbines (GTG1, GTG2, GTG3 & GT-PAC).

- 4.1 Supply of complete redundant SIL2 (UL Listed, FM approved) Fire detection & Alarm Control System with redundant CPU's, I/O modules, Power supplies, communication modules, control modules etc. installed in the control panel. All the cards installed in control panel shall be hot swappable and can be replaced online without affecting the system (means failure/replacement of any single module shall not affect the system). The supplied SIL certified Fire detection and alarm control system should be proven-in-use, highly available and reliable system. The FAS should be redundant and fault-tolerant design. The mean time between failure should be very high.
- 4.2 Supply of all the field devices required for completeness of the system shall be under bidder's scope. Such as Fire detectors, Notification devices, CO<sub>2</sub> release SOV, Pressure switches, fittings etc.
- 4.3 Erection & Commissioning and integration of the above system including Factory Acceptance Test (FAT) & Site Acceptance Test (SAT). Fire Alarm System shall be designed & installed in accordance with the National Fire Protection Association (NFPA72) and IS2189 code of practice recommendations. All the fire alarm controls panel modules shall be UL Listed & FM approved.
- 4.4 Supply of ~~two years~~ <sup>3-12M</sup> mandatory spares @ ~~20%~~ <sup>10%</sup> of each item.
- 4.5 System Operation, maintenance, Diagnostic and on/off line program package training. Advance Training to NFL Operation & maintenance engineers at NFL site.
- 4.6 Detailed engineering, software's and its development as per existing system and Factory acceptance testing (FAT) and supply of all documents.
- 4.7 System packing / forwarding, transportation, Erection, commissioning and site acceptance of complete system.
- 4.8 All the mounting and functional accessories required for the complete functioning of the system shall be in the scope of the supplier.
- 4.9 All consumables (such as cable glands, terminal strips, ferrules, lugs etc.) required for site erection & commissioning.
- 4.10 Panel to panel / system power distribution from the power source, interconnecting cabling between field devices/ equipment's and field junction boxes shall be under bidders scope. 110VAC & 230VAC Power supply shall be provided by NFL at one point for each supplied Fire control panels. Further distribution of power as per their system design shall be under bidders scope.
- 4.11 Documentation, drawings and all certifications.

**Note :** Vendor's representative can visit (if required) the site for assessment of the site on any working day before submission of bid at their own cost. Vendor to design/supply the required "complete fire detection & alarm control system for 4 nos. of Gas Turbines (GTG1, GTG2, GTG3 & GT-PAC)" to suit the existing Gas Driven Turbines & equipment's installations to avoid any major changes. All the details & other items required for completeness of system and for effective performance of system are to be considered by the bidder in submitted bid as mentioned in Bidders scope of supply & technical specifications of the required system.



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## 5.0 Fire Detection & Alarm Control panel

### 5.1 Enclosure

The Fire Detection and Gas Control (FAS) Panel shall be rack mount and be mounted within a suitable enclosure that also houses the Redundant Control Module, IO module, Communication module, Power Supply, Batteries, Charger module etc. within a common enclosure. Operational Temperature shall be 0 to 50 degrees Celsius and operational humidity range shall be 5 to 95% non-condensing. The Panel structure shall be wall mounted or self-standing cabinet type.

All the Fire control cabinets are to be placed in the existing Control rooms of all GTGS. All the cabinets dimensions are to be specified by vendor /bidder as per system requirement.

Access to the cabinet can be from front side. Doors shall be provided with key locks; cabinets shall have openings on the bottom with removable gland plates. All the isolation relays, barriers and isolators shall be installed inside the Cabinets. On the front of cabinet Power supply OK, System OK, indications shall be provided.

The cabinets shall be supplied complete with all necessary hardware and accessories with complete wiring. Wiring shall comply with the applicable IEC codes. The cabinets shall be of same type and colour provided with proper lighting, cooling fans arrangements. The power supply of the fans shall be independent of system power supply. Bulk power supply (if any) positioned in the cabinet shall be preferably on the top to avoid electromagnetic interference to electronic components.

The workmanship and accessories shall be of high quality as per international standard with identification and traceable markings with reference to the as built- in drawings.

Cable glands suitable for I/O cables, supply shall be in the vendor's scope. The cable glands shall be of Aluminium. The base frames required for fixing of all the cabinets with all fixing bolts / anchor fasteners shall be in the scope of vendor.

### 5.2 Central Processing Unit

The FAS Panel shall have redundant (UL Listed, FM approved) SIL2 CPU system with hot swappable capability, so that the switch-over shall take place automatically and bump-less without affecting existing status of outputs. CPU shall have a redundant control BUS along with watchdog controllers' facility. All programmable data and the operating system shall be held in non-volatile FLASH RAM. The system shall be fitted with double Ethernet ports to allow programming and retrieval of data and control information (as & when required).

### 5.3 Fire Detection

All Fire Detection cards and equipment within the FAS Panel shall be (UL Listed, FM approved) SIL2 certified by approved agencies. All I/O Modules shall be addressable. All Fire detectors shall be connected to individual channel of the Input cards and not as a single loop. Similarly, all actuation devices shall be connected to individual channels of the Output cards.

### 5.4 Alarm Actuation and Control

Actuations and controls within the FAS panel shall be SIL2 certified by approved agencies. Actuation of outputs shall be addressable & should be monitored. The actuation of outputs shall be through relay modules.

### 5.5 Extinguishing Module

The Extinguishing module shall be redundant (UL Listed, FM approved) SIL2 certified and be capable of providing suppression control for up to 4 suppression zones within the one panel.

### 5.6 Power Supply

Power supplies shall be sized according to the load requirements of the project. PSU's will be housed within the FAS panel mounted in rack and shall be capable to drive the complete load of the system. PSU shall be redundant (UL Listed, FM approved) SIL2 certified and hot swappable. Hot swapping of one power supply shall not affect the uptime or functionality of the system. The vendor shall submit the load calculation report for sizing reference.

### 5.7 Battery & Battery Charger

Battery & its charger module shall be selected as per power supply sizing & rating and shall be redundant and hot swappable. Battery charge and aging status monitoring facility along with surge, short-circuit & reverse battery protection shall be available. The installation & mounting of battery & its charger shall be under bidder's scope as per standards, depending upon system design. Battery shall be leak proof and should have backup of minimum 24 hours standby or meeting NFPA 72 standards.

### 5.8 Programming & Communication

Facility of configuration of FAS PLC through Windows based PC/Laptop is required via TCP/IP protocol and a direct RS485/232 connection and be able to communicate via a LAN or a Serial cable. Configuration and control software shall operate on a Latest Windows Based PC/Laptop.

Communication module shall be redundant and hot swappable. The system shall have the facility to be able to communicate with third-part supervisory systems (DCS or SCADA) using OPC Server or Modbus interface/ Ethernet TCP/IP.

Programming Laptop make Dell/HP shall be supplied with all latest hardware & software configuration with Licensed Microsoft OS, MS Office and Licensed FAS programming software. The FAS programming software shall be UL Listed.

### 5.9 Operator Interface

The operator interface shall be LED backlit graphic display (UL Listed) with password protection at different levels. It shall be of a dust proof design and contain LEDs to identify all module status OK, alarms & fault, disabled modules etc. Buttons shall be provided for Sounder Silence, Panel silence, Reset, Evacuation, Scroll and assigned function keys. The graphic display unit shall have Hot swappable capability so that replacement can be done online without any interruption.

### 5.10 Safe Input and Output Cards (UL Listed, FM approved)

- 1) All the Input and Output control cards associated with the system shall be approved for SIL2 operation.
- 2) Individual I/O control cards shall be rack mounted and be removable from the front of the rack, Control cards shall be hot swappable. Hot swap of one card shall not affect the functionality of the rest of the system. All control cards shall have self-checking facility like watch dog, and be monitored/checked by the system for

both configuration and faults. All I/O cards shall be addressable with all the diagnostic facilities.

- 3) The vendor to provide details of maximum configurable I/O Cards & racks combination with Input devices and Output actuation devices.

#### 5.11 Control Module (UL Listed, FM approved)

- 1) Control Card shall be certified to SIL2 in redundant configuration, with hot swap facility performing all required controls and actuations for an extinguishing function.
- 2) The control module shall be able to provide separate logic functions such as: timers, flip-flop, toggle etc.
- 3) Modbus Protocol Serial Communications Card.
- 4) Relay Cards – for use to control various output controls.
- 5) Mimic Display Module to provide a LCD display of the system operation.
- 6) The control module shall incorporate all controls and functions available on every device with all the diagnostic facilities.
- 7) The control module and all addressable detection devices & actuation devices shall be SIL2 certified.

### 6.0 Addressable Field Devices

#### 6.1 General

This part specifies the requirements of the material, installation, testing and commissioning of analog addressable field devices. FAS system, repeater panel, detection components, alarm and notification devices, cables and other material shall be as per specification and approved by concerned authorities.

#### 6.2 Addressable Manual Call Points (AMCP)

The addressable manual call points shall monitor and signal to the control and indicating equipment the status of a switch operated by a 'break glass' assembly. The Addressable module shall be housed on explosion proof enclosure. The AMCP shall have the breakable glass operation or manual switching operational action with LED indication. The AMCP card shall be UL Listed, FM approved

#### 6.3 Addressable Sounder Driver Module

The addressable sounder driver module shall be capable of monitoring and driving a circuit of alarm sounders. It shall be capable of operating the sounders in a pulsing or continuous mode with minimum power consumption. Facility to monitor the failure of sounders power supply. It shall provide a red LED indication that the sounder circuit has been actuated.

#### 6.4 Addressable Plant Interface Module

The plant interface module shall be redundant (UL Listed, FM approved) & shall provide inputs and outputs required to monitor and control any plant and machinery. It shall provide multiple potential-free DPDT changeover relay contacts rated for 240 VAC @ 5 Amps. The changeover relay contacts of the plant interface module shall be monitored and controlled by commands signaled from the fire alarm system control panel via the addressable loop. The output of the Plant Interface module (potential-free DPDT changeover relay contacts) shall be connected to Gas Turbine Control systems Mark IV, V & Mark VIe for tripping the respective gas turbine machine in case of fire detection.

#### 6.5 Addressable Performance Smoke Detector

The Addressable smoke detectors shall be UL Listed, FM approved and shall be installed in Turbine control room cabinets.



**6.6 Addressable Alarm and Notification Device**

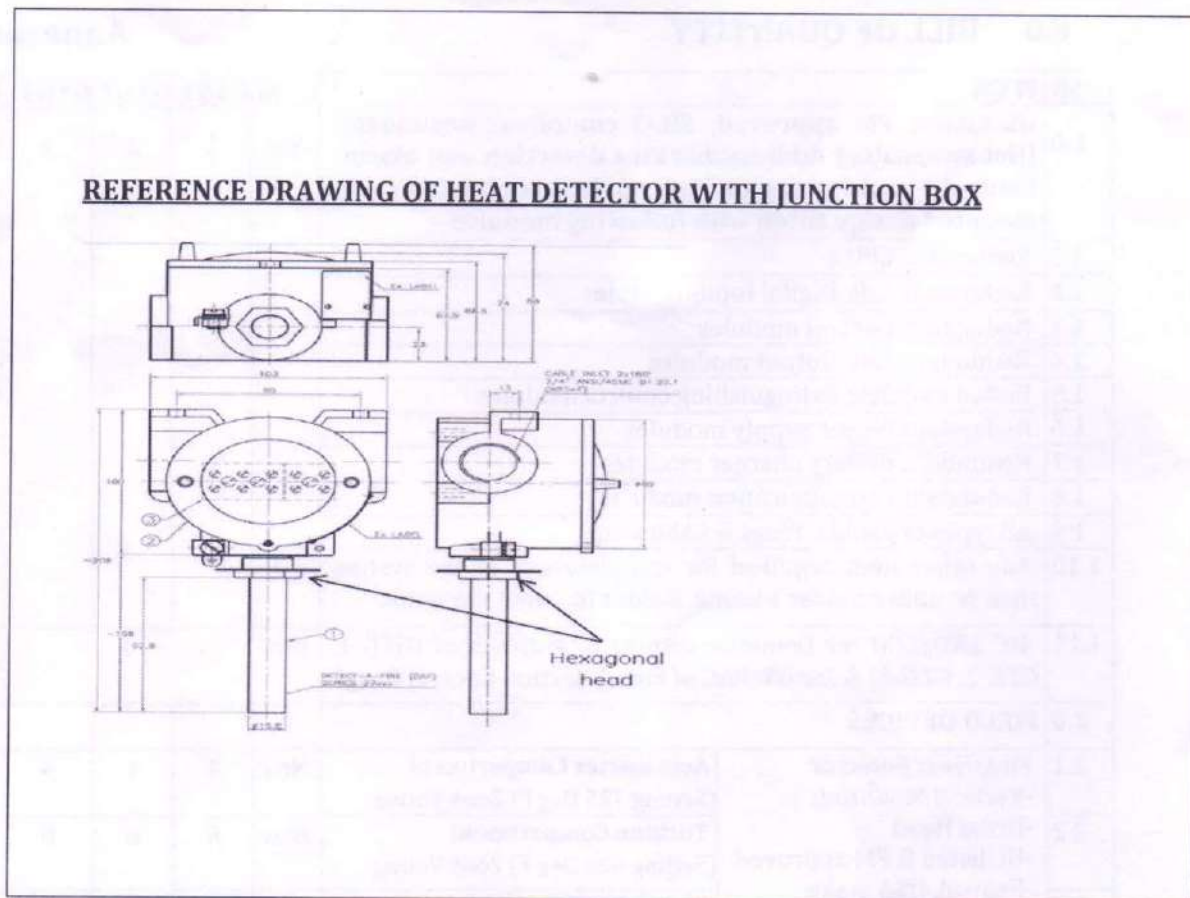
Addressable Alarm and Notification Device shall be Visual (flashing) and audible, FM approved and NFPA 72 compliance. It shall be located at all Gas Turbine panels and control rooms.

**6.7 Fire/Heat Detectors**

- 1) The heat/fire detectors shall be UL Listed, FM approved and shall be installed in Gas Turbines and accessories compartment. The average temperature inside the compartment varies from 150-300 deg Celsius. All the detectors shall be installed according to NFPA-72 guidelines for Gas turbine applications. Accordingly, vendor to offer suitable detectors having long life & repeatability. Detectors be fully compatible with the system offered and shall comprise a fixed base which can be used with other types of detector head. The base shall have fixed non-corroding terminals and contain no electronic components, except those required for short circuit isolator. The Fire detectors shall be of M/s Fenwal, USA make only.
- 2) The detector shall be DETECT-A-FIRE series, Rate-Compensated type detector.
- 3) The fixed element of the heat detector shall be the type that can be reset for renewed detection. The detector shall be fully operational after initiation of an alarm without any maintenance.
- 4) The detectors shall initiate a fault condition if the sensor cable has an open or short circuit condition present.
- 5) The detectors shall be suitable for use in hazardous areas in Gas Turbine application and have Junction box and piping for protection for cables.
- 6) The detectors shall be installed in Accessories, Turbine & Reduction Gear Compartments of GTG1, GTG2, GTG3 & GTPAC.
- 7) The Data sheet & Reference drawing for Fire/Heat Detectors is mentioned below:

SN	LOCATION	Instr. Range Min/Max LRL/ URL		Temp Setting / Tolerance / Color	Housing material	Mounting head type and material
		Principle		Max. Amb Temp	Contacts action/Rating	Thread
1	ACCESSORY COMPARTMENT FIRE DETECTOR	0 / 325 °F	Ex d IIC T3	325°F/ ±10 °F / Red	IECEX AISI 316L / IP66	Hexagonal head 304 SS SIL3
		Rate compensated (per NFPA72)		325°F	Normally Opened Closes on Fire/ 0.5° @ 115 VDC	½ " NPT
2	TURBINE COMPARTMENT FIRE DETECTOR	0 / 600 °F	Ex d IIC T3	600°F / ±20 °F / Orange	IECEX AISI 316L / IP66	Hexagonal head 304 SS SIL3
		Rate compensated (per NFPA72)		600°F	Normally Opened Closes on Fire/ 0.5° @ 115 VDC	½ " NPT

**REFERENCE DRAWING OF HEAT DETECTOR WITH JUNCTION BOX**

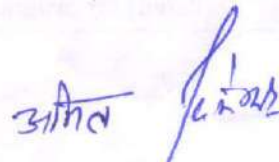


**7.0 EXISTING CARBON DI-OXIDE GAS BASED FIRE SUPPRESSION SYSTEMS**

**7.1 SCOPE OF WORK & GENERAL REQUIREMENTS**

1. The existing CO<sub>2</sub> cylinders and piping from cylinder to Spray nozzle shall be retained. Supply, installation, testing and commissioning of new CO<sub>2</sub> release Pilot Solenoid valves, Pressure switches and manual release valves along with required pipe fittings for full functioning of the existing CO<sub>2</sub> gas based Fire suppression system in GTG1,GTG2,GTG3 & GTPAC. The offered Solenoid valves & switches shall meet OISD & NFPA 72 standards and guidelines requirement.
2. The Vendor shall be responsible for the supply, installation, testing and commissioning of CO<sub>2</sub> Release Solenoid Valves, Pressure switches and associated fittings. The tentative port connection size of existing Solenoid valves is 1/4-inch BSP thread for GTG3 & GTPAC, and for GTG1 & GTG2 will be "Swivel Nut 1.25-18 UNEF-2B connection". Accordingly, vendor to select solenoid valves, however final size and fittings of SOV shall be decided during detailed engineering compatible with our existing system.
3. The activation command for the CO<sub>2</sub> Pilot Release SOV's and output from Pressure switches shall be interfaced from supplied Fire Detection & Alarm system for all Gas Turbines (GTG1,2,3 & GTPAC).





8.0 BILL OF QUANTITY

Annexure-A

SN	ITEM	UOM	GTG1	GTG2	GTG3	GTPAC
1.0	<b>UL Listed, FM approved; SIL-2 compliant Redundant (Hot swappable) Addressable Fire detection and alarm Control Panel for gas turbine application having rack mounted design fitted with following modules</b>	Set	1	1	1	1
1.1	Redundant CPU's					
1.2	Redundant Safe Digital Input modules					
1.3	Redundant Control modules					
1.4	Redundant Safe Output modules					
1.5	Redundant Safe Extinguishing control modules					
1.6	Redundant Power supply modules					
1.7	Redundant Battery charger modules					
1.8	Redundant Communication modules					
1.9	All types of glands, Plugs & Cables etc.					
1.10	Any other item required for completeness of the system shall be under bidder's scope. Bidder to quote the same.					
1.11	40" LED/LCD for Common display of graphics of (GTG-1, GTG-2, GTG-3) & for GT-PAC of Fire detection Control Panel	Nos		1		1
2.0	<b>FIELD DEVICES</b>					
2.1	Fire/Heat Detector -Vertical Mounting <b>Accessories Compartment</b> (Setting 325 Deg F) 2oo4 Voting	Nos	4	4	4	4
2.2	-Brass Head -UL listed & FM approved -Fenwal, USA make <b>Turbine Compartment</b> (Setting 600 Deg F) 2oo6 Voting	Nos	6	6	6	6
2.3	- Detect-A-Fire Series <b>Reduction Gear Compartment</b> (Setting 600 Deg F) 2oo3 Voting	Nos	3	3	6	3
2.4	Manual Call Point (Explosion proof) fitted with addressable UL Listed Module.	Nos	3	3	3	3
2.5	Addressable Field Key switch	Nos	2	2	2	2
2.6	Addressable Bell/Sounder & Horn	Set	2	2	2	2
2.7	Addressable LAMP	Nos	2	2	2	2
2.8	Addressable MANUAL PULL RELEASE SWITCH	Nos	2	2	2	2
2.9	Addressable Smoke detector (UL listed)	Nos	2	2	2	2
2.10	Battery (Sealed and Leak proof)	Set	1	1	1	1
2.11	CO2 Release Solenoid Valves (UL Listed, Ex-proof)	Set	2	2	2	2
2.12	CO2 Release Pressure switches (UL Listed, Ex-proof)	Set	2	2	2	2
2.13	Network accessories like media convertors, switches, LIU's etc.	Set	1	1	1	1
2.14	High temperature Nickel coated copper cables PTFE Insulated (suitable for Gas Turbines application to withstand upto 350 Deg C) 1CX2.5 square mm (multi strand) meeting applicable IS and IEC standards. Vendor shall submit all test certificate from NABL accredited laboratory.	Mtr.	500	500	1000	1000
2.15	24C X 1.5 square mm, armoured, FRLS signal cable meeting applicable IS and IEC standards. Vendor shall submit all test certificate from NABL accredited laboratory.	Mtr.	200	200	200	400
3.0	Programming Laptop with latest configuration (32 GB RAM, 1TB SSD) make Dell/HP shall be supplied with all latest hardware & software configuration with Licensed Microsoft OS, MS Office. Licensed FAS programming software (UL listed) for programming the FAS system.	No	1	NA	NA	1



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TECHNICAL SPECIFICATIONS OF FIRE DETECTION AND ALARM SYSTEM FOR GAS TURBINES

4.0	Supply of CO2 pilot release SOV's, actuators, Pressure switches, associated pipe fittings etc. for fixing on existing CO2 cylinders fitted with various components for completeness of the system.	Lot	1	1	1	1
5.0	Any other items not included above and are required for completeness of supplied system as per scope of supply & technical specifications shall be in bidder's scope. Bidder to consider & quote the same, otherwise bidder has to supply the same free of cost, if noticed at later stage.	Lot	1	1	1	1
6.0	Training as per clause no-16.	Lot	1			
7.0	Supply of documentation & certificates as per clause no-15.	Lot	1			
8.0	Erection & Commissioning of complete supplied system.	Lot	1			
9.0	<b>Mandatory Spares</b>					
9.1	Mandatory Spares for Fire Alarm System (Smoke Detectors, Heat Detectors, Manual Call Points, Isolator Modules, CPU, Power supply module, Loop Control Modules, I/O Modules, Communication modules, Horns, Hooters, CO <sub>2</sub> Release SOV, actuators, fittings & Pressure switches, Network accessories like LIU, Media Convertors, Patch cords etc.	LOT	10% of total supplied quantity subject to min. 1 (one) no. of each installed item.			
9.2	Any other spares not included above in mandatory spares may be considered and vendor to offer the same.					

**Note :**

**MANDATORY SPARES:**

It is mandatory that vendors have to indicate, supply and quote @10% of the total supplied quantity for any other item / module used in the system which is not specified in the above list, failing which vendor has to supply the same free of cost if noticed on a later stage. Mandatory Spares shall be supplied @10% subject to minimum one number of each item supplied along with the system.

**9.0 PROJECT ADMINISTRATION & DETAILED ENGINEERING**

The vendors may survey the site to understand the system installation and to estimate the quantum of job before submission of bids.

**PROGRESS REPORT:** After awarding of contract Vendor shall inform to owner about stage wise progress of the system. The Owner may visit vendor works to see stage wise progress at any time. After placement of Purchase / Work Order vendor shall submit all engineering documents and project implementation schedule to owner for approval.

They shall also take care to revise the project schedule as per site requirement. The detailed schedule shall include general preparation, procurement, detailed engineering and design, stage wise testing/ checking, assembling and testing for trial run, preparation for FAT, notice to owner for FAT, schedule for FAT, packing/ forwarding, dispatch, final erection & commissioning and handing over the system after completion.

The detailed engineering shall be done for up-gradation of system as per scope of supply. Accordingly, all hardware & software's shall be selected. A kick-off meeting shall be arranged after awarding of order for finalizing detailed engineering of the system. During detailed engineering the supplier has to submit plan for stage wise progress details.

All the control rooms shall be handed over to the vendor for Installation, Erection & commissioning of all the supplied Fire Control Panels and laying of cables upto Field Junction boxes.

However, Installation of Fire/Heat detectors inside the GT compartment and other field devices shall be done in phased manner depending upon availability of Machine (GTG) shutdown. NFL will inform the bidder 10 days earlier, before shutdown of machine accordingly Bidder has to depute his expert manpower for installation, testing and acceptance of systems.

#### 10.0 PANEL WIRING

Wiring for different voltage signals or different functions shall be terminated separately on dedicated terminal strips with colour coding. Wiring shall be accomplished with flexible stranded copper wires sized in compliance with the applicable IEC codes.

Wires shall be housed in plastic raceways of suitable dimensions to accommodate system cables, I/O signal cables etc. having 40% spare space for future expansion. The supply and laying of the interconnection cables, wiring, Terminations and tagging shall be in the scope of the vendor. The engineering documents shall be supplied as per schedule given by the vendor during kick off meeting.

Terminal strips shall be of adequate size min. 2.5mm<sup>2</sup> PHOENIX/WIEMULLER make terminal strips are only acceptable. Fusible Terminal strips & MCB'S shall be provided for all the entry power cables & shall be knife edge types. Terminal strips shall be segregated as: Analog/ digital Input, Analog/ Digital Output etc.

#### 11.0 FACTORY TESTING AND ACCEPTANCE (FAT)

After detailed engineering and custom software generation and loading on the system, the simulation will be done at the manufacturer works in the presence of NFL Engineers. The system shall be accepted only after successful testing in all respects including hot redundancy check during FAT. If NFL Engineers are not satisfied with the system performance, the whole system will be rejected. NFL will not responsible on this account and no financial claim will be accepted by NFL. Vendor to submit FAT Procedure. It shall be the vendor's responsibility to modify and/or replace any hardware and modify the software if the specified functions are not completely achieved satisfactorily during testing and factory acceptance.

#### 12.0 SITE ACCEPTANCE TEST (SAT)

The system shall be considered acceptable only after all sub-system including hardware, software, communication system, auxiliaries have been supplied, installed and commissioned to the full satisfaction of the Owner.

#### 13.0 INSPECTION, CHECKING PROCEDURE AND ACCEPTANCE

The supply will be subject to inspection and tests attended by owner as required in this specification and according to the methods indicated on the **inspection data sheets (IDS)**. The owner witness does not relieve the vendor from his responsibilities for hardware, software, other accessories and services if required. Vendor shall submit factory test, installation, commissioning and acceptance procedures during the first vendor meeting.

#### 14.0 QUALITY ASSURANCE

Complete supervision of erection, commissioning, training and testing of the supplied controller system will be in vendor's scope. The vendor shall ensure and shall conduct quality assurance test. The complete system shall be assembled/ wired and powered on at vendor works as per standards. Internal tests (manufacturer tests), Quality control test, System Pre-test, System power-up test, Owner Presence tests, site testing etc. shall be performed by the vendor as per standard procedures and the test report shall be forwarded to the owner representative with results & sign of personnel's name carrying following details: -

- a) Testing for correct operation of the interlocks/logics sequence, in
- b) Accordance with the logic diagram, when varying input status of each Fire control Panels.
- c) Testing the correct operation of each Fire control Panels input/output.
- d) Programming station testing, System configuration test.
- e) Simulation of power supply break and system restart.
- f) 100% online System checks & loop checks of complete system.
- g) Software details, CPU, memory loading and system diagnostics checks.
- h) System behaviour test under simulated fault conditions.
- i) System behaviour test under max. Allowed supply voltage fluctuation conditions.

## 15.0 DOCUMENTATION & MANUALS

Three sets in Hard & soft copy of all the documents such as Maintenance & operation Manuals, Programmed logics, as built-in drawings, wiring diagrams, panel lay out drawings, Maintenance manuals of all field installed equipment's /instruments etc. after final installation of system with prior approval of NFL Engineer in charge. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate/maintain the equipment and system. Extra One set of all documentations is required before commissioning of system.

## 16.0 TRAINING

The training programs & course shall be supplied & conducted by the vendor as below:

- a) Operational training of the supplied System at NFL site for Operation & Safety staff. This training shall be conducted in 2 batches. Each batch will have 6 NFL personnel at a time for 2 working days. Course material shall be supplied by vendor.
- b) Operation, Maintenance & advance engineering/programming training of the supplied System at NFL site. This training shall be conducted in 2 batches. Each batch will have 6 NFL personnel at a time for 2 working days. Course material shall be supplied by vendor.

## 17.0 GUARANTEE

The supplied system shall be covered under guarantee for a period of 2 years (24 months) from the date of final commissioning and acceptance. It will be obligatory on the part of the vendor to modify or replace any hardware free of cost in case any malfunction is revealed during operation after taking over by the owner within the guarantee period. Vendor shall make suitable changes in system if problems are detected during the guarantee period without any cost implication.

## 18.0 PAYMENT TERMS

NO ADVANCE PAYMENT shall be made to vendor. Progressive payments shall be made on the basis of achievement of following mile stone:

- a) For supply of hardware & software: 70% of PO Value towards supply portion + taxes within 30 days after receipt and inspection of material at NFL. Balance payment i.e 30% within 30 days after successful installation, commissioning & acceptance of system.
- b) If site clearance is not given due to reasons attributed to NFL, balance 30% supply portion shall be released, against advance Bank Guarantee after six months of supply and acceptance of complete material at NFL site.
- c) For Services (Installation, Erection & Commissioning): 100% payment towards erection & commissioning within 30 days from date of invoice after successful completion of Erection & Commissioning of individual Gas-Turbine on pro-rata basis.

**19.0 SPECIAL TERMS & CONDITIONS FOR COMMISSIONING****19.1. Site Mobilization:**

- a) The security of the contractors' equipment's and material is their own responsibility. NFL shall accept no liability for loss or damage to contractors' materials.
- b) The contractor shall submit list of employees deployed at NFL Vijapur site with full Bio-data.
- c) The contractor will be responsible for providing all material, tools & tackles and consumables, etc. required for execution of work as per the best Engineering practices.
- d) Messing & Accommodation: The contractor will make his own arrangement for messing and accommodation of contractor's personnel. However, accommodation may be provided by owner on chargeable basis subject to availability.
- e) First Aid: The contractor may have access to the owner's first aid post if available in case of accident.
- f) Erection and commissioning teams including site engineers shall be deputed by the contractor for erection and commissioning of supplied control system.
- g) Entire work is to be completed as per the time schedule already submitted and approved by the owner. The contractor shall conform to the targets set forth in the time schedule.

19.2. **Subletting of Contract:** No subletting of contract is allowed by the vendor.

**19.3. Employment of Labour at NFL site:**

- a) The contractor will employ only his regular skilled/ semi-skilled/ unskilled employees with experience in erection & commissioning of supplied control system. No person below the age of 18 years shall be employed. The wage rates should not be less than the stipulated minimum wage rates, notified by Central Government / MP State Government whichever is higher from time to time with respect to work performed/rendered, without any discrimination on grounds of caste/creed/religion/gender.
- b) All notices and instructions issued by the owner must be strictly adhered to by the contractor and his employees and shall conform to all rules of conduct, etc. established by owners. Failure to do so will be sufficient cause for removal of such person from the site.
- c) Contractor will take umbrella insurance cover for all his employees for all purposes of claims under Workman's Compensation Act during stay at Owner site and shall submit a copy of the same to the owner. The expenditure incurred for insurance shall be to the contractor's account.
- d) In case the Owner becomes liable to pay any dues to the labour of the contractor or to any Government Agency or any other agency under any of the provision of the Minimum wages Act, Workmen compensation Act or any other law due to act of omission of the contractor, the owner shall recover the same from the Contractor's bills.

**19.4. Working and Safety Regulations:**

- a) The contractor shall fulfill all statutory and legal requirements enforced by Central, State Governments and local authorities applying to the work as well as safety requirements for the same.
- b) The contractor shall strictly follow regulations laid down by owner, Factory Inspector, Government and state authorities in all respects.
- c) The contractor shall strictly comply with all electricity safety regulations.
- d) Explosive material/equipment prone to explosion shall not be allowed inside the owner premises. The contractor shall make his own arrangement for fire extinguishers and other safety equipment for his office and storage.



