Gasum

Neste Jacobs Oy	**Purchase Requisition**	Number **3060009_3-06A-00004**	
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Subject **KOMPA PROJECT GAS TURBINE FUEL GOVERNOR KOUVOLA B**	Inquiry	Area	Code
	Revision No. | Checked for Purchasing	Equipment Number	
Seller	Order No.	Delivery Time	

Revision	Date	Description	Distribution	Issued	Check.	Appr.
1	7.2.2017	AFI		MIKKOJUK	KOIVIVES	HEIKKHEI
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1 INTRODUCTION

1.1 This purchase requisition covers the minimum requirements for retrofit of Fuel Governor (FG) planned to be implemented at following GASUM Oy's natural gas compressor station Kouvola B in Finland.

1.2 Following terms will be used hereinafter in this document:

- Seller: The Company delivering the FG.
- Buyer: GASUM Oy and/or their agent.
- System: Fuel governor system (FG) including all HW, software, functionality and services needed for fulfilling the requirements of this document.

1.3 The Seller shall advise the Buyer in writing of any conflict between this purchase requisition and any of other documents referred, for resolution by the Buyer.

2 STRUCTURE OF SELLERS PROPOSAL

2.1 Headings and order of handling

2.1.1 The Seller shall produce his proposal following the procedure and main headers in this purchase requisition.

2.1.2 The Seller may also offer as an option technical enhancements for the current turbine units including for example:
- fuel gas metering/control valves
- field transmitters and actuators (where reasonable)

The Seller shall specify separately the prices of the above mentioned enhancements when proposed.

2.2 Review of deviations

2.2.1 The Seller shall prepare and submit with the bid a comprehensive review of compliance as a list comparing the inquiry documents and the bid.
The following expressions shall be used in the list when the paragraphs of the documents are commented:

<u>Enhancement (E):</u>
The features of the System exceed the functional or structural requirements.

Conforms (C):
The features of the System fulfil the functional or structural requirements.

Variation (V):
The features of the System deviate from the functional or structural requirements. The deviations shall be described in the bid.

Alternative (A):
The features of the System do not match with the functional or structural requirements, but the Seller bids an alternative for the mentioned function or structure. The substituting alternative shall be described in the bid.

Exception (Ex):
The Seller cannot fulfil this requirement and it is thereby not proposed. The reason for Exceptions shall be described in the bid.

Noticed and Understood (NU):
The Seller hereby acknowledges that he has noticed and understood the paragraphs clarifying the requirements with necessary background or instructions.

2.2.2 Any other statement by the Seller shall not be considered to overrun the requirements on the Buyer's purchasing documents unless clearly indicated by an "Exception" answer and a reason for deviation thereby given as stated in above.

2.2.3 The Seller shall clearly indicate in the review of compliance if some proposed System feature is still under development or not fully tested or requires work of a development nature during the project.

2.3 Unit prices

The Seller shall propose unit prices for project scope changes covering all the equipment, application program items and services (man hours).

3 FIELD OF APPLICATION

3.1 General

Gasum Oy has responsibility of natural gas import, sales and transmission in Finland. There is about 1000 km high pressure pipeline and three compressor station sites in the Gasum's pipeline network.

3.2 Existing machinery and control system

3.2.1 Kouvola compressor station B

Station B has been built in late 90s. In the station B there is one gas turbine driven centrifugal compressor unit (GB-5200) and reservation for another. Turbine type is PGT10 DLN (dry low nox version) and compressor type is PCL 603 made by Nuovo Pignone.

The station level controls are executed in the station control system (DCS by Valmet Automation).

Unit control system is combined turbine and compressor control system Suvimac II (upgraded 2004). Manufacturer of the UCS system is Nuovo Pignone.

The master capacity control of the whole site, load sharing and anti-surge controls for all of the units in the stations A and B are executed in the CCC system.

3.2.2 Remote control system

All compressor stations in all sites are now and will be in future remote controlled from dispatching control centre (DCC) in Kouvola (Kouvola). All stations and units have also local operation possibility from the local control rooms. The remote and local control operations are executed on a single window basis through the DCS operator work stations.

3.3 Environmental constrains

3.3.1 Control Room

The Control room is equipped with normal air-conditioning.

3.3.2 Rack Room

The Rack room is located on safe area in the same space with the control room and equipped with normal air-conditioning. Temperature range in the Rack rooms is +20°C…+25°C. The Rack room is also equipped with automatic fire extinguishing systems (gas operated); therefore the system cabinets shall be internally ventilated (not closed).

4 SCOPE OF THE SUPPLY

4.1 General

4.1.1 The System shall comprise, but is not limited to, the equipment, functions and system services as defined below. The Seller shall complete the equipment listings with the correct model number and quantity of all equipment required to provide a fully functional system to comply with this requisition.

4.1.2 Engineering requirements and related standards for proposed equipment and software shall be applied as required in the System engineering specification in chapter 5. The Seller shall indicate all the standards applied to design and manufacturing of the System and also provide the certificates awarded by independent inspection and standardization associations/institutes.

4.2 System Hardware

4.2.1 Marshalling and signal conditioning

The Buyer will deliver the marshalling cabinets including the barriers if required for intrinsic safe (Exi) signal conditioning by the System process interface.

4.2.2 Scope of the HW

The Seller shall include to the supply the following:

a) System cabinets to support the I/O, containing all system components such as processors, power supplies, I/O modules etc. A HMI/engineering workstation shall be included for each site. Seller shall specify all components.

b) Set of system and highway cables complete with plugs for interconnecting above cabinets and workstations.

4.3 System software

The Seller shall propose all the system software and application software to meet the functional requirements of the system. The Seller shall specify which of the programs will be Buyers property and which required runtime licenses include yearly payments.

4.4 System Services

4.4.1 Factory acceptance test (FAT)

The Seller shall include one week period to perform customer witnessed FAT at the Seller's premises.

4.4.2 Field support

The Seller shall propose a field service rate structure for the Field support during the installation, pre-commissioning, commissioning and start-up.

4.4.3 Training (Option)

The Seller shall recommend appropriate training programs. The Seller shall deliver table of content (including price of the course and training material) for each recommended training course to be conducted either on site or at the Seller's facilities. The language of training and training material shall be in Finnish or English.

4.5 Documentation

The Seller shall provide two (2) sets (one paper copy and one copy in electrical format) of documentation as defined in item 9. The delivery schedule of the documentation will be agreed mutually in the kick-off meeting, but in minimum the documentation shall be delivered in three shipments:

1. For information: including the general data required for Buyer own design work.
2. Approved for construction (AFC): including all the required detailed specifications and drawings for total project implementation.
3. As built: including required revision of the detailed specifications and drawings after accepted SAT and commissioning.

4.6 System functional requirements

4.6.1 General

4.6.1.1 For the individual control loops and functions the Seller shall produce acceptable designs and acceptable documentation of all designed features.

4.6.1.2 System shall be designed with such manners that the output power-, efficiency- or the emissions of the gas turbine will not be degraded.

4.6.1.3 By default the control features of System shall cover mainly the combustion and combustion related controls such as the combustion itself, shaft speeds and exhaust temperature. All other required control and monitoring functions are excluded from System delivery and will be implemented in DCS's (Station Control Systems, SCS), Capacity Control Systems (CCS), Machine Monitoring

and Protection Systems (MPS), safety systems (SRS) and fire/gas monitoring systems provided by others.

4.6.1.4 System shall receive its operational commands from the SCS. All critical signals are hard wired via I/O. Other control and monitoring signals are transferred via dedicated communication links. All emergency shutdowns are performed by the Buyer's SRS, from where a shutdown signal is hard wired to the System input. System shall provide required status signals for the SCS in order to support single window operations from the SCS.

4.6.2 System control functions

The Seller shall propose in minimum the following System core control and monitoring functions:

- Fuel gas control
- IGV control
- Nozzle (NCV) control
- RVDT control
- Ignition & combustion control, flame detection and monitoring
- Dry Low Nox control
- Combustion chamber pulsation control
- Bleed valves' control
- HP speed control
- LP speed control
- EGT temperature control and protection

4.6.3 System interfaces

4.6.3.1 General

In addition to the turbine field equipment System interfaces with the SCS and the SRS.
The required minimum I/O is listed on chapter 4.6.3.6. The number of needed I/O shall be considered as an estimate. The amount of I/O can be altered, if chosen solution so requires.

4.6.3.2 Field interfaces, Turbine I/O

Measurements and controls shall be connected directly to System I/O. Measurements and controls shall be made with primary signals. Only the needed Ex barriers/isolators are connected to the circuits by the Buyer.
A cold end compensation measurement shall be applied to thermocouple measurements.
All double or multiple measurements shall include required calculations (eg. average, median, etc) and validation procedures.

4.6.3.3 I/O-interface with the SCS

System shall connect directly with I/O to the SCS in order to handle the critical control and monitoring signals. Other signals are transferred via a communication link.

4.6.3.4 I/O-interface with the SRS

System shall connect directly with I/O to the SRS in order to handle the emergency shutdown (ESD) input.

4.6.3.5 Communication with the SCS

4.6.3.5.1 System shall communicate to the SCS via a data highway or a serial link conforming to the requirements of the chapter 5.3.4. The communication protocol shall be approved by Buyer.

4.6.3.5.2 The communication shall preferably be done directly between the SCS and the System (not via a separate PC).

4.6.3.5.3 The communication method and protocol shall be fast enough, fault tolerant and monitored against fault.

4.6.3.5.4 The interface configuration shall include transfer of 220 signals per turbine unit from the System to the SCS.

4.6.3.5.5 The interface configuration shall also include the transfer of 10 signals per turbine unit from the SCS to the System.

4.6.3.6 System I/O List

All the required I/O-interfaces per turbine unit are specified without spares in the following table:

Turbine unit	AI	AO	TI	FI	LVDT	SERVO	DI	DO	**Total**
Kouvola B/ GB-5200	20	1	26	6	5	6	10	10	**84**

AI = Analogue input 4…20mA
AO = Analogue output 4…20mA
TI = Thermocouple input: K-type
FI = Frequency input: speed pick-up (4) & combustion chamber pulsation sensor (2)
DI = Digital input: dry contact
DO = Digital output: 24VDC, 1A
LVDT = Control position feedback measured with LVDT-type sensor
SERVO = Control of bipolar type hydraulic servo actuator

4.7 Limits of Supply

The following limits of the supply and responsibilities shall be followed in the System delivery:

		Responsibility by:	
Device or activity	**Limit specification**	**Seller**	**Buyer**
System hardware engineering		X	
Engineering of field cabling termination cabinets in the equipment room			X
System specification " " "	 Approval	X	 X
System hardware		X	
System software and utility programs		X	
System application software		X	
System configuration: - displays - trends - alarms - SCS communication interfaces		 X X X X	
System documentation - cabinet layout and construction drawings - assembly drawings - power distribution diagrams - System internal connections - System cabling - bus network drawings - signal address and definition lists for the communication with the SCS		 X X X X X X X	
Instrument loop diagrams " " "	 System side data	 X	X
System manuals		X	
Delivery time schedule " " "	 Approval	X	 X
Progress reports		X	
Minutes of meetings		X	
Factory acceptance test	As defined in item 8.1	X	X
Site acceptance test	As defined in item 8.2	X	X
Final acceptance test	As defined in item 8.3	X	X
Inspection and test procedures and records " " " "	 Approval	X	 X
Transportation of System to the site		X	
Insurances - during transportation - during installation - during commissioning	 Until the System has been moved to its final position	X	 X X

...continued

Responsibility by:

Device or activity	Limit specifier	Seller	Buyer
Installations			
- storage before installation			X
- facilities for the Seller's representatives during installations and commissioning			X
- moving of System cabinets to mounting places			X
- cranes and tools for cabinets transfer			X
- preparation of installation places			X
- installation of System cabinets			X
- laying of internal cables between separate System parts inside the rack room			X
- laying of home run cables between field and equipment room			X
- connecting of all System internal cables		X	
- connecting of field cables to cross-connection (marshalling) cabinets			X
- laying and connecting of cables from cross-connection cabinets to System process interface terminals			X
- laying of power supply and earth cables			X
- connecting of power supply and earth cables to System cabinets			X
- laying and connecting of data transmission cables between the System and the SCS			X
- System power-up and SAT		X	

5 ENGINEERING SPECIFICATION

5.1 Introduction

5.1.1 Deviation from this specification is prohibited without a written permission given by the Buyer.

5.1.2 In case of contradiction between this and other engineering specifications, applicable standards and codes, interpretation shall be made by the Buyer in co-operation with the parties involved, before adopting any of those as a basis of detail engineering.

5.2 System design requirements

5.2.1 Standards

The following standards and guidelines shall be followed in applicable parts: All designed features, controls and equipment shall meet the needed requirements of the necessary standards in applicable parts, listed below

- IEC 61508 Functional safety: safety-related systems
- EN ISO 13849-1 Safety of machinery, Safety-related parts of control systems, Part 1: General principles for design

All the proposed equipment shall be ATEX compliant where required. The field equipment are installed in Ex Zone 1 classified process area.

5.2.2 Configuration

5.2.2.1 The System shall be functionally independent from any other control system. The System shall be independent by hardware, by software and by power supply from other automation systems.

5.2.2.2 The instruments connected to the System (sensors, transmitters) shall not be used for purposes not related to the System, i.e. parallel use in other systems is not allowed.

5.2.2.3 No failure of a single channel of programmable electronics hardware should cause a dangerous mode of failure of the total configuration of the System.

5.2.2.4 In the same way faults within the software associated with a single channel of programmable electronics should not cause a dangerous mode of failure of the total configuration of System.

5.2.3 Reliability

5.2.3.1 System safety integrity

5.2.3.1.1 The system shall be designed such, that when a system failure arises, the system will control the outputs, which are under the influence of the failure, to the de-energized state (fail-safe principle).

5.2.3.1.2 All components of the system, i.e. the central processing units, I/O-buses and I/O-units, shall operate according to fail-safe principle by means of frequent tests and/or inherently fail-safe components.

5.2.3.1.3 The correct execution of the program shall be ensured by monitoring the time which the CPU takes to run the program (watch-dog test).

5.2.3.1.4 The internal power supplies of the system shall be monitored such, that the defined behavior in the event of an interruption in the supply of the power is ensured.

5.2.3.2 Availability

5.2.3.2.1 Availability of the System shall be high. The system shall be designed for maximum (100% aprox.) up-time to support the process on the plant. However the control CPU and I/O redundancy is not required.

5.2.3.2.2 The System shall be supplied by the direct battery back-upped 24 VDC and/or 230 VAC (UPS) provided by the Buyer. The failure of a single supply shall not cause interruption in the function of the system. The Seller shall provide redundant power supply units to power up all functional units of the system, ie. processing units, process interfaces, etc.

5.2.3.2.3 Loss of power for more than the period protected by the battery back-up time shall not require any reconfiguration of any part of the system.

5.2.3.2.4 The Seller shall guarantee that communications and its support system shall not lock-up due to excessive traffic on the SCS communication link.

5.2.4 Overall quality

The system shall be designed and manufactured by using an established Quality Assurance system.

5.2.5 Response and Cycle time

The system shall react to process changes from input to output within 20 ms.

5.2.6 Time Stamp of Alarms

5.2.6.1 All alarms shall be time stamped.

5.2.6.2 The time stamp of alarms shall be performed inside the System. The alarms with the time stamp shall be transmitted via the communication link to the SCS.

5.2.6.3 For the alarm handling purposes the real time clocks of the SCS and the System shall be synchronized. The master system is the SCS.

5.3 Hardware and software requirements

5.3.1 General

Control components shall preferably be of the plug-in type grouped together in racks containing plug-in connectors to receive the components. Cables and wiring connecting the I/O-interface equipment to the processors, power supplies, etc. shall be furnished and installed in the cabinets by the Seller. The Seller shall propose the equipment listings with the correct model number and quantity of all equipment required to provide a fully functional System to comply with this requisition.

5.3.2 System cabinets

5.3.2.1 Cabinets shall be delivered with internal wiring fully installed and tested. They shall be mounted in a heated and air-conditioned equipment room with temperature monitoring. The Seller shall deliver detailed installation data and cabinet dimensions and the requirements for environmental conditions considering at least 15 years of operation.

5.3.2.2 Cabinets shall be designed and assembled together so that they can easily be moved to their mounting places taking into account doors and other obstacles. Maximum height of cabinets is 2200 mm.

5.3.2.3 Cabinet doors shall be supplied with handles and firm document pockets inside. The opening direction of the doors shall be alterable.

5.3.2.4 Terminal blocks and cable trunking shall be installed on a mounting plate. Power supply and signal wiring shall have separate routes.

5.3.2.5 When required, the following make of spring loaded terminals shall be used for I/O-connections:

- Phoenix
- Weidmuller
- Wago

The Seller shall choose terminals for signals and power supplies and get the Buyer’s approval for them.

5.3.2.6 Cabinets shall be equipped with necessary ventilation fans and openings. The fans shall have status contacts or lights for monitoring their operation or there shall be at least three separate fans with capacity of two enough for cabinet cooling. Malfunction of a fan shall not affect the others. Alarms of cabinet temperatures shall be provided if temperature limits have been specified.

5.3.2.7 There shall be separate clearly marked earth bars for the protective earth (PE) and the signal earth (TE) in the cabinets. All conducting metallic parts shall be connected to the protective earth bar (PE).

5.3.2.8 Mounting of equipment on the cabinet doors is not allowed.

5.3.2.9 Cabling shall be introduced through the bottom of cabinets. All connections, joints and branching of System cables shall be installed and marked to be clearly visible and easily reachable.

5.3.2.10 Cabinets shall be marked with plastic labels visible on both sides of the cabinet when applicable and visible with doors opened. The labels shall normally be white with black letters. The Buyer shall define the identifiers to be indicated in the labels.

5.3.2.11 Cabinets shall be equipped with internal lightning and 230VAC socket for maintenance purposes.

5.3.2.12 All cables and individual wires connected to the terminal block shall be tagged at both ends. All equipment shall be labelled. Stranded wires shall be furnished with ferrules (Weidmuller). The national standards shall be used in wiring work.

5.3.2.13 The following colors shall be used for wires in cabinets:

- Brown: General
- Black: Phase (L) 230 VAC supply
- Light Blue: Neutral (N) 230 VAC supply
- Yellow/Green: Earth (PE)
- Black: Terminal Earth (TE)
- Red: +24 VDC supply
- White: -24 VDC supply

5.3.3 Power supplies (internal)

5.3.3.1 The Buyer will provide two independent battery back-upped 24 VDC and/or 230 VAC (UPS) supplies. The Seller shall provide connections for two independent supplies for each of System cabinets delivered.

5.3.3.2 The voltage of field instruments connected to the System are 24 VDC.

5.3.3.3 All internal power supply units to power the system and the field I/O subsystems shall be supplied by the Seller.

5.3.3.4 Each power supply unit shall be redundant.

5.3.3.5 Each power supply unit shall be oversized so that under normal loads, less than 70% of the capacity is in use. Separate circuit breakers shall be provided for each power supply unit.

5.3.3.6 The Seller shall provide the necessary power supply conditioning for transients and surges resulting from a noisy process environment and shall state limitations of his equipment.

5.3.3.7 The system shall be capable to monitor and report status of all supplies within the system.

5.3.4 Communication interface with the SCS

5.3.4.1 Any real time operational data from the System shall be possible to be transferred to the SCS. Typically, this data consists of analogue measurement, binary status values and calculated variables. The data types typically used are float (32 bits), integer, binary and ASCII character. Information of validity shall be attached to all transferred data.

5.3.4.2 Data transferred from the SCS to the System typically consists of control and selection variables (eg. speed set points and operating mode commands) used for FG operational controls. The data types typically used are binary and integer. Acknowledging and resetting of the System alarms shall be possible via the SCS communication interface.

5.3.4.3 The SCS interface shall be implemented by default as an Ethernet connection utilizing Modbus TCP protocol.

5.3.4.4 The preferred communication media is optic fiber. The Seller shall provide the required media converters.

5.3.5 Diagnostics

5.3.5.1 The System condition monitoring shall be implemented with on-line diagnostics allowing inquiry of a status of any variable in the System at any time.

5.3.5.2 The scope of supply shall include comprehensive diagnostics software and displays that assist trouble shooting on the System and indicate the load rates and the amounts of free memory of the essential parts of the System, like controllers and buses.

5.3.5.3 Extensive diagnostic capability up to module level is required. Each CPU shall incorporate automatic self-diagnostic routines and fault detection facilities, I/O status checks and watchdog timer to determine the health of each module within the System.

5.3.5.4 Diagnostic routines shall automatically identify alarm, isolate and contain faults without compromising system performance.

5.3.5.5 Diagnostic routines shall run without interfering with application program scan or execution time. The System auto-test shall be performed while the System is in normal operation.

5.3.5.6 All critical system diagnostic error or status information shall be communicated to the SCS for alarming and history collection. These diagnostic errors include but are not limited to:

- CPU failures;
- Loss of external data communications;
- Loss of an I/O channel identified to the module;
- Field or chassis power supply failures;
- Cabinet over temperature alarms;
- Failure of fuses;
- Field device open circuit or short circuit.

5.3.5.7 The System shall have an automatic failure register, which can store information about system failures.

5.3.5.8 Detection of a discrepancy or failure of any component shall cause an alarm to be displayed at the System HMI/Engineering Workstation indicating the type of fault that has occurred. Summarized alarm signals shall be transferred by communication link to the SCS.

5.3.5.9 The indications shall be sufficient to locate the fault and define the cause.

5.3.5.10 Clearly written instructions on using each diagnostic tool shall be delivered. Hardware requirements for running each diagnostic tool shall be defined in these operating manuals.

5.3.6 System HMI/engineering workstation

5.3.6.1 The HMI/engineering workstation shall consist of a HMI and an engineering interface for off line/on line system monitoring, configuration, tuning, evaluation and documentation. It shall comprise all needed software, disks, displays, printer, sufficient HW for testing and simulation of design configurations and communication interfaces with the SCS.

5.3.6.2 The engineering workstation functions shall include rapid system data base and configuration reloading complete with back-up media. In case of workstation malfunction it shall be possible to connect a backup workstation (laptop) directly to the System in order to maintain monitoring of the System status.

6 IMPLEMENTATION PLAN

The project execution will consist of the following phases:

6.1 Project development

Project development shall be defined as the period prior to purchase order placement and shall consist of the following steps:

- the Seller shall propose the System as described in this requisition and offer alternatives where applicable.

- the Seller shall deliver preliminary details of the System components, their characteristics, performance and dimensional data, to allow first phase engineering work to be carried out by others.

- the Buyer shall review the Seller's proposal for compliance, technical content, analysis of alternatives, price, delivery and terms.

- the purchase order will be placed with the successful bidder.

6.2 Purchase order

The purchase order phase shall be defined as the period from the Seller's receipt and acceptance of the purchase order for the system. During this phase, there shall be a two way exchange of information between the Buyer and the Seller, to allow timely completion of manufacturing and a timely completion of second phase engineering work by others to support and house the System. First task of the System manufacturer will be the preparation of the system specification (SS), to fully define the functional and technical aspects of the system.

6.3 Project implementation

The Seller's scope of work include the design, procurement/manufacture, programming, testing, packaging, transport, supervision of installation, commissioning, warranty, supply of standard firmware and documentation in accordance with the requirements of the purchase order.

6.4 Delivery schedule

6.4.1 The estimated preliminary milestones (final milestones to be specified in the kick-off meeting later on) for the System delivery of the project are as follows:

Kouvola (GB-5200)	
Action	**Week/Year**
Purchase order placement	22/2017
Kick off meeting	23/2017
Delivery of the Buyer's basic technical data required for development of the System specification	25/2017
Freezing of the Buyer's technical and functional definition data	37/2017
System specification ready	42/2017
Factory acceptance test (FAT)	19/2018
Transportation and installation	20-21/2018
System power up and Site acceptance test (SAT)	22/2018
Compressor station shutdown period	18-31/2018
Commissioning period	32-39/2018
Final acceptance and hand over	48/2018

6.4.2 The Seller shall provide the Buyer with a detail implementation schedule at the beginning of the project reflecting the milestone dates. This shall be based on a PERT, a Critical Path Analysis network diagram or other approved equal, with projections forward from an earliest start date and backwards from latest completion date, to establish available slack on each activity and the critical path through the activity network. An overall network diagram shall have as its activity completion events, the major milestones in the project.

6.4.3 Each activity shall then be broken down to its own detailed network.

6.4.4 Critical inputs to such a network must include delivery lead times on hardware, manpower availability restrictions on parallel activities, receipt of design data from the Buyer as well as progressive Buyer approval.

6.4.5 The schedule shall be approved by the Buyer Project Manager prior to commencement of actual work.

7 PROJECT MANAGEMENT

7.1 Personnel

The Buyer and the Seller shall each appoint a Project Manager for the duration of the project. All communications regarding this project shall be done between these two Project Managers or their designated representatives.

7.2 Progress administration

Following steps shall be taken by the Seller to keep the Buyer informed of the progress of the project.

7.3 Reports

The Seller shall submit a monthly progress report throughout the engineering, manufacturing and testing period. This report should contain at least the following:

1) Current updated project schedule indicating the upcoming major milestones.

2) If slippages occur, an explanation of each slippage and the effect of each slippage on the overall schedule.

3) Personnel changes and current assignments.

4) Problem areas; with notes how these are being resolved and who is working on the problem(s).

5) Major decisions which will affect the project.

6) Major tasks performed in the previous month.

7) Status of the sub-Seller's supplies and services.

7.4 Meetings

Co-ordination and design review meetings shall be held as required by the Buyer to discuss any problem areas identified in the most recent monthly progress report. Approaches to resolutions of the problems shall be reviewed and approved or disapproved by the Buyer or his designated representatives. Agenda for each such meeting shall be prepared in advance by the Buyer.

8 INSPECTION AND TESTING

The System shall be tested in the following three phases:

1) Factory Acceptance Test (FAT)
2) Site Acceptance Test (SAT)
3) Final Acceptance Test

8.1 Factory acceptance test (FAT)

8.1.1 General

8.1.1.1 Before the FAT, the Seller shall ensure that an integration test on the System hardware and basic software has been performed and all the configuration work and wiring are completed and tested by the Seller's engineers according to the Seller's quality control system.

8.1.1.2 The FAT shall be divided for the following parts:
- visual inspection
- system test

8.1.1.3 The FAT shall be executed at the Seller's factory.

8.1.1.4 The responsibilities of making the needed test procedures for each part are defined on the following paragraphs.

8.1.1.5 The definition and requirements for the test result documentation shall be included in the test procedures.

8.1.2 Visual inspection

8.1.2.1 The Buyer will carry out an inspection test including at least the following:
- hardware check based on the Seller's drawings, System specification and the procurement documentation
- visual check of the manufacturing quality

8.1.2.2 The Buyer has responsibility of making the test procedure for this part.

8.1.3 System acceptance test

8.1.3.1 After the visual inspection has been carried out, the System testing shall be continued with the System acceptance test, which includes the testing and acceptance of both hardware and software.

8.1.3.2 Buyer representatives will witness the entire system acceptance test.

8.1.3.3 The Seller shall first demonstrate the general functionality of the System software with standard testing and diagnostic tools.

8.1.3.4 The total functionality of the System shall be tested including application programs, process interface signals, redundancy, system diagnostics, system alarms, operator interface, engineering tools etc.

8.1.3.5 The Seller shall demonstrate the functionality of the System data bus network. All different type of data transmission signals between the System equipment shall be demonstrated.

8.1.3.6 A part of the System test is also the data transmission test between the System and the external Systems. These tests shall be carried out by using the external demo or real systems. All data transmissions between the System and external systems shall be demonstrated.

8.1.3.7 The Seller has responsibility of making the test procedures for this part and shall submit procedures for Buyer approval prior to the test.

8.1.3.8 The Seller is responsible for providin all the required simulating, measuring, monitoring, etc. equipment required in execution of tests.

8.2 Site acceptance test (SAT)

8.2.1 When the FAT has been successfully finished the Seller shall transport the System to the site for installation.

8.2.2 The completion of the installation shall be verified in two phases before connecting the field instruments to the process interface:

8.2.2.1 Phase 1: inspection of the installation:
The whole System shall be ready in its final location with the internal cables and wires connected. The power supply and earth cables shall be connected but the power shall not be switched on yet. The field instruments shall not yet be connected to the System.
The Seller shall check that the System installation, cabling and wiring are according to the Buyer and the Seller documentation.

8.2.2.2 Phase 2: installation acceptance test:
The power supply shall be switched on under supervision of the Buyer and the Seller representatives and the Seller shall carry out the installation acceptance test ensuring that the System performs completely as at the end of the preceding acceptance tests.

8.2.3 The Seller has responsibility of making the test procedure for this part and shall submit procedures for Buyer approval prior to the test.

8.3 Final acceptance test

The final acceptance test is part of the final System acceptance and hand-over procedure. The final acceptance test shall be performed after the successful commissioning of the System and procedure shall be specified in the procurement contract.

9 ENGINEERING DATA, DOCUMENTATION AND DRAWING REQUIREMENTS

The Seller's responsibilities on preparing the specifications, engineering documents and drawings shall be confirmed in negotiations, but at least the following shall apply.

9.1 Document Management System (DMS)

The DMS of the project Engineering Contractor will be used for delivery of the Seller documentation in electrical format throughout the project lifecycle. The required sign-up information and guidelines will be provided to the Seller after the kick-off meeting.

9.2 System specification

9.1.1 The Seller's scope of supply includes preparation of a System Specification.

9.1.2 The System Specification shall be based on the requirements of this specification and other procurement documents. All aspects of the Seller's detail engineering shall be covered, complete with a detailed list and specifications of all software, hardware, wiring, components etc. to be supplied by the Seller.

9.1.3 Buyer's tag numbering for the equipment, instruments, cabinets, etc. shall be used in Seller's application programs and documents.

9.1.4 The System Specification shall be subject to the Buyer's approval.

9.1.5 Before compiling the System Specification, the Seller shall submit a table of contents with a brief outline of each chapter to the Buyer for discussion and approval.

9.1.6 Typical contents of the System Specification are following:

- project specific hardware, cabling, power supply and layout drawings
- general specifications of the System hardware for the project
- functional specifications of the process interface
- functional specifications of the application software
- functional specifications of the user interface
- specifications of the interfaces to external systems

9.3 Loop diagrams and connection drawings

9.2.1 The Seller shall deliver the System cabling, connection and wiring data. The Buyer shall then introduce this data to his cabling and wiring database.

9.2.2 The Buyer and the Seller shall mutually agree of the procedure of producing the required data (formats, contents, time schedule etc.).

9.2.3 The Seller shall be responsible for producing the process connection data and getting the Buyer's acceptance for it before starting to manufacture System cabinets.

9.2.4 The Buyer shall produce the combined loop diagrams and connection drawings based on his own design of field and equipment room connections and the System connection data from the Seller.

9.4 Preliminary data with quotation

9.3.1 Estimate of the total electrical power consumptions and heat dissipation of the System on full load shall be attached to the quotation. All significant parts of the System shall be specified in this estimate.

9.3.2 Dimensions and weights of different parts of the whole System shall be attached to the quotation.

9.3.3 General specifications of the equipment and typical layouts of all cabinets shall be attached to the quotation.

9.3.4 Environmental constraints (temperature, air cleanness, EMC protection etc.) for different parts of the System shall be attached to the quotation.

9.5 Drawings to be delivered after purchase order

The Seller shall produce cabinet drawings typically containing the following:

- Layout drawings of cabinets
- Construction drawings of cabinets
- Assembly drawings and bills of materials
- Distribution diagrams of electrical power
- Detailed schedule of necessary power supplies and design data for them
- Diagrams of the System (internal) connections
- Schedule of System cables including cable numbers, number and size of wires etc.
- Signal address and definition lists for the interfaces with external systems
- Earthing diagrams

9.6 Documentation language

All documentation shall be in Finnish or English language.

9.7 Documentation delivery formats

Data and documentation shall be delivered in agreed original file format, like MS EXCEL, MS WORD and AutoCAD release 2014 or newer, during the design phase or if it will be kept up to date after the project. Maintenance instructions, manuals etc. shall be delivered in HTML or PDF format.

The final delivery of documents shall be agreed at the procurement phase.

10 MAINTENANCE

10.1 Maintenance during warranty

During the warranty the Seller shall provide service personnel on Buyer request for preventive maintenance, fault finding, repair and replacement of all equipment and software supplied. The guarantee period and obligations of the Seller and the Buyer shall be defined in the Procurement Contract.

10.2 Maintenance after warranty

The proposal shall include the details and costs of all standard maintenance agreements available from the Seller which are suitable for the proposed system (hardware and software). Buyer shall be under no obligation to select all or any of the agreements detailed and shall be free to negotiate a unique maintenance agreement with the Seller. The maintenance agreement shall not form part of the contract and the Seller shall therefore propose validity on cost for a period of not less than twelve (12) months from the date of completion of contract.

11 SPARE PARTS

11.1 Spare parts for continuous operation (option)

The Seller shall propose as an option spare parts for continuous operation. One spare part of each type as recommended by the Seller shall be included.
The cost of recommended spares shall be proposed separately part by part.
The list of spare parts shall be approved by the Buyer and shall detail:

a) Identifying model and/or figure number of the main equipment being proposed.

b) Part number and identifying name.

c) Drawing or sketch number.

d) Source of the part. When a part is not manufactured by the Seller, the original Supplier's identification must be given.

e) Price of spare parts when ordered with the main equipment being bid.

f) The lead time for supplying additional spares, shall be proposed (eg. ex-stock, 30 days, subject to quotation, etc).

g) The Seller shall indicate whether complete units or modules are recommended for the peripheral equipment. For all units, spare fuses and consumable items shall be provided as individual packages.

h) All spare parts shall be clearly marked and identified using a concise tag number.

i) Spare parts should be adequately protected and packed to prevent deterioration of components and contact surfaces during prolonged storage.

11.2 Start-up spares

The Seller shall propose start-up spares, as required, in order to avoid the use of any of the spare parts for four years continuous operation (see previous paragraph). The Buyer will not take possession of start-up spares.