



Exploration & Production

GENERAL SPECIFICATION

INSTRUMENTATION

GS INS 110

Instrumentation for package units
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1. Scope

This document covers the works, equipment, services and responsibilities that shall be provided or executed by the package vendor for instrumentation associated with major mechanical or process equipment, systems or units.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems Functional safety – Safety instrumented systems for the process industry sector Programmable controllers- Programming languages Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems
IEC 61511	
IEC 61131-3	
IEC 62061	

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
94/9/EC (ATEX 100 a ⁵ /ATEX 95 ⁶)	European Directive 94/9/EC (23/03/94) on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres European Directive 1999/92/EC (16/12/99) on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres
1999/92/EC (ATEX 118 ⁵ /ATEX 137 ⁶)	

Codes

Reference	Title
Not applicable	

**Other documents**

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS SAF 261	Pressure protection and relief, emergency shutdown and depressurisation
GS SAF 312	Guidelines for selecting and installing fire and gas detection systems
GS SAF 331	Carbon dioxide fire extinguishing system
GS ELE 011	Electrical requirements for packaged units
GS ELE 031	Design of earthing and bonding systems
GS MEC 290	Rotating machines packages
GS INS 101	Instrumentation engineering, supply and construction general requirements
GS INS 102	Instruments identification
GS INS 107	Design and installation of instrumentation links
GS INS 134	Design and supply of Integrated, control and safety system
GS INS 137	Design and supply of on/off valve control panels
GS INS 146	Design of generation and distribution of hydraulic energy
GS INS 150	Design method for system configuration – standard functions
GS INS 900	Instrument hook-up diagrams

3. Definitions and abbreviations

COMPANY	:	TOTAL E&P or any TOTAL E&P subsidiary.
CONTRACTOR	:	any company TOTAL E&P has signed a contract with for the Engineering, Procurement, Construction, Installation of a part of a project.
VENDOR	:	the package vendor sub-contracted by the CONTRACTOR.
Package or package unit	:	prefabricated process or utility self-contained unit, generally able to operate on its own, supplied fully tested and ready for immediate installation.
EWS	:	Engineering WorkStation
FAT	:	Factory Acceptance Test
FGS	:	Fire and Gas System

HMI	:	Human Machine Interface
ICSS	:	Integrated Control and Safety System
PCS	:	Process Control System
PLC	:	Programmable Logic Controller
PSS	:	Process Shutdown System
SAT	:	Site Acceptance Test
SIL	:	Safety Integrity Level
SSS	:	Safety Shutdown System
UCP	:	Unit Control Panel
UPS	:	Uninterruptible Power Supply
VDU	:	Video Display Unit

4. Instrumentation and control philosophy

4.1 Package type

Basically, three types of packages shall be considered:

4.1.1 P1 type packages

The package is delivered with its instruments but without cables and cable ducts.

This type corresponds to packages with few instruments.

These packages are fully controlled by the ICSS.

4.1.2 P2 type packages

The package is equipped with its instruments, cables and cable routings. Instruments are wired and connected up to junction boxes.

This package type is foreseen for packages with many instruments but which control and safety logic is simple and does not exist as standard supply by the VENDOR or for packages considered as integral part of the facility process functions.

These packages are fully controlled by the ICSS. The VENDOR shall provide the CONTRACTOR with a detailed functional analysis to be forwarded to the ICSS contractor. The VENDOR shall be involved in the ICSS FAT to validate the control and safety algorithms.

4.1.3 P3 type packages

They are similar to P2 type packages, but control and shutdown functions are implemented in a dedicated package control system, hereafter called UCP, with associated cabinets as part of the package supply, including all relevant control equipment.

Control logic for a P3 package should not require specific development and package vendors should propose their own standard control algorithms.

The UCP always includes an automated system, performing total or partial control of the package, with its operator interface. Multi-parameters monitoring devices, e.g. vibration

monitoring system, or local hand controlled panels with buttons, switches and lamps, shall not be considered as UCP's.

UCP controlled packages shall generally be supervised and controlled on a higher level by the ICSS. In this case, normal operation shall be from the ICSS ("Remote" mode) but operation in "Local" mode shall be possible at the UCP. Full access to package parameters, shall only be possible from the UCP.

5. General instrumentation principles

5.1 Instruments

Packages are equipped with all their instruments, necessary piping and accessories for process connection, cables and cable routings, according to their classification.

The packages instruments shall be fed from the control system they are connected to.

The instrumentation on packages shall comply with the requirements of [GS INS 101](#).

The packages instrumentation shall be uniform with the project general instrumentation, i.e. same technology, manufacturer and model for the same use.

The instruments shall be installed according to [GS INS 900](#) requirements.

5.2 Area classification/protection

All equipment must comply with the requirements of the specific hazardous area where they are installed

For any installation, [ATEX European Directive](#) shall be followed.

Specifically all field instruments shall be certified category 2 as per the [ATEX European Directive](#).

If some instrument/equipment is not available with such certification, it will be de-energized in case of gas detection.

For category 3 equipment, certification by Manufacturer is not accepted. A "Statement of compliance" shall be delivered by a Notified Body.

Preferred protection methods are Ex d, Ex e, Ex i, Ex m according to IEC standards. Use of protection mode Ex p and Ex n shall be limited to specific applications and submitted to COMPANY approval.

Intrinsically safe circuits shall be installed in accordance with IEC regulations. An IS loop calculation sheet shall be submitted for each installed IS instrument.

5.3 Cabling

For all types of packages, when a special type of cable is required (i.e. fibre optic, non-standard multicore arrangement cables, coaxial, etc) it shall be specified and provided by the VENDOR.

The length from package skid edge to the final connection point shall be calculated by the CONTRACTOR. VENDOR shall verify this length is compatible with the technical requirements.

5.3.1 P1 packages

Junction boxes are not included in the package supply.

Instrument shall be connected to the plant junction boxes as defined by the CONTRACTOR.

5.3.2 P2 packages

Instruments within the package shall be wired and connected up to junction boxes located at the edge of the package skid. All cables shall be run on cable trays.

Junction boxes shall be grouped per signal type on steel frames. Signals segregation shall be as specified in **GS INS 107**.

Junction boxes shall be accessible from the ground level and their arrangement shall allow easy access for installation and wiring of multi-cables.

The cables between the junction boxes and the marshalling cabinet shall be specified, provided and installed by the CONTRACTOR.

5.3.3 P3 packages

In addition to P2 packages requirements, P3 packages comprise the marshalling terminal strips, mirror of the package junction boxes, and the "system" termination boards, mirror of the I/O cards.

Cross-wiring between the marshalling panels and the system termination boards shall be done by the VENDOR.

As an alternative and in order to minimize UCP size and installation works, remote I/O's can be used,.

5.4 Instrument air/gas and hydraulic energy distribution

Whatever the type of energy, the package shall be supplied at a single point. Internal distribution shall be arranged from this delivery point to the different customers.

When instrument gas is used, instruments exhausts shall be collected to a common vent line which shall be different from any process vent line. Hydraulic oil individual exhausts shall also be piped to a common return header. Both gas and hydraulic return headers shall be routed to the skid end, flanged connections to the outside.

5.5 Power supply

5.5.1 P1 and P2 packages

The instrumentation on P1 and P2 packages shall be powered from outside the package.

5.5.2 P3 packages

The CONTRACTOR shall make only the following power supplies available for the UCP:

- 230 VAC from UPS, for PLC, supervisory system and cabinet fans,
- 230 VAC "normal" for cabinet sockets and lighting.

If two incoming cables are needed for the 230 VAC UPS due to availability requirements, the redundancy of the sources shall be handled in the UCP.

The package instruments shall be powered from the UCP. Voltage shall be 24 VDC, floating, provided by the VENDOR. The 24 VDC shall be created from a 230 VAC/24 VDC stabilized power supply part of the UCP.

The VENDOR shall also take care of the generation and distribution of any other voltage rate required for the package or the UCP.

In case the package needs DC voltage referenced to earth, this shall be managed using an isolation transformer./converter

All power sources shall be monitored and alarms shall be transmitted to the ICSS.

5.6 Grounding

Grounding of package instrumentation and associated equipment, field and technical room mounted, shall respect **GS ELE 031**.

5.7 Fire and gas

5.7.1 P2 and P3 packages

When required by project documents, fire and gas detection and associated actions (e.g. fire extinguishing) shall be supplied with the package.

Fire and gas signals can be processed either in the ICSS or in the UCP as defined by the project specifications.

When treated in the UCP, a dedicated logic solver will be used.

Criteria for selecting the fire and gas detectors are given in **GS SAF 312**.

Carbon dioxide flooding systems shall be provided for enclosed mechanical packages. Design shall be as per **GS SAF 331** and project Safety Concept.

6. Unit Control Panels

For P3 packages only.

The package control system shall be PLC based and shall perform the following functions:

- process control,
- parameters monitoring and associated shutdown actions

Additional functions will be also performed as per project specifications, such as :

- supervision and data archiving functions
- printing facilities.

The UCP shall include marshalling and PLC cabinets.

The UCP will generally be located inside a pressurized technical room, thus considered as a safe area. Refer to the project environmental specification for further information about ambient conditions in the technical room.

When installed outside, in a process zone, the UCP shall be certified for the relevant hazardous area. Refer to the project environmental specification and hazardous areas layout drawings for further information.

Depending on the size of the package, the UCP may be composed of several PLC's and display units.

6.1 Programmable Logic Controllers

6.1.1 General

The type (manufacturer and model) of PLC shall be uniform with the other PLC's provided for the project and must be submitted to COMPANY approval by the VENDOR.

The PLC shall be supplied with its own engineering workstation and all tools, hardware (including all necessary cables) and software with required licences, necessary for control, configuration, development and maintenance.

For large packages, when a great number of information must be exchanged, preferred solution is that the package control system is based on the same type of controller as the main ICSS, so as to be considered as a node of the ICSS network. In such cases, VENDOR keeps the technical responsibility of the package control system and of its integration in the ICSS network. Special attention shall be paid to the firmware release for all modules.

6.1.2 SIL requirements

Generally, package control systems comprise only one PLC dealing with all the process control and shut-down functions.

The SIL level, as defined in the [IEC 61508](#), shall be as per [GS SAF 261](#).

This SIL requirement includes the controller, the programming software, the I/O modules and termination boards. The VENDOR shall provide the relevant certificates and associated reports.

Regarding machines, methodology and requirements, to assign the SIL and to enable the appropriate design, will be as per the [IEC 62061](#).

Regarding the application software, the recommendations of [IEC 61511](#) shall be followed.

SIL calculations may be needed for some loops having an impact on the safety of the complete installation. This will be requested by project specifications. Calculations shall be performed by the VENDOR.

6.1.3 Reliability and availability

Special attention shall be paid to the UCP availability in close relationship with importance of the package. A commonly admitted figure for UCP minimum availability is 99.97%, except for packages which have a major role in the control and mitigation of fires and explosions where a minimum availability of 99.99% is required.

Calculations shall include the I/O termination boards.

The power supplies shall be considered for the calculation of the UCP availability.

6.1.4 PLC hardware

6.1.4.1 General

The PLC shall be supplied in a cabinet fully wired and tested. This includes:

- power generation and/or distribution with all protecting devices,
- PLC chassis and modules,
- system interconnecting cables,
- Input/Output mirror termination boards,

- cross-wiring to marshalling terminals,
- cabinet utilities, e.g. lighting, fans, temperature monitoring, heating/drying system when necessary, sockets...

All PLC parts, except CPU's and power supply modules when not redundant, shall be able to be changed live.

Spare capacity shall be provided as follow:

- power supply modules: each module shall not be loaded at more than 80% of total power consumption at in- rush conditions,
- CPU memory: sufficient memory for the start-up configuration plus 20%,
- Input/Output modules: 5% per type of card,
- spare slots in PLC rack: 5% of housing capacity.

Each input/output shall be pre-wired up to I/O mirror terminals.

6.1.4.2 Power supply modules

They shall be redundant and shall generate the PLC internal voltage rates from the 230 VAC UPS power source or from the 230 VAC/24 VDC power supply provided by the VENDOR.

6.1.4.3 Central Processor Units

Memory modules shall be of the non-volatile type.

When RAM are used, they shall be battery saved. Batteries shall not be able to provide spark after the main power has been cut off due to gas detection.

A battery low voltage lamp shall be available on the CPU front face.

The PLC shall be able to issue self-diagnostic alarms like:

- PLC watchdog,
- power supply failure,
- I/O channel failure,
- I/O card failure,
- communication failure,
- ...

Every alarm shall be identified in the package supervisory system; a common alarm shall be sent to the ICSS.

The program scan rate shall not exceed 250 milliseconds at initial configuration.

When redundant CPU's are used, switching from "master" to "slave" shall be without interrupt of control and loss of data.

6.1.4.4 Input/Output modules

Process and Safety I/O's shall be segregated.

Discrete Input and Output cards:

The cards shall have integrated LED's showing card and channels statuses.

Inputs shall be powered from the cards. Galvanic isolation shall be provided per channel.

Outputs shall be volt free contacts; power distribution shall be done at marshalling terminal strips.

Output signals for fire protection devices as well as specific inputs, such as manual activation buttons, shall be line monitored and powered from the card.

Analogue Input and Output cards:

The cards shall have integrated LED's showing card statuses.

Inputs and outputs shall be powered from the cards.

Input cards shall support 0-22 mA signals. .

Output signals shall be 4-20 mA with 750 ohm maximum load.

Analogue cards shall be so designed that a short circuit or high voltage on one channel shall not induce any fault on the other ones.

6.1.4.5 Remote Inputs/Outputs

Remote I/O architecture may be foreseen with modules mounted inside field junction boxes or panels.

The complete assembly shall be suitable for the relevant hazardous area.

The replacement of I/O or power supply modules shall be possible under power.

Diagnostic tools shall be available at the supervisory system.

Access to the parameters of smart transmitters shall still be accessible at the UCP.

6.1.4.6 Communication cards

The cards shall have integrated LED's showing card and communication port statuses.

When redundant communication links with the ICSS are required, redundant communication cards shall be installed.

The communication cables and connectors shall be in the scope of the package VENDOR.

6.1.5 PLC application software

PLC programming shall be carried out using a standard software tool installed on the EWS supplied with the UCP.

The configuration software shall authorize the studying, key-in, modifications, simulation of the application software from the programming PC without connection to the CPU.

It shall also allow on line monitoring of all PLC inputs, outputs and internal variables.

Special care shall be taken for initialization (software, parameters, ...) upon a black start.

The programming languages shall be in accordance with [IEC 61131-3](#), preferably by function blocks and shall be able to support literal comments or descriptions.

Programs will be developed based on standard functions; these as far as possible will follow the principles of **GS INS 150** and the corresponding detailed GS. This specification becomes mandatory when the package control application software is not a VENDOR's standard.

All non Vendor standard functions shall be subject to preliminary acceptance testing.

6.1.5.1 First up alarm

The first event initiating a shutdown shall be determined at the PLC level, displayed on the package HMI, and sent to the ICSS.

Only this alarm shall be sent to the ICSS. The other alarms generated after the first event have to be managed by the PLC. All alarms shall be time stamped.

If several parts of the package are shut down due to several faults, the first up alarm shall be determined for each of them.

For more information about the first up alarm processing, see **GS INS 178**.

6.2 Supervisory system

Packages are normally operated from the ICSS operator stations in the Central Control Room. Nevertheless, as not all data and parameters are transmitted to the ICSS, detail supervision functions shall be available at a display unit located on the UCP itself.

This shall include:

- operating parameters display,
- trending functions,
- equipment statuses display,
- detail alarm processing,
- package safety displays,
- inhibition facilities,
- tuning,
- system maintenance overview,
- local data archiving,
- ...

Failure of the UCP supervisory system shall not affect the package operation. Special attention shall be paid to the self-adjustment of the parameters when restarting the HMI computers.

6.2.1 Hardware

The package supervisory unit shall be installed in the UCP.

It shall include one or more colour VDU, with associated computer, keyboard, storage means, printer, if requested by project specifications, and as many hardwired signal lights and push buttons as necessary. VDU will generally be integrated in the PLC cabinet front door.

A local control panel, with command and display devices hardwired to the UCP, can be installed on the package for local operation, maintenance and emergency.

6.2.2 Software

Displays design shall follow **GS INS 134** and associated standard functions specifications, and, as far as possible, will be similar to the ones used for the ICSS HMI.

Faults diagnosis displays shall be available.

The display refreshment rate shall be 1 second at the maximum.

The display configuration software shall be installed on the EWS laptop.

6.2.3 Data archiving

The package supervisory unit shall be able to keep track of main events and package parameters for a period of one week minimum.

It shall be delivered with a software tool allowing data retrieval, sorting and trends drawing functions, and, if requested, connected to a printer for screen hardcopies and event list printouts.

The software tool shall allow transfer of the data to a standard office application (e.g. Excel).

6.3 Communication with the ICSS

The package VENDOR shall provide the list of recommended data to be reported to the ICSS.

This list shall be commented and completed by the CONTRACTOR and COMPANY based on project Control Philosophy.

6.3.1 Local/Remote management

Packages are normally operated in "Remote" mode from the ICSS workstations but may be run in "Local" mode from the package supervisory system.

In case of digital link communication failure between the ICSS and the UCP, the package shall automatically switch over to "Local" and be kept in operation under the control of its own control system. The management of local /remote mode will be as per the operating philosophy. Special care shall be taken for adjusting the internal logic values and settings after a loss of communication.

Safety functions shall remain active whatever the selected mode.

6.3.2 Process information

UCP will communicate with the PCS via digital links using industrial standard protocols like Ethernet or Modbus.

The communication master shall always be the PCS.

Links shall be redundant for critical packages, which list shall be given in project documents.

When only a small number of data points are involved (less than 20), hardwired links shall be envisaged.

Information critical for the package shall be hardwired (e.g. speed control and feed back for rotating machine).

6.3.3 Safety information

Communication with the SSS and the FGS shall be through hardwired inputs/outputs.

Exchange of interlock signals with the PSS shall always be through hardwired inputs/outputs.

Status information may be sent through the software link with the PCS.

Except for line monitored signals, hardwired signals shall always be treated as failsafe, i.e. trip actions shall be initiated in case of signal loss.

6.4 Cyber security

When the supervisory and/or the engineering workstation are based on a computer, PC type using standard computer operating systems (Windows, etc) and standard network protocol (TCP/IP), the following rules shall apply:

- Engineer / Maintenance modes shall not be accessible to operators. Limitation by key, badges, passwords or any combination is mandatory.
- Access to the operating system commands shall be restricted to Engineer mode only.
- External mass storage devices (CD-ROM, floppy, USB memory, etc) shall not be accessible in normal operation (could be removed from the setup).
- When remote access for maintenance is necessary, a formal request shall be made to COMPANY Remote maintenance through a stand alone modem shall not be permitted. . Specific procedures shall be set up with COMPANY. The connection shall be made through the COMPANY local network using secured procedures with strong authentication (e.g. secure ID). In any case a preliminary evaluation of possible impact on the package's operation resulting of errors or failure of this remote operation shall be made.
- All software original licenses, software disks (including operating system) and tools shall be provided with a detailed procedure including all system parameters for a full re-installation from scratch.
- Before start-up the vendor shall verify and ensure that the UCP including all associated computers and associated configuration and maintenance tools are virus free.
- The VENDOR shall verify and ensure any electronic documentation supplied is virus free.

6.5 Marshalling cabinets

Field multi-cables shall be terminated in the UCP marshalling cabinet. Marshalling terminal strips shall be the mirror of the field junction boxes and all cores, including spare ones, shall be connected to a terminal block.

Details about the design and construction of marshalling cabinets are given in **GS INS 101** and **GS INS 134**.

Special attention shall be paid to the signal segregation. Terminals for signals of different types/systems shall be installed in different sections.

When available space inside the technical room is reduced, combined marshalling/system (PLC) cabinets shall be studied and submitted to COMPANY for approval.

7. Package VENDOR scope of work

7.1 General

Appendix 1 and Appendix 2 depict the typical scope of work for supply and engineering related to control and instrumentation included within a package.

The tables are typical only and may be modified through particular requirements as stated in the project specifications. They will be reviewed and discussed in order to adjust the VENDOR scope of supply.

7.2 Engineering and design

In order to standardize the documents presentation, the documentation produced by the package VENDOR shall be implemented using forms designed and provided to the VENDOR by the CONTRACTOR.

The complete engineering and detailed design for the instrumentation, including the package control system shall be performed by the VENDOR in accordance with Appendix 2.

All corrections or modifications requested by the CONTRACTOR/COMPANY regarding the package supply and agreed by the VENDOR will be performed under his responsibility to ensure that the modified unit is operable and safe regarding process and safety.

The part of the instrument database related to the package shall be included into the overall project database.

The CONTRACTOR shall provide the VENDOR with the range of numbers to be used for numbering of the instruments. Double tagging, i.e. VENDOR's tags different from CONTRACTOR's tags, is not allowed.

Detailed functional analysis description requested in Table 2.3 shall include as a minimum:

- all hardware and software components used for the instrumentation of the unit,
- the interface principles with the other systems,
- description of all logic sequences like start-up, normal stops, purging, etc,
- description of all emergency shutdown sequences and interlocks,
- normal operating description,
- data exchange tables,
- workstation typical mimic displays,
- ...

Regarding the ICSS, the package VENDOR scope of work shall include the definition of both process control and safety logic requirements to be included in the ICSS as well as the functions to be performed by the HMI to monitor and operate the package. The ICSS CONTRACTOR's scope of work shall include the engineering and implementation of the control logic and operating displays.

7.3 Supply

The VENDOR shall provide all instruments, control equipment and accessories (impulse lines,

labels, cables glands, cables from instruments to the skid mounted junction boxes UCP, etc).

The VENDOR shall also provide all package components necessary to a good working of the package and that are not installed on the skid (surge valves for compressors, UCP, programming tools, HART communicator, etc).

All software original licenses, software disks (including operating system) and tools shall be provided with a detailed procedure including all system parameters for a full re-installation from scratch

If the package control has to be implemented in the ICSS, all necessary information for the configuration, displays, etc, shall be provided by the VENDOR.

7.4 Services

Services to be provided by the package VENDOR shall include the co-ordination, assistance to the CONTRACTOR and ICSS contractor during the studies, FAT, SAT, start-up, and performance tests stages.

7.4.1 Factory Acceptance Test

The package, including the UCP if any, shall be fully commissioned and tested in the VENDOR factory prior to delivery.

FAT procedures shall be prepared by the VENDOR and submitted to CONTRACTOR and COMPANY agreements.

Prior to the FAT of the UCP, the communication link with the ICSS, the ICSS displays related to the package and the interlocks between the ICSS and the UCP shall be tested. The ICSS contractor shall attend this part of the FAT and shall supply the required interface means with the UCP as well as the minimum equipment to simulate operation and monitoring of the package from the ICSS HMI.

7.4.2 Site activities

The VENDOR shall provide assistance for the Site Acceptance Test, pre-commissioning and commissioning operations, and start-up activities.

The SAT procedures shall be prepared by the VENDOR and submitted to CONTRACTOR and COMPANY agreements.

Appendix 1 Typical scope of work for package instrumentation and control – Part 1: Supply

- To be reviewed as per particular project requirements -

LEGEND:

V = PACKAGE VENDOR

C = CONTRACTOR

V/C = VENDOR or CONTRACTOR defined by project specifications

Table 1.1 SUPPLY		SCOPE OF WORK		
DESIGNATION	PACKAGE TYPE	DESIGN	SUPPLY	INSTALL.
Field instrumentation	P1, P2, P3	V	V	V
Emergency pushbuttons on machine, within skid area	P1, P2, P3	V	V	V
Fire & Gas detection	P1	C	C	C
Fire & Gas detection	P2, P3	V	V/C	V/C
Fire call points within skid limit	P1	C	C	C
Fire call points within skid limit	P2, P3	V	V/C	V/C
Fire & Gas visual and audible alarm devices in skid area	P1	C	C	C
Fire & Gas visual and audible alarm devices in skid area	P2, P3	V	V/C	V/C
Fire fighting within skid limit	P1, P2	C	C	C
Fire fighting within skid limit	P3	V	V/C	V/C
Cables trays within skid for control & instrumentation and instrument power supply	P2, P3	V	V	V
Junction boxes at skid edges	P2, P3	V	V	V
Local control panel on machine/skid	P2, P3	V	V	V
Electrical distribution to instrument and control devices within skid	P2, P3	V	V	V
Special cables (metering, serial, F.O., etc) within skid up to technical room	P1, P2, P3	V	V	V
Cables from skid instrumentation to plant JB's	P1	C	C	C
Cables from instrumentation to skid JB or local panel and associated cables glands	P2, P3	V	V	V
Cables from skid JB/panel or instrumentation to technical room and associated cables glands	P2, P3	C	C	C
Access means to instrumentation: gangways, ladders	P1, P2, P3	V	V	V
Instrument air/gas or hydraulic energy distribution network and isolation valves within skid	P1, P2, P3	V	V	V



Table 1.1 SUPPLY		SCOPE OF WORK		
DESIGNATION	PACKAGE TYPE	DESIGN	SUPPLY	INSTALL.
UCP	P3	V	V	C
Maintenance/configuration/test tools in Instrument Technical Room (1)	P3	V	V	V
Human–Machine Interface facilities within UCP	P3	V	V	V
PLC and HMI programs sources and property (1)	P3	V	V	V
Spare parts for pre-commissioning, commissioning and start-up	P1, P2, P3	V	V	

(1) After the SAT, the property of all software shall be transferred to the COMPANY.

Appendix 2 Typical scope of work for package instrumentation and control – Part 2: Engineering

- To be reviewed as per particular project requirements -

LEGEND:

V = PACKAGE VENDOR
C = CONTRACTOR

Table 2.1 GENERAL		SCOPE OF WORK	
DESIGNATION	PACKAGE TYPE	V	C
Engineering rules and tools (procedures, typical drawings, forms, database format, documents numbering, etc)	P1, P2, P3	Implements	Produces & Updates
Instrumentation general specification	P1, P2, P3	Implements	Produces & Updates
Numbering rules for equipment	P1, P2, P3	Implements	Produces & Updates
Tagging rules for instruments	P1, P2, P3	Implements	Produces & Updates
Tagging rules for wiring	P2, P3	Implements	Produces & Updates
P&ID's	P2, P3	Produces & Updates	Comments
Equipment list	P1, P2, P3	Produces & Updates	Comments
Package operating, control and safety philosophy	P2, P3	Produces & Updates	Comments
Safety logic diagrams / cause & effect matrixes	P2, P3	Produces & Updates	Comments
Utilities consumption (Inst. air/gas, AC/DC power...)	P1, P2, P3	Produces & Updates	Comments

Table 2.2 INSTRUMENTS		SCOPE OF WORK	
DESIGNATION	PACKAGE TYPE	V	V
Package layout drawing with instrumentation, JB's, cable routing, F&G, etc	P1, P2, P3	Produces & Updates	Comments
Instrument index	P1, P2, P3	Produces & Updates	Comments
Instrument database (using Instrument database software tool)	P1, P2, P3	Comments	Produces & Updates
Instrument data sheets	P1, P2, P3	Produces & Updates	Comments
Calculation notes (PSV's, control valves, flow-meters, level sketches...)	P1, P2, P3	Produces & Updates	Comments
Intrinsic Safety loops calculation sheets	P2, P3	Produces & Updates	Comments
Instruments hook-up typical drawings	P1, P2, P3	Implements	Produces & Updates
Instruments hook-up drawings (itemized)	P1, P2, P3	Produces & Updates	Comments
Junction Boxes connection diagrams (using Instrument database software tool)	P1	Comments	Produces & Updates
Junction Boxes connection diagrams (using Instrument database software tool)	P2, P3	Initiates & Comments	Produces & Updates
Marshalling terminal strips connection diagrams (using Instrument database software tool)	P3	Initiates & Comments	Produces & Updates
Card image termination boards connection diagrams (using Instrument database software tool)	P3	Initiates & Comments	Produces & Updates
Instrument cables index (individual and multi-cables) (using Instrument database software tool)	P2, P3	Initiates & Comments	Produces & Updates
Instrument loop diagrams (using Instrument database software tool)	P2, P3	Initiates & Comments	Produces & Updates
Instrument loop diagrams (using CAD software)	P2, P3	Initiates & Comments	Produces & Updates
Installation manual (for installation by others)	P1, P2, P3	Produces & Updates	Comments
Material Take-Off (MTO) with manufacturers references	P1, P2, P3	Produces & Updates	Comments

Table 2.3 UCP		SCOPE OF WORK	
DESIGNATION	PACKAGE TYPE	V	C
Package control system architecture diagram	P3	Produces & Updates	Comments
UCP detailed functional analysis	P3	Produces & Updates	Comments
UCP / ICSS interface requirements (operating modes, interlocks logic diagrams, exchanged data, operating displays, alarm...)	P3	Initiates & Comments	Produces & Updates
SIL and availability calculations	P3	Produces & Updates	Comments
UCP Inputs/Outputs list (using Instrument database software tool)	P3	Initiates & Comments	Produces & Updates
UCP programming: rules, typical function blocks	P3	Produces & Updates	Comments
PLC program with detailed documentation	P3	Produces & Updates	Comments
UCP / ICSS digital link signals index (with memory allocation)	P3	Produces & Updates	Produces & Updates
ICSS HMI mimic displays detailed design	P3	Comments	Produces & Updates
UCP HMI display design: rules, standard functions, typical blocks...	P3	Produces & Updates	Comments
UCP HMI mimic displays detailed design	P3	Produces & Updates	Comments
UCP – Typical interconnection diagram	P3	Produces & Updates	Comments
UCP – Electrical distribution diagram	P3	Produces & Updates	Comments
UCP – Grounding diagram	P3	Produces & Updates	Comments
UCP – Cabinets detailed layout drawings	P3	Produces & Updates	Comments
UCP – Internal wiring diagrams	P3	Produces & Updates	Comments
UCP – Detailed part list	P3	Produces & Updates	Comments

Table 2.4 FINAL DOCUMENTS		SCOPE OF WORK	
DESIGNATION	PACKAGE TYPE	V	C
Control/instruments/equipment vendor documentation.	P1, P2, P3	Produces & Updates	Comments
Operating manuals	P1, P2, P3	Produces & Updates	Comments
Maintenance manuals	P1, P2, P3	Produces & Updates	Comments
Instrument calibration reports	P1, P2, P3	Produces & Updates	Comments
Test reports	P1, P2, P3	Produces & Updates	Comments
FAT procedures	P2, P3	Produces & Updates	Comments
FAT reports	P2, P3	Produces & Updates	Comments
Performance tests procedure	P2, P3	Produces & Updates	Comments
Performance tests performing and report	P2, P3	Produces & Updates	Comments
SAT procedures	P2, P3	Produces & Updates	Comments
Electrical / ATEX certificates	P1, P2, P3	Produces & Updates	Comments
Material / painting certificates	P1, P2, P3	Produces & Updates	Comments
Certification dossier for local authorities	P1, P2, P3	Produces & Updates	Comments