



Exploration & Production

GENERAL SPECIFICATION

GS EXP 103

Precommissioning and commissioning technical preparation

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1. Scope

The present specification provides information, procedures, and support documents, required to carry-out the technical preparation of the Precommissioning and of the Commissioning of a new plant in a planned and efficient manner.

The preparation tasks are divided into two groups:

- Those, related to Precommissioning, Commissioning, or both, which are carried-out during the Basic and Detailed Engineering phase of the project by the Engineering CONTRACTOR of the facilities
- Those, purely related to Commissioning, which are performed before the actual start on site of the Commissioning execution activities by the commissioning Team's senior staff.

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
Not applicable	

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EXP 101	Precommissioning and Commissioning Specifications
GS EXP 105	Precommissioning Execution
GS EXP 107	Commissioning Execution
GS EXP 501	Equipment & piping numbering

3. Preamble

3.1 Specifications

The Precommissioning and Commissioning activities are relatively sophisticated operations, but of relatively short duration. It is then impossible to afford in these areas a learning curve that would be disastrous for such short works.

COMPANY policy is therefore to thoroughly prepare the Precommissioning and Commissioning execution activities long before they actually start on site, in accordance with a standard methodology.

This specification shall be read in conjunction with the following documents:

- **GS EXP 101** "Precommissioning and Commissioning Specification", which gives the definitions, rationale and key principles of Precommissioning and Commissioning, thus allowing an easier approach to anyone having to prepare or execute this kind of activities
- **GS EXP 105** "Precommissioning Execution", which covers the Precommissioning execution, and all Precommissioning preparation tasks under the Construction CONTRACTOR responsibility
- **GS EXP 107** "Commissioning Execution", which defines all tasks related to the actual performing on site of the Commissioning.

3.2 Wording

The present specification is drafted in such a way that it can be implemented in various contractual contexts, particularly in either of the following cases:

- The performance of the Commissioning is the responsibility of a CONTRACTOR, whose scope of work includes a part, or the totality, of the Commissioning activities of a project.
- The performance of the Commissioning is the responsibility of a Total entity, part of a project organisation or subsidiary.

The present specification therefore defines which activities must be performed by the Commissioning Team, without presupposing which party will be in charge: it is the contract, or a COMPANY internal arrangement, that will define case by case, which equipment, part of the plant, or plant are to be commissioned by which party.

Consequently, the following wording was used in the present document:

- "Project Team" designates the organisation set up by the COMPANY to manage all phases of the project "Engineer", or "Engineering CONTRACTOR" designates the organisation in charge of the detailed engineering of the facilities
- "Construction CONTRACTOR" designates the organisation in charge of the fabrication and Precommissioning of the facilities
- "Commissioning", "Commissioning Team", and "Commissioning personnel" designate any organisation and its members assigned, by contract or by a COMPANY internal arrangement, to carry out Commissioning activities of equipment, part of plant, or plant
- "COMPANY/Operator" designates the client for whom the Commissioning performs Commissioning activities, or the entity of whom Commissioning works on behalf, i.e.:
 - COMPANY, when the Commissioning is a CONTRACTOR
 - Operator, when the Commissioning is part of COMPANY.

4. Safety

For works due to take place in Construction yard, the Permit To Work system will be run by the yard Authorities if approved by COMPANY.

If not, Commissioning shall prepare and submit to COMPANY for approval, two months before the start of commissioning works, a Permit to Work procedure on the basis of "COMPANY Rule" related to the Permit To Work System. This procedure shall be applied in the yard by all personnel and controlled by the Commissioning Safety Officer, from the time the energisation of the facilities begins.

For works on COMPANY site, the Commissioning shall adhere to the Operator Permit to Work procedure.

In all cases, an internal Commissioning procedure shall be issued to define Issuing Authorities, and all other aspects related to the proper application within the Commissioning of the Permit to Work system.

In countries where access to the site is subject to having attended a specific safety training, the Commissioning shall prepare and organise such training for all Commissioning personnel, with the assistance of the Operator safety department.

The Commissioning shall also prepare a specific Safety Induction Course so that all personnel in the Commissioning Team are provided with the basic information and knowledge of the Commissioning safety rules prior to starting work on the site.

5. Common Technical preparation

5.1 Introduction

The present chapter covers the part of the Precommissioning and Commissioning technical preparation under the responsibility of the Engineering CONTRACTOR. This preparation work mainly consists of the following, but not limited to:

- Define list of systems and subsystems according to the "System Approach" methodology (refer to **GS EXP 101**)
- Define plant start-up sequence
- Issue marked-up PID's and OLD's showing limits of subsystems
- Compile equipment lists by subsystem
- Define all tasks related to the partition of the plant into systems and subsystems

Although this activity is also relevant for the organisation of precommissioning, it is essentially driven by start-up and commissioning considerations. However, the definition of systems and subsystems is part of the Engineering CONTRACTOR scope of work, as it shall take place during the Detailed Engineering phase of the project, i.e. at a time when the Commissioning senior staff is usually not yet mobilised.

If this partition was already initiated at Basic Engineering stage then the Engineering CONTRACTOR shall review it with the latest information to ensure that the whole plant is covered.

Additional tasks shall also be considered, according to the list of procedures/documents, as attached annex 5 & 6.

5.2 Systems and subsystems

5.2.1 The "Systems Approach"

The overall planning of the project shall be optimised if the Precommissioning and Commissioning activities are organised, not as whole plant activities, but by sections of the plant, called "systems" and "subsystems" (refer to **GS EXP 101**).

It is therefore required, as part of the Precommissioning and Commissioning preparation phase:

- To split the installation into systems and subsystems
- To define exactly the limits and contents of each system and subsystem.

These activities are an Engineering CONTRACTOR responsibility.

5.2.2 Partition of the installation into systems and subsystems

A system is a major subdivision of an installation, being either process or utility, that performs a major operational function of the plant. The system includes all the various equipment that allows it to operate. The division into systems generally corresponds to the various fluids or services prevailing.

A subsystem is a further subdivision of a system, that performs a given operational function, with no or little interference from the other subsystems for the Commissioning execution.

The Precommissioning and Commissioning operations, such as defined in **GS EXP 105** and **GS EXP 107**, shall be prepared, carried-out, and reported by **subsystem**.

Unless the partition of the installation into systems and subsystems has been carried-out during the plant Basic Engineering phase and included in the contractual documentation, the Engineering CONTRACTOR shall establish and submit to COMPANY for approval the list of systems and subsystems constituting the plant.

This partition shall be performed in accordance with the following rules:

- **The list of systems and subsystems shall be submitted to COMPANY for approval during the basic Engineering phase**
- The systems and subsystems is numbered with consistency with a functional breakdown and the equipment/tagging numbering.

For this reason, in order to be consistent with the **GS EXP 501** "Equipment & piping numbering", a sub-system should be identified by five digit number as follows: **IS-Znn**, where:

- "I" (number or letter), identifying the installation, physically independent, managed through a project or sub-project (Wellhead PF 1...2, Production PF, Off-site, PLANT, part of a PLANT, etc.)
- "S", from 0 to 9, identifies the type of system as per defined in **GS EXP 501**
- "Z", from 0 to 9, identifies the type of subsystem as per defined in **GS EXP 501**
- "nn", from 00 to 99, identifies the subsystem number, when several sub-systems for the same type of sub-system "Z".

For summary, the relationship between **GS EXP 501** and OPERCOM/ICAPS is as follows:

Used if several installations	According to GS EXP 501 definition			Sequential numbering (00 if only 1 subsystem for the sub-system type "SZ")	
I	S	Z	n	n	
System number for OPERCOM/ICAPS breakdown			Sub-system number for OPERCOM/ICAPS breakdown		

The Commissioning system number is a combination of Installation number and "**GS EXP 501**" System.

The Commissioning sub-system number is a combination of "**GS EXP 501**" subsystem and a sequential number if several systems must be created.

Whenever a system is not divided into subsystems, it will nevertheless be identified, and processed, as a subsystem.

The subsystem is defined so as to be as independent as possible, not too small, yet of manageable size (a maximum of 200 should be applied).

Typical breakdowns of PLANT into systems and subsystems are found for reference in appendix 1 of this specification.

The list of subsystems shall be established so that it is compatible with the requirements of the plant initial start-up sequence: equipment, or parts of the plant, started-up at different steps of the start-up sequence will not belong to the same subsystem.

5.2.3 Subsystems definition

The Engineering CONTRACTOR shall define the limits and contents of each subsystem by marking-up on Engineering and VENDORS PID's and One Line Diagrams all lines, vessels, mechanical equipment, electrical feeders, busbars, belonging to that subsystem.

A system of colour coding the various subsystems shall be used to differentiate several subsystems appearing on the same document, PID or One Line Diagram.

The Engineering CONTRACTOR shall issue for approval a set of marked-up drawings showing the subsystems definition not later than one month after the systems and subsystems list has been approved by COMPANY, or not later than five months after the beginning of the Detailed Engineering phase, if the subsystems list was part of the contractual documentation.

The subsystems definition will not require up-dating on every later issue of PID's and One Line Diagrams, unless addition of major lines or equipment has taken place. However, a revision of the subsystems marked-up drawings will be issued on "Approved for construction" documents and on the best available revision at start of physical commissioning works.

The subsystems definition is to be carried-out in accordance with delimitation rules given in appendix 2 of this specification.

5.3 Subsystems equipment lists

The Engineering CONTRACTOR should produce computerised subsystem Equipment Lists with all necessary coding and technical information, i.e.:

- Equipment list
- Lines list
- Instrument list
- Cable schedule.

Those computerised list shall be issued to COMPANY for approval, not later than four months before the start of physical precommissioning works.

5.4 Precommissioning & Commissioning schedule & Start-Up sequence

The Engineering CONTRACTOR shall establish and submit to COMPANY for approval a detailed subsystems initial start-up sequence in accordance with the main Start-up milestones or guidelines issued by the COMPANY.

This activity shall be led in parallel with the partition of the installation into subsystems, as the partition shall be devised so that it matches the requirements of the start-up sequence: equipment due to start at different points in time of the initial start-up sequence (typical: duty and stand-by equipment) must not be part of the same subsystem (refer to paragraph 5.2).

Precommissioning and Commissioning schedule shall be carried out in detail (resource/duration to be evaluated) and shall be checked with Construction. The CONTRACTOR shall demonstrate that the Construction schedule and plan will deliver in due time required systems.

This check shall be carried out at early stage of the detailed Engineering, not later than four months after beginning of the Detailed Engineering.

5.5 Preparation planning and progress

The CONTRACTOR shall manage the preparation of the Precommissioning and the Commissioning like a project itself with identifying:

- Milestone for procedures/documents deliverables in accordance with contractual milestones
- Progress indicators in order to control and follow up the preparation phase.
- Manpower and resource mobilisation

The preparation schedule/definition shall be issued not later than three months after beginning of Detailed Engineering.

5.6 Co-ordination procedures

The Precommissioning and Commissioning co-ordination procedures consist of defining organisation principle, like witnessing, interim certificate signature, Hand over, reports.

The necessary co-ordination procedures shall be drafted not later 6 months after beginning of the detailed Engineering for approval by COMPANY.

If not already defined in the contract, the Engineering CONTRACTOR shall issue for approval by COMPANY the following procedures and support documents, which cover the various interfaces between the Commissioning and the other parties, COMPANY and Construction CONTRACTOR:

- Precommissioning procedures:
 - **Ready for commissioning (two months before the start of Precommissioning)**
 - **Precommissioning witnessing (two months before the start of precommissioning).**
 - **Punch list clearing (two months before the start of Precommissioning)**
- Commissioning procedures:
 - **Commissioning reporting (two months before the start of Commissioning)**
 - **Modifications requests (two months before the start of Commissioning)**
 - **Ready for Start-up (two months before the start of commissioning)**
 - **Co-ordination meetings (two months before the start of commissioning).**

6. Precommissioning Technical preparation

6.1 Introduction

The present chapter covers the Precommissioning technical preparation tasks. This preparation includes not only the long and mid-term activities such as the definition of the scope of work, the planning of execution, the issuing of procedures and contracts, but also the thorough review

and addressing of all required Precommissioning support, e.g. co-ordination with others parties, gathering of documentation, etc.

Additional preparation scope of work in order to carry out the Precommissioning execution (planning, resource, logistic, spares, internal organisation, material, etc.) and the relevant procedures to be draw up shall also be considered. Typical list is appended annexe 5.

6.2 Status index

6.2.1 Objectives

The computerised Precommissioning Status Index, basic management tool of the Precommissioning preparation and execution, is the summary of the Precommissioning scope of work.

It is used at preparation stage to quantify the Precommissioning workload, hence it **allows manpower and planning estimates**. The Status Index is also the reference document used by the Construction CONTRACTOR to prepare all precommissioning support documents, **Check-Lists and Test Sheets**.

During the execution phase, the Status Index constitutes the basic progress monitoring tool and the key handover document to the Commissioning Team.

The realisation of the Precommissioning Status Index is an Engineering CONTRACTOR responsibility.

6.2.2 Definition

The Precommissioning Status Index is essentially the listing of every item of equipment that will be subject to one or several precommissioning operations, i.e. checks or tests, as defined in **GS EXP 105**.

The Status Index, arranged by subsystem, discipline, and type of item of equipment, indicates for each item of equipment the corresponding Precommissioning tasks it will be subject to, by giving the reference number of the corresponding task support document, i.e. check-list number and, when applicable, test sheet number.

6.2.3 Preparation

From the subsystems equipment lists, the Engineering CONTRACTOR shall prepare the computerised Precommissioning Status Index, in accordance with the technical specification given in appendix 3 of the present specification.

The Engineering CONTRACTOR shall implement the Status index on ICAPS software, and shall input all necessary data, whether they are Engineering data or VENDORS packages data.

The Status Index reports shall be issued for COMPANY approval not later than three months before the start of physical Precommissioning works (see appendix 3).

After COMPANY approval, the Status Index is issued, depending contractual arrangements, by the COMPANY or by the Engineering CONTRACTOR to the Construction CONTRACTOR or whichever party is responsible for the Precommissioning works.

The Engineering CONTRACTOR shall review the set of Precommissioning Master Forms (conformity checks and static tests) available in **GS EXP 105**, and may adapt or amend these Master Forms as required by the distinctive features of the project. These modifications of existing forms and related procedures shall be submitted to COMPANY approval.

The Engineering CONTRACTOR may develop new forms and related procedures whenever relevant documents are not available in **GS EXP 105**. These new forms and procedures shall be submitted to COMPANY approval and forwarded to TDO/EXP.

The set of the typical check lists and test sheets shall be then prepared and issued for COMPANY approval not later than six months before the start of physical Precommissioning work.

The set of check sheets and test sheets fill out according to the Status Index shall be printed out and issued for COMPANY approval not later than two months before the start of physical precommissioning work.

6.3 Planning, manpower and progress

6.3.1 Precommissioning planning

The Engineering CONTRACTOR shall perform the following Precommissioning planning activities, but not limited to :

- Estimation of manpower and duration of the Precommissioning activities of each Subsystem
- Preparation of the Precommissioning bar chart planning level 1, i.e. the schedule by Subsystem of the Precommissioning execution activities, which shows the activities duration of each Subsystem and the points in time at which they will start and finish

The inputs to the Precommissioning planning level 1 is :

- The best adapted logical precommissioning sequence
- The Subsystems Precommissioning duration estimates
- The Commissioning planning level 1, or, if not available, the subsystems Commissioning sequence, both to be issued by the Commissioning Team, unless the sequence is part of the contractual documentation.

The Precommissioning planning shall be devised so that it does not restrain the Commissioning activities: the Commissioning planning level 1, or, if not available, the subsystems Commissioning sequence, issued by the Commissioning Team (or available in the contractual documentation) shall be the priority input to determine the Precommissioning planning.

The above Precommissioning planning activities performed by the Engineering CONTRACTOR shall be completed and the corresponding documents issued for COMPANY approval, not later than four months before the actual start on site of the Precommissioning activities.

6.3.2 Manpower

The Engineering CONTRACTOR shall perform, and issue for COMPANY approval not later than four months before the actual start on site of the Precommissioning activities:

- The evaluation of the overall Precommissioning man-hours, duration, and execution histogram by discipline
- The preparation of the field Precommissioning organisation and deployment schedule.

6.3.3 Progress

The Engineering CONTRACTOR shall issue for COMPANY approval the detailed Precommissioning progress calculation procedure, three months before the start of Precommissioning, according to the principles defined in GS EXP 101.

6.4 VENDORS

The Engineering CONTRACTOR shall identify the need for VENDORS special equipment and special tools required for the execution of the Precommissioning and Commissioning activities.

The list shall be submitted to COMPANY approval then processed in accordance with contractual arrangements.

The Engineering CONTRACTOR shall identify the need for VENDORS and field equipment spares required for the execution of the Precommissioning and Commissioning activities.

The lists shall be submitted to COMPANY approval then processed in accordance with contractual arrangements.

7. Commissioning technical preparation

7.1 Introduction

The present chapter covers the Commissioning technical preparation tasks. This preparation includes not only the long and mid-term activities such as the definition of the scope of work, the planning of execution, the issuing of procedures and contracts, but also the thorough review and addressing of all required Commissioning support, e.g. co-ordination with others parties, gathering of documentation, etc.

This additional preparation scope of work in order to carry out the Commissioning execution (planning, resource, logistic, spares, internal organisation, material, etc.) and the relevant procedures to be draw up shall also be considered. Typical list is appended annexe 6.

A part of these activities shall be performed in parallel with the preparation of Precommissioning activities, with respect of the Precommissioning preparation milestone.

7.2 Basic functions

7.2.1 Definition

An item or group of items of equipment that performs an elementary function of the PLANT is named a Basic Function.

It is the smallest equipment which can be subject to a Commissioning operation: switchboards, transformers, electrical heaters, process control loops, emergency shutdown valves, loudspeakers loops, pumps, vessels, etc., are typical types of Basic Functions.

Every instrument, electrical, and telecommunications Basic Function of the plant is subject to a functional test (refer to paragraph 7.4).

The identification of all instrument, electrical, and telecommunications Basic Functions constituting the plant is a **Commissioning responsibility**.

7.2.2 Preparation

The Commissioning shall establish the list of all instrument, electrical, and telecommunications Basic Functions of the plant, be they part of packages or of field equipment.

This list shall be arranged by subsystem and by discipline, and established in accordance with the coding, description, and definition drawings of all possible types of Basic Functions given in specification **GS EXP 107**, chapter 6, Functional tests.

7.3 Technical data base

7.3.1 Definition

The Commissioning Technical Data Base is the computerised exhaustive description of the physical contents of all subsystems.

All Basic Functions, in particular, grouped by subsystem, discipline, and type of Basic Function, are listed in the Technical Data Base, which indicates, for each Basic Function, the type of required commissioning operation, by reference to the task report form number of this operation. The Technical Data Base also includes other relevant information (set points, drawings no., etc.).

The completion date of each activity is also recorded, so that it is a working document used to follow up the Commissioning progress.

The preparation of the computerised Technical Data Base, main tool of the Commissioning preparation and of the follow-up of its execution, is a Commissioning Team responsibility.

7.3.2 Preparation

The Commissioning shall prepare the computerised Technical Data Base, in accordance with the technical specification given in appendix 4 of the present document.

The Commissioning shall implement the Technical Data Base on ICAPS software, and shall input all necessary data, whether they are Engineering data or VENDORS packages data.

The input data to the Technical Data Base will be found in the following documents, but not limited to :

- List of systems/subsystems
- Subsystems equipment lists
- Subsystems marked-up drawings (PID's and one line diagrams)
- Instrument and electrical troubleshooting diagrams
- Precommissioning status index
- Engineering registers.

The preparation of the Technical Data Base shall be completed not later than three months prior to the start on site of physical commissioning works.

The Technical Data Base reports shall be issued to COMPANY for approval not later than three months before the start of physical commissioning works (see appendix 4).

The Commissioning Team shall afterwards keep the Data Base permanently up-dated throughout the Commissioning phase in accordance with later issues of Engineering Drawings and all modifications carried out on site.

7.4 Functional tests

7.4.1 Definition

These are the live tests performed on each **instrument, telecommunications, and electrical**, elementary function.

For commodity, an item or group of items of equipment that performs an elementary function of the plant is named a **Basic Function**. It is the smallest equipment which can be subject to a commissioning operation. **GS EXP 107** lists and defines the main types of Basic Functions of a plant: switchboards, transformers, heaters, process control loops, ESV's, loudspeaker loops, pumps, vessels, etc.

The functional tests are carried out in accordance with technical specifications, the results being recorded on **Functional Test Sheets**.

One Test Sheet form is available in **GS EXP 107** for every type of functional test listed in the Classification of activities, one form being filled in for each test performed.

There are no spot or random functional tests: every instrument, electrical, and telecommunication Basic Function of the plant is subject to one functional test, **be it part of field or package equipment**.

7.4.2 Preparation

The Commissioning shall review the set of electrical, instrument, and telecommunications Functional Test Sheet Master Forms available in specification **GS EXP 107**, chapter 6, and may adapt or amend these Master Forms as required by the distinctive features of the project.

These modifications of existing forms and procedures shall be submitted to COMPANY approval.

The Commissioning may develop new Test Sheets and test procedures whenever relevant documents are not available in **GS EXP 107**. These new forms and procedures shall be submitted to COMPANY's approval and forwarded to TDO/EXP.

The review of the functional test sheets (typical) shall be then issued to COMPANY for approval not later than six months before the start of physical commissioning works.

The Commissioning shall prepare the Functional Test Sheets of all instrument, electrical, and telecommunications Basic Functions by filling in the heading of each form, which includes information such as:

- Basic Function number, description, location
- Subsystem number
- Drawing number
- Form revision
- Etc.

The Functional Test Sheets are then be grouped by discipline and subsystem.

The Functional test sheets shall be issued not later than two months before the start of physical commissioning works.

7.5 Pre-Start-up Activities (PSA)

7.5.1 Definition

The Pre-Start-up Activities are all specific Commissioning activities required to prepare the oil-in or gas-in:

- Leak test
- Drying-out
- Inerting
- Loading of chemicals
- Chemical cleaning.

The scope of work and procedures guidelines for each of the above activities are available in specification **GS EXP 107**, chapter 7.

7.5.2 It may happen that some of these activities are not related to a single system or subsystem (the leak test, for instance, is carried out by level of pressure rather than by subsystem). A Task report may therefore be created to report the results, which are then referred to in all concerned subsystems commissioning dossiers. Preparation

The Commissioning shall establish the list of Pre-Start-up Activities of each subsystem.

The Commissioning shall develop detailed procedures and support documents as required for the performance of the pre-start-up activities, in accordance with the guidelines disclosed in **GS EXP 107**. **These procedures and documents shall be submitted to COMPANY for approval, not later than two months prior to the beginning of commissioning physical works on site.**

7.6 Operational tests

7.6.1 Definition

Once all Basic Functions have been functionally tested, system, subsystem or group of subsystem, is subject to an Operational Test, wherever applicable.

It consists of bringing the system into operation under conditions as close as possible to normal with inert fluids, not only to live test the automated devices, controls, normal and shutdown sequences, but also to reveal possible mechanical or electrical faults (water tightness, vibrations, overheating, overloading, etc.) which may occur during prolonged normal use.

Every operational test is a multi-discipline activity, conducted in accordance with an **Operational Test Procedure (OTP)**, which has been established during the Commissioning preparation phase and approved by the Operator. There is no standard OTP, since they vary with the plant, but a reference procedure format is given in **GS EXP 107**.

Typical subsystems subject to an operational test are, but not limited to: fire water pumps, air compressors, power generation, ESD system, export pumps in recycle, process compressors in recycle (with air or nitrogen if possible, under gas after Start-up if not), sub-sea equipments, freon or propane packages, hot oil loop, etc.

7.6.2 Preparation

Unless the list of subsystems to be subject to operational testing is included in the contractual documentation, and also when the Commissioning activities are not covered by a contract, the Commissioning shall establish and **submit for approval to COMPANY the list of planned operational tests, not later than five months before the start on site of physical commissioning works.**

This list shall be established in accordance with the guidelines available in **GS EXP 107**, chapter 8, paragraphs 8.1.2 and 8.2.1, and complemented, for each test, by a test summary and schematics. Acceptance criteria shall be defined at early stage and approved by COMPANY/Operator.

Once the list and key features of tests have been approved by COMPANY, the Commissioning shall develop the Operational Tests Procedures and their support documents, in accordance with the test guidelines and procedures format given in **GS EXP 107**, chapter 8, paragraphs 8.2 and 8.3.

The OTP's shall be submitted to COMPANY for approval, not later than two months prior to the start on site of physical commissioning works.

7.7 Progress/Status

The Commissioning shall issue to COMPANY for approval the detailed Commissioning progress/status calculation procedure, three months before the start of Commissioning, according to the principles defined in GS EXP 101.

7.8 Planning and manpower

The Commissioning shall perform all Commissioning planning activities, including the following:

- Development, essentially from the Technical Data Base, of the Tasks Register, list by subsystem of all elementary commissioning tasks to be carried out on that subsystem, i.e.:
 - Preliminary checks
 - Each functional test
 - Main steps of the pre-start-up activities
 - Main steps of the operational test

with their execution budget man-hours and other information as required so that the Tasks Register be the data bank for all computerised planning applications.
- Estimation of man-hours, manpower, duration of the:
 - Preliminary Checks
 - Functional Tests
 - Pre-Start-up Activities
 - Operational Tests

of each subsystem.
- Development of the Commissioning network, or subsystem precedence diagrams, showing the various constraints between subsystems activities, as well as external

constraints, such as the start-up sequence and the availability of temporary means. From the precedence diagrams will be derived the subsystems Commissioning sequence.

- Development, from the subsystems activities man-hours estimates and the Commissioning network, of the Commissioning planning level 2, i.e. the schedule by subsystem and type of activity (Preliminary Check, Functional Tests, etc.) of the Commissioning execution activities, which will show the activities duration and the points in time at which they will start and finish. The critical path will be highlighted.
- Preparation of the Commissioning planning level 1, i.e. the schedule by system of the Commissioning activities.
- Preparation of the "Ready For Start-Up" dates, i.e. the points in time of which the Commissioning activities of each subsystem will be completed.
- Preparation of a Commissioning progress calculation method, which will be based on physical progress, i.e. on Commissioning tasks actually completed, and on a theoretical S-shaped progress curve, that will be derived from the level 2 planning.
- Preparation of an execution man-hours follow-up method, based on individual time sheets providing detailed allocation of execution man-hours expended each day, at least per subsystem and type of activity:
 - Preliminary Checks
 - Functional Tests
 - Pre-Start-up Activities Operational Tests
 - Non productive man-hours (i.e. Precommissioning witnessing, assistance to others, operations, maintenance, stand-by, punch list clearing, etc.)
- Evaluation of the overall Commissioning man-hours, duration, and preparation of the execution histograms by discipline (instrument, electrical, mechanical, operations)
- Preparation of the field Commissioning organisation and deployment schedule.

The above Commissioning planning activities shall be carried out on computer equipment, and with planning/resources softwares, approved by COMPANY. They shall be completed, and the corresponding documents issued for COMPANY approval, not later than two months before the actual start on site of Commissioning execution.

The planning documentation will be thereafter kept updated according to actual project progress, and revisions issued accordingly.

7.9 Logistics: Tools, test equipment, consumables, spares, lubricants, chemicals, and special tools.

The Commissioning shall establish the lists of tools, test equipment, and consumables required to carry out Commissioning operations, and shall provide them. The lists shall be submitted to COMPANY approval then processed in accordance with contractual arrangements.

The Commissioning Team shall compile and review the lists of spares, lubricants, chemicals, and special tools included in the various project purchase orders, and make sure all Commissioning needs are adequately covered.

The lists shall be submitted to COMPANY for approval then processed in accordance with contractual arrangements.

In case additional material is required, it shall be provided by the Commissioning

For COMPANY own Commissioning applications not covered by a contract, the Commissioning will perform, organise, or simply follow up the delivery of equipment and extra equipment depending on the Project's organisation.

The stocks of spares, lubricants, and chemicals shall be followed up during the Commissioning execution, and all unused items handed over to the COMPANY at the time of the handover of the related equipment, if they are specific to that equipment, at the end of the operations if they are bulk.

All special tools shall be handed over to the COMPANY at the same time as the equipment itself.

The Commissioning shall prepare detailed procedures for spares, lubricants, chemicals, and special tools stocks control and transfer of surplus.

The Subsea Commissioning group shall likewise compile and review the list of spares, lubricants, chemicals, hydraulic fluid etc. both for Commissioning and "first fill" requirements.

Special tools for the Subsea Commissioning activities shall be defined and in particular the requirement for an ROV during sub-sea Precommissioning and Commissioning activities. This ROV should be fully independent of other ROV and ROV marine spreads in the field during the Commissioning activities. The ROV shall be equipped with all necessary intervention tools such as torque tools for valve manipulation, choke valve, Subsea control module and flow meter retrieval/replacement running tools and any specific override tooling.

7.10 Temporaries

The Commissioning activities require the availability of numerous utilities (air, nitrogen, power generation, steam ...). During the Commissioning Schedule preparation, a particular attention should be paid to these requirements, and temporaries should be foreseen if the one of the utilities is on a critical path.

The Commissioning shall define all temporary facilities, equipment, and connections necessary to carry out Commissioning operations and shall perform all detailed engineering studies of these temporaries as required.

The detailed information related to the temporary facilities shall be issued to COMPANY for approval at least two months before the start of commissioning works.

The Commissioning shall then issue the purchase orders, rental contracts, and fabrication contracts for the supply and installation of this equipment, in accordance with Project and/or COMPANY procedures.

7.11 Personnel

7.11.1 Commissioning by CONTRACTOR

When the Commissioning activities are covered by a Contract, the CONTRACTOR shall submit to COMPANY approval the Commissioning field organisation, its deployment schedule, and the curriculum vitae of all Commissioning Team's senior staff including the:

- Commissioning Manager and/or Site Leader(s)
- Discipline Superintendents and System Engineers

- Safety Officer(s)
- Planning Engineer(s)

Not later than eight months before the start of execution activities.

The CONTRACTOR shall supply all Commissioning personnel for the preparation and the execution of Commissioning activities.

7.11.2 Commissioning by COMPANY

When the Commissioning activities are carried out by a Total entity, the Commissioning manager and/or Site Leader(s) will, but not limited to:

- Prepare for management's approval the plan for the commissioning staff and execution personnel origin (possible origins being DGEP/Headquarters, Operator, CONTRACTORS)
- Issue personnel mobilisation schedule
- Prepare all contracts necessary for call-out of execution, direct and indirect, personnel
- Start selection, first of key personnel, then of execution personnel, from CONTRACTORS, in accordance with the requirements of the mobilisation schedule.

7.12 VENDORS

The Commissioning shall identify the need for VENDORS representatives' assistance during Commissioning activities. As the equipment warranty should in no case be invalidated, the Commissioning shall mobilise VENDORS representatives during all critical commissioning activities, unless it has been formally stated by the VENDORS that such assistance was not required.

The Commissioning shall prepare and issue for COMPANY approval two months before the start of commissioning works the VENDORS representatives schedule, then keep it updated along with the actual project progress.

The Commissioning shall prepare or update relevant purchase orders for call-out of VENDORS representatives, liaise with VENDORS, and mobilise their representatives as required.

The Subsea Commissioning group shall attempt to retain the services of the VENDOR engineers that carried out the FAT and EFAT testing of the Subsea SPS equipment and control system. These personnel are considered to be the best qualified and experienced with the specific sub-sea installation.

7.13 Documentation

The Commissioning shall organise and prepare its own technical documentation, selected in the following documents, but not limited to :

- Engineering drawings list
- VENDORS documents list
- Project specifications and standard lists
- Purchase orders list
- Equipment list.

As a minimum, the Commissioning shall gather and file the following documentation, which will be required for the proper preparation and execution of Commissioning tests, as follows but not limited to:

- Subsystems drawings and equipment lists
- Sets of PID's and PFD's
- Layout and general arrangement drawings
- Piping specification
- Operating manual
- Equipment data sheets
- Instrument data sheets
- TSLD's
- Logic diagrams
- F&G/ESD matrixes
- Process control configuration
- F&G layout
- Electrical distribution one line diagrams
- Switchboards one line diagrams
- Cables list
- Electrical selectivity study
- Power balance
- Load shedding/load sharing specifications
- Wiring diagrams
- Lighting layout
- VENDORS manuals (installation, Precommissioning, Commissioning, operation, maintenance)
- Lubrication schedule
- Spare parts list
- Special tools list
- Main equipment calls for tenders.

7.14 Assistance by other parties

7.14.1 Subcontracted operations

A number of operations, part of the Commissioning scope of work, such as:

- Chemical cleaning of piping
- Cleaning, drying-out of pipelines/sea lines

- High pressure nitrogen leak testing

are usually contracted or subcontracted to specialised companies.

The Commissioning shall list and plan all such activities and prepare for each of them the contracts necessary for the call-out of these CONTRACTORS or SUBCONTRACTORS.

7.14.2 Construction CONTRACTOR

The Commissioning shall review the clauses covering the assistance to Commissioning included in the Construction Contract, usually related to the following scope:

- Personnel assistance
- Logistics
- Supply of equipment, tools, consumables.

The Commissioning shall then define, schedule, and request from Construction CONTRACTOR this assistance in accordance with contractual clauses.

7.15 Cost control

(This part of the Commissioning preparation is relevant only for commissioning carried out by a COMPANY entity).

The Commissioning shall prepare a cost control procedure that will comply with Project Management Procedures.

The budget breakdown structure shall identify the following cost codes, but not limited to :

- Management (as identified on Figure 1)
- Personnel assistance to the management, i.e. permanent office personnel for documentation, materials and logistics, computers, etc. (Figure 1)
- Execution personnel, i.e. technical disciplines personnel performing productive or unproductive works (Figure 1)
- VENDOR representatives
- Ad hoc field assistance personnel for indirect works like scaffolding, cleaning, etc.
- Temporary installations subdivided into:
 - Temporary equipment, materials and consumables
 - Labour cost for installation
- Testing equipment and apparatus
- Consumables for the execution works
- Lube oil, fuel oil, desiccants, chemicals, nitrogen, Freon, Halon, etc., corresponding or not to an initial loading
- Spare parts and materials for permanent installation like punch list materials
- Any major works to be committed under a single contract, e.g. nitrogen/helium full pressure leak testing including personnel, equipment and consumables

Appendix 1 Typical lists of systems/subsystems

1. Typical wellhead platforms (case of a project with 2 identical WellHead Platform)

Red digits, according to **GS EXP 501** definition to be applied. Black digits to be defined according to Commissioning break-down.

Systems WHP 1	Sub-systems WHP1
10 WHP1 Safety/critical systems	(Typical Subsystem list for WHP1) 10 100 Fire Fighting 10 200 Safety/evacuation equipment 10 300 ESD and F&G 10 500 Emergency power generation 10 700 Air/gas inst – Hyd. power generat. 10 800 Communication/telecom 10 900 HVAC
11 Hydrocarbon extraction	11 001 Wells/flowlines WELL1..n 11 002 Wells/flowlines WELLn+1..p 11 100 separation/test
.....	
16 Electrical	16 100 Power distribution 16 200 Lighting
17 Other utilities	
.....	

Systems WHP 2	Sub-systems WHP2
20 WHP1 Safety/critical systems	(Typical Subsystem list for WHP1) 20 100 Fire Fighting 20 200 Safety/evacuation equipment 20 300 ESD and F&G 20 500 Emergency power generation 20 700 Air/gas inst – Hyd. power generat. 20 800 Communication/telecom 20 900 HVAC
21 Hydrocarbon extraction	21 001 Wells/flowlines WELL1..n 21 002 Wells/flowlines WELLn+1..p 21 100 separation/test
26 Electrical	26 100 Power distribution 26 200 Lighting
27 Other utilities	

2. Typical production platform (PP0)

Red digits, according to **GS EXP 501** definition to be applied. Black digits to be defined according to Commissioning break-down.

Systems PP0	Sub-systems PP0
00 PP0 Safety/critical systems	(Typical Subsystem list for PP0) 00 101 Fire Fighting Area 1 00 102 Fire Fighting Area 2 00 200 Safety/evacuation equipment 00 301 ESD and F&G Area 1 00 302 ESD and F&G Area 2 00 500 Emergency power generation 00 600 Auxiliaries power generation 00 700 Air/gas inst – Hyd. power generat. 00 800 Communication/telecom 00 900 HVAC
02 Produced liquid processing	02 000 Separation/manifold/... 02 300 transfer (pump, metering, pipe,..) 02 700 Oil water processing 02 800 Open/closed drain
.....	
03 Gas processing	03 600 Gas disposal (Flare/Vent)
.....	
06 Electrical	06 101 Power distribution area 1 06 102 Power distribution area 2 06 201 Lighting area 1 06 202 Lighting area 2
07 Other utilities	07 000 Fuel gas 07 500 Chemical storage/injection 07 800 Lifting equipment
.....	

Appendix 2 Systems/subsystems delimitation rules

1. Interfaces between process and utility systems/subsystems

1.1. General rule

As a general rule the physical limit of a Process or Utility System or Subsystem will be, wherever possible, an isolation valve, allocated to the System or Subsystem that has the highest priority and is to be commissioned first (figures 1, 2 and 3).

Where a blind is necessary, the Subsystem limit will be at the most suitable flange.

In certain instances where a facility is being extended, the limit will be at the tie-in point.

1.2. Flare Systems/Subsystems

The Flare Systems or Subsystems will include the isolation valves between associated Process systems and the Flare systems.

Consequently, Flare limits will be downstream of:

- Safety valves
- Pressure control valves
- Blowdown valves
- Choke valves (Figure 4).

1.3. Closed Drains Systems/Subsystems

The above rule applies (Figure 5).

1.4. Diesel Oil and Fuel Gas Systems/Subsystems

System/Subsystem limits to user Systems or Subsystems will be downstream of the last manual supply isolation valve to each consumer. All controls, blowdown or ESD valves, filtration systems and so on will be part of the consumer Subsystem (Figure 6).

1.5. Inert Gas System/Subsystems

As above, System/Subsystem limits to user Systems or Subsystems will be downstream of the last manual supply isolation valve.

1.6. Chemical Injection Systems/Subsystems

The System/Subsystem limit will be downstream of the supply isolation valve for each injection point into the Process Lines or items of Equipment.

1.7. Hydraulic Systems/Subsystems

System/Subsystem limits will be downstream of the first supply isolation valve to each user.

1.8. Exchangers

When Heat Exchangers require a utility service such as cooling water, hot oil, steam, etc., to control the temperature of a Process stream, the Heat Exchanger will be part of the Process System/Subsystem (Figure 7).

The utility pipework within the limits of the Heat Exchangers supply and return valves will also be part of the Process system/subsystem.

Refrigeration Heat Exchangers operating on the principle of evaporation of a liquid such as Propane or Freon will be part of the Refrigeration loop (Figure 8).

1.9. Instrument air

The instrument air distribution subsystem in its totality will be considered as part of the instrument air system. Limits will be made at each branch of the distribution system downstream of the final piping isolating valves, and before the item of equipment being supplied with instrument air by the said branch line, i.e. control valves, etc. (Figure 9).

2. Interfaces for instrument subsystems

7.1. Process or utility subsystems

A process control loop will preferably be allocated to the Process or Utility Subsystem where the measuring device is installed (Figures 1, 3 and 10).

Where a Distributed Control System is utilised, it is considered to stand alone as a DCS Subsystem from the Input/Output racks. Outgoing wiring to individual loops will be allocated to Process or Utility Subsystems as either open or closed loops, as defined by the Trouble-Shooting Loop Diagrams (TSLD's).

7.2. Emergency Shutdown System (ESD)

ESD Programmable Logic Controller (PLC) based system will stand alone as a Subsystem, from the Input/Output racks as for Distributed Control Systems. Input/Output loops will be classified as open loops and allocated to Subsystems as the outgoing wiring of Distributed Control Systems.

7.3. Fire and Gas (F&G)

F&G Programmable Logic Controller (PLC) based system will stand alone as a Subsystem from the Input/Output racks. Loops will be classified as open loops and allocated to Fire and Gas Subsystems, with the exception that these Subsystems will be based on designated Fire Areas.

3. Instrument/Electrical interfaces

When there is an interface between an Electrical and an Instrument Subsystem, the Instrument limit will normally be at the terminals of the item of Electrical equipment shown on the Instrument Trouble-Shooting Loop Diagram (TSLD).

4. Interfaces for electrical subsystems

7.1. Electrical Distribution Network

The Electrical Distribution Network will be sub-divided by category of service: i.e.:

- Normal Service
- Essential Service
- Emergency Service.

Switchboards and Distribution Boards are dedicated to a service and this forms the basis of an Electrical Subsystem. Depending on the complexity of the distribution network then these base Subsystems will be further sub-divided to suit the Project requirements.

The interface/break points between Subsystems will be at the most practical point as required the commissioning energisation sequence.

Typical break points:

- Transformers
- Switch/Distribution Board incoming breakers.

An Electrical Subsystem will contain all items relative to the distribution network but excluding all starters, contactors, switch-fuse, etc., where the electrically powered device is allocated to a Process or Utility Sub-System.

7.2. Process or Utility Subsystems

As stated above, any electrically powered device (i.e. item of equipment) will be allocated to the Process or Utility Subsystem.

For example, where the electrically powered device is a Motor, then the following will also be included in the applicable System or Subsystem:

- Starter at switchboard
- Cabling (power and control)
- Associated control gear
- Motor.

The interface with Instrument Group will be at the point of the termination of any electrical control into an instrument device, e.g. Marshalling box, Process Control System (PCS) cabinet, Fire and Gas (F&G) cabinet, etc.

7.3. Trace heating

For ease of installation and Commissioning, Trace Heating will be split differently from the description above. The circuit breaker/fuse, cabling and associated junction boxes, will be grouped within an Electrical Subsystem. Trace Heating tapes will then be grouped into the Process or Utility System/Subsystem to which the piping is allocated.

7.4. Uninterrupted Power Supply (UPS) system

Certain large machines have Uninterrupted Power Supplies which are dedicated to that machine only.

In this instance the Uninterrupted Power Supply (UPS) system and distribution will be allocated to that Process or Utility System/Subsystem.

7.5. Multicore cables

All multicore cables, the cores or pairs of which are connected to equipment belonging to different subsystems, will be included in a specific multicore subsystem.

The subsystem limits will be:

- At the Output racks in the technical room (marshalling cabinet)
- At the field junction boxes.

The junction boxes will be also part of the multicores subsystem.

The multicores cables, all cores of which are connected to equipment of a single subsystem, will belong, with the junction boxes, to that subsystem.

5. Mechanical equipment

Items of Mechanical Equipment will fall completely within the limits of a Process or Utility System or Subsystem.

In certain instances, Stand-by and/or Parallel equipment, which are often complete VENDOR Packages, may also be designated as complete Subsystems. This will match the initial Start-Up philosophy, in order to achieve, for example, early Oil or Gas production.

Typical examples:

- Main Oil Pump "B"
- Gas Compressor "S"
- Main Generator "C"
- Pedestal Cranes
- Lifts.

6. Telecommunications

7.1. Radios

When Troposcatter Radio or Line of Sight Multichannel Techniques are used, the Multiplexer will be included in the Radio System. The Multiplexer device will interface between, the telephones, computers, and telexes. The limit of this Subsystem will be the input terminals on the Multiplexer.

There are instances where a "Phone Patch" interface is used to patch the Public Address System and/or Radio into the Telephone System and vice versa. In these cases, the "Phone Patches" will either be included into the Telephone or Radio System, depending on the VENDOR.

7.2. Telephones

The Telephones Subsystem will include the PABX, Extensions, Operator Console, Facsimile, Telex, Main Distribution Frame (MDF) and cabling out to the Multiplexer and/or single unit Radio Transceiver, also cabling to the Public Address Control Panels.

7.3. Public address

The Public Address Subsystem will include the Alarm Racks, Amplifier, Control Panel, Override Stations, Loudspeakers and Interconnecting Cabling. The limit of the Subsystem will be the Input/Output terminals on the Control Panel, and the Input loop terminals in the Alarm Rack from the Fire and Gas detection system.

7. Sub-sea Network

7.1. Sub-sea Systems

The Sub-sea Network will be sub-divided into four category of system following:

- Production loops and lines
- Water injection loops and lines
- Gas injection loops and lines
- Control.

7.2. Sub-sea Subsystems

The sub-sea loops are further divided into packages using a numeric code to signify a sub-sea equipment item/package:

- Xmas tree
- Well jumpers
- Manifold
- Lines and riser
- Dynamic control umbilical
- Static control umbilical.

The sub-sea equipment that forms part of the individual loop or line is categorised as packages based on equipment type and the method of pre-commissioning, installation and commissioning.

The sub-sea control system is divided into two stand-alone packages:

- Control station
- Hydraulic power unit

One being the control system itself and this could be stand-alone as a separate sub-system as for the Distributed Control System or a package to be integrated in the D.C.S. The second package in the control system is the hydraulic power unit. This sub-system will also be attached to a dedicated sub-system (Loop or Hydraulic control).



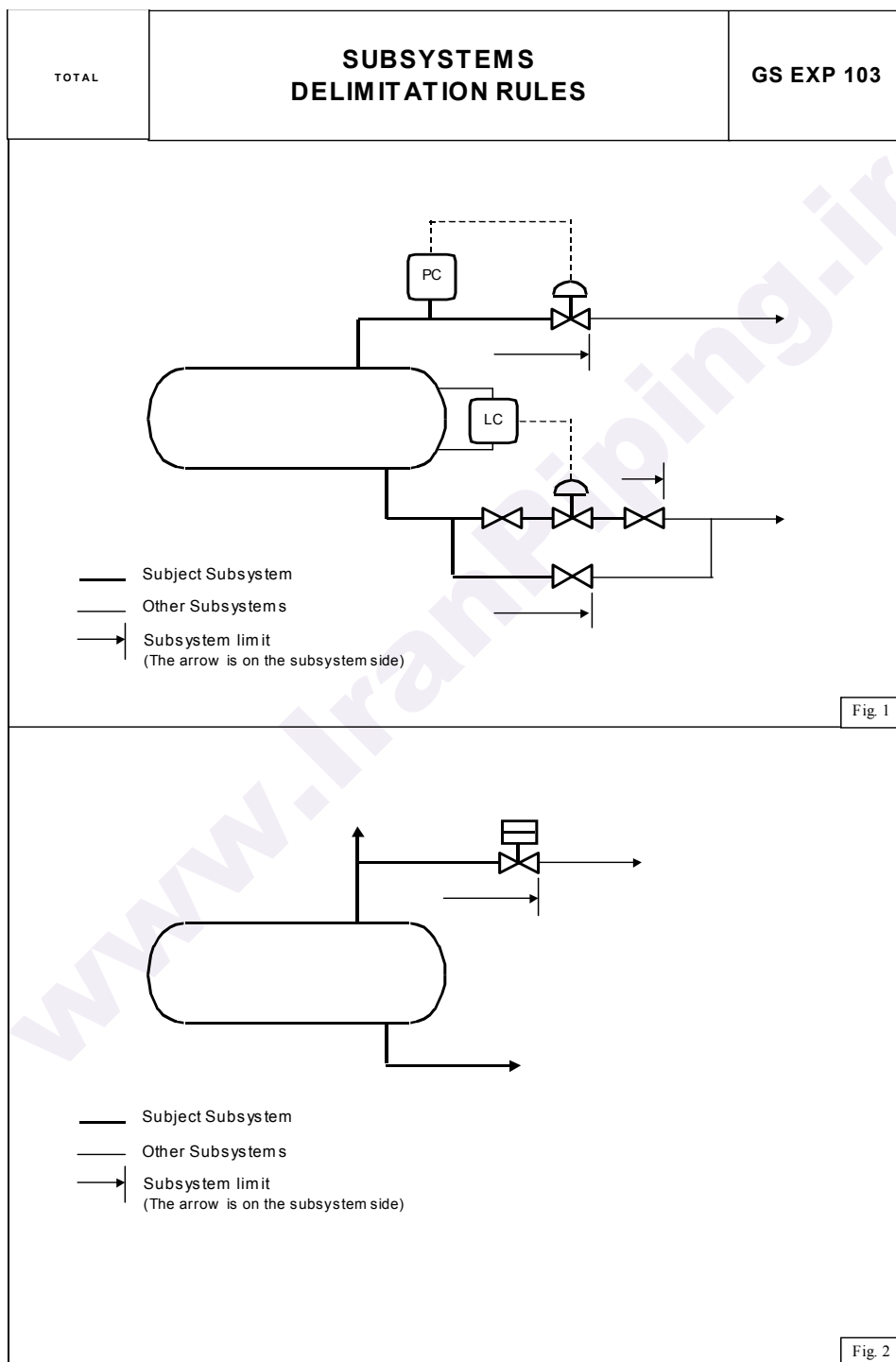
Consequently there will normally be partial hand-over of systems and sub-systems for sub-sea equipment as drilling and sub-sea installation activities are carried out in parallel with commissioning and start-up.

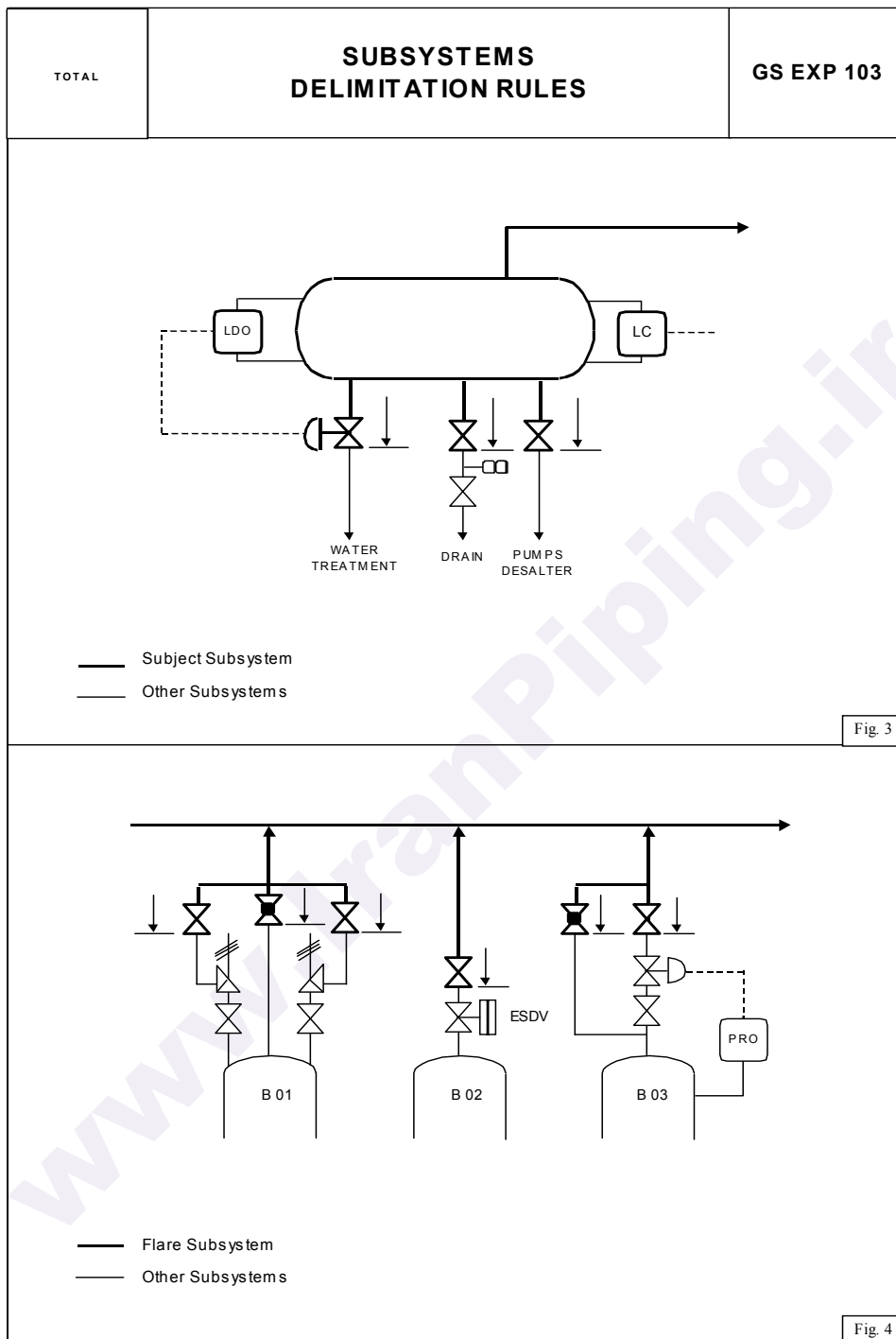
For example, the hand-over for the first production loop will contain all flowlines and risers, all control umbilical, all production manifolds and possibly only one or two Xmas trees. A similar example for an injection line would be that the first hand-over would include all flowlines and risers, all control umbilical all umbilical connection devices and possibly only one injection Xmas tree.

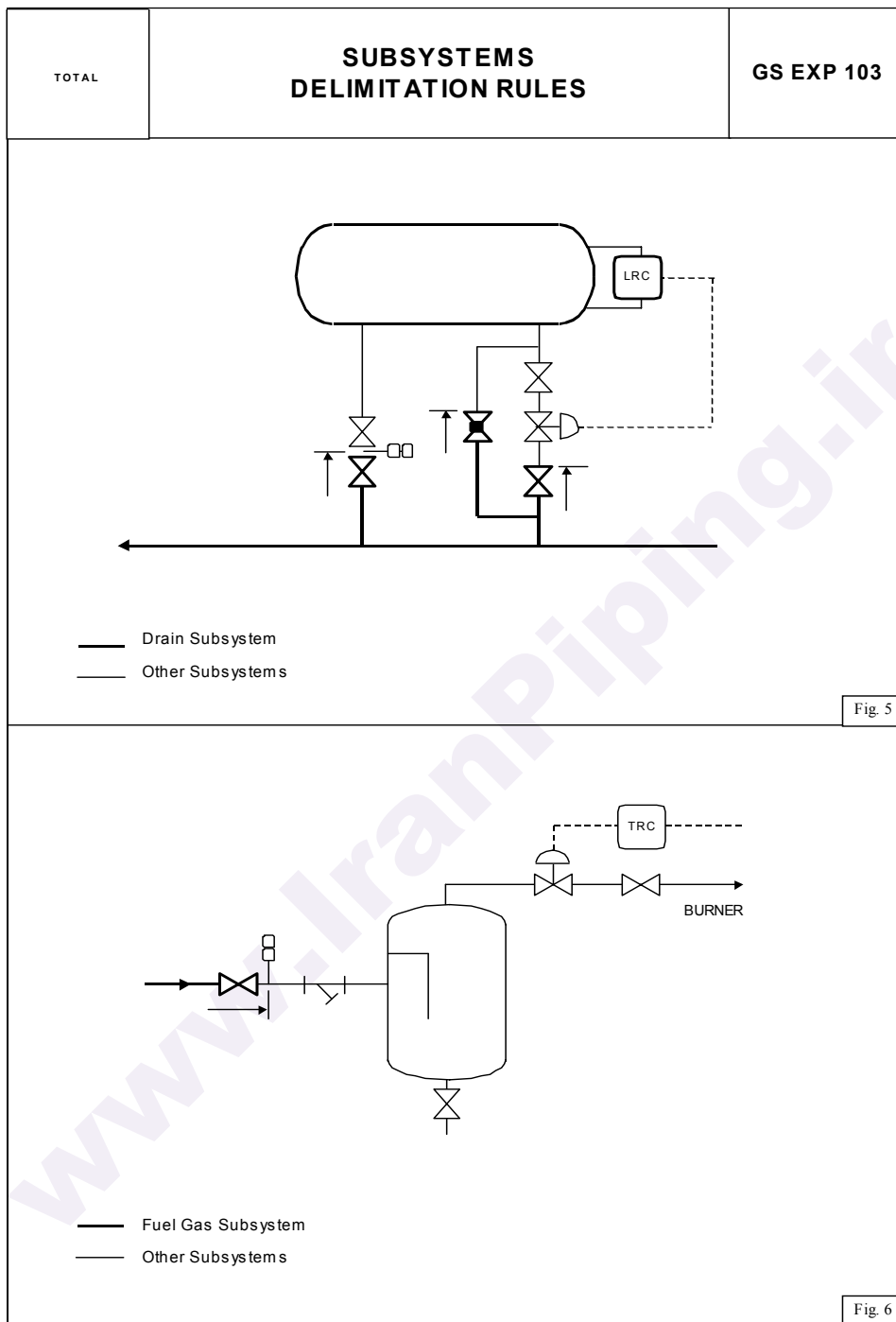
See figures 11 and 12 for examples of sub-sea production and injection packages/sub-systems boundary limits.

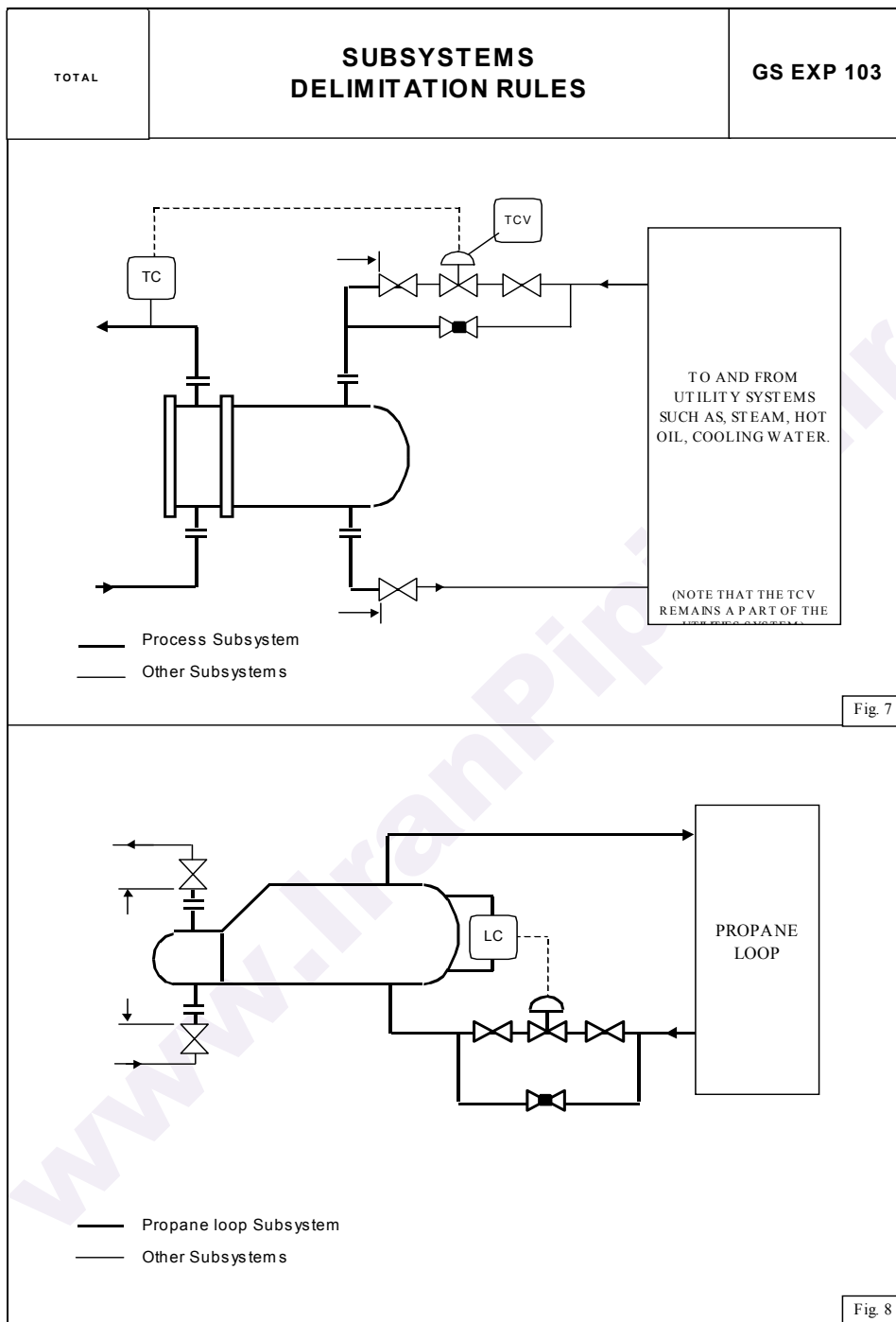
8. Other cases

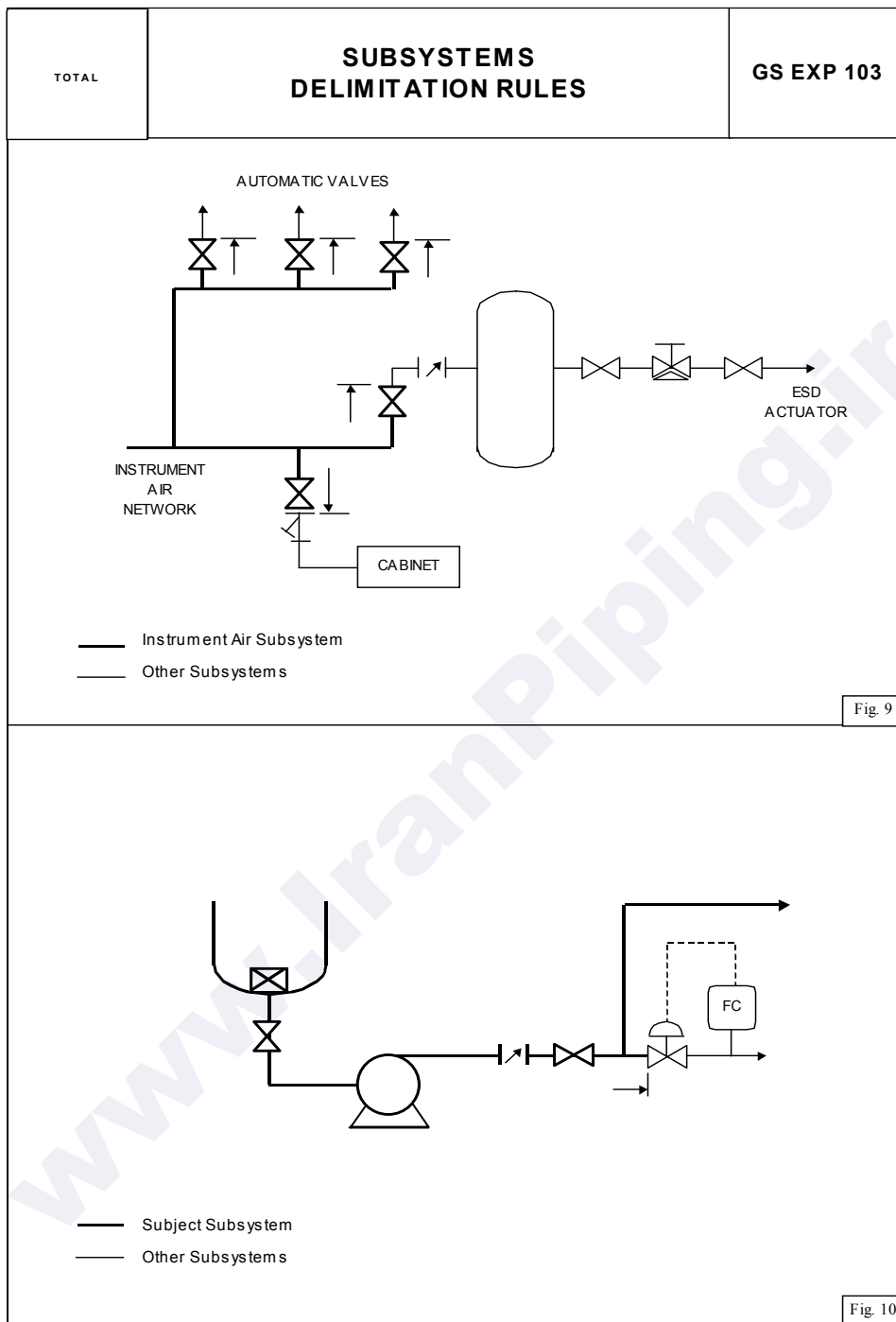
Whenever the above Subsystems delimitation rules do not cover any specific case, the Engineering CONTRACTOR will define a delimitation rule adapted to that case and submit it to COMPANY's approval.











Total	Sub-systems delimitation rules	GS EXP 103
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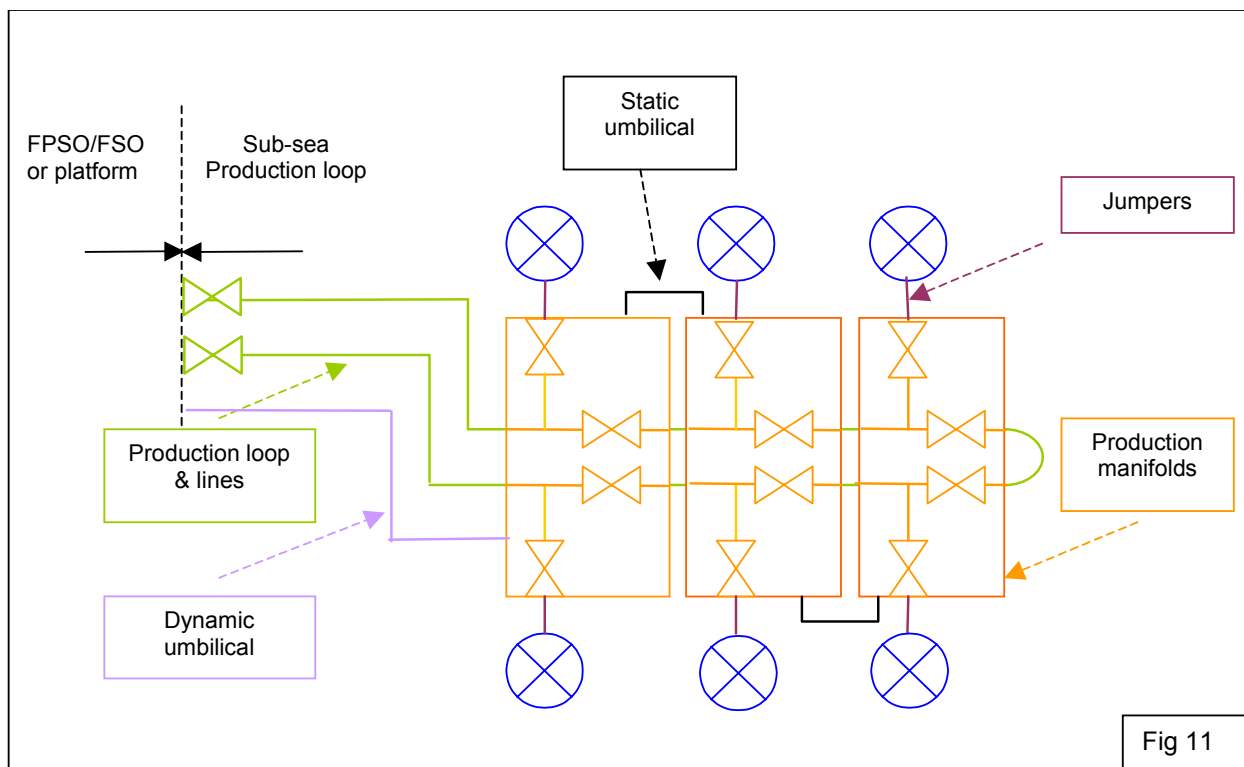


Fig 11

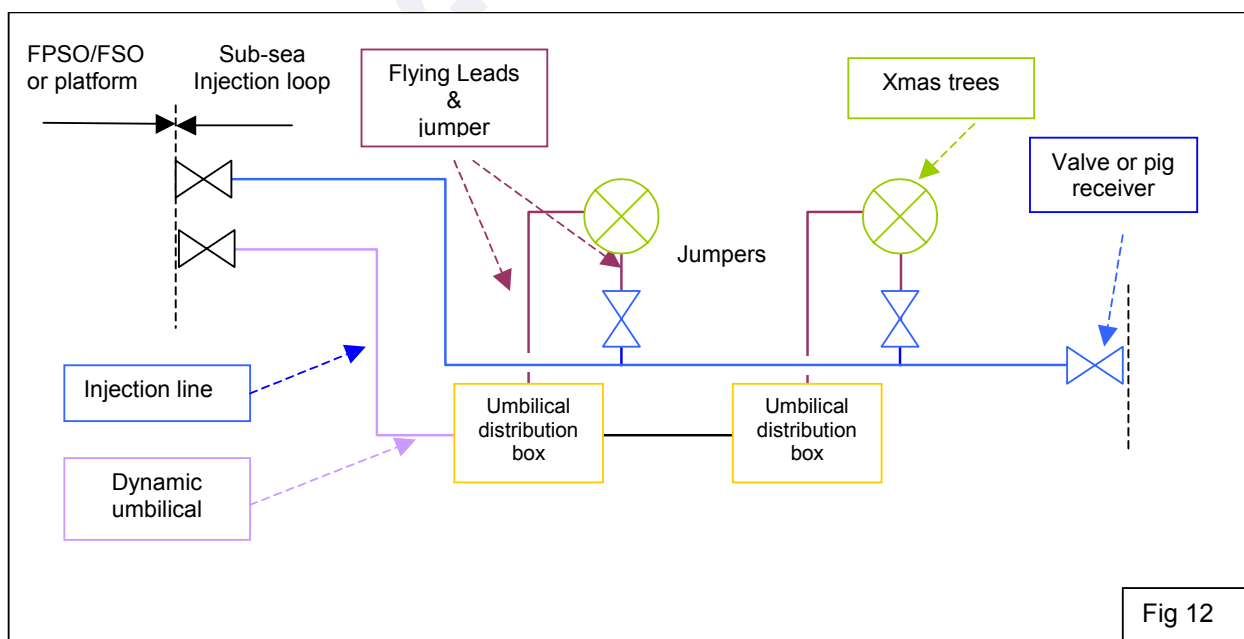


Fig 12

Appendix 3 Precommissioning status index technical specification

1. Introduction

ICAPS software application mandatory for each Total project provides the means to organise and to follow all Precommissioning activities according to the OPERCOM methodology. Particularly all the information following should be implemented on ICAPS software.

- Status Index (scope of Precommissioning activities)
- Depending on the equipment type, ICAPS generates automatically the corresponding precommissioning tasks, Check Lists and Test Sheets.

The preparation consists mainly to check all the types of equipment (Items) of the project and to ensure the consistency in the ICAPS Database with the associated OPERCOM sheet.

2. Identification

Each item of equipment or component subject to a precommissioning operation, check and, whenever applicable, test, will be identified by its tag number, taken from Engineering and Package VENDORS documents.

The list of type of components subject to precommissioning operations will be found in **GS EXP 105** specification.

Specific cases:

- Multicore cables: Each core, or pair, of the multicore cables will be one item of the Electrical Status Index
- Piping: Each line number will be one item of the Piping/VENDORS Status Index (as per the Engineering line list).

3. Arrangement by discipline

The Status Index will be arranged by discipline, according to the following list:

- Instrumentation
- Electricals
- Telecommunication
- Mechanical
- Piping and Vessels.
- Sub-sea.

4. Fields

The list of parameters (fields) to be given for each item of equipment, depending the discipline is specified in table 1, where the following information applies:

- Tag number: Item of equipment or component tag number
- Subsystem: Four digit reference number of the subsystem
- Discipline:
 - Electrical
 - Or Instrument
 - Or Telecom
 - Or Mechanical
 - Or Piping.
 - Or sub-sea
- Description: Function of the item e.g.: pump, motor, electrical cable, pressure transmitter, etc.
- Location: Area, module, platform number, etc.
- Work unit: Estimated workload of the precommissioning of the item
- Check-list: Reference number of the relevant Precommissioning Check-List (refer to **GS EXP 105**)
- Test sheet 1: Reference number of the relevant Precommissioning Test Sheet (refer to **GS EXP 105**)
- Test sheet 2: To be used when two Test Sheets are applicable for one item e.g. piping pressure test and flushing test sheets
- P&ID: Reference number of the relevant P&ID
- Drawing: Reference number of the drawings others than P&ID(s)
- Spare 1/2: For any useful parameter not part of this parameter list
- VENDOR: VENDOR's name
- Trip set point high/low: For instruments generating trips only
- Test pressure: Piping/vessels test pressure
- Design Flow: For piping vessels only
- Pipe number: Piping serial
- Operating pressure: For piping/vessels only
- Voltage: For electrical equipment only
- Revision: Document revision number and date

- Test number: Piping or vessels pressure test number (to be entered by the Precommissioning CONTRACTOR upon test completion)
- Completion date (for checks and tests): Completion date of checks and tests, to be entered by the Pre-Commissioning CONTRACTOR in versus the relevant Check-Lists and Test Sheets, upon checks or tests completion.

5. Reports

The following reports will be accessible from the Status Index.

Discipline Reports, including, as a minimum, the following fields:

- Tag number
- Description
- PID
- Drawing
- Check-list
- Test sheet 1
- Test sheet 2
- Revision
- Check completion date
- Test completion date.

It will be possible to edit those reports by:

- Subsystem
- Tag number
- Location.

A parameter search capacity must also be available. A typical Status Index report is shown on figure 2.

Table 1 - Status index fields

Field	Electrical	Instrument	Telecom	Mechanical	Pip./Vessel
Tag number	X	X	X	X	X
Subsystem	X	X	X	X	X
Discipline	X	X	X	X	X
Description	X	X	X	X	X
Location	X	X	X	X	X
Work units	X	X	X	X	X
Check-list	X	X	X	X	X
Test sheet 1	X	X	X	X	X
Test sheet 2					X
P&ID		X		X	X
Drawing	X	X	X	X	
Spare 1	X	X	X	X	X
Spare 2	X	X	X	X	X
VENDOR	X	X	X	X	
Trip set point high		X			
Trip set point low		X			
Test pressure					X
Design Flow					X
Pipe number					X
Operating pressure					X
Voltage	X				
Revision	X	X	X	X	X
Revision date	X	X	X	X	X
Test number					X
Check completion	X	X	X	X	X
Test completion 1	X	X		X	X
Test completion 2					X



Exploration & Production

General Specification

GS EXP 103

Date: 04/04

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Appendix 3

Figure 2 - Precommissioning status index

Item-Tag	Item Description	Item Type	Locat. Area	Disc	SubSys	Check Sheet	Task Date Completed	Test Sheet	Task Date Completed	Drawing
1-00-JBSA-51	Junction Box 1-00-JBSA-51	JBOX	CPF	I	1101	CJX31				YPP-12-1-001-C
1-00-JBSA-51-D	Multicore Cable 1-00-JBSA-51-D	CABL	CPF	I	1101	CPX09		TPX09		YPP-12-1-001-C
1101-PIPE	INSULATION OF ALL PIPING INCLUDED IN SSY 1101	PIPE	CPF	P	1101	CXX01				YPP-12-1-001-C
1101-PIPE	PAINTING OF ALL PIPING INCLUDED IN SSY 1101	PIPE	CPF	P	1101	CXX02				YPP-12-1-001-C
1-1101-HTP-01	PIPE LINE INVOLVED: 10"-PIPELINE-S1-CPF (from ESDV-0141 to 1-R-0140);	PIPE	CPF	P	1101	CLX02		TMX03		YPP-12-1-001-C
1-1101-HTP-01	PIPE LINE INVOLVED: 10"-PIPELINE-S1-CPF (from ESDV-0141 to 1-R-0140);	PIPE	CPF	P	1101			TMX04		YPP-12-1-001-C
1-1101-HTP-01	PIPE LINE INVOLVED: 10"-PIPELINE-S1-CPF (from ESDV-0141 to 1-R-0140);	PIPE	CPF	P	1101			TMX05		YPP-12-1-001-C
1-1101-HTP-01	PIPE LINE INVOLVED: 10"-PIPELINE-S1-CPF (from ESDV-0141 to 1-R-0140);	PIPE	CPF	P	1101			TMX07		YPP-12-1-001-C
1-1101-HTP-01	PIPE LINE INVOLVED: 10"-PIPELINE-S1-CPF (from ESDV-0141 to 1-R-0140);	PIPE	CPF	P	1101			TMX14		YPP-12-1-001-C
1-1101-HTP-01	PIPE LINE INVOLVED: 10"-PIPELINE-S1-CPF (from ESDV-0141 to 1-R-0140);	PIPE	CPF	P	1101			TMX25		YPP-12-1-001-C
1-BDV-0115	ON/OFF BLOW DOWN VALVE	VALV	CPF	I	1101	CJX23		TJX02		YPP-12-1-002-C
1-ESDV-0112	EMERGENCY SHUT DOWN VALVE	VALV	CPF	I	1101	CJX23		TJX02		YPP-12-1-002-C
1-FE-0112	ORIFICE PLATE	INST	CPF	I	1101	CJX15		TJX07		YPP-12-1-002-C
1-FIT-0112	FLOW INDICATOR TRANSMITTER DP CELL	INST	CPF	I	1101	CJX04		TJX04		YPP-12-1-002-C
1-FIT-0112-A	DP FLOW TRANSMITTER CABLE	CABL	CPF	I	1101	CPX09		TPX09		YPP-12-1-002-C
1-GDT-0001	GAS DETECTOR	INST	CPF	I	1101	CJX42		TJX00		YPP-28-1-101-E
1-R-0140	CPF PIG RECEIVER	MISC	CPF	M	1101	CCX02		TMX00		YPP-12-1-001-C
1-V-0110	SLUG CATCHER	TANK	CPF	M	1101	CCX01		TMX26		YPP-12-1-002-C
1-AM-0121A-C	LV MOTOR CONTROL CENTER CABLE	CABL	CPF	E	1102	CPX09		TPX09		YPP-60-1-101-E
1-PM-0620A	WATER FLASH DRUM PUMP MOTOR "A"	MOTO	CPF	E	1201	CPX06		TPX13		YPP-60-1-101-E
1-CLM-99-01-P	UPS PANELBOARD TELECOMMUNICATION CABLE	CABL	CPF	T	1401	CPX09		TPX09		YPP-60-1-101-E
1-ER-99-05	CCTV/METEOROLOGICAL MASTER CLOCK CABINET	PNEL	CPF	T	1401	CJX30				YPP-60-1-101-E
1-SAT-99-01-P	UPS PANELBOARD TELECOMMUNICATION CABLE	CABL	CPF	T	1403	CPX09		TPX09		YPP-60-1-101-E
1-90-JB-002-P-S	JUNCTION BOX FOR WELDING RECEPTACLE #1 CABLE	CABL	CPF	E	1501	CPX09		TPX09		YPP-60-1-101-E
1-00FPS02-N	SSS MARSHALING CABINET CABLE	CABL	CPF	I	1604	CPX09		TPX09		YPP-28-1-101-E
1-FDT-0013	FLAME DETECTOR	INST	CPF	I	1608	CJX42		TJX00		YPP-28-1-101-E
1-FDT-0013-M	ANALOG SIGNALS F&G JB CABLE	CABL	CPF	I	1608	CPX09		TPX09		YPP-28-1-101-E
1-FDT-0014	FLAME DETECTOR	INST	CPF	I	1608	CJX42		TJX00		YPP-28-1-101-E
1-FDT-0014-M	ANALOG SIGNALS F&G JB CABLE	CABL	CPF	I	1608	CPX09		TPX09		YPP-28-1-101-E
CPF-POWER-GEN	FIRE CONTROL PANEL CABLE	CABL	CPF	I	1608	CPX09		TPX09		YPP-28-1-101-E
2-HCV-0714	CHOKE VALVE	VALV	S1	I	2101	CJX24		TJX01		YPP-12-2-001-C
4504-PIPE	INSULATION OF ALL PIPING INCLUDED IN SSY 4504	PIPE	NPA	P	4504	CXX01				YPP-12-4-006-C
4504-PIPE	PAINTING OF ALL PIPING INCLUDED IN SSY 4504	PIPE	NPA	P	4504	CXX02				YPP-12-4-006-C
4-PK-4210	AIR PACKAGE 4-PK-4210	MISC	NPA	M	4504	CZX01M				YPP-12-4-006-C
4-PK-4210	AIR PACKAGE 4-PK-4210	MISC	NPA	P	4504	CZX01P				YPP-12-4-007-C
4-V-4210	DRY AIR RECEIVER 4-PKG-4210	TANK	NPA	M	4504	CCX01		TMX26		YPP-12-4-006-C

Total-Items:

36

Quantity of Check To Do:	31
Quantity of Static Test To Do:	28
Total of Precommissioning Task To Do:	59
Quantity of Check Completed:	0
Quantity of Static Test Completed:	0
Total of Precommissioning Task Completed:	0

Appendix 4 Technical data base specification

1. Introduction

ICAPS software application mandatory for each Total project provides the means to organise and to follow all Commissioning activities according to the OPERCOM methodology. Particularly all the information following should be implemented on ICAPS software.

- Technical Database (scope of Commissioning activities)
- Depending on the Basic Function type, ICAPS generates automatically the corresponding Commissioning tasks, Functional Test Sheet.

The preparation consists mainly to check all the types of basic function of the project and to ensure the consistency in the ICAPS Database with the associated OPERCOM sheet.

2. Arrangement by discipline

The Technical Data Base will be split in five discipline Data Bases, according to the following list:

- Instrumentation
- Electrical
- Telecommunications
- Mechanical/corrosion
- Piping and vessels.

3. Fields

The data base will contain the following data items (fields):

BF	Is the corresponding basic function number of up to 20-characters long, and is validated against duplication e.g. PT90802 which can be an equipment tag.
DISCIP	Is a single character reference to the first letter of the discipline selected, e.g. I for Instrum, E for Electricity, etc.
SUBSYS	Is a structured code of up to five characters of the subsystem, e.g. "7601".
WU	Is a four numeric field reference to the Work Units.
TESTYPE	Is a six character reference code to the testsheets, e.g. FJ01A1.
DESCRIP	Is a 30-character field reference to the description of the basic function, e.g. [Cable - Valve - Transmitter, etc.).
SERVICE	Is a 30-character field reference to the service the basic function e.g. (Fuel Gas - Flare - Compressor, etc.).
LOCATION	Is a 10 characters physical location code.
ASSTAG	Is a 30-character field reference to the basic function associated tags.
DWG	Is a 20-character field corresponding to the drawing number or TSLD number.

TASK	Is a planning priority code up to eight characters.
REV	Is two characters long and refers to the revision - to be incremented at each issue.
REVDATE	Is a system field. It is the date when a basic function has been entered, deleted, or amended.
COMPDATE	Is the date when the basic function is completed.
COMMENT	Is a 30-character field reserved for more information.
SPARE 1	Is 15 characters long. It is an additional field.
SPARE 2	Is 15 characters long. It is an additional field.
SPARE 3	Is 15 characters long. It is an additional field.

In addition to the foregoing data items, the following fields will be available with the different disciplines.

3.1 Instrumentation

PID	Is a 8-character field reference to the number of the PID drawing.
CALIB	Is 8 characters long, and refers to the instrument calibration.
EU	Is the corresponding engineering units (Bar-Psi, etc.) - 6 characters.
SETHIGH	Is a 6-character field reference to the high set point.
SETLOW	Is a 6-character field reference to the low set point.
CABINET	Is a 6 characters cabinet number.

3.2 Electricity

VOLTAGE	Is 10 characters long and refers to the electrical voltage rating.
PWRCABLE	Is 10-character field reference to the electrical power cable.
SWBOARD	Is 10-character field reference to the electrical switch board.
MCC	Is 10-character field reference to the electrical MCC.

3.3 Mechanical

PID	Is a 8-character field reference to the number of the PID drawing.
POWER	Is 10 characters long and refers to the equipment power.
PACKAGE	Is 10 characters long and corresponds to the package references.
PO	Is the purchase order number - 10-characters.
VENDOR	Is 10-characters long and refers to the name of the VENDOR.

3.4 Piping

CORRPROB	Is a 30-character field reference to the Corrosion Probe.
PID	Is a 8-character field reference to the number of the PID drawing.
PACKAGE	Is 10 characters long and corresponds to the package references.
DESIPRESS	Is 10 characters long and refers to the design pressure.

DESITEMP	Is the corresponding design temperature - 10 characters.
OPERPRESS	Is a 10-character field reference to the operating pressure.
PIPCCLASS	Is a 6-character field reference to piping class.
HYDRO	Is a 4 characters hydro test.
LINESIZE	Is 4 characters long and corresponds to the line size.
DESIPRESS	Is 4 characters long and refers to the line length.
VESSVOL	Is a 4-character field reference to the vessel volume.

4. Reports

Two standard reports and one user definable report will be available:

- Discipline follow-up standard report.

This report will be identical for the five disciplines and will contain all fields necessary to follow up the commissioning:

BF - DISCIP - SUBSYS - TESTYPE - SERVICE - LOCATION - TASK - COMDATE - REV - WU.

Records will be available by basic function, subsystem, service, location, test type.

- Discipline details standard reports.

These reports will contain specific fields of each data base, so each discipline will have a different type of report.

The report will have the same facilities to select and sort records as the follow-up report.

A typical Technical Data Base report is shown on figure 3.

**Figure 3 - Commissioning
Technical Data Base**

Item Number	Item Composition	Item Description	Item Type	Locat. Area	Test Type	Disc	Subsystem	MNH Estim	MNH Exp	Task Form	Task Date Completed
BF-1-90-TF-011	1-90-TF-011	RESIDENTIAL BUILDING TRANSF	TRF	CPF	FTS	E	1606	20		FP5A	
	1-90-TF-011(E/P-R/P-S/P-T)	TRANSFORMER CABLE	CABL								
	1-90-LVMCC-001N-11G	RESIDENTIAL BUILDING TRANSF DRAWER	DWER					2		FP0/4	
	1-90-LVMCC-001N-11G	RESIDENTIAL BUILDING TRANSF DRAWER	DWER					4		FPL0	
	1-90-DB-011	PANEL UPS OFFICE BUILDING	PNEL					20		FP6A	
BF-1-90-UPS-002	1-90-DB-011-P	UPS PANELBOARD TELECOMMUNICATION CABLE	CABL	CPF	FTS	E	1501	16		FP2	
	1-90-UPS-002-B	UPS-002 BY-PASS CIRCUIT PWR SUPPLY.	UPS								
	1-90-UPS-002-E2, 1-90-UPS-002-P2	POWER CABLE	CABL								
	1-90-LVMCC-001E-11C	UPS-002 BY-PASS POWER SUPPLY DRAWER	DWER					2		FP0/4	
	1-90-LVMCC-001E-11C	UPS-002 BY-PASS POWER SUPPLY DRAWER	DWER					4		FPL0	
OTP-NPA-02	1-90-UPS-002-N	UPS-002 NORMAL PWR SUPPLY.	UPS	NPA	OTP	T	4401	16		FP2	
	1-90-UPS-002-E1, 1-90-UPS-002-P1	POWER CABLE	CABL								
	1-90-LVMCC-001E-5H	UPS-002 NORMAL POWER SUPPLY DRAWER	DWER					2		FP0/4	
	1-90-LVMCC-001E-5H	UPS-002 NORMAL POWER SUPPLY DRAWER	DWER					4		FPL0	
	1-90-LVMCC-001E-5H	UPS-002 NORMAL POWER SUPPLY DRAWER	DWER							5300	
OTP-NPA-02	Telecommunication System Phone Device	TELECOM SYSTEM (Telecom, Phone Device)	MISC	NPA	OTP	T	4401	12			
OTP-NPA-03	PCS	CONTROL SYSTEM (PCS, ESD/F&G)	MISC	NPA	OTP	I	4301	12			
OTP-NPA-04	ESD/F&G	CONTROL SYSTEM (PCS, ESD/F&G)	MISC	NPA	OTP	I	4302	12			
OTP-NPA-04	4-PK-4210A/B	AIR SYSTEM (Air supply)	MISC	NPA	OTP	M	4504	12			
OTP-NPA-04	4-V-4210	AIR SYSTEM (Air supply)	TANK	NPA	OTP	M	4504	12			
PRC-NPA-M-03	GENERAL MECHANICAL AND PIPING EQUIPMENT	GENERAL MECHANICAL AND PIPING EQUIPMENT	MISC	NPA	PRC	P	4101	4		2621M	
BF-4-ESDV-0111	4-ESDV-0111	EMERGENCY SHUT DOWN VALVE	VALV	NPA	FTS	I	4101	3		FJ01F	
	4-HS-0111A	HAND SWITCH FOR SOV OVERRIDE KEY (LP)	INST								
	4-HS-0111B	HAND SWITCH FOR TEST (LP)	INST								
	4-HS-0111D	HAND SWITCH FOR RESET SOV (LP)	INST								
	4-HS-0111E	HAND SWITCH FOR LOCAL OPEN/CLOSE COMMAND (LP)	INST								
	4-PSL-0111	PRESSURE SWITCH LOW	SWCH								
	4-SOV-0111A	SOLENOID VALVE	VALV								
	4-SOV-0111B	SOLENOID VALVE	VALV								
	4-HS-0111O	HAND SWITCH FOR OPEN COMMAND	INST								
	4-XA-0111	DISCREPANCY ALARM	MISC								
	4-XL-0111A	OVERRIDEN SIGNALLING	MISC								
	4-XL-0111B	RESET SIGNALLING	MISC								
	4-ZLC-0111	CLOSED STATUS INDICATOR	SWCH								
	4-ZLO-0111	OPENED STATUS INDICATOR	SWCH								
	4-ZS-0111	PARTIAL STROKING SWITCH	SWCH								
BF-4-FIT-0312	4-ZSC-0111	CLOSED STATUS LIMIT SWITCH	SWCH	NPA	FTS	I	4201	12		FJ05	
	4-ZSO-0111	OPENED STATUS LIMIT SWITCH	SWCH								
	4-FE-0312	RETRACTABLE ORIFICE PLATE CARRIER	INST								
	4-FIT-0312	FLOW INDICATOR TRANSMITTER (METER 1)	INST								
	4-FR-0312	FLOW RECORDER (METER 1)	INST								
BF-4-FV-0315	4-PIT-0312	PRESSURE INDICATOR TRANSMITTER (METER 1)	INST	NPA	FTS	I	4101	4		FJ01B3	
	4-PR-0312	PRESSURE RECORDER (METER 1)	INST								
	4-TE-0312A	TEMPERATURE ELEMENT (METER 1)	INST								
	4-TE-0312B	TEMPERATURE ELEMENT (METER 1)	INST								
	4-TR-0312	TEMPERATURE RECORDER (METER 1)	INST								
BF-4-FV-0315	4-FE-0315	ORIFICE PLATE	INST	NPA	FTS	I	4101	4		FJ01B3	
	4-FIT-0315	FLOW INDICATOR TRANSMITTER	INST								
	4-FI-0315	FLOW INDICATION	INST								
	4-PI-0320	PRESSURE INDICATION	INST								
	4-PI-0320A	PRESSURE INDICATION	INST								
BF-4-LSH-0303	4-PIT-0320	PRESSURE INDICATOR TRANSMITTER	INST	NPA	FTS	I	4101	4		FJ01B	
	4-FV-0315	CONTROL VALVE FLOW	VALV								
	4-FIC-0315	FLOW INDICATOR AND CONTROL	INST								
	4-LSH-0303	LEVEL SWITCH HIGH	SWCH								
	4-LAH-0303A	LEVEL ALARM HIGH	MISC								
BF-4-PDIT-0316	4-LAH-0303B	LEVEL ALARM HIGH	MISC	NPA	FTS	I	4101	4		FJ01B	
	4-PDIT-0316	PRESSURE DIFF. INDICATOR TRANSMITTER	INST								
	4-PDAH-0316A	PRESSURE DIFF. ALARM HIGH	MISC								
	4-PDI-0316A	PRESSURE DIFF. INDICATION	INST								
	4-PDAH-0316	PRESSURE DIFF. ALARM LOW	MISC								
BF-COND-PUMP-A	4-PDI-0316	PRESSURE DIFF. INDICATOR	INST	S1	FTS	E	2502	2	1	FP0/4	17/dec/03
	2-90-LVMCC-001-6C	CONDENSATE PUMP "A" DRAWER	DWER								
	2-P-4720A/B	Diesel System (Diesel Alimentation.)	MISC								
	2-PSV-0721A	PRESSURE RELIEF VALVE	VALV								
	2-PSV-0721A	PRESSURE RELIEF VALVE	VALV								
PSA-CPF-07	PSA LEEK TEST SLUG CATCHER	ALL PIPE LINES INVOLVED IN CPF	MISC	CPF	PSA	M	1101	12		4241	
PSA-CPF-09	PSA INERTING	ALL PIPE LINES INVOLVED IN CPF	MISC	CPF	PSA	M	1101	4		4451	
BF-1-PRP-PABX	1-PRP-99-01-05-MH	Power Generation Building (Multipair Protector)	MISC	CPF	FTS	T	1403	20		I05C5	
	1-PRP-99-01-03-MH	Workshop-Warehouse Building (Multipair Protector)	MISC								
	1-PRP-99-01-02-MG	Telecom Room 3, Laboratory (Multipair Protector)Building	MISC								
	1-PRP-99-01-06-MH	Fire Water Pump Building (Multipair Protector)	MISC								
	1-PRP-99-02-01-MG	IDF for Voice (Multipair Protector)	MISC								
	1-PRP-99-01-01-MF	Telecom Room 2, Office Building (Multipair Protector)	MISC								
	1-PRP-99-01-04-MH	Guard House Building (Multipair Protector)	MISC								
	1-PRP-99-02-02-MH	IDF for Voice, GN Trailer (Multipair Protector)	MISC								
Total:		17						213	1		
Total of Test to Do		25									
Total Test Completed		1									



Appendix 5 Precommissioning procedures list

These Procedures shall be developed by CONTRACTOR during the Initial Precommissioning/Commissioning Preparation Phase, CONTRACTOR shall in addition define & develop all other Procedures as may be required.

Precommissioning Procedure Schedule
Sub-System Breakdown and Control Procedure
VENDOR Package FAT and Precommissioning / Commissioning Punch listing Procedure
Mechanical Completion Procedure
Precommissioning ICAPS Development & Control Procedure
Precommissioning Organization & Mobilization Procedure
Planning/Progress/Control & Reporting Procedures
Flushing / Cleaning/Dewatering Reinstatement Procedures
Precommissioning Modularisation Procedure
Gross Leak Test Procedures
Cold Wire Loop testing / Point to Point Loop Testing
VENDOR Drawing's Updating / As-Built & Manuals Control Procedure
Precalibration Procedures
Relief Valve Testing Procedure & Schedule
Dedicated Construction Punch List & Clearance Procedure
FAT Inspections / Testing & Witnessing Procedure
As-Precommissioned: As-Built Drawings Procedure
RFC Handover / Dossier Procedure
Vessel & Equipment Inspection Procedures
COMPANY Witnessing / Notification Procedure
Equipment Alignment Procedures
Construction Radio & Communication Procedures
Bolt Tensioning / Torqueing Procedures
Precomm Transfer of Responsibility Procedure
Precomm Battery limits/ Interface & Coordination Procedures
Hazop & PTR Review Procedures
Precomm Preservation/Maintenance/Lubrication/Storage Procedure & Schedule
Precomm Safety Review Procedures
Precomm Inspections and Testing Procedures
Non-Commisionable Sub-System Procedures
Training plan for OPERCOM/ICAPS set up

Appendix 6 Commissioning procedures list

These Procedures shall be developed by CONTRACTOR during the Initial Precommissioning/Commissioning Preparation Phase, CONTRACTOR shall in addition define & develop all other Procedures as may be required.

Management Organization / Mobilization (incl. VENDORS) Procedure / Job Descriptions Procedure
Individual Sub-System Commissioning Procedures / Scope of Work
Planning/Progress/ Reporting & Control Procedures
Comm Organizational Procds during Eng /Prep / Module Fab Yards / Integ Yards & Offshore
Comm Scope of Work per Module
Commissioning Meeting Schedule Procedure
Commissioning ICAPS Control Procedure
Dedicated Commissioning Punch List & Clearance Procedure
Final Relief Valve Testing Procedure & Schedule
Operational Test Procedure Description & Schedule
Permit to Work Procedure Electrical Isolation / Lock-Out / Tag-Out Procedures
Permit to Work Procedure (SIMOPS with Construction)
Operational Test Procedures
UTILITIES Performance Test & Start-Up Procedures
Energization Procedures
Factory Acceptance Test Procedure (FATs) and/or Site Acceptance Test Procedure (SATs)
Operating/Maintenance Manuals Development Procedure during Commissioning
Tie - In Procedures
Red Line Mark-Ups and As -Commissioned & Final Drawing Procedure
Blind List Procedures
Consumables & Tools / Radios Communication Procedures
Spares Control & Handover Procedure
Plant Leak Test (including valves) / Body & Seat Testing of Critical Valves
Control Software Modification Procedure
Control System Test Procedures
Modularization Test Procedures
Temporary Commissioning Equipment Procedure
All First Fill / Oils / Grease / Procedures
Drying / Vacuum / Inerting / Purging Procedures
Test Equipment Test Procedures
As -Commissioned Drawing Procedure
COMPANY Witnessing / Notification Procedure



Exploration & Production

General Specification

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Appendix 6

RFSU / Partial RFHO / RFHO Handover Procedure
Comm Transfer of Responsibility Procedures
Pre-Start-Up Activity Procedures
Valve Tagging Procedure
Final Vessel & Equipment Inspection & testing Procedures
Final Documentation Handover Procedure
Comm Radio & Communication Procedure
Comm Safety Review Procedures
Contingency Procedure for Offshore Carry-Over
Pipeline Commissioning Procedures
Commissioning Services to COMPANY Procedures
Commissioning Preservation/Maintenance/Lubrication/Storage Procedure & Schedule
Training plan for OPERCOM/ICAPS set up