

GENERAL SPECIFICATION

Field Operations

GS EP EXP 101

Pre-commissioning and Commissioning Specification
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General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 2 of 97

Contents

1. Scope	5
2. Reference documents.....	5
3. Introduction	6
4. HSE.....	8
4.1 Permit To Work (PTW).....	9
4.2 Risk Assessment / Job Safety Analysis (RA / JSA)	10
4.3 Lock-Out / Tag-Out (LO/TO)	10
4.4 Simultaneous Operations (SIMOPS).....	10
4.5 Competency and Training	11
5. Definitions.....	11
5.1 Pre-commissioning and Commissioning.....	11
5.2 Start-up.....	13
5.3 Hydrocarbons and hazardous materials	14
5.4 OPERCOM™ methodology.....	15
5.5 The Systems Approach.....	16
5.6 Non Commissionable Systems	18
6. Pre-commissioning	19
6.1 Pre-commissioning activities	19
6.2 Pre-commissioning Task Register.....	21
6.3 Pre-commissioning certificate	22
6.4 Pre-commissioning Punch List	22
6.5 Pre-commissioning witnessing	23
6.6 Preservation during Pre-commissioning	23
6.7 Pre-commissioning dossiers	23
6.8 Pre-commissioning activities summary	24
7. Commissioning	25
7.1 Commissioning activities	25
7.2 Commissioning Task Register.....	29

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 3 of 97

7.3	Commissioning Certificate	29
7.4	Commissioning Punch List	30
7.5	Commissioning witnessing	30
7.6	Preservation, Operation and Maintenance during Commissioning	30
7.7	Commissioning dossier	30
7.8	Commissioning activities summary	32
8.	Preservation, Operation & Maintenance, Mothballing	33
8.1	Preservation	33
8.2	Operation & Maintenance	33
8.3	Mothballing	34
9.	Punch List	35
9.1	Punch Items Categories	35
9.2	Punch Item description	37
9.3	Punch List management	38
10.	Witnessing	39
10.1	Witnessing levels definition	39
10.2	Witnessing Matrix	40
10.3	Witnessing organisation	41
11.	Progress Measurement	42
11.1	Engineering Phase	42
11.2	Execution Phase	42
12.	Role, Responsibilities and Organisation	43
12.1	Pre-commissioning and Commissioning Engineering Phase	43
12.2	Pre-commissioning Execution Phase	43
12.3	Commissioning Execution Phase	44
12.4	Pre-commissioning team organization	44
12.5	Commissioning team organisation	44
12.6	Typical Organisation	48
13.	Co-ordination with Company	50
13.1	Engineering phase	50
13.2	Factory / Workshop Testing Phase	51

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 4 of 97

13.3	Pre-commissioning Execution Phase	51
13.4	Commissioning Execution Phase	52
14.	Transfer of Operation and Maintenance.....	53
14.1	Foreword.....	53
14.2	General principle	53
14.3	Transfer of Operation and Maintenance certificate.....	53
14.4	Transfer Rules	53
15.	Particular Technical Certificates.....	55
15.1	Temporary Release Certificate for Discipline Progress	55
15.2	Site Certificate.....	56
16.	Particular Cases and Points of Attention.....	57
16.1	Offshore projects Specificity	57
16.2	Wellhead Platform Specificity	58
16.3	Package Specificity	58
16.4	Modules Specificity	60
16.5	Modifications on existing facilities Specificity.....	61
17.	Subsea	62
17.1	Factory / workshop activities	64
17.2	Site activities.....	65
17.3	Transfer to Commissioning	66
17.4	Site activities by Commissioning Team	66
18.	Glossary	67
Appendix 1	Activities classification	69
Appendix 2	Company Pre-commissioning Witnessing Requirement	82
Appendix 3	Company Commissioning Witnessing Requirement	90
Appendix 4	Transfer of Operation & Maintenance: 1/3	95
Appendix 5	Transfer of Operation & Maintenance: 2/3	96
Appendix 6	Transfer of Operation & Maintenance: 3/3.....	97

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 5 of 97

1. Scope

This specification define how the Pre-commissioning and Commissioning activities shall be carried out from a technical point of view without presupposing which party is in charge.

Hence, this specification shall be applied by the various parties involved in the project, according to their respective obligations defined in the contractual documents.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
Not applicable	

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
GS EP EXP 103	Pre-commissioning and Commissioning Engineering
GS EP EXP 105	Pre-commissioning Execution
GS EP EXP 107	Commissioning Execution
GS EP EXP 213	Minimum maintenance requirements
GS EP SPS 001	Design philosophy and requirements for subsea stations

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 6 of 97

3. Introduction

The Pre-commissioning and Commissioning activities correspond to the final checks and tests of a facility, aimed at verifying that each element complies with design and operational specifications before transfer to Company.

The objectives of Pre-commissioning and Commissioning are in order of prevalence:

- Ensure Safety: for the people, for the environment, for the equipment.
- Guarantee the proper integrity and operation of the equipment for their lifetime as per design and specifications.
- Ensure a smooth Start-Up (i.e. without unplanned downtime and delays).

These objectives are achieved by:

- Defining and prioritizing the Pre-commissioning and Commissioning activities.
- Checking and testing exhaustively all the components of the plant.
- Ensuring full traceability of these tests and checks.

To cover this specific aspect of project Pre-commissioning and Commissioning activities, Company, based on know-how and experiences, has developed the **OPERCOTM** methodology as defined hereafter:

OPERCOTM:

OPERCOTM: Trademark, property of Company, designating the methodology of the Pre-commissioning and Commissioning activities described through a set of four specifications:

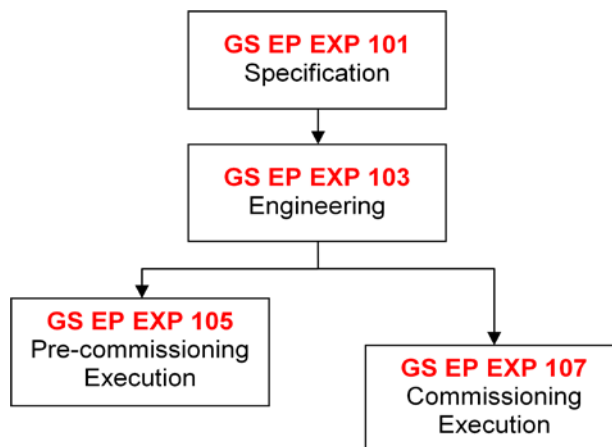
- **GS EP EXP 101** : Pre-commissioning and Commissioning Specification (this document)
- **GS EP EXP 103** : Pre-commissioning and Commissioning Engineering
- **GS EP EXP 105** : Pre-commissioning Execution
- **GS EP EXP 107** : Commissioning Execution

It should be noted that the above set of documents does not cover all Quality Control activities to be achieved on a new plant which are normally part of the Project Inspection and Test Plan (ITP) managed by QA/QC Department.

These tasks are covered by a different methodology defined in the Construction QC manuals issued by the Construction contractor following the Company specifications.

The **OPERCOTM** set of 4 specifications is organised as follow:

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 7 of 97



Company has also developed the software **ICAPS®** based on the **OPERCOTM** methodology.

ICAPS®:

ICAPS®: (Integrated Commissioning And Progress System) Software, property of Company. Designates the tool to be used during the Pre-commissioning and Commissioning activities in order to support and implement the **OPERCOTM** methodology.

ICAPS® covers the preparation and execution of Pre-commissioning and Commissioning activities, as per the **OPERCOTM** methodology.

ICAPS® main functionalities are:

- Register on a standard database all Project items and related elementary activities to be performed during the Pre-Commissioning and Commissioning.
- Generate / print out automatically the Pre-commissioning and Commissioning forms.
- Update / monitor status and progress of the Pre-commissioning and Commissioning.
- Trigger the signature process of Pre-commissioning and Commissioning acceptance certificates.
- Generate / print out automatically all required records and monitor the status of Preservation.
- Record and follow-up the Punch list activity.
- Generate status and progress report as required.

OPERCOTM and **ICAPS®** shall be the tools to reach a smooth and progressive transfer of the plant to the Operator, safely, in line with plans, schedule and with full confidence.

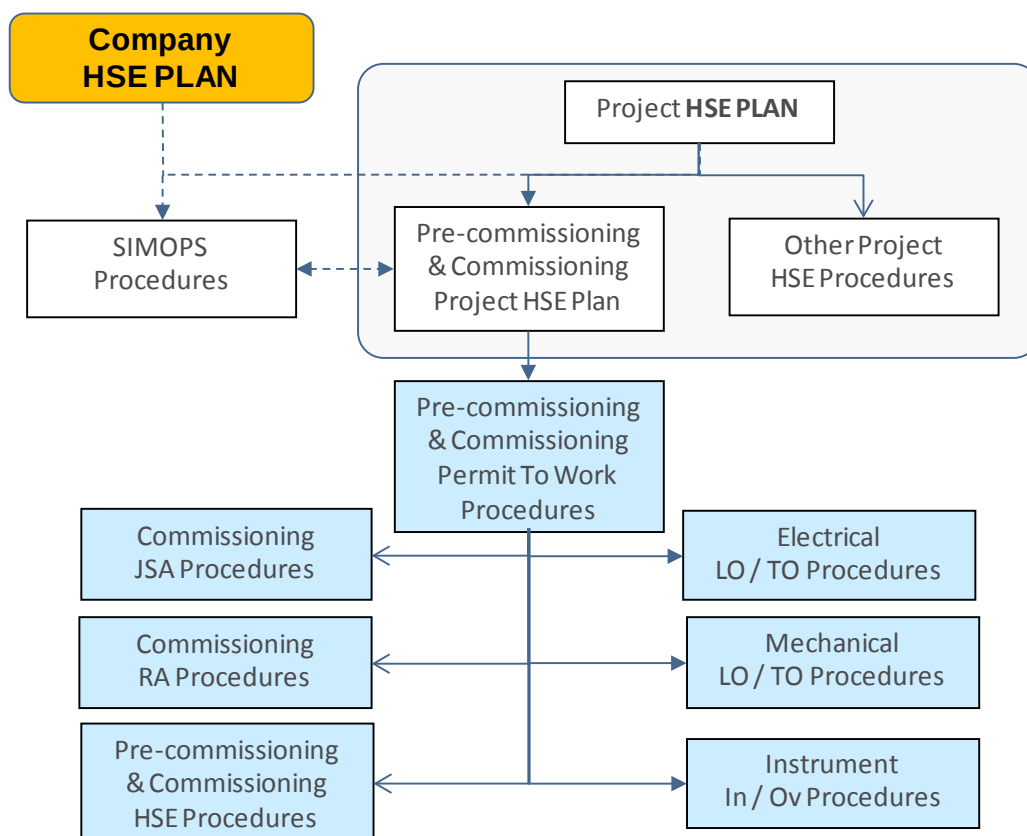
OPERCOTM specifications and the **ICAPS®** software shall be used for each Company project.

4. HSE

The Health, Safety and Environment Standards of the Company governs the principles as well as the practical approach to be applied in the management of HSE during Pre-commissioning, Commissioning and Operation activities within or under the control of the Company.

Moreover, specific HSE requirements shall be established related to the specificities of the Project Pre-commissioning, Commissioning and Operations activities. These requirements shall be part of the Project HSE Plan.

In particular, instrument isolations, electrical isolations, mechanical isolations, confined space entry, hot work, gas monitoring etc., shall be thoroughly addressed, and the Responsible, the Issuing and the Performing authorities shall be clearly identified.



A detailed Commissioning HSE plan as well as specific dedicated documents and procedures shall be prepared and implemented, as requested and specified by **GS EP EXP 103**.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 9 of 97

4.1 Permit To Work (PTW)

The Permit To Work System covers two distinct domains:

- The Management: The entity who control (Care & Custody).
- The Procedures: The main PTW forms, the associated permit forms and the particular procedures.

For the Pre-commissioning, Commissioning and Operations activities, the Permit To Work System to be used shall be defined in the Project Pre-commissioning and Commissioning PTW procedure part of the project HSE plan.

In all cases Company HSE policy shall apply. Here below are some typical cases to be taken into account with respect to the Permit to Work:

- For the activities due to take place at Contractor worksites, the Contractor yard Permit To Work System can be proposed. This system will be audited by Company prior to start any Pre-commissioning and Commissioning activities, and will be implemented only if Company qualifies it as being in accordance with specifications, local legislation and recognized international standards. If not, the system will be upgraded and subject to Company approval.
- For the activities in a Company site, the full Company HSE management system shall apply, and may be amended as applicable by bridging documents signed by the concerned parties. The Care and Custody is with Company from day one, and will not be transferred to Contractor.

Refer also to the schematic in Appendix 6: Typical Modification on Existing Facilities.

PERMIT TO WORK	MANAGEMENT	COMPANY
	PROCEDURES	COMPANY

- For the activities due to take place on Company site in an area of the plant that can be comprehensively and safely isolated from the existing live parts, the PTW System, during the early stages of the work, may be different from the one used by Company.

At a predefined stage of the works, Company will require to manage all the activities on the site. The management of the PTW is then switched from the Contractor to the Company. This is called Transfer of Care and Custody.

In order to have a smooth transfer, the Company PTW procedures can be put in place prior to the Transfer of Care and Custody, in order to have all the Project personnel familiar with the Company PTW procedures.

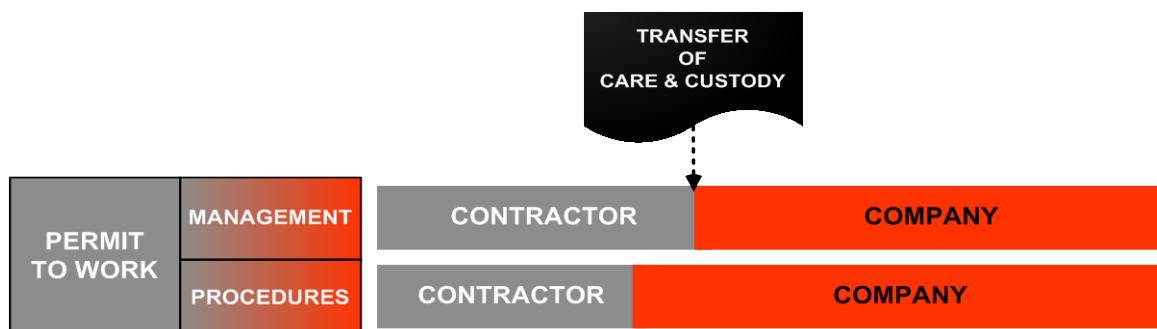
A dedicated training program shall be developed and put in place as well as a proper Management of Change.

Refer also to the schematic in Appendix 5: Typical Onshore Plant Project.

This case also applies when the plant is built in a yard and is moved to the final site location. Once at the final site, and at predefined stage, the management of the PTW is switched from the Contractor to the Company

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 10 of 97

Refer also to the schematic in Appendix 4: Typical FPSO Project



4.2 Risk Assessment / Job Safety Analysis (RA / JSA)

Some of the Pre-commissioning and Commissioning activities involve pressurizing process circuits with high pressure fluids, energizing low and high voltage electrical circuits, handling of high temperature fluids, tests done in the vicinity of rotating equipment, handling of hazardous product, heavy lifting, etc...

For each of these activities a Job Safety Analysis (JSA) and a Risk Assessment (RA) shall be performed prior to their commencement. These analysis and assessments shall be part of the relevant activities dossier and shall be approved by Company.

The PTW Management Procedure shall include all necessary provisions and instruction related to the execution of the JSA / RA.

4.3 Lock-Out / Tag-Out (LO/TO)

Particular Pre-commissioning and Commissioning activities will require the isolation of mechanical, electrical or instrumentation devices / equipment. These situations are likely to increase the level of risk such as when HV distribution systems are energized and / or when process fluids are introduced or Systems are pressurized.

These particular isolation / de-isolation activities shall be managed in line with project specifications and Company's procedures.

The PTW Management Procedure shall include all necessary provisions and instructions related to the application of LO/TO specification.

The Commissioning Team shall be formally involved and timely provide proper input to cover all aspects related to the various disciplines LO/TO requirements in the Project HSE Plan as requested and specified by **GS EP EXP 103**.

4.4 Simultaneous Operations (SIMOPS)

Particular SIMOPS activities on the same location are likely to increase the level of risk such as when process fluids are introduced in the plant.

These particular simultaneous activities shall be managed in line with project specifications and Company's procedures.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 11 of 97

The Commissioning Team shall be formally involved and timely provide proper input to cover all aspects related to SIMOPS in the Project HSE Plan.

4.5 Competency and Training

Pre-commissioning, Commissioning and Operations activities in each discipline shall be carried out only by competent and experienced personnel.

A specific Safety Training program shall be developed particularly tailored to be addressed to all personnel involved in Pre-commissioning, Commissioning and Operations activities, including Construction Contractor, Subcontractors, Vendors and Company personnel.

All personnel in the Pre-commissioning and Commissioning teams and / or involved in any activities related to the Pre-commissioning, Commissioning or Operations shall be provided with the required information and knowledge of the safety rules prior to starting the work, including all requirements related to the PTW System, RA/JSA, LO/TO, confined space entry, working at height, SIMOPS etc.

5. Definitions

5.1 Pre-commissioning and Commissioning

The Pre-commissioning and Commissioning activities consist of a series of checks and tests carried out before the plant is due to be brought on line. The aim of these activities is to ensure and verify that every piece of equipment is built, and can operate as per design.

The Pre-commissioning and Commissioning activities are also the last critical check of the design. Their ultimate goal is to ensure that the plant and associated equipment are safe and trouble free.

The Pre-commissioning and Commissioning activities are sequential and executed in a predetermined order of priority based on the requirements of the start-up sequence.

The Pre-commissioning and Commissioning roughly correspond to static and dynamic tests phases respectively.

The Pre-commissioning and Commissioning activities basically include:

- The Engineering phase:
 - Development of management and general procedures.
 - Development of Pre-commissioning and Commissioning technical procedures.
- The Execution phase:
 - The Factory / workshop Testing phase.
 - The Pre-commissioning execution phase.
 - The Commissioning execution phase.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 12 of 97

5.1.1 Engineering phase

The preparation of Pre-commissioning and Commissioning is referred as “Pre-commissioning and Commissioning engineering” in this specification.

The Pre-commissioning and Commissioning engineering activities shall begin at the effective date of the contract.

All the Pre-commissioning and Commissioning engineering deliverables listed in the OPERCOM™ specifications and in the contract, shall be prepared during the Detailed Engineering phase,

The set up and the population of the ICAPS© data base shall also be performed and completed during the Engineering phase.

5.1.2 Factory / workshop Testing

Packages and equipment shall be inspected and tested to the maximum extent in the factory or workshop prior to their departure to the worksite or site.

The tests performed in the factory or workshop are often followed by an overall package test called Factory Acceptance Tests (FAT)

These Factory Acceptance Tests shall demonstrate the correct design, manufacture, operation and performance of the equipment in accordance with the project specifications.

Note that factory / workshop are also the place where the first preservation activity starts.

5.1.3 Pre-commissioning Execution

Pre-commissioning:

Pre-commissioning consists in a comprehensive series of Static and De-energized Checks and Tests to be carried out on each item of the plant in order to ensure that the Facilities have been constructed in compliance with Project Documents, Specifications and Standards.

Pre-commissioning activities can be carried out at various locations like: factory, workshop, worksite and final site.

The Pre-commissioning includes three main types of activity:

- Conformity Checks: Carried out on each item to verify compliance with Project requirements.
- Static/de-energised Tests: Carried out on item to verify their individual quality / performance.
- Piping Tests: Carried out on pipe work, preliminary air or water flushing, pressure test (hydro test), piping cleaning activities, blowing etc.

The Pre-commissioning is validated upon successful completion of all these Checks and Tests.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 13 of 97

5.1.4 Commissioning Execution

Commissioning:

Commissioning consists in a comprehensive series of Dynamic & Energized Checks and Tests to be carried out in order to demonstrate and ensure that the Facilities are ready to operate safely and steadily in compliance with Project Documents, Specifications and Standards.

Commissioning activities can be carried out at various locations like: factory, workshop, worksite and final site.

The Commissioning phase includes four main types of activity:

- Preliminary Checks to ensure that the construction and Pre-commissioning works are completed and documented.
- Functional Tests to prove that each plant elementary function performs properly.
- Piping and Vessels Preparations of the pipe work to prove tightness and ability to receive live fluids safely. This includes a number of activities, such as piping drying-out, Process leak testing and inerting, or loading of various chemicals and catalyst.
- Operational Tests to prove the readiness of the equipment for continuous operation by running them during a significant period of time.

The Commissioning is validated upon successful completion of all these activities, including if required, the Operational Tests with hydrocarbons and hazardous material, as defined in paragraph 5.3 of this specification.

5.2 Start-up

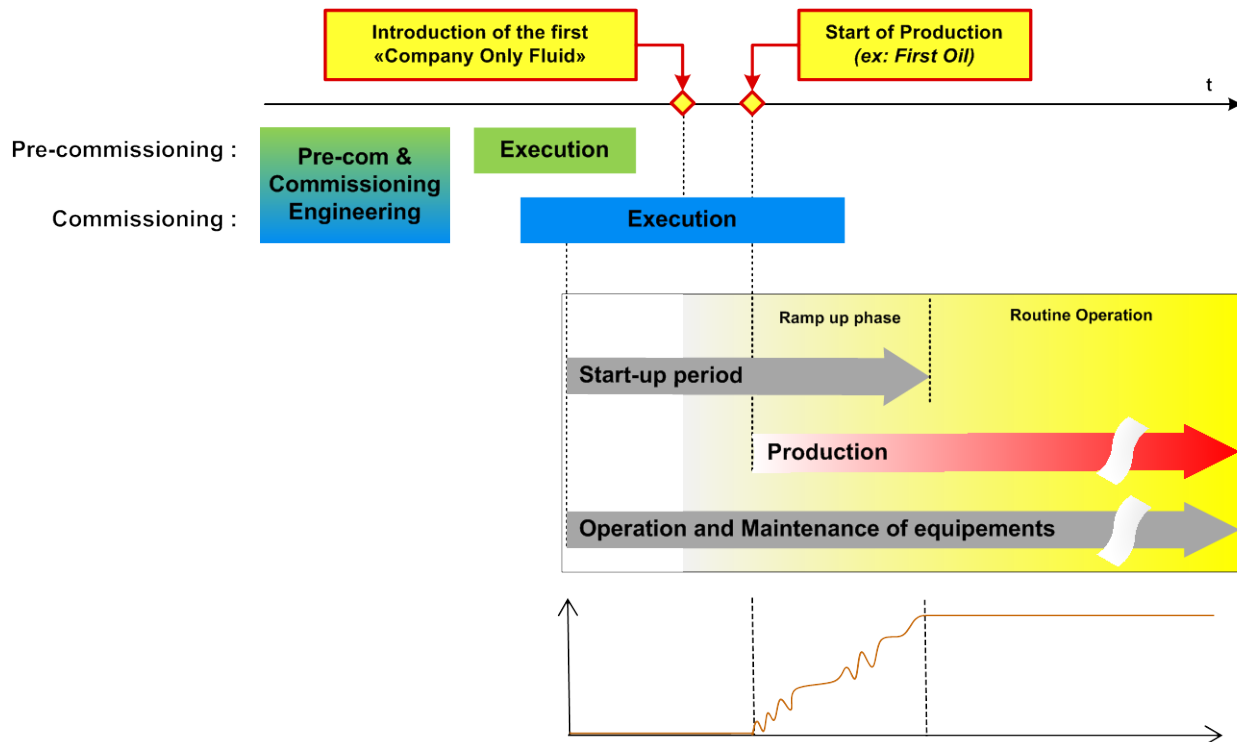
Start-Up:

Start-Up is the period during which "Utility" and "Process" packages and equipments are gradually put into service.

Start-up begins when the first equipment are energised and remains in service. These are typically lighting circuits, UPS, HVAC, utilities, etc...

Start-up ends when all machines and equipment are stable and operating normally. The PLANT is then fully in operation and is ready for the demonstration of the performance test.

The following diagram summarises the above described phases:



Notes:

- Refer to the next paragraph for the definition of “Company Only Fluid”.
- Equipment and machines are often started up before Commissioning of the corresponding Sub-system is completed.
- Commissioning activities overlap with Start-up activities.
- The last Commissioning activities and the start of Production period overlap during the Start-up period.

5.3 Hydrocarbons and hazardous materials

For safety reasons, it is important to classify potentially hazardous hydrocarbons and / or materials that are used during **Commissioning** activities.

A distinction shall be made between two categories:

Company Only Fluids (COF):

Company Only Fluids shall be managed / handled strictly and only under the control of Company.

These usually include oil, natural gas (to be used as fuel gas source), methanol, chemicals, well effluents, etc., often required to complete the **Commissioning** activity.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 15 of 97

Contractor Authorised Fluids (CAF):

Contractor Authorised Fluids may be handled by Contractors with Company authorisation and under strict safety controls.

These usually include diesel oil and, LP steam, propane from bottle, etc.

Note that the word "Fluid" is generic and may cover also handling of solids material (case of mines) or operation of the electrical network.

The **Company Only Fluids** and **Contractor Authorised Fluids** shall be listed and approved by Company during the early engineering phase of the project.

The **Company Only Fluids** and **Contractor Authorised Fluids** list shall be maintained as required during the course of the project.

A typical classification is given here below as an example:

Contractor Authorised Fluids	Company-Only Fluids
- Inert gas - Diesel Oil - LP Steam - Electrical network up to 20 kV	- Feedstock from wells - LP and HP Natural Gas - HP Steam - Methanol 260 kV Electrical Network

Whenever potentially hazardous hydrocarbons and / or materials are introduced into the facilities, there are pre-requisites and consequences to be carefully considered and managed such as:

- The switch of the Permit To Work System management (i.e. Transfer of Care & Custody), associated with the Responsible of Safety and Environment on Site (RSES) nomination.
- The organisation of SIMOPS, hot work permits allowance.
- The POB allowance, mobilization of operations personnel, etc.

5.4 OPERCOM™ methodology

The **OPERCOM™** methodology described in this specification is compulsory and shall be strictly applied.

The Checks and Tests to be carried out during **Pre-commissioning** and **Commissioning** activities shall be systematic and exhaustive according to the methodology described herein. There shall be no spot or random Checks and Tests, be it part of field or package items.

No equipment or part of the plant shall be accepted without performing successfully the associated Checks and Tests and delivering of all relevant documentation.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 16 of 97

Each Check and Test shall be recorded on a dedicated form, dated and signed by the parties involved, according to the contractual organisation and the witnessing principles as defined in chapter 10. The name of the representative of each party shall be clearly and legibly indicated and recorded.

In the event that **Conformity Check** lists or **Static Test** sheets provided in **GS EP EXP 105**, and Check sheets or **Functional Test** sheets provided in **GS EP EXP 107** are omitted or not adapted for any item or equipment of the project, the specific requirements shall be reviewed, and check or test sheets shall be modified or created from scratch, and issued to Company for approval.

Company shall be informed of the omission from these specifications of any documentation required for the correct achievement of **Pre-commissioning** / **Commissioning**.

No deviation from these specifications shall be implemented without formal approval from Company.

The team responsible for the **Pre-commissioning** and / or **Commissioning** shall have a good knowledge and practice of the **OPERCOM™** methodology and the **ICAPS©** software. In order to do so, mobilisation of dedicated resources and training shall be planned at an early stage of the Detailed Engineering.

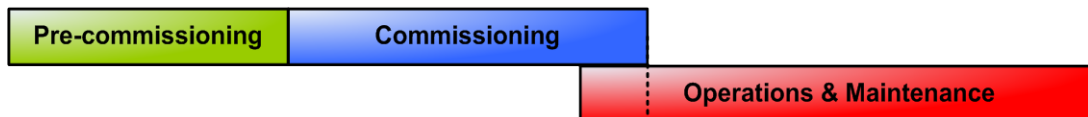
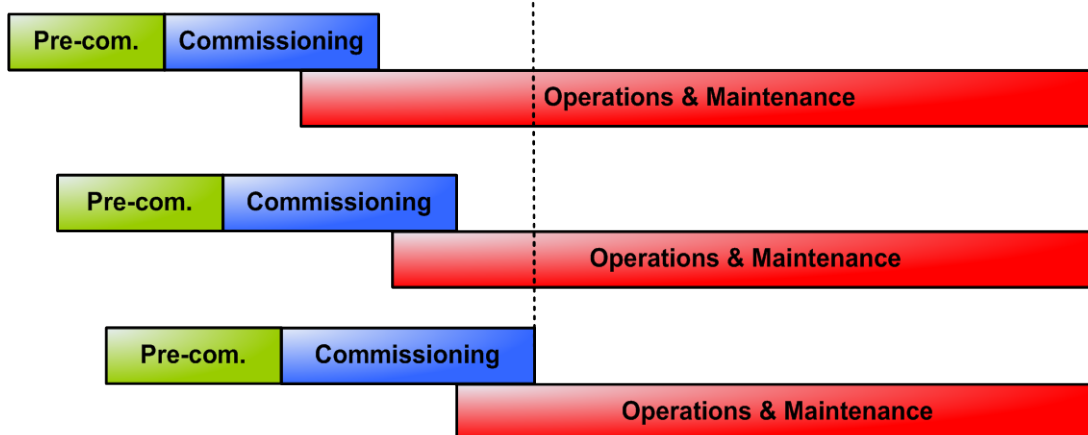
5.5 The Systems Approach

The checking and testing activities of a plant are a relatively detailed and sophisticated process. Also, during the construction phase, not all parts of the plant reach the same degree of completion at the same time. It would therefore be a waste of time to wait for the whole plant to be built before starting the **Pre-commissioning** and **Commissioning** activities.

The Start-Up sequence of a plant is driven by operational constraints where safety equipment and critical utilities are given the highest priority. Some utilities and power generation are required earlier than the process equipment. Hence, contrary to the construction work progress, which is essentially planned by trades, areas and equipment tonnage, the optimisation of Start-Up phase, goes through the timely and sequential completion of multi-trade operational units: air distribution system, fire pumps, power generation, gas detection, etc, that are required first for start-up.

In addition, for reasons of optimisation of means and resources, not all tasks related to **Pre-commissioning** and **Commissioning** disciplines can be undertaken simultaneously.

To combine the requirements described above, while limiting the impact on the planning, the solution is to stage the activities in a strictly controlled manner. To reach this objective, the plant is divided into functional **Systems** and functional **Sub-systems**, and the basic principle of Commissioning is applied to each functional **Sub-system**:

BASIC APPROACH

SYSTEM APPROACH


The principle is as follows:

System:

A System is a major subdivision of a plant, being either process or utility, which performs a major operational function of the plant.

A System includes all the various equipment that allows it to operate.

The division into functional **Commissioning Systems** generally corresponds to the prevailing fluids or services.

The Fire fighting, Power generation, Air generation, Control systems, Telecommunications, Oil, Gas, Water processing, etc., are typical examples of functional **Systems**.

Sub-system:

A **Sub-system** is a further sub-division of a System, which performs a partial operational function of the System, with little or no interference from the other Sub-systems.

The Sub-system is the basic unit for Commissioning

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 18 of 97

Here after are typical examples of functional **Commissioning Sub-systems**.

- Emergency electrical power generation.
- Oil Production Manifold 01.
- Oil Production Manifold 02.
- First Stage Separator Train A.
- First Stage Separator Train B.
- Nitrogen Generator package A.
- Nitrogen Generator package B.
- Living Quarter Gulley water drain, etc.

Note:

As the basic unit of **Commissioning** shall be the **Sub-system**, it must be understood that there can be several hundred's of **Sub-systems** on a project.

Each of these **Sub-systems** shall reach a **Pre-commissioning** completion status and a **Commissioning** Completion status.

The breakdown of a plant into **Systems** and **Sub-systems** for the **Pre-commissioning** and **Commissioning** activities shall be performed as early as possible during the Engineering phase and shall always be approved by Company.

The breakdown of a plant into **Systems** and **Sub-systems** is a key preparation activity, which has a major impingement on all aspects of the successful completion process. The **Sub-systems** shall be defined so as to be as independent as possible, not too small, but of manageable size, and adapted to the requirement of the Start-Up sequence.

The plant shall be broken down into **Sub-systems** which shall form the basis for the organisation of completion and Start-Up activities and for the issuance of the relevant completion certificates.

The breakdown shall be carried out in accordance with the **Sub-systems** delimitation rules specified in **GS EP EXP 103**, and identified on marked-up PID's, One Line Diagram's and any other type of documents necessary to define precisely and exhaustively the **Sub-system** boundaries.

5.6 Non Commissionable Systems

Some **Systems** and **Sub-systems**, are some that are non-functional. These are referred as Non Commissionable **Systems** and **Sub-systems** and are typically related to:

- Structures, jackets, Buildings, shelter.
- Multicores cables and junction boxes.
- Civil works: Concrete supports, bridge, fencing, etc.
- Geographic Zone like: Escape routing, Upper deck, helideck, 1st Floor corridors, etc.

Even if Non Commissionable, these Non Commissionable **Systems** and **Sub-systems** shall be subject to QA / QC Inspection & Test Plan, and **Pre-commissioning** activities as applicable.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 19 of 97

6. Pre-commissioning

The Company Pre-commissioning Specifications are:

- **GS EP EXP 101:** Pre-commissioning and Commissioning Specification (this document).
- **GS EP EXP 103:** Pre-commissioning and Commissioning Engineering.
- **GS EP EXP 105:** Pre-commissioning Execution.

These specifications provide all required information's, procedures and supporting documents to prepare and carry out the **Pre-commissioning**.

The **Pre-commissioning** tasks are predominantly done at **Item** level:

Item:

An item is the smallest piece of equipment identified by a tag, and subject to one or several Pre-commissioning tasks: Checks and /or Tests.

Typical **Items** are: Instrument, cable, line, vessel, lighting fixture, Junction box, panel, valve, motor coupling, transformer, etc...

6.1 Pre-commissioning activities

The **Pre-commissioning** shall be organised by **System** and **Sub-system**, following an approved **Commissioning** sequence based on the project Start-Up sequence.

From a methodological point of view, the **Pre-commissioning** has been divided into three separate types of activities:

- **Conformity Checks.**
- **Static Tests.**
- **Piping Tests.**

6.1.1 Conformity Checks

Conformity Checks:

These Checks are carried out on each item in order to verify visually the condition of the equipment, the quality of the installation and the compliance with Project drawings and Project specifications.

The Conformity Check is called CCK in ICAPS®.

Conformity Checks shall be performed in accordance with the requirement of the project technical specifications and the results shall be formally reported on the **Pre-commissioning Conformity Check** lists (CCK).

These **Conformity Check** Lists shall define exhaustively the exact scope of work that shall be systematically performed on every **Item** of the plant.

A set of typical **Conformity Check** list (CCK), each one adapted to a specific type of **Item** or package, is provided for reference in the **GS EP EXP 105**.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 20 of 97

Each and every **Item** of the plant shall be checked and the relevant **CCK** filed in the **Sub-system** dossier in the relevant discipline section.

6.1.2 Static Tests

Static Tests:

These tests are carried out on **Items** in order to ensure their individual quality/performance.

These Static Tests are called STS in ICAPS®.

Static Tests shall be performed in accordance with the requirement of the project technical specifications, and the results shall be formally reported on the **Static Test** sheets (**STS**).

Static Tests shall concern all disciplines: e.g. calibration of instruments, machinery alignments, setting of safety valves, cables insulation and continuity tests, etc.

A set of typical **Static Test** sheets (**STS**), each one adapted to a specific type of equipment, or packages, is provided for reference in the **GS EP EXP 105**.

Each and every **Item** of the plant shall be checked and the relevant **STS** filed by in the **Sub-system** dossier in the relevant discipline section.

6.1.3 Piping tests

Piping Tests:

These tests are carried out on pipe work in order to verify their mechanical integrity, cleanness, alignment, etc...

These Piping Tests are called PIP in ICAPS®.

Piping Tests are typically, but not limited to air or water flushing, pressure test (hydro test), chemical cleaning, reinstatement, gross air leak test (GALT), blowing etc

Piping Tests may be carried out on lines included in different **Sub-systems**. Specific procedures, reports, **Conformity Checks** and **Static Tests** sheets are available in **GS EP EXP 105** to support the documentation preparation process.

Piping Tests shall be organized by **Test Packs**.

Test Packs:

A Test Pack is a group of spools or lines subject together to one or several piping tasks at the same time.

Each Test Pack shall be linked to a unique Sub-system number.

As the **Piping Test** breakdown may not fully match with a hierarchical **Sub-systems** breakdown, the **Test Pack** dossiers shall be provided with the reference of all the associated **Sub-systems**, and the listing of the lines with their identification on P&ID and Isometric drawings.

Each Test Pack dossier shall include, but not limited to:

- The **Test Pack** number.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 21 of 97

- The **Sub-system** number.
- The reference to the applicable safety procedure.
- The reference to the applicable test procedure used.
- The associated tasks.
- The spools identification and /or line numbers.
- The list of critical devices to be removed for the test.
- The NDT clearance status (per line).
- The associated Sub-system (per line).
- The concerned PID (per line) and its revision number.
- The Isometric drawing numbers and optionally the associated spool numbers.
- The test results.
- The record chart diagram of the test.

Test Pack for Gross Air Leak Tests shall be systematically performed on all pipe work after re-instatement, with the objective to demonstrate that the re-instatement of the circuits that have been dismantled has been performed correctly.

The **Test Pack** dossiers shall be submitted to Company for approval.

6.2 Pre-commissioning Task Register

The **Pre-commissioning** tasks are listed in a document called **Pre-commissioning Task Register**.

Pre-commissioning Task Register:

The **Pre-commissioning Task Register** is the exhaustive list of all the **Pre-commissioning** tasks. It is the reference document used to follow up the **Pre-commissioning** execution status and progress.

The **Pre-commissioning Task Register** is issued by ICAPS®.

The **Pre-commissioning Task Register** shall be established during the engineering phase and shall be permanently maintained / updated during the execution phase.

The **Pre-commissioning Task Register** shall be organised per **Sub-system**, discipline and type of Item. It shall be created from data coming from the various Engineering and vendors / manufacturers equipment listings (instrument list, cables list, line list, etc.).

The **Pre-commissioning Task Register** shall indicate for each Item of equipment (instrument, electrical cables, pumps, etc.) the corresponding **Pre-commissioning** tasks, i.e. Checks and Tests with the reference number of the task report document, i.e. **Conformity Check** list and **Static Test** sheet numbers.

The completion data of each task shall be recorded, so that the **Pre-commissioning Task Register** is used to follow up the **Pre-commissioning** progress.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 22 of 97

6.3 Pre-commissioning certificate

The achievement of all the **Pre-commissioning** tasks on a **Sub-system** is formalised by the signature of a specific document called **Ready For Commissioning** Certificate.

Ready For Commissioning:

A Sub-system reaches the Ready For Commissioning status (RFC) when:

- All Pre-commissioning activities on that Sub-system have been successfully completed and approved.
- All reservations preventing Commissioning have been cleared.

This certificate states that the Sub-system is ready for the commencement of the associated Commissioning activities

The Ready For Commissioning status is called RFC in ICAPS®.

The pre-requisites for the signature of the **Ready For Commissioning** Certificate shall be:

- The successful completion of all the **Pre-commissioning** activities.
- The field inspection of the **Sub-system** done with the **Commissioning** Team.
- The review and approval of the **Pre-commissioning** dossier.

The establishment of the reservation list agreed with the **Commissioning** Team, and the clearance of all reservations points preventing the commencement of the **Commissioning** activities.

The categorisation of the reservation list (punch list) is detailed in chapter 9 of this specification.

Note:

The contractual wording to be used for the **RFC** certificate shall be the one provided in the contract.

Summary of characteristics for **RFC**:

	Applies to :	Sub-system
	Prerequisites :	All Pre-commissioning Activities successfully completed
	Consequences :	Authorization to begin Commissioning activities **

** : Not applicable for non Commissionable **Sub-systems** (structure, roads, areas, etc ...)

6.4 Pre-commissioning Punch List

Management of reservations (Punch list) during **Pre-commissioning** is detailed in chapter 9 of this specification.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 23 of 97

6.5 Pre-commissioning witnessing

Witnessing of activities during **Pre-commissioning** is detailed in chapter 10 of this specification.

6.6 Preservation during Pre-commissioning

Preservation during **Pre-commissioning** is detailed in chapter 8 of this specification.

6.7 Pre-commissioning dossiers

All documentation pertaining to the **Pre-commissioning** activities shall be compiled in specific Dossiers, arranged by:

- **System.**
- **Sub-system.**
- **Discipline.**

There shall be one **Pre-commissioning** dossier by **Sub-system**.

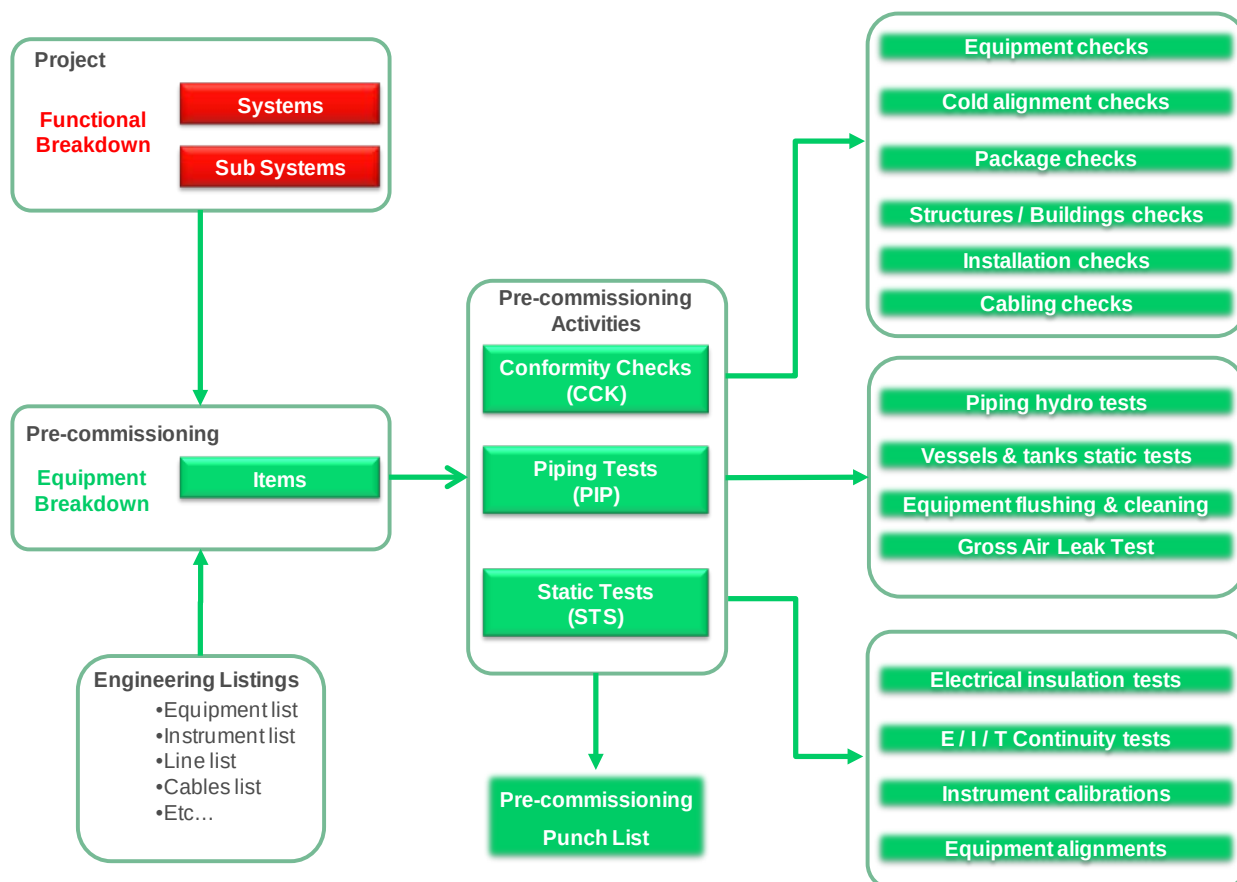
These dossiers shall contain all the information's required to demonstrate that a **Sub-system** has reached the "**Ready For Commissioning**" status (**RFC**).

The **Pre-commissioning** dossiers shall include, but shall not be limited to, the following documents:

- Dossier Index / table of contents.
- **Ready For Commissioning (RFC)** Certificate.
- **Sub-system** description and identification drawings (PID, SLD, layouts, etc...) showing the sub-system boundaries.
- Copy of the full **sub-system** punch list **Category A** at the date of **RFC** sorted by discipline.
- Remaining **Category B & C** punch item of the **Sub-system** at **RFC** date, sorted by discipline.
- Specific procedures and tests.
- **Pre-commissioning** Task Register by discipline.
- **Pre-commissioning** Record sheets (Checks & tests by discipline).
- Vendors/Manufacturers datasheet for each equipment (attached to the check sheet).
- Vendors/Manufacturers reports of FAT, worksites intervention, etc.
- Preservation and maintenance procedures with routine inspection log sheets.
- Equipment and inspection report.
- Miscellaneous correspondence, etc.
- Readable Red Line Mark-Up copy of "As Pre-commissioned" drawings.
- List of modifications and associated worksites queries related to this sub-system.
- Extract of the worksites queries and modifications follow up register, as applicable.

These dossiers, once completed, shall be transferred to Company as per the format and quantities specified in the contract.

6.8 Pre-commissioning activities summary



Activity	Discipline	Number	Supporting Document
Conformity Checks	All	1 per item 1 per package (wherever OPERCOM™ not applied)	1 Check list per Check - Pre-commissioning Task Register
Static Tests	All	1 test per Item 1 test per item of package (wherever OPERCOM™ not applied)	1 Test sheet per Test - Pre-commissioning Task Register
Piping Tests	Piping	1 per group of lines per Sub-system or network	- Specific procedure and report - Test Pack dossier - Pre-commissioning Task Register
Factory Testing	All	As appropriate for each vendor supplied package	- FAT report. - Pre-commissioning Task Register

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 25 of 97

7. Commissioning

The Company **Commissioning** Specifications are:

- **GS EP EXP 101**: Pre-commissioning and Commissioning Specification (this document).
- **GS EP EXP 103**: Pre-commissioning and Commissioning Engineering.
- **GS EP EXP 107**: Commissioning Execution.

These specifications provide all required procedures and support documents to prepare and carry out the **Commissioning**.

7.1 Commissioning activities

As for the **Pre-commissioning**, the **Commissioning** activities shall be organised by **System** and **Sub-system**, following the same approved sequence based on the project Start-Up sequence.

From a methodological point of view, the **Commissioning** scope of work has been divided into four separate types of activities:

- **Preliminary Checks.**
- **Functional Tests.**
- **Piping and Vessels Preparations.**
- **Operational Tests.**

7.1.1 Preliminary checks

Preliminary Checks;

The Preliminary Checks are the cross verification done by the Commissioning Team. They take place when a Sub-system nears or reaches the Ready for Commissioning status, and consist of:

- A physical check on site of the installation.
- A thorough review of the Pre-commissioning Dossier.

The Preliminary Checks is a multidiscipline activity.

The Preliminary Checks are called PRC in ICAPS®.

The **Preliminary Checks** shall be completed and approved prior to the issuance of the relevant **Sub-system RFC** certificate during the field inspection done with the **Commissioning** Team of the **Sub-system**.

The **Preliminary Checks** shall be carried out by each **Commissioning** discipline and formalised on a report form provided for reference in the **GS EP EXP 107**.

Once the **Preliminary Checks** have been successfully done, the **PRC** form can be issued and signed by each discipline Commissioning representative.

The signature of the **PRC** certificate shall be a pre-requisite to the issuance of the **Sub-system RFC** certificate.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 26 of 97

7.1.2 Functional Tests

The **Functional Tests** are the live tests performed on each electrical, instrument and telecommunication **Basic function**.

Basic Function:

The Basic Function is the smallest referenced unit that can be subject to one or several Commissioning tasks. It is constituted by one or several Items and performs an elementary function of the plant.

Each Basic Function shall have a unique tag.

The Basic Functions are called BF in ICAPS®.

GS EP EXP 107 lists and defines the main types of Basic Functions of a plant: switchboards, motors, heaters, control loops, ESDV's, loudspeaker loops, etc...

Each Basic Function shall be subject to a **Functional Test**.

Functional Tests:

The Functional Tests are the dynamic tests made on each Basic Function in order to prove their operation according to the relevant design intent criteria.

The Functional Tests are called FTS in ICAPS®.

Typical examples of such Functional Tests are electrical motors uncoupled runs, instrument loops tests, electrical breakers operation. Powering up of the electrical distribution network is part of this activity.

The Functional Tests shall be carried out in accordance with technical specifications, and the results formally reported on individual Functional Test sheets.

A set of typical Functional Test sheets (FTS), each one adapted to a specific type of Basic Function is provided for reference in the GS EP EXP 107.

Each and every Basic Functions of the plant shall be tested and the relevant FTS filled by Sub-system and by type of Basic Functions for each discipline.

7.1.3 Piping and Vessels Preparations

Piping and Vessels Preparation:

Piping and Vessels Preparation consists of a number of activities carried out on pipe work and vessels in order to demonstrate their readiness for the commencement of operation in term of tightness, cleanness, oxygen free, etc...

The Piping and Vessels Preparation is called PVP in ICAPS®.

There are specific Commissioning activities required to prepare the piping and vessels network before the introduction of the process fluids into the plant.

Typical Piping and Vessel Preparation activities are, but not limited to: Piping drying-out, pipe network leak testing and inerting, loading of various chemicals and catalyst, etc...

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 27 of 97

Piping and Vessel Preparation activity can be organised by test packs that may not fully match with a hierarchical Sub-systems breakdown, e.g.: Leak tests are carried out by level of pressure rather than by Sub-system. In that case, specific dossiers shall be provided and then referenced in each impacted Sub-systems Commissioning dossiers.

The Piping and Vessel Preparation dossiers shall include the pressure test value, the fluid used, the test duration and the test boundaries identification on P&ID, Isometric drawings or any other relevant drawings or documents.

Specific reports forms and test sheets are provided for reference in the GS EP EXP 107.

7.1.4 Operational Tests

As part of the Commissioning activity, equipment, System, Sub-system or groups of Sub-systems, shall be subject to an Operational Test.

An Operational Test shall not proceed until all the relevant Functional Tests and Piping & Vessel Preparation have been successfully completed.

An Operational Test shall demonstrate that the equipment, System, Sub-system or groups of Sub-systems is ready for safe and permanent operation. It is not intended to demonstrate the individual Basic Functions that have been tested prior to the Operational Test itself.

The Operational Test is a key Commissioning activity.

Operational Tests:

An Operational Test consists of bringing into service, as close as possible to normal operating condition and for a significant period of time, the equipment, using inert or process fluids as necessary, in order to:

- test all situations and configurations that might lead to problems during normal operation
- prove that the safety key performance standards, the integrity, the operating range, design parameters, the readiness are suitable in the site final configuration,

The Operational Tests apply either to equipment, System, Sub-system or a group of Sub-systems.

These tests are called OTS in ICAPS©

Typical equipment, System, Sub-system or group of Sub-systems subject to Operational Tests are, but not limited to: Fire water pumps, air compressors, power generation, ESD systems, furnaces, boilers, export pumps in recycle, process compressors in recycle, sub-sea equipment, Freon or propane packages, hot oil loop, etc.

The Operational Test shall demonstrate the project Safety Key Performance Standards,

The Operational Test shall demonstrate the design parameters and the safe reaction of the equipment under test in downgraded situations or unexpected events such as sudden and / or partial loss of electrical and or hydraulic power or air supply for example.

The various parameters measured during the Operational Test shall be used as the reference measurement for the equipment as it is the first time it is used in its final configuration.

An Operational Test shall includes the live demonstration of the automated devices, controls, activation of all Normal and Emergency shutdown sequences, load sharing and load scheduling,

and shall be conducted in such a way to reveal possible mechanical or electrical faults (water tightness, vibrations, overheating, overloading, etc.) which may occur during prolonged normal use.

The **Operational Test** demonstration shall be done under conditions as close as possible to normal operation. As a consequence, the amount of Inhibits, Overrides, Process by-passes, and manual simulation shall be recorded and kept to the strict minimum in order to have a representative test.

The **Operational Test** demonstration shall take into account the climatic conditions in case of large variation between winter and summer. In this case, the test of the parameters that are sensitive to the climatic environment shall be performed at both seasons or at both locations if the **Operational Test** was initially performed in a country different from the final location of equipment. e.g.: **Operational Test** done in Asia for a final location in Arctic region.

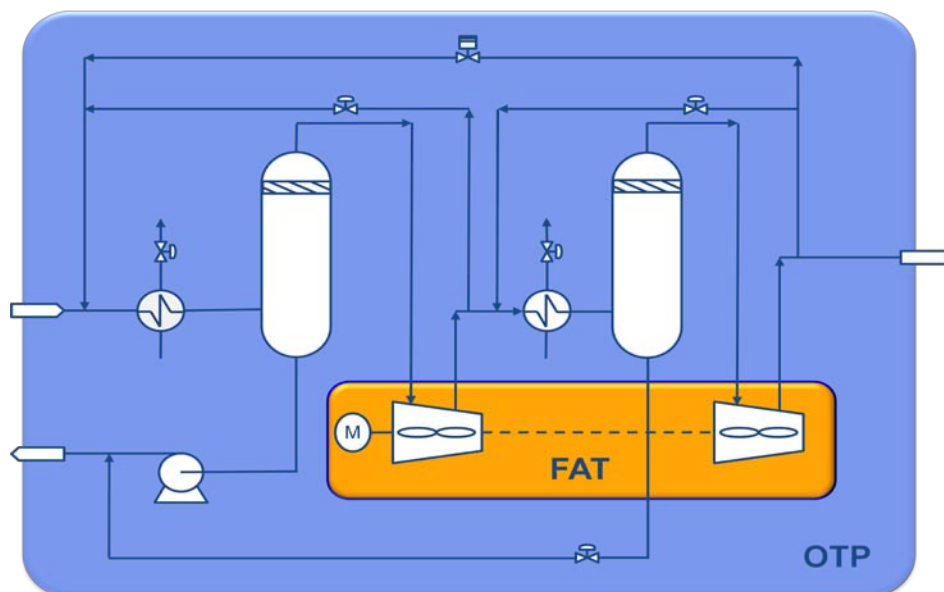
The **Operational Test** is a multi-discipline activity and shall be conducted in accordance with an exhaustive **Operational Test Procedure (OTP)**. This procedure shall be prepared and approved during the **Commissioning** engineering phase.

There is no standard **Operational Test Procedure**, as by definition they shall be specific to the **System**, **Sub-system**, or group of equipment to be tested. The **Operational Test Procedures** shall be approved by the Company.

Some **Operational Tests** have to be performed with **Company Only Fluids (COF)**. These tests shall be strictly carried out under the control of Company.

An **Operational Test** shall not be compared to a Factory Acceptance Test (FAT) or Site Acceptance Test (SAT) as the boundaries of FAT and SAT are limited to the main piece of equipment provided by the manufacturer, while the purpose of an **Operational Test** is to demonstrate that the said equipment is performing as per project specifications within its final environment in the plant.

The **Operational Tests** are made on equipment, **System**, **Sub-system** or a group of **Sub-systems** as shown in the following example for a process **Sub-system**.



General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 29 of 97

7.2 Commissioning Task Register

The Commissioning tasks are listed in a reference document called The **Commissioning Task Register**.

Commissioning Task Register:

The Commissioning Task Register is the exhaustive list of all the Commissioning tasks. It is the reference document used to follow up Commissioning execution.

The Commissioning Task Register is issued by ICAPS®.

The **Commissioning Task Register** shall be established during the engineering phase and shall be permanently maintained / updated during the execution phase.

The **Commissioning Task Register** shall indicate, for each **Sub-system** all the Commissioning activities to be performed (PRC, FT, OT, PVP), and shall be organised by **Sub-system**, disciplines and type of activities.

The completion date of each task shall be recorded, so that the **Commissioning Task Register** is used to follow up the **Commissioning** progress.

7.3 Commissioning Certificate

The achievement of the **Commissioning** on a **Sub-system** is formalised by the signature of a specific document called **Achievement Of Commissioning Certificate**.

Achievement Of Commissioning:

A Sub-system reaches the Achievement Of Commissioning status (AOC) when:

- All Commissioning activities on that Sub-system have been successfully completed and approved.
- All reservations preventing safe and continuous operation have been cleared.

The Achievement Of Commissioning certificate is a pre-requisite to the transfer of operation and maintenance of the Sub-system.

The Achievement Of Commissioning status is called AOC in ICAPS®.

This certificate only states that the **Commissioning** on the **Sub-system** is completed, and does not imply any transfer of responsibility.

The pre-requisites for the signature of the **Achievement Of Commissioning Certificate** for a **Sub-system** shall be:

- The successful completion of all the **Commissioning** activities on that **Sub-system**.
- The field inspection of the **Sub-system** done with the Company.
- The review of the **Commissioning** dossier.
- The consolidation of the reservation list agreed with Company, and the clearance of all reservations points preventing the operation of that **Sub-system**.

The categorisation of the reservation list (punch list) is detailed in chapter 9 of this specification.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 30 of 97

Note:

The contractual wording to be used for the AOC certificate shall be the one provided in the contract.

Summary of characteristics for AOC:

	Applies to :	Sub-system
	Prerequisites :	All Commissioning Activities successfully completed
	Consequences :	Pre-requisite for transfer is achieved

7.4 Commissioning Punch List

Management of the reservations (Punch list) during Commissioning is detailed in chapter 9 of this specification.

7.5 Commissioning witnessing

Witnessing of activities during Commissioning is detailed in the chapter 10 of this specification.

7.6 Preservation, Operation and Maintenance during Commissioning

During Commissioning, equipment may be required to run on a permanent basis, while some others shall be preserved / mothballed until the time arrives to put them in normal operation.

Operation, Maintenance and Preservation during Commissioning is detailed in chapter 8 of this specification.

7.7 Commissioning dossier

All documentation pertaining to the Commissioning activities is compiled in a specific Dossier, arranged by:

- System.
- Sub-system.
- Discipline.

These dossiers shall contain all the information required to demonstrate that a Sub-system has reached the "Achievement Of Commissioning" status.

The Commissioning Dossier shall include, but not be limited to:

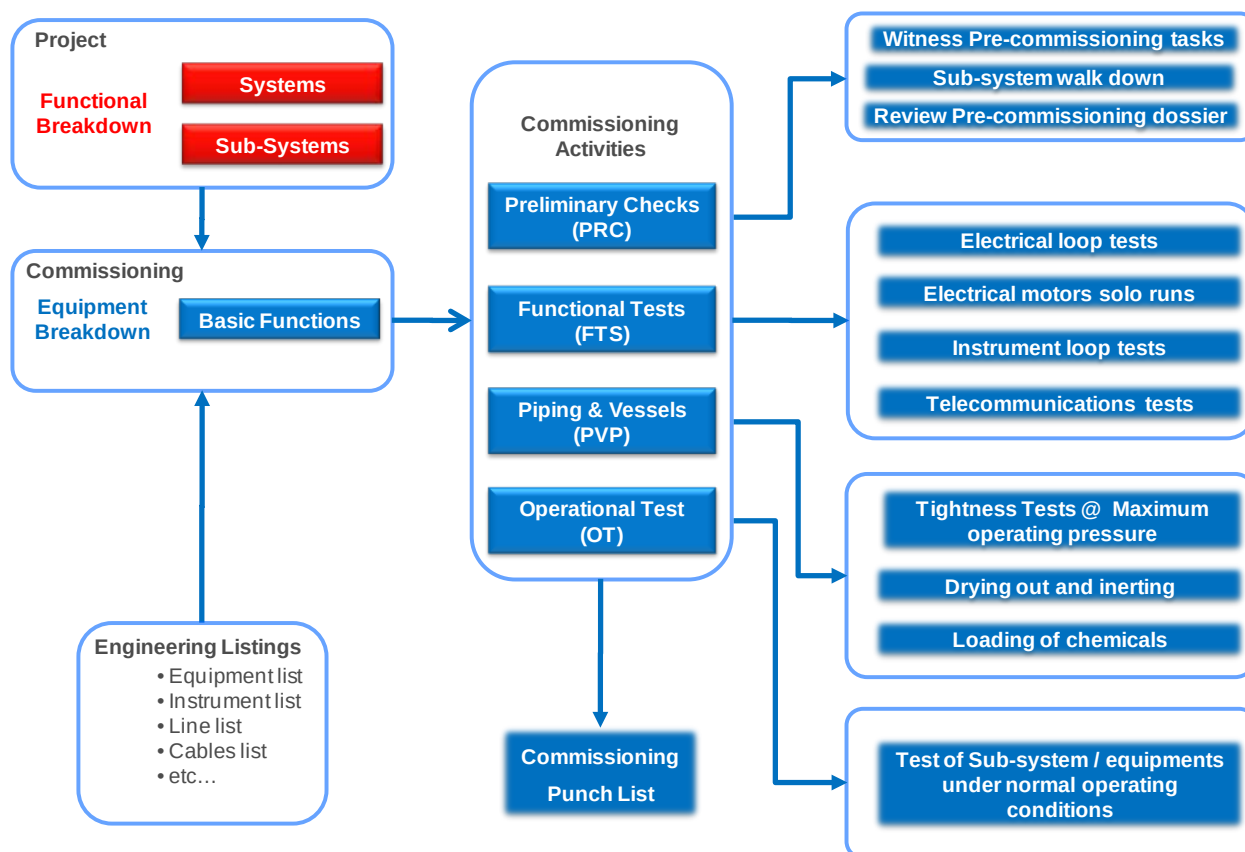
- Dossier Index / table of contents.
- Achievement Of Commissioning Certificate.
- Sub-system description and identification drawings (PID, SLD, Layouts, etc...) showing the Sub-system limits.
- Copy of the full Sub-system punch list Category B at the date of AOC sorted by discipline.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 31 of 97

- List of **Category C Punch List** of the **Sub-system** at the date of **AOC** sorted by discipline.
- **Commissioning Task Register** by discipline.
- **Commissioning** record sheets (**Functional Test** sheets, **Operational Tests** sheets, **Piping and Vessel Preparation** sheets by discipline).
- Certificates issued by Third party.
- **Operational Tests Procedure**, **Operational Tests** results & reports.
- PSV and instrument ranges, alarms & trip settings.
- Preservation and maintenance procedures with routine inspection log sheets.
- Sea fastening specific procedures and reports.
- Mechanical reports.
- Chemical cleaning reports.
- Leak tests and inerting procedures and final reports.
- Flange Management status report.
- Vendors / Manufacturers Reports and technical correspondences.
- Specific procedures or tests and Pre start-up activities Procedures, etc.
- All relevant parts of the FINAL DOCUMENTATION.
- List of Modifications with relevant references and associated SITE queries.
- Vendors / Manufacturer's SAT reports.
- Readable Red Line Mark-Up copy of "As Commissioned" P&ID's, Single Line Diagrams, Loop Diagrams, Vendor's / Manufacturer's drawings and manuals, etc.
- **Sub-system** Status at **AOC** stage:
 - Location and position of blinds/spades.
 - Location and position of isolation LO & LC valves.
 - List of electrical isolation status.
 - List of remaining inhibits and overrides, etc.
 - Identification of pressurized section such as inerting or section filled with fluids.
- Copy of transmittal for:
 - Spare parts.
 - Consumables.
 - Special tools.
 - Vendor's / manufacturer's documentation, etc.

These dossiers, once completed, shall be transferred to Company as per quantities and the format specified in the contract.

7.8 Commissioning activities summary



Task	Discipline	Number	Support Document
Preliminary Checks	All	One by Sub-system	1 cross inspection report per Sub-system + punch list items in Pre-commissioning Dossier - Commissioning Task Register
Functional Tests	Electrical Instruments Telecomm. Safety	One test or more by Basic Function	1 Functional Test sheet per test - Commissioning Task Register
Piping & Vessels Preparations	Process	One activity or more by Sub-system	- Leak test report, - inerting reports, etc... - Test pack dossier - Commissioning Task Register
Operational Tests	All	One test by equipment, System, Sub-system or groups of Sub-systems	1 Operational Test Report. - Commissioning Task Register

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 33 of 97

8. Preservation, Operation & Maintenance, Mothballing

8.1 Preservation

There are a number of situations where equipments are not in a safe, stabilized and monitored environment. After being dispatched from factory / workshop, and until the equipments are in normal operation on site, all of them might spend some time in transportation, storage, on stand-by, etc...

During this time, equipment can be exposed to a number of aggressive environments or situations, and could be deteriorated / damaged. Ensuring integrity and functionality of an equipment is critical in keeping its availability through that time and at the time where it will be required for service.

In order to safeguard the integrity and functionality of equipment, it is necessary to preserve it, taking in consideration the following criteria's as a minimum:

- Weather conditions: condensation, sun radiation, frost, water ingress, dust, etc.
- Local conditions: corrosive atmosphere, presence of sand, animals, etc.
- Duration: long term v/s short term preservation requirement, expiry date of consumables, etc.
- Functionality: Mechanical deformation when not running, seizing, external chocks, etc.
- Project phases: Storage, construction, transportation, handling, Pre-commissioning, Commissioning, drilling, stand-by time etc.

The **preservation** is required to safeguard the integrity and functionality of equipment from any of these possible harms.

Preservation

Preservation refers to the activities performed on all equipment, all piping, and all spare parts, special tools and consumables in order to protect them against external and internal deterioration factors and to keep them in unimpaired condition until the equipment are in normal operation.

The **Preservation** engineering shall be performed during the engineering phase, and shall be based on the requirement of the specification **GS EP EXP 103**.

The **Preservation** related activities shall be prepared and tracked using **ICAPS®** Preservation record sheet until the equipment is formally transferred to Company.

The **Preservation** history and records shall be made available at any time until the equipment is formally transferred.

8.2 Operation & Maintenance

During **Commissioning** some equipment may be required to be brought into operation on a permanent basis, e.g. air compressors, electrical generators, HVAC, etc...

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 34 of 97

Once equipment have been started, they shall be subject to a routine Operation & Maintenance program which shall at the minimum satisfy to the requirements of manufacturer regarding warranty issues.

The Maintenance program shall be performed as per the requirement of **GS EP EXP 213** until the equipment are formally transferred to Company.

The Operation & Maintenance program shall be also applied to temporary equipment whenever applicable.

The Operation & Maintenance program shall be based on manufacturer documentation. This program shall be implemented until the package or piece of equipment is formally transferred to Company.

This program shall include, but shall not be limited to:

- Routine visit and filling of related log sheet as required by the program.
- Lubrication schedule and substitute lubricant list if applicable.
- Routine maintenance as per the vendor's / manufacturer's recommendations.
- Preservation and de-preservation procedures and related check sheets as required by the program.
- Provision of consumables and spare parts including all HSE material (Material Safety Data Sheet, etc).
- Provision of manpower for work on shift if required.
- Provision of maintenance procedure schedule, registers, log sheets, etc.

8.3 Mothballing

Packages, piece of equipment, large modules or even complete installation may need to be preserved / mothballed for a significant period in some particular cases like:

- Transportation from construction yard to the final site.
- Early delivery.
- Drilling campaign on a well head platform.
- Platform ready to operate but in stand-by because of external constraint (other part of the project not ready), etc.

This activity will be referred as Mothballing.

The mothballing activity is generally similar to the preservation, but it has particularities in some instances:

- Specific studies and programs have to be developed for the object subject to long term mothballing.
- Equipment needs to be in continuous service to maintain the integrity of the facility. Typical examples are running of HVAC, circulation of hot medium or permanent purging.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 35 of 97

- Mothballing of a facility might require the removal of some critical part such as core engine or the periodic running of some equipment.
- The de-mothballing of a facility shall be followed by all required **Pre-commissioning** and **Commissioning** activities as applicable.

The mothballing related activities shall be prepared and tracked using **ICAPS®** Preservation record sheet until the equipment is formally transferred to Company.

9. Punch List

While the **Pre-commissioning** and **Commissioning** activities are being performed, all discrepancies, damaged or missing equipment, malfunctions, missing documents, if not corrected immediately, are called **Punch item** and shall be recorded in the relevant **Sub-system Punch List**.

Punch Item

A Punch Item is an uncompleted, unsatisfactory or missing work, identified as being part of a scope of work, which shall be cleared during the course of the project at a specific contractual milestone.

The Punch Items are recorded in a consolidated document called Punch List.

The **Punch Item** shall be managed under one single overall project **Punch List** using the **ICAPS®** software.

A **Punch Item** is considered as a blocking point if it leads to a potential hazard with respect to the following:

- Safety or operational aspect of the ongoing or upcoming activity in the completion process.
- Any missing requirement from project specifications.
- Any missing requirement related to particular local rules/regulations.

Are not to be considered as **Punch Items**,

- Items related to construction / installation work still not completed before starting a **Pre-commissioning** activity.
- Items which are not exclusively part of the Scope of work such as additional works or additional requirements not covered by the Contract and specifications, or any requirement to improve the plant in whatever way not specified within project documentation.

9.1 Punch Items Categories

The management of the **Punch Item** is done by categories.

The methodology to determine the **Punch Item** category shall be based on pre-requisite to achieve a **Pre-commissioning** or **Commissioning** technical milestone: **RFC** or **AOC**.

The categorisation shall not be based on a criticality rating or a planning priority.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 36 of 97

Through the course of the project, Company shall review and approve the categorization, the responsible party for clearance and the clearance location of any **Punch Item**.

The category, responsibility and the clearance location assigned to a **Punch Item** shall not be modified without formal approval from Company.

The categories of the **Punch Item** shall be determined as follows:

Category A:

Punch Item considered as a blocking point for the commencement of the Commissioning activity of the Sub-system.

Consequence:

Category A Punch Items prevent the signature of the RFC certificate of the relevant Sub-system.

Typical **Category A** Punch Items are: Electrical cable defect, broken lighting fixtures, valve stuck in position, missing equipment or support, etc...

Category B:

Punch Item considered as a blocking point for the operation of the Sub-system.

Consequence:

Category B Punch Items prevent the signature of the AOC certificate of the relevant Sub-system.

Typical **Category B** Punch Items are: Faulty transmitter, Oil leakage on a transformer, wrong logic sequence, non achievement of design criteria during Operational test, excessive vibrations on an equipment, missing critical vendor documentation or certification, etc...

Category C:

Punch Item considered as a blocking point for the signature of the contract Completion Certificate.

Typical **Category C** Punch Items are: paint touch up works, non essential documentation, installation of missing tags, etc ...

For the vendor packages, modules, subsea equipment, etc, requiring transportation from one place to another, additional **Punch Item Category** shall be created as follows:

Category 0:

Punch Item considered as a blocking point for the shipment of the package / subsea equipment / module from the vendor premises, construction yard or the like.

The **Punch Items** discovered in the vendor / manufacturer premise for the packages, modules or subsea equipment, etc, shall be cleared prior the shipment of the equipment.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 37 of 97

Only, with Company approval, the agreed **Punch Items** not cleared before shipment shall be added, in the relevant Sub-system **Punch list** with:

- The relevant **Punch Item Category (A, B or C)**.
- The responsibility for clearance.
- The clearance location.

For the case of the wet subsea equipments, no physical **Punch list** items (discrepancies, damaged or missing equipment, malfunctions, etc...) shall be accepted prior to the final installation subsea.

9.2 Punch Item description

Each **Punch item** shall be recorded in **ICAPS®** with the following information, but not limited to:

- **Sub-system**.
- **Item** identification tag.
- Defect description.
- Discipline in charge of the corrective action.
- Party in charge of the corrective action.
- Location of the corrective action.
- Expected date of corrective action.
- Estimated duration of the corrective action (m/h).
- **Punch Item Category (A, B, C)**.
- Originator name.
- Originated date.
- Description of the corrective action done.
- Corrective action: Done by and date.
- Corrective action: Checked by and date.
- Corrective action: Approved by and date.
- Vendor assistance requirement (Y/N).
- Materiel requirement (Y/N).
- Engineering assistance requirement (Y/N).
- Schedule.

9.3 Punch List management

The **Punch list** shall be kept permanently updated during the project execution, so as to have a precise status of each **Sub-system** at each of the **Sub-system** completion milestones:

- **Ready For Commissioning (RFC)** status.
- **Achievement Of Commissioning (AOC)** status.

Prior to the **Ready For Commissioning (RFC)** stage of a **Sub-system**, the agreed Punch list shall be issued for approval to the **Commissioning** team.

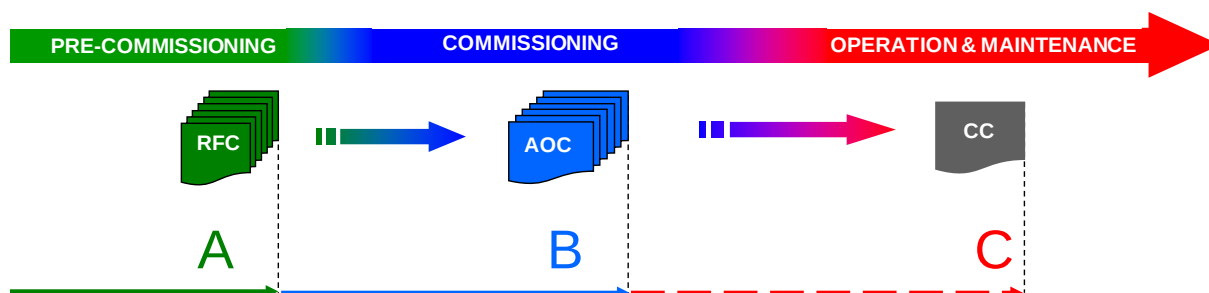
Only **Category B** and **Category C** shall remain at this stage.

The **Sub-system Punch list**, once established at the date of the **Ready For Commissioning** stage, remains continually updated during the **Commissioning** by adding new **Punch Items** and approving the clearance of existing ones.

At the **Achievement Of Commissioning (AOC)** stage of a **Sub-system**, the agreed **Punch list** shall be issued for approval to Company.

Only **Category C** shall remain at this stage.

The clearance of **Punch Item** is summarised hereafter:



Punch List clearance

Punch List clearance means that a proper corrective action has been implemented and the correction of uncompleted, unsatisfactory or missing work is considered completed

Company shall be the sole entity to decide and approve the clearance of a Punch Item.

The **Punch List clearance** requirements on site shall be taken into account during the preparation phase in order to plan the correct level of resource and means (clearance team, procurement of parts, record and follow-up, liaison with engineering and vendors, remedial actions, etc.).

The mobilization plan shall include a dedicated **Punch List** multidiscipline team in order to timely clear the **Punch Items** during the course of the project.

During the project execution, regular **Punch List** meetings shall be organized with Company in order to expedite timely the clearance of the **Punch Items** and to avoid the transfer of the clearance of the **Punch Items** from one location to another.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 39 of 97

10. Witnessing

Witnessing is defined as the visual verification and control, at various locations during the project, of some predefined Construction, **Pre-commissioning** and **Commissioning** activities.

This paragraph specifies the requirement of Company in term of Witnessing. The different levels definitions indicated here, only relate to the Company attendance.

These verifications and controls can be performed by different entities of Company:

- The Company Construction, **Commissioning** and Operation Teams.
- Delegated Parties on behalf of Company.
- Third Parties.

These parties are referred as Company in this paragraph.

Witnessing consists typically of the following, but not limited to:

- Check of workshop activities such as FAT's, E-FAT's, qualification tests, etc.
- Check on worksite and final site of equipment including SIT's, SAT's, etc.
- Check specific construction, Pre-commissioning and Commissioning activities during the project life cycle.
- Verify the compliance with Local Regulations, International Safety Standards etc.

The specific required attendance to each activity to be witnessed shall be addressed in a dedicated Witnessing Matrix, as requested by **GS EP EXP 103**.

Moreover, Company shall have the right to request at any time during the Project life, to witness any **Pre-commissioning** or **Commissioning** activities, even not included in the Witnessing Matrix.

10.1 Witnessing levels definition

The three levels at which the **Pre-commissioning** and the **Commissioning** activities will be witnessed shall be as follows:

- Hold (H).
- Witness (W).
- Monitor (M).

Level 1: HOLD (H)

HOLD points are defined as points within the project life cycle for which the formal approval of Company shall be obtained in order to proceed with the activities.

Consequence:

Subsequent activities directly linked to an HOLD Point shall not proceed until an inspection / surveillance activity is carried out by Company.

If not attended by Company, the activity shall not be recognized as valid, and shall be redone in the presence of Company.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 40 of 97

Hold points shall be subject to a minimum notification time of:

- 72 hours for a Pre-commissioning activity.
- 1 week for a **Commissioning** activity.

Notes:

1. The above mentioned notification times shall be considered as the minimum requirement. That shall be provided formal approval if these times are subject to modification.
2. Geographical location shall be considered in the calculation of the notification time in order to take into account any transportation time if required.
3. The time notice for **Commissioning** activities is required to allow sufficient time to mobilise a specialist representative to attend the tests.

Level 2: WITNESS (W)

WITNESS points are defined as points within the project life cycle that Company may decide to witness and approve progress to subsequent activities as applicable

Consequence:

Should Company not be present at the appointed time for a **WITNESS** Point, then based on agreement with Company, the activity is permitted to proceed.

Witness points shall be subject to a minimum notification time of:

- 48 hours for a **Pre-commissioning** activity.
- 72 hours for a **Commissioning** activity.

Note: Same as Level 1 notes

Level 3: MONITOR (M)

MONITOR points are defined as points within the project life cycle for which Company may monitor activities, service, equipment or material, but where specific approval is not required for the activities to proceed.

Notification time is not applicable to Level 3.

10.2 Witnessing Matrix

The **Pre-commissioning** and **Commissioning** witnessing matrix shall be adapted to the specificities of the project and developed during the Detailed Engineering phase as specified in the **GS EP EXP 103**.

The project witnessing matrix shall take into account the Company witnessing requirement as indicated in the tables of Appendix 02 and 03 of this specification.

These tables include the following requirement from Company:

- Company Construction team for the construction and **Pre-commissioning** activities they need to witness (**H**, **W** or **M**).

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 41 of 97

- Company **Commissioning** team for the construction, **Pre-commissioning** and **Commissioning** activities they need to witness (H, W or M).
- Company Operation team for the construction, **Pre-commissioning** and **Commissioning** activities they need to witness (H, W or M).

The project witnessing matrix shall be submitted to Company for review and approval.

Once approved, this matrix shall be issued and used to:

- Timely notify the Company representatives.
- Customise the footer of the Test and Check sheets as the example below:

	Performed by: Sub-Contractor 1	Verified by: Supervisor 1	Approved by: Main Contractor		Witnessed by: Third Party	Witnessed by CPY Operation
Signature						
Name						
Date						

10.3 Witnessing organisation

A two weeks look ahead schedule for witnessing of **Pre commissioning** and **Commissioning** activities shall be issued to Company for information.

This two weeks look ahead shall not be a substitute for the formal notification timeline mentioned above.

Witnessing activities shall be discussed during the daily and weekly meeting.

Witnessing representative will only sign the check or test sheet relevant to the **Pre commissioning** or **Commissioning** activities that have been witnessed.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 42 of 97

11. Progress Measurement

The progress of the **Pre-Commissioning** and **Commissioning** Engineering and Execution activities shall be strictly monitored and assessed through all the project duration.

11.1 Engineering Phase

The **Pre-commissioning** and **Commissioning** Engineering consists in the preparation of the **ICAPS©** data base and issuance of the contractual deliverables.

The overall **Pre-commissioning** and **Commissioning** Engineering progress measurement shall indicate the following breakdown of activities:

- Data base set up:
 - **ICAPS©** population.
- Issuance of deliverables as listed in **GS EP EXP 103** and in the contract:
 - **Pre-commissioning** and **Commissioning** management.
 - **Pre-commissioning** engineering.
 - **Commissioning** engineering.

The **Pre-commissioning** and **Commissioning** Engineering progress measurement shall be based on the above mentioned breakdown with weight factors

11.2 Execution Phase

The **Pre-commissioning** and **Commissioning** execution progress by man-hours shall be reported by **Sub-system** using **ICAPS©** and the following definition:

Estimated man-hours: Estimated time to perform one task entered in **ICAPS©**

Earned man-hours: Time earned on one task completion

The **Pre-commissioning** and **Commissioning** execution progress shall be calculated from the execution **Estimated man-hours** for each type of tasks for each discipline: **CCK**, **STS**, **PIP**, **PRC**, **FTS**, **PVP** and **OT**. **Estimated man-hours** assigned to **PVP** and **OT** shall be evaluated on a case by case basis.

The individual tasks **Estimated man-hours** once approved by Company shall be entered in **ICAPS©** and used as the reference man-hours for the whole project duration.

The execution progress shall be:

$$Progress\ in\ \% = \frac{Total\ of\ Earned\ man - hours \times 100}{Total\ of\ Estimated\ man - hours}$$

ICAPS© Weighting factors corresponding to different work locations and environments shall be submitted to Company for approval.

The **Pre-commissioning** and **Commissioning** execution progress figures shall be calculated by **ICAPS©** based on the above mentioned **Estimated man-hours** and location weighting factor.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 43 of 97

12. Role, Responsibilities and Organisation

A dedicated organisation shall be implemented to achieve all requirements of the **Pre-commissioning** and **Commissioning** activities as defined in the **OPERCOM™** specifications.

The **Pre-commissioning** and **Commissioning** engineering and execution shall be performed using dedicated suitably trained and qualified team with confirmed experience and expertise.

A typical **Pre-commissioning** and **Commissioning** role and organisation for the engineering and execution phases is presented here below:

12.1 Pre-commissioning and Commissioning Engineering Phase

The engineering team shall be made of personnel that will be part of the future **Pre-commissioning** and **Commissioning** Execution Teams.

All the necessary **Pre-commissioning** and **Commissioning** specialists shall be timely mobilized to fulfil the requirements of the **OPERCOM™** specifications and project schedule requirement.

The **Pre-commissioning** and **Commissioning** engineering team shall also actively liaise and coordinate with other department like engineering, procurement, planning, cost control, logistic, etc... in order to ensure a proper execution of the scope of work.

The **Pre-commissioning** and **Commissioning** engineering team shall coordinate the activities and timely obtain the necessary documentation from process licensor's, vendor's and any subcontractor participating in the project.

The **Commissioning** Manager shall manage, follow-up and report on the preparation activities and shall ensure that the activities are completed in full compliance with the **OPERCOM™** specifications and contract requirements. He shall be mobilized immediately after the effective date of the contract.

According to Project specificities, the need of discipline specialists to interface with other packages **Pre-commissioning** and **Commissioning** activities shall be timely identified, and specialists mobilised accordingly.

12.2 Pre-commissioning Execution Phase

A **Pre-commissioning** Execution Team shall be mobilized at each work location and shall be independent from the **Commissioning** team.

The **Pre-commissioning** Execution Team shall:

- Carry out **Pre-commissioning** activities as defined herein and in accordance with the project specifications.
- Participate in coordination meetings with Construction and **Commissioning** teams.
- Assist **Commissioning** Team.
- Prioritize Construction and **Pre-commissioning** works as per **Commissioning** Priorities defined by the **Commissioning** Team based on the project start-up sequence.
- Ensure that the **Pre-commissioning** documentation is properly built-up.
- Ensure that all the activities to be performed are identified and timely traced in **ICAPS®**.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 44 of 97

12.3 Commissioning Execution Phase

The **Commissioning** Execution Team shall be in any case independent from the **Pre-commissioning** Team and the Construction Team.

A **Commissioning** Team shall be mobilized for each work location.

The **Commissioning** Team shall:

- Carry out **Commissioning** activities as defined herein and in accordance with the project specifications and the contract.
- Review requests for information, technical site queries, and change orders for impact on Commissioning.
- Review Construction / **Pre-commissioning** meeting minutes for impact on Commissioning.
- Participate in coordination meetings with Construction / **Pre-commissioning** / Company.
- Instruct the **Pre-commissioning** Team on the priorities set by the Start-Up Sequence and the **Commissioning** Sequence.
- Witness activities as defined herein, and in particular piping pressure test and flushing to ensure that proper procedures are followed and that fragile devices have been properly removed/protected.
- Provide assistance to Company on request.
- Ensure that all the activities to be performed are identified and timely traced in **ICAPS®**.

12.4 Pre-commissioning team organization

Pre-commissioning is part of the Construction organization. The composition of the team is not part of this specification.

12.5 Commissioning team organisation

The **Commissioning** Team shall be supported in their task by a dedicated team of **Commissioning** supervisors and technicians.

The **Commissioning** team shall be organized with the following positions, which shall not be limited to:

12.5.1 Commissioning Manager

The **Commissioning** manager shall be in charge of:

- All the **Pre-commissioning** and **Commissioning** engineering (preparation).
- All the **Commissioning** execution activities. He shall nominate and manage the Commissioning Site Leader(s) (CSL).

He shall ensure proper continuity between the worksite teams and the final site teams and take long term decisions.

The Commissioning Manager position shall be identified and defined as key role in the organisation.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 45 of 97

12.5.2 Commissioning Site Leader (CSL)

Depending on the size of the project and the geographical location (onshore site and / or offshore site), the Commissioning Team can be divided in several Commissioning Site Teams, each managed by a Commissioning Site Leader.

The CSL's shall report to the Commissioning Manager and shall be in charge of their respective scope of work at yard and / or at the final site.

The CSL's shall ensure that the Pre-commissioning and Commissioning documentation is properly built-up and tasks to be performed at final site are identified and clearly updated through the ICAPS© database.

The CSL's shall gather from the early stage of the project, all the necessary data required for the issuance of the Commissioning close out report.

The CSL position shall be identified and defined as key role in the organisation.

12.5.3 Process System Engineers

The Process **System** Engineers shall report to the **Commissioning** Site Leader (CSL). They shall be in charge of the **Commissioning** activities of utilities / process, with predominant operation and safety considerations.

They shall be in charge of the progress and documentation follow-up and especially the vendor documentation. They shall coordinate the disciplines Superintendents, for the **Sub-systems** they have the responsibility of.

They shall gather from the early stage of the project, all necessary data required for the issuance of the **Commissioning** close out report.

The Process **System** Engineers shall be identified and defined as key role in the organisation.

12.5.4 Discipline Superintendents

They shall report to the **Commissioning** Site Leaders (CSL's). These Superintendents are typically for Electrical, Instrumentation, Telecommunication, Mechanical, Piping, HVAC, Subsea, etc...

They shall directly manage their execution teams. They shall witness **Pre-commissioning** checks and control preliminary checks, basic function tests, and operational tests.

They shall check for their respective disciplines that the **Punch Item** have been cleared according to the actions required.

They shall be responsible for all the **Commissioning** activities related to their discipline and the interfaces with other disciplines.

They shall gather from the early stage of the project, all necessary data required for the issuance of the **Commissioning** close out report.

12.5.5 ICAPS© Engineer(s)

ICAPS© engineer(s) shall report to the **Commissioning** Manager or **Commissioning** Site Leader (CSL). They shall be accountable for:

- Coordination with design engineering for the population of **ICAPS©** data base.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 46 of 97

- Ensuring consistency of **ICAPS®** database with latest engineering developments and site construction activities in co-ordination with field Engineering Manager.
- The correct implementation and Operation of **ICAPS®** software on the different worksites.
- Reviewing all the various Inspection and Test Plan applicable to the project and update the witnessing matrix accordingly.
- Co-ordination with the 3rd Party witnessing authority and the Planning engineer(s) for notification of the witness "Hold" and "Witness" points.
- Final definition of Sub-system scope of work in conjunction with discipline engineers
- Supply of progress information and tracking to the Project planning engineer.
- Producing figures for **Pre-commissioning** and **Commissioning** engineering and execution progress.
- Providing reports to Management as required and requested.

The **ICAPS®** Engineers shall be identified and defined as key role in the organisation.

12.5.6 Preservation & Maintenance Team

The **Commissioning** team shall issue, maintain and implement the required procedures covering Storage, Preservation, Mothballing, Lubrication and Maintenance of all equipments of the project, including temporary equipment and installations.

The **Commissioning** team shall timely mobilize a preservation and maintenance team that shall be in charge of:

- The preservation of the equipment during the Construction and **Pre-commissioning** phases and the preservation of the equipment in stand-by during **Commissioning**, until formal transfer to Company.
- The routine maintenance of the equipment put in service during **Commissioning**, until formal transfer to Company.

This team shall manage all the preservation and maintenance aspects of the project that are, but shall not be limited to:

- Issuance of general and specific procedures.
- Design and supply of temporary facilities as applicable.
- Procurement of material and equipment as applicable.
- Using **ICAPS®**, implement, follow up and log / report all the preservation activities, (including during storage transportation / tow as applicable).
- Perform the required routine visits and checks on the equipment as per approved plan and procedures in order to ensure that proper measures are taken to keep the result of the work in proper condition.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 47 of 97

12.5.7 Initial Operations Team

Initial operations covers the operation activities performed on equipment until their formal transfer to Company.

The **Commissioning** team shall mobilize an initial operations team, who shall be in charge of the preparation and execution of the start-up and initial operations activities.

The initial operations team shall report to the **Commissioning** organisation (Commissioning manager or CSL).

The initial operations team shall include field and control room (panel) operators as required by the plant specificity, to be in charge of the routine operations until their formal transfer to Company.

12.5.8 Planning and Reporting Engineer

He shall report to the **Commissioning** Manager, and shall be responsible for:

- Assisting for the development of **Commissioning** sequence.
- Liaison with **Commissioning** discipline leaders to develop the **Commissioning** plan.
- Development of the **Commissioning** histograms and S-curves, monitoring of progress, and providing progress reports to management, update of planning in co-ordination with construction teams and Construction manager.
- Liaising with Construction manager and the Project Planning department to follow-up the critical path(s) and transfer of **Sub-systems** from construction to **Commissioning**.
- Monitor the achievement of project milestones.

12.5.9 Punch list clearance Team

The **Commissioning** team shall nominate a **Pre-commissioning** and **Commissioning punch list** coordinator to ensure that all the activities related to Punch List management are strictly followed up, timely executed and that there is no **Punch Item** transferred from one location to another without Company approval.

The **Commissioning** team shall dedicate a team to manage all the **punch list** aspects of the project that are, but shall not be limited to:

- Issuance of general and specific procedures.
- Expediting procurement of material and equipment as applicable.
- Expediting Engineering or vendor assistance as applicable.
- Clearing, follow up and log / report into **ICAPS®** the **punch list** activities.

12.5.10 Support Positions

The **Commissioning** team shall provide all suitable and experienced **Commissioning** support positions to fulfil its contractual requirements, in particular with regards to Safety, Work permit control, fire watch, Logistics, IT support, Document control, As built documents consolidation, Cost control, etc... These positions shall appear in Commissioning organisation charts.

12.5.11 Subcontractor and Vendors

A subcontractor and vendor's mobilisation plan shall be issued and updated on a regular basis. This plan shall mention the duration of the scheduled vendor mobilisation and the associated scope of work.

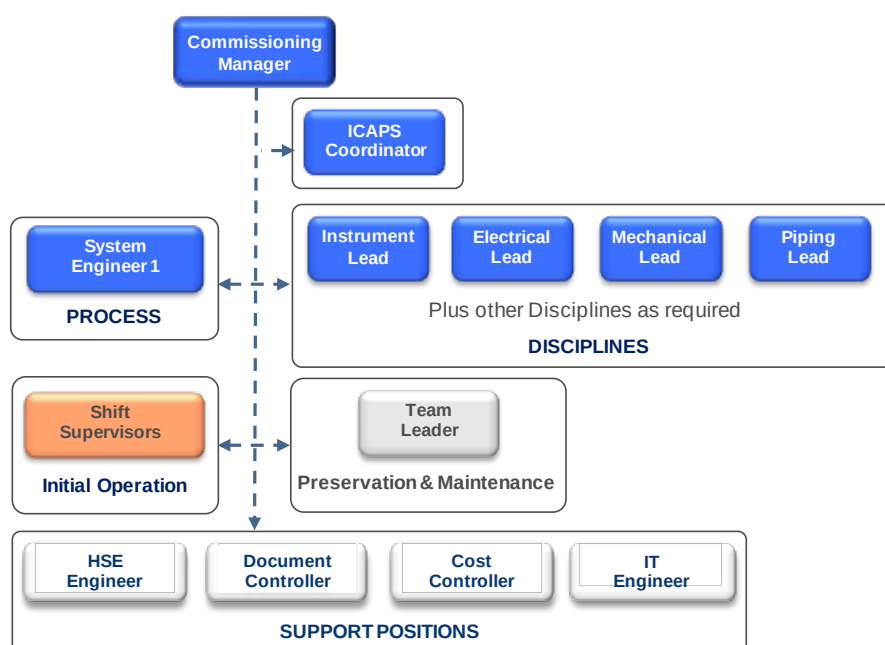
At the end of each subcontractor and/or vendor's intervention, a full activity report shall be prepared and discussed in a dedicated close-out meeting, before the subcontractor / vendor departure from any of the project location (construction yards, shipyards, integration yards, final site, etc ...).

The vendor basic responsibilities shall include, but not be limited to:

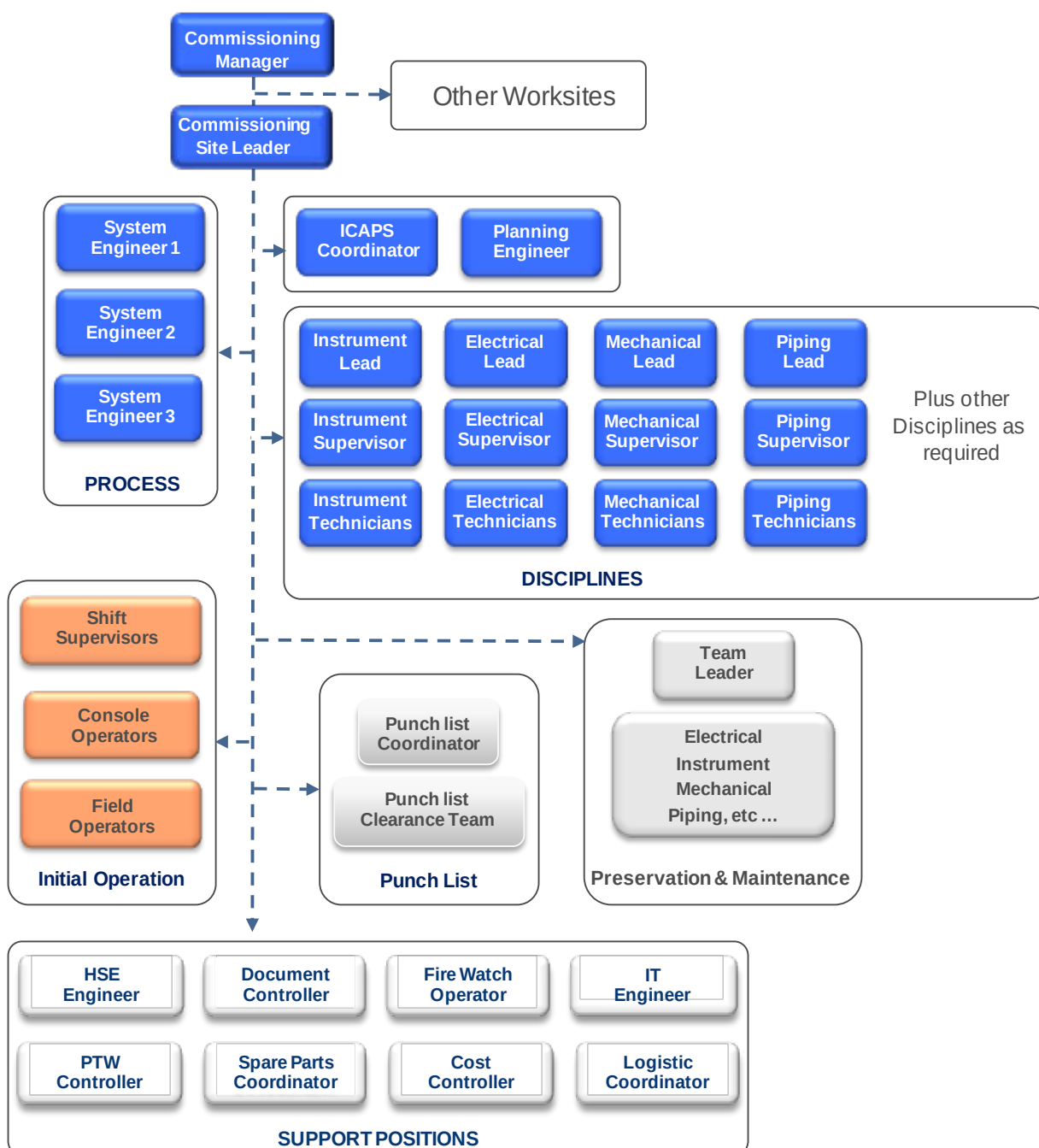
- Factory Acceptance Testing of equipment / packages (witnessed by Company and Contractor).
- Site Acceptance Testing of equipment/packages as applicable (witnessed by Company and Contractor).
- Provision of documentation and site intervention reports.
- Assistance and supervision with respect to installation and **Pre-commissioning, Commissioning**, Start-Up and Performance Testing of the equipment and packages.
- Assistance with respect to offshore **Pre-commissioning**, offshore **Commissioning**, Start-up and performance testing of the equipment / packages.
- Review and approve **Commissioning** Engineering deliverables with particular attention to the **Operational Test** Procedures for any equipment supplied by a vendor.

12.6 Typical Organisation

Typical positions for a comprehensive **Commissioning** Engineering team are as follow:



Typical positions for a comprehensive **Commissioning** Execution team are as follow:



General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 50 of 97

13. Co-ordination with Company

This chapter aims to identify the typical points of coordination between the parties involved in the **Pre-commissioning** and **Commissioning** activities and Company through the duration of the project.

These points of co-ordination apply to documents and / or to activities as specified in the contract and are formalised in the following documents:

- Document review matrix.
- **Pre-commissioning** and **Commissioning** witnessing matrix.
- This specification.

13.1 Engineering phase

The point of co-ordination with Company during the **Pre commissioning** and **Commissioning** engineering are predominantly the review, comment and approval of document on top of the regular coordination meetings.

13.1.1 Pre-commissioning and Commissioning management

The co-ordination points with Company are, but not limited to:

- Prepare the implementation of the Company Permit To Work procedures and management.
- HSE requirements.
- Participate in the writing and review the simultaneous operation (SIMOPS) procedure.
- Start-up sequence.
- **Sub-system** list, limits and definitions.
- **Commissioning** sequence based on Start-up sequence.
- Milestones at which the plant, or part of it, will be formally transferred to Company.
- Factory Acceptance Tests procedures.
- List of **CAF** and **COF**.
- List of activities and / or requisites necessary for the introduction of **COF** (technical checks, safety audits, organizational audits, etc...).
- Project schedule and the personal mobilisation plan in liaison with the overall project integrated planning, particularly when the project is split into several subprojects and contracts (FPSO, Subsea, onshore plant, off sites, housing, offshore platform, etc ...).
- Vendor Co-ordination and mobilisation / demobilisation plan.
- **Pre-commissioning** and **Commissioning** witnessing matrix, etc.
- Identification of interfaces with other parties involved in the project.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 51 of 97

- Means for assistance to start-up and performance test (assistance to be provided by Contractor, Vendors, Licensors, ...).

13.1.2 Pre-commissioning Engineering

The co-ordination points with Company are, but not limited to:

- Risk assessment review for the **Pre-commissioning** activities.
- Flange management procedure.
- Isolation procedures.
- List of critical elements.
- Acceptance criteria for pipe cleaning.
- Preservation procedure and records.

13.1.3 Commissioning Engineering

The co-ordination points with Company are, but not limited to:

- Risk assessment review for the **Commissioning** activities.
- List of spares, consumables, test equipment, chemicals, and logistics means required for **Commissioning**.
- List of **Operational Tests** to be performed with **CAF** and **COF**.
- Leak testing procedures.
- Preservation procedure and records.
- Definition of the Operational Test Procedures objectives, boundaries, fluids to be used, duration of the tests and acceptance criteria values, etc.
- Black re-start procedure.

13.2 Factory / Workshop Testing Phase

The co-ordination points with Company are, but not limited to:

- Participate and witness the factory and workshop activities.

13.3 Pre-commissioning Execution Phase

The co-ordination points with Company are, but not limited to:

- Participate in the pre-defined Construction and **Pre-commissioning** witnessing activities with a particular attention to the reinstatement of the pipe work and the Gross Air Leak Test activities.
- Participation in base line inspection activities.
- Co-ordination with third party inspection and / or classification party.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 52 of 97

13.4 Commissioning Execution Phase

The co-ordination points with Company are, but not limited to:

- Participation in base line inspection activities.
- Participation in the **Commissioning** witnessing activities.
- Co-ordination with third party inspection and / or classification party.
- Complete first fills.
- Review of certification documents, vendors and process licensor documentation, red line mark ups, application software's and licences, etc.
- Review detailed process start-up procedures, perform operational risk assessment and environmental assessment impact.
- Check, review and participate in the final safety tests (ESD, F&G, deluge, etc.) with the provision of associated documents (safety procedures, isolation, inhibition, etc.).
- Participation in all **Operational Tests** without **COF**.
- Participation in the audits and project technical reviews scheduled required prior to the introduction of **COF**.
- Check and review the pre-requisite for introduction of **COF**, and line up of pipe work and vessels accordingly:
 - Check that all valves subject to a "locked status" are in the lock open or lock closed position, in accordance with the Approved drawings and procedures.
 - Check that all isolations by spading and blinds are in accordance with the Approved drawings and procedures.
 - Check that all the ICSS inhibition are in accordance with the Approved drawings and procedures.
 - Obtain final clearance for introduction of **COF**.

The Company manages the activities related to the introduction of **COF**.

Once all pre-requisites are met for the first introduction of the **COF** into the plant, the co-ordination is typically, but not limited to:

- Control the outstanding **Commissioning Operational Tests** to be performed.
- Bring the process in operation (Oil/gas-in, water injection...) and ensure a safe and steady ramp-up of the equipment.
- Request vendor assistance from Contractor as required.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 53 of 97

14. Transfer of Operation and Maintenance

14.1 Foreword

The Transfer of Operation and Maintenance and the Transfer of Care and Custody, are two independent subjects and shall not be mixed:

- Transfer of Care & Custody is linked to HSE, Legal and Insurances responsibilities.
- Transfer of Operation & Maintenance is linked to Operational responsibilities only.

14.2 General principle

The **Commissioning** team shall be responsible for the correct Operation, Maintenance and Preservation of all the equipment and **Sub-systems** of the plant until they are formally transferred to Company.

The Transfer of Operation and Maintenance of the plant, or part of it, means that the receiving party become responsible for the Operation, Maintenance and Preservation of the same.

Notes:

- The Operation and Maintenance is always transferred on the Company initiative and cannot be on the **Commissioning** team request.
- The Transfer of Operation and Maintenance shall not be construed as an acknowledgement that all or part(s) of the plant transferred is completed.

14.3 Transfer of Operation and Maintenance certificate

The transfer of Operation and Maintenance (TOM) of the plant, or part of it, from the **Commissioning** team to the Company shall be formalised by a Transfer of Operation and Maintenance Certificate (TOMC)

This certificate ratifies the change of responsibility for the Operation, Maintenance and Preservation of the plant, or a part of it.

14.4 Transfer Rules

A Transfer of Operation and Maintenance applies to the basic **Commissioning** unit: the **Sub-system**, and is carried out by Groups of **Sub-systems**.

The **Achievement Of Commissioning** (AOC) certificate of a **Sub-system** shall be approved before it is transferred to Company.

The Transfer of Operation and Maintenance scheme shall be based on the Start-Up sequence and shall be processed according to the **Pre-commissioning** and **Commissioning** break down defined during the engineering phase.

The **groups** of **Sub-systems** for the purpose of Transfer shall be technically consistent and geographically coherent so as to ensure that their boundaries allow an independent management of Operation and Maintenance in a safe manner.

It applies in particular to all equipment which has been energized, and includes Operation, Maintenance, Preservation, and all other activities, which shall be safely carried out on or with the equipment.

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 54 of 97

The prerequisites for the Transfer of Operation and Maintenance of the plant, or part of it, shall include all related and necessary documents and material in order for Company to safely operate, maintain and preserve the equipments.

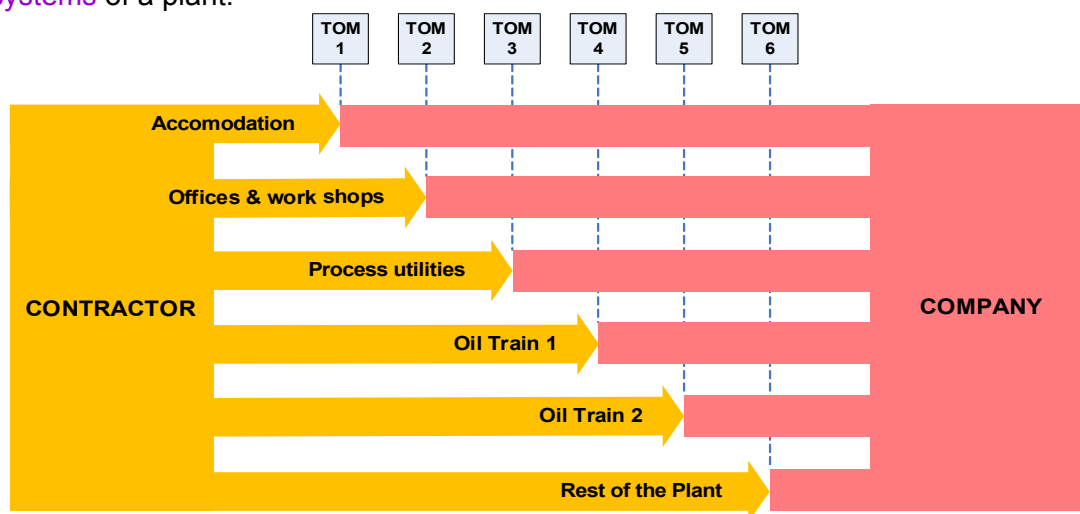
Prior to the Transfer of Operation and Maintenance of the plant, or part of it, a walk down of the relevant **Sub-systems** shall be performed by the **Commissioning** team accompanied by the Company in order to visually check on site that no equipment are damaged or clashed although fully commissioned and can be operated safely.

The Transfer procedure defining the group of **Sub-systems** and the prerequisites for their Transfer shall be issued as specified in the **GS EP EXP 103**.

This procedure shall specify for each step, but not limited to:

- The list of **Sub-system** grouped by Transfer steps.
- All the engineering deliverables including the vendor documentations.
- The complete transfer of historical data, dossier and information throughout the various project phases.
- The current status of the Sub-systems (running, stand-by, preserved, pressurised, etc.).
- The current status of the ongoing permit to work including the status of the electrical isolations, the Inhibits and Override log books, the mechanical isolation index (spades, blinds, lock open or close valves register, etc.).
- The preservation records, maintenance and operation log books.
- All specific requirements as per contract (Operating & Maintenance manual, spares parts, consumables, special tools, etc.).
- A copy of all the commissioned Red Line Mark Up (RLMU) drawings.
- The availability of **RFC / AOC** dossier and relevant vendors reports.

Hereafter a typical example of a staggered Transfer of Operation and Maintenance by group of **Sub-systems** of a plant:



General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 55 of 97

Note:

The Transfer of Care & Custody can happen at any time in this sequence depending on the project particularities.

15. Particular Technical Certificates

The RFC and AOC Certificates states only that the activity associated to this certificate is completed and their signature shall not presume that the concerned Sub-system is transferred.

Hereafter the characteristics summary of the RFC and AOC certificates:

		
Applies to :	Sub-system	Sub-system
Prerequisites :	All Pre-commissioning Activities successfully completed	All Commissioning Activities successfully completed
Consequences :	Authorization to begin Commissioning	Pre-requisite for transfer is achieved

In some cases, specific certificates are required in order to formalise a particular milestone due to the Project schedule, location, etc...

15.1 Temporary Release Certificate for Discipline Progress

A Sub-system is made of equipment that are interdependent in order to complete their Commissioning, but some parts of the Sub-system may be independent regarding Pre-commissioning and the first Commissioning activities.

Provided that outstanding activities would not impact the safety, the equipment and activities already completed, a part of a Sub-system can be released temporarily to allow relevant Commissioning activities to be carried out before the whole Sub-system is RFC.

In this respect a Temporary Release Certificate may be issued to allow the accepting party to start their Commissioning activities according to the specifics following rules:

- It shall be always an exceptional procedure.
- It shall have a limited duration, typically a week.
- It shall be fully documented with respect to the boundary limits.
- It shall be always submitted for approval to the Company.
- There shall not be any safety or technical interference from any other discipline in the Sub-system.
- It shall be demonstrated that there is a significant value in carrying out the work in order to progress the Commissioning scope for the affected Sub-system.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 56 of 97

Once the relevant **Commissioning** activities have been completed on the part of the **Sub-system** subject to a Temporary Release Certificate, all the equipment shall be de-energized or put in safe conditions in order to finalize safely the remaining **Pre-commissioning** activities until the **RFC** of the full **Sub-system** is reached.

In any case, the concerned **Sub-system** shall never be split into several **Sub-systems**.

15.2 Site Certificate

In some cases during the construction of package, module or deck, it is possible to have several work sites where early **Pre-commissioning** and **Commissioning** activities can be performed until the arrival at the final site.

The strict follow-up of these early activities will minimize reworks at the final site. To formalize these early activities, **Site Certificates** can be issued at **Sub-system** level and processed through the various work sites.

For each location, a clear scope shall be defined and formalized in the **Pre-commissioning and Commissioning Task Register**, in order to identify precisely the prerequisites for the signature of the Site certificate.

Site Certificates

Site Certificates stipulates that the relevant **Pre-commissioning** and / or **Commissioning** activities for a specific location has been completed.

Site Certificates apply to **Pre-commissioning** and **Commissioning** status and shall be called **RFC Site (RFCS x)** and **AOC Site (AOCS x)**

As an example, a **Site Certificate** process could be as follow:

Module	Sub-System	Worksite 1	Worksite 2	Final Site
Module 1	SS 1055	RFCS 1 AOCS 1	RFCS 2 AOCS 2	RFCS AOCS
Module 1	SS 1855	RFCS1	RFCS AOCS 2	AOCS
Module 2	SS 3520	RFCS 1 AOCS 1	RFCS AOCS	
Module 3	SS 6020	RFCS	AOCS	

In this example:

- SS 1055 of Module 1 reaches the **RFCS and AOCS** status on the final site.
- SS 1855 of Module 1 reaches the **RFCS** status on the worksite 2, but reaches the **AOCS** status on the final site.
- SS 3520 of Module 2 reaches the **RFCS and AOCS** status on worksite 2.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 57 of 97

- SS 6020 of Module 3 reaches the **RFC** status on worksite 1, but reaches the **AOC** status on worksite 2.

When a **Sub-system** has reached an **RFC** or **AOC** status on a worksite, it shall be subject to a walk down on the final site in order to visually check that no equipment are damaged or clashed although fully commissioned.

This walk down shall be performed prior to the Transfer of Operation and Maintenance.

16. Particular Cases and Points of Attention

16.1 Offshore projects Specificity

The main objective for the offshore projects shall be always to complete as much as possible the **Commissioning** scope onshore in order to:

- Discover possible defects when time and means are available to correct them.
- Save time on the overall planning.
- Minimize the amount of offshore **Commissioning** activities with associated consequences in term of resources and equipment.

The **Commissioning** methodology applied for offshore projects does not differ from that of a single phase installation, excepted that some **Commissioning** tests shall be repeated and / or finalised once the plant is installed at its final location.

The list of these tests shall be determined during the **Commissioning** engineering phase and shall be approved by the Company.

These tests shall be repeated and / or finalised for:

- **Systems** related with safety or critical functions.
- **Systems** with equipments / loose **Items** to be re-installed after Hook-Up.
- **Systems** with equipment subject to sea-fastening / preservation.
- **Systems** with equipment subject to stress constraint due to moving, lifting or towing.
- **Systems** with equipment visually damaged or clashed although fully commissioned.

These tests shall be, but not limited to:

- SAFETY tests such as (life boats trials, ESD demonstrations, Blow down test at real operating pressure, Fire fighting and extinguishing **Systems** including real condition deluge test and foam test, etc...).
- Communication **Systems** final tuning.
- HVAC final balancing.
- Loops checks, if there are doubts that the equipment may have been damaged during load-out or installation.
- HV switchboards and generators windings insulation tests post de-preservation.
- Final machinery alignments.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 58 of 97

- Final PSV calibration on site.
- First fill and / or re-fills.
- Dynamic verification for all equipment not fully verified onshore.
- Final verification and energisation of electrical equipment.
- Final tightness test of piping circuits after offshore hook-up.
- Final tightness test of all circuits containing toxic or flammable fluids.
- Final testing of Sub-sea equipment after hook-up (controlled from DCS through SCU, SPCU, etc.).

These checks and tests shall be done on a **Sub-system** basis and shall include, but not be limited to:

- Assessment that all the **Pre-commissioning and Commissioning** tasks have been successfully completed.
- Review of As Commissioned drawings.
- Review of the punch list items.
- Visual inspection for integrity, operability, etc.

16.2 Wellhead Platform Specificity

On top of the requirement mentioned in the previous paragraph, the following points shall be addressed during engineering phase and shall apply in the particular case of a well head platform:

- Means of protection during the drilling phase shall be studied in detail. The preservation plan shall include all consumables and physical protection around the drilling area to be installed in order to protect the equipment.
- Identification of the equipment or items that have been already checked and tested and have to be removed as a part of the protection plan.
- Identification of the **Pre-commissioning** and **Commissioning** scope of work and responsibilities to be performed onshore and offshore. This applies in particular to the final hook-up spools and other works to be completed post drilling.
- Status of the platform at the time of Transfer to Company (exact battery limits, preservation pressure of Nitrogen, temporary air and / or electrical supply, available documentation, etc.).

16.3 Package Specificity

16.3.1 General

A package is a prefabricated process or utility self-contained unit, generally able to operate on its own, and that is supplied comprehensively tested and ready for installation.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 59 of 97

For a package, part of both **Pre-commissioning** and **Commissioning**, is carried out in the manufacturer workshop and during the Factory Acceptance Tests (FAT's) and may be repeated after installation and hook-up to the plant.

As **Pre-commissioning** and **Commissioning** activities in the manufacturer workshop are not carried out sequentially according to the **OPERCOTM** Methodology, these activities will be referred to as testing during this period.

During early project phase, and for each of the vendors / manufacturers, the detail engineering and the **Commissioning** engineering teams shall demonstrate that the inspection, tests and checks plans for **Pre-commissioning** and **Commissioning** at factory or workshop guarantee the same quality, exhaustivity, and traceability as **OPERCOTM** standards.

Where this cannot be demonstrated, the detail engineering and the **Commissioning** engineering teams shall ensure that **OPERCOTM** is implemented at vendors / manufacturer's factory or workshop.

The detail engineering and the **Commissioning** engineering teams shall implement the above requirements in the relevant package Purchase Specifications and Purchase Orders.

As packages are subject to transportation, specific Package Site Inspection & Test plan and procedures shall be developed to cover all the **Pre-commissioning** and **Commissioning** tests to be re-performed after installation on site for equipment / items that have been:

- Removed / re-installed.
- Modified through sea-fastening / de-sea-fastening or preservation / de-preservation installation activities.
- Subject to stress constraint due to moving, lifting or towing.
- Damaged, altered or clashed during transportation although fully commissioned.

In any case, all the activities identified in these specific Package Site Inspection and Test plans shall be logged in the **ICAPS©** database.

Specific Preservation plans shall be implemented during transportation.

16.3.2 Testing In Workshop

The testing activities shall be maximised at the factory or workshop, and witnessed by the **Commissioning** Teams.

All activities related to Package testing at workshop shall be properly included in the Project **Witnessing Matrix** (see Par. 10).

The factory or workshop test plan shall include the simulation of all interfaces signals within the package itself, and between the package and the various plant safety and control systems (ESD, DCS, F&G, PMS, etc ...)

In all cases, the **Commissioning** team shall follow-up the testing activities done by vendors or supplier's at factory or workshop in his consolidated **ICAPS©** database in order to ensure full traceability of all activities.

Particular attention shall be given to the timely clearance and follow up of the **Punch Items** during the workshop phase prior to shipment in order to prevent carry over work to site.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 60 of 97

16.3.3 Pre-commissioning On Site

A reduced site **Pre-commissioning** scope can be accepted on the packages, but this shall be subject to the demonstration through **ICAPS©** that the checks and tests have been thoroughly and successfully performed at the supplier's or manufacturer's factory / workshop, and that nothing has impinged the result of the completed tests.

After package installation, a comprehensive inspection shall be performed. Overall discipline conformity Check sheets are available in **GS EP EXP 105** for this purpose.

Pre-commissioning on site shall include also all the works identified in the specific Package Site Inspection and Test plan as described in the above paragraph.

The **RFC** status of the package or of the **Sub-system** of the package shall be only reached when all **Pre-commissioning** activities after integration / installation at site have been successfully carried out, completed and logged in the **ICAPS©** database.

16.3.4 Commissioning On Site

A reduced site **Commissioning** scope can be accepted on the packages, but this shall be subject to the demonstration through **ICAPS©** that the tests have been thoroughly and successfully performed at the supplier's or manufacturer's factory or workshop, and that no activity has impinged the result of the completed tests.

For these packages, the scope shall be, but not limited to:

- All works identified in the specific Package Site Inspection and Test plan.
- 10 % **Functional Testing** of the Electrical and Instrument **Basic Functions**, (spot checks based on criticality, previously discussed and agreed with Company).
- Full Functional Testing of all items for which a proper record is not available within **ICAPS©** Database.
- Full **Functional Testing** of all **Basic Functions** involved in interfaces.
- Full **Functional Testing** of all the safety functions related to the machinery, process and HSE items. This typically apply, but is not limited to functions related to: Ultimate Safety System (USS), Emergency Shut Down system (ESD), Process Safety System (PSS), Fire & Gas System, Machinery control, etc.

The **AOC** status of the package or of the **Sub-system** of the package shall be only reached when all **Commissioning** activities after integration / installation have been successfully carried out, completed and logged in the **ICAPS©** database.

16.4 Modules Specificity

Modules shall be tested following the **OPERCOM™** methodology as described in this specification.

Modules are subjects to the following specificities that have to be addressed during the **Pre-commissioning** and **Commissioning** engineering phase:

- As modules are subject to transportation, specific Module Site Inspection & Test plan and procedures shall be developed to cover all the **Pre-commissioning** and **Commissioning**

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 61 of 97

tests to be re-performed after installation on site as detailed in the paragraph related to Package Specificity of this specification.

- As modules are pre-fabricated on worksites, some **Sub-systems** might reach a **Site Certificate** status **RFCS** or **AOCS** since all **Pre-commissioning** and **Commissioning** activities cannot be completed on the worksites.
- **Pre-commissioning** and **Commissioning** responsibilities for final connections on site shall be clearly identified for each discipline involved.
- The **Pre-commissioning** and **Commissioning** dossiers for each **Sub-system** shall be delivered on site with the module.
- Specific Preservation / mothballing plans shall be in place, and implemented during the module transportation.

16.5 Modifications on existing facilities Specificity

The following subjects have to be addressed during the **Pre-commissioning** and **Commissioning** engineering phase:

- Organisation:
 - Permit To Work system shall be bridged with the existing ones.
 - SIMOPS procedures shall be developed in close liaison with Company.
 - Coordination with Company Operation (purging, inerting, discipline isolations procedures, Shutdown/restart activities, etc.).
 - "Hot" change over procedures, if applicable, shall be always subject to Company approval.
 - In case of planned shutdown, the gap between the duration required to make the plant safe (depressurised and inerted) and the duration required to perform the works shall be clearly understood by all parties.
 - Transfer of Operation and Maintenance shall be developed in close liaison with Company.
- List of tie-ins (Electrical / Instrumentation / Piping, etc ...) requiring shut-down shall be identified during early stage of the detail engineering.
- For each tie-ins (Electrical / Instrumentation / Piping, etc ...) done while the plant is live, a specific procedure shall be developed on a case by case basis.
- Hydro-test of piping circuits involving part of existing facilities.
- The test pack limits shall be approved by Company.
- High Pressure Leak testing on piping circuits involving part of existing facilities.
- Prior to such leak test, an inspection survey (corrosion, thickness survey, etc....) shall be performed on the existing part of pipe work before starting the HP leak Test at the maximum operating pressure (MOP).

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 62 of 97

The possibility of having leakage through existing valves has to be assessed on a case by case basis in order to have a representative leak test. When isolation against existing piping is not possible, alternative solution might be considered (witness joint, use of self testing gaskets, service tests, etc ...). These alternative solutions shall be assessed during **Pre-commissioning** and **Commissioning** engineering phase.

- Leak testing of piping tie ins done during a shut down and requiring service test.
- The leak test pressure shall be the maximum operating pressure corresponding to the design of the new facilities.
- **Operational Tests:**
 - **Operational Tests of new equipment** shall be performed after interconnection / integration with the existing equipment completed.
 - **Operational Tests** of control or safety systems interconnected with existing systems shall be subject to a detailed review of what can be tested in real conditions, and what can only be simulated.
 - A pre-**Operational Test** with temporary means may be arranged in advance to ensure functionality and integrity of the new equipment prior to tie-in with existing equipment.
 - Assess the possible impact or process upset on the existing facilities during the performance of **Operational Tests** using means from existing plant (supply of electrical power, air, nitrogen, fresh water, cooling water, etc ...)
 - **Operational Tests** shall demonstrate the effect of additional equipment to the existing equipment operability and performance.

17. Subsea

The subsea projects involve two categories of equipment: the equipment located on the surface facilities, and the equipment installed in the water.

The equipment and **Items** located on topsides, (sub-sea control system, sub-sea hydraulic power unit, etc...) shall be pre-commissioned and commissioned using the **OPERCOTM** methodology as defined particularly in the chapters 6 and 7 of this specification and shall also include the specificities of packages and offshore projects detailed in paragraph 16.1 and 16.3 of this specification.

The sections of this chapter are specific to the equipment installed in the water, referred also as the "wet part" of the subsea equipment.

The **Pre-commissioning** and **Commissioning** of a project subsea wet part, is different from conventional project due to the followings:

- The word "system" used by the vendors and / or manufacturers in the subsea domain has a different meaning from the functional **Systems** of **OPERCOTM**.

These systems are typically oil christmas trees, gas christmas trees, water manifolds, special tools (ROV), etc... while **OPERCOTM** functional **Systems** will be oil production loop, gas injection loop, hydraulic power unit, etc...

- The testing performed up to the final installation on the sea bed, is done at equipment level and tracked by serial number, while the **Commissioning** activities, after installation,

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 63 of 97

are done by equipment identified by a process tag and grouped into **OPERCOM™** functional **Sub-systems**.

- Wet equipment cannot be considered at its final location until all **Commissioning** activities at site (seabed) have been successfully completed. Only at this time, the process tag can be permanently assigned to the equipment that was identified by a serial number.
- The **Pre-commissioning** and the **Commissioning** of a functional **Sub-system** might involve several independent parties. These are typically:
 - Subsea Production System (SPS) Contractors. They basically supply and test the SPS equipment in the factory / workshop and provide assistance to other parties.
 - Drilling & well services Contractors. They install and test some of the SPS equipment (e.g. christmas tree assembly).
 - Subsea Umbilical / Riser / Flow line (SURF) Contractors. They design, install and connect their equipment with the SPS items and topside equipment.
- The achievement of the respective testing and **Pre-commissioning** activities of these parties is formalised by the following certificates as per project specification:
 - SPS → **Mechanical Completion** Certificate.
 - Drilling → **Well Handover** Certificate.
 - SURF → **Ready For Commissioning** Certificate.
- During the course of the project, some of the tests performed on one equipment have to be repeated:
 - At various times: prior / post transport, prior / after subsea installation and / or hook-up to the topsides or onshore plant.
 - At various locations: factory, integration yard, service bases, installation vessels, drilling rigs, etc.
 - By various parties: SPS, SURF, Drilling and Company.
- All physical **Punch Item** shall be cleared prior to final installation.

As a consequence to the above mentioned points, the approach for subsea testing, **Pre-commissioning** and **Commissioning** is organised into the following sequence of activities:

- In Factory / workshop / yard:
 - SPS contractor: equipment testing.
 - SURF contractor: equipment testing.
- On site:
 - Drilling contractor: testing activities.
 - SURF contractor: **Pre-commissioning** activities.
 - **Commissioning** team: **Commissioning** and **Start-up** activities.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 64 of 97

17.1 Factory / workshop activities

Prior installation on worksites, all subsea equipment and material shall be subject to a comprehensive verification and acceptance testing program as defined in project specifications, in order to demonstrate that:

- The design of the equipment, whether it is field proven or not, will satisfy all specified requirements and will perform satisfactorily in service.
- All subsea equipment and material have been mechanically completed.
- All subsea equipment have been tested and calibrated as per approved plans.

As for the packages, where **Pre-commissioning** and **Commissioning** activities in the manufacturer workshop are not carried out sequentially according to the **OPERCOM™** Methodology, these activities will be referred as "Testing" during this period.

The tracking of these testing activities shall be maximised and tracked in **ICAPS©** in order to ensure traceability of the tests performed on the equipment's.

17.1.1 Factory / workshop SPS Testing

The SPS test program in factory / workshop shall be based on the requirement defined in the project specifications.

These requirements will be compiled in the SPS Inspection and Test Plan.

Based on this Inspection & Test Plan, and the witnessing matrix provided in Appendix 02 of this specification, the **Commissioning** team shall witness and record these SPS testing activities.

The **Commissioning** team shall review and adapt this witnessing matrix to include any specific or particular requirement.

For this purpose, a set of typical **Conformity Check** lists and **Static Test** sheets is provided for reference in **GS EP EXP 105**. These **Conformity Check** lists and **Static Test** sheets shall be customised to match any specific requirement of the project SPS Inspection and Test Plan as specified in **GS EP EXP 103**.

These **Check Lists** and **Static Test** sheets shall be a record summary of the testing activities including all raised punch items if any, and shall refer to the relevant record books / documentation of the SPS contractor.

The **Commissioning** team shall prepare, execute and implement these **Conformity Check** lists and **Static Test** sheets in the **ICAPS©** database.

17.1.2 Factory / workshop SURF Testing

The **OPERCOM™** methodology shall be strictly applied for all the SURF activities performed in the workshop.

The SURF test program in factory / workshop shall be based on the requirement defined in the project specifications.

All activities related to testing at workshop shall be properly included in the Project **Witnessing Matrix** (refer to chapter 10).

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 65 of 97

The **Commissioning** team shall review this witnessing matrix to include any specific / particular requirement.

For this purpose, a set of typical **Conformity Check** lists and **Static Test** sheets is provided for reference in **GS EP EXP 105**. These **Conformity Check** lists and **Static Test** sheets shall be customised to match any specific requirement of the project SURF Inspection and Test Plan.

The SURF Contractor shall prepare, execute and implement these **Conformity Check** lists and **Static Test** sheets in the **ICAPS®** database.

17.2 Site activities

Site activities are split into:

- Testing and **Pre-commissioning** activities performed by Contractors.
- **Commissioning** activities performed by **Commissioning** team.

The SPS wet equipment testing on site is generally performed by the SURF contractor and/or the Drilling contractor. The SPS contractor only provides support and assistance.

17.2.1 SPS equipment testing

The SPS equipment tests to be performed on site by the Drilling and the SURF contractors shall be based on the requirement defined in the project specifications.

The **Commissioning** team shall keep a record of the testing activities performed by the Drilling contractor, and shall gather and compile all the information's related to the well status prior to transfer to **Commissioning**.

These information's shall be, but not limited to, valves positions, preservation status, punch list, pictures and / or videos as applicable, etc...

The **Commissioning** team shall prepare and implement these **Conformity Check** lists in the **ICAPS®** database.

17.2.2 SURF Pre-commissioning

The SURF contractor shall strictly apply the **OPERCOM™** methodology for all SURF activities performed on site.

The SURF contractor shall prepare and populate the **OPERCOM™** **Conformity Check** lists and **Static Test** sheets in the **ICAPS®** database.

These **Conformity Check** lists and **Static Test** sheets shall be a detailed record of the **Pre-commissioning** activities, and shall refer to the relevant record books / documentation of the SURF contractor.

The **Commissioning** team shall review this witnessing matrix to include any specific / particular requirement.

Based on the Inspection & Test Plan, and the witnessing matrix provided in Appendix 02 and 03 of this specification, the **Commissioning** team shall identify and witness the SURF site testing activities.

17.3 Transfer to Commissioning

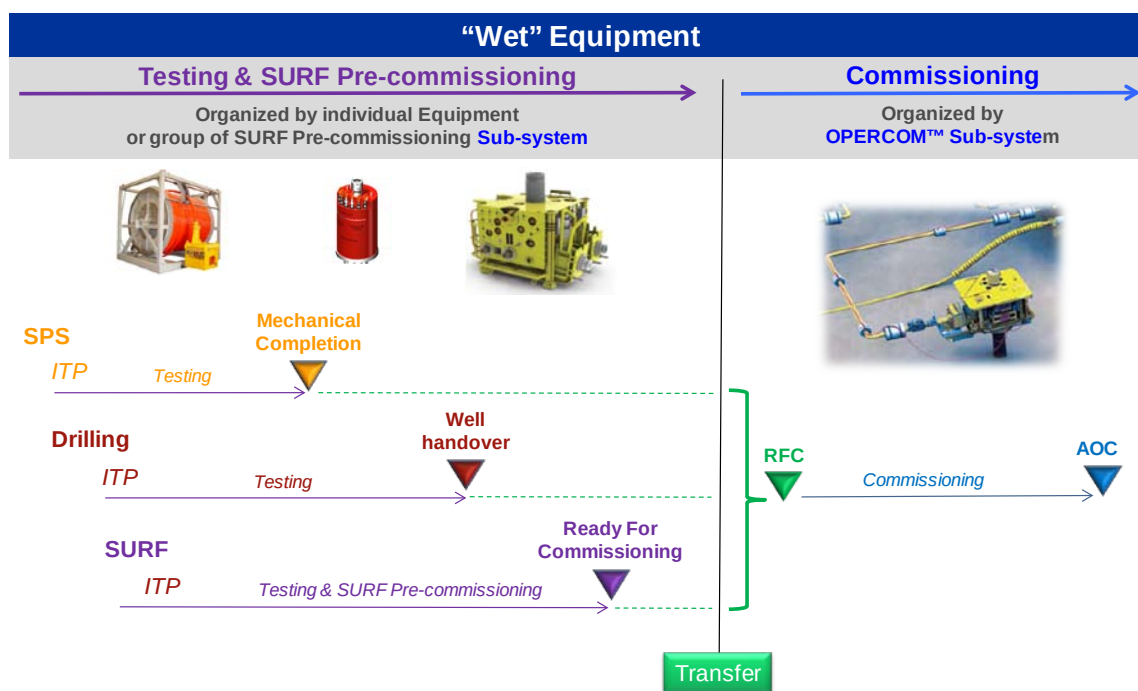
The objective of this paragraph is to describe the prerequisites to be fulfilled for transfer of the subsea works to the **Commissioning** team.

The Transfer process described in this paragraph is applicable to all subsea functional **Sub-systems** and conforms to the **OPERCOTM Sub-system** breakdown described in the specification **GS EP EXP 103**.

The **Commissioning** team shall be the sole entity to validate the **OPERCOTM** overall **Ready For Commissioning** status of a subsea functional **Sub-system** as it involves several independent parties to reach this milestone, including part from the topside or onshore plant in some cases.

Once the subsea functional **Sub-system RFC** is approved by the **Commissioning** team, the remaining **OPERCOTM Commissioning** activities can proceed

The above can be summarised as follow:



17.4 Site activities by Commissioning Team

The functional subsea **Sub-systems** shall be commissioned at the final location as the whole functional **Sub-systems** are only complete on site, after hook-up to the surface facilities is completed.

The **Commissioning** team shall complete the remaining activities that shall be, but not limited to:

- Final electrical and instrument communication and function tests.
- Equipment operational tests.
- Leak testing.
- Dewatering.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 67 of 97

- Drying.
- Inerting.
- Preservation.

The equipment manufacturer and Contractors will provide support and assist the **Commissioning** team during these activities.

The **Commissioning** activities shall be carried out according to the **OPERCOTM** methodology supported by **ICAPS** software and organised by functional **Sub-systems** which delimitation rules are presented in **GS EP EXP 103**.

After completion of these activities, an **Achievement Of Commissioning Certificate** is signed for each functional **Sub-systems**.

The **Sub-systems** are then transferred to Company for Operation and Maintenance.

The **Commissioning** team shall remain in assistance to Operation.

18. Glossary

This chapter does not intend to provide any definitions; it only aims at providing explanations for some of the wording used in this specification. The contract documentation shall be the reference document for any definition.

Specific wording related to **OPERCOTM** are provided in the core text of this specification.

Agreement	Refer to the Agreement definition. Terms and Conditions of the Contract, this is the reference document.
Certifying Authority	Refer to the Agreement definition. The Third Party in charge of the verification that the relevant Standards and Codes are met.
Company	Refer to the Agreement definition. The party who signs the contracts.
Main Contractor	Refer to the Agreement definition. The organisation usually in charge of Engineering, Procurement Construction, and in some cases of the Commissioning of the facilities.
Performance tests	Refer to the Agreement definition. Tests carried-out to prove the plant and equipment design capacities, products specifications
Project Team	Refer to the Agreement definition. The organisation set up by Company to manage all phases of the project, from Basic Engineering until Final Acceptance
Vendor	Refer to the Agreement definition. Entity that provides equipment to Contractor
Workshop	Refer to the Agreement definition. Usually manufacturer premises like factory.

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 68 of 97

Worksite	Refer to the Agreement definition. Usually any site where a physical project activity takes place
Supplier	Refer to the Agreement definition. Entity that provides equipment to Company
Final site	Refer to the Agreement definition. Site of the plant
FAT	Factory Acceptance Tests
EFAT	Extended Factory Acceptance Tests
EP(S)C	Main contract including: Engineering, Procurement, Supply & Construction
EP(S)CC	Main contract including: Engineering, Procurement, Supply, Construction & Commissioning

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 69 of 97

Appendix 1

Appendix 1 Activities classification

The Project **Pre-commissioning** and **Commissioning** activities are now further defined in the following "classification of activities".

This classification, although it cannot be considered as an exhaustive scope of work, provides a useful list of all main **Pre-commissioning** and **Commissioning** activities by discipline and major types of equipment, and it establishes to which category they belong, namely **Pre-commissioning** or **Commissioning**.

The above, however, is a mere guideline, as the split of scope of work Contractor / Project team / Company may not exactly be the **Pre-commissioning** / **Commissioning** / Start-Up technical split as shown by the following examples:

- Sub-sea and packages are very specific equipment usually dealt with specific contract by several sub-contractors. Part of both **Pre-commissioning** and **Commissioning** is carried out during the Factory Acceptance Tests (FAT's) and may be repeated after installation and hook-up to the topsides or plant equipment.
- The HVAC is a specific equipment usually dealt with as a turnkey contract by a sub-Contractor. Therefore, even if the Project is implemented through an a) or b) type contract the **Commissioning** of the HVAC system will in this case be performed by the Main Contractor.
- Similarly, the cranes, hoists, lifts, etc., load testing in accordance with local regulations is classified as a **Commissioning** operation, but this equipment may be required for construction purpose, hence its **Commissioning** will be generally included in the Contractor's scope of work.

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 70 of 97

Appendix 1

	Pre-Comm	Comm
Electrical		
Check condition of equipment, quality of installation, and compliance with Project drawings, manufacturer's instructions, safety rules, specifications and good practice	X	
Perform preliminary tests with equipment de-energised, including: - Insulation resistance measurements - Di-electric strength tests - Loops and circuits continuity tests - Earthing resistance measurements	X	
Fill in transformers with oil and carry out breakdown test of oil samples	X	
Control earthing network	X	
Fill in batteries with electrolyte	X	
Check installation of emergency and instrument power systems	X	
Check installation of electrical heat tracing	X	
Modify connections if wrong direction of rotation		X
Check direction of rotation of electrical motors (with assistance of the main contractor if required)		X
Energise and test control power system		X
Perform all functional tests, including: - Adjustment and testing of protective devices - Check-out and adjustment of electrical instruments - Operation of safety devices		X
Energise and test emergency and instrument power systems		X
Start up and test power plant		X
Carry out preliminary load test (when possible)		X
Energise sub stations after completion of all tests		X
Carry out batteries discharge tests		X
Test battery chargers, inverters, UPS		X
Perform motors four hours no load runs. Test motors ancillary equipment		X
Check temperature rise of motors, bearings, transformers, relays, when loaded (if possible), vibration		X
Check operation of manual and auto controls		X

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 71 of 97

Appendix 1

Check Essential, Normal and Emergency circuits lighting and intensities		X
Energize installation of electrical heat tracing		X
Carry out functional test on thyristor controlled heater		X
Conduct Operational Tests		X
Instrumentation		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Remove all fragile devices before hydro tests	X	
Perform required pressure tests on: - Instrument take-off piping - Air piping - Air tubing	X	
Reinstall all fragile devices after pressure tests and flushing of the process lines	X	
Calibrate all instruments other than F&G detectors prior to installation	X	
Check continuity of transmission and identification of indication, control and alarm signals - Perform continuity and insulation tests for instrument cables - Perform continuity and tightness tests for pneumatic tubing	X	
Install sealing fluids where required	X	
Calibrate / operate all control valves, on/off valves, lubricate as required	X	
Install all safety devices e.g pressure relieve valve after testing	X	
Check and adjust all safety devices and seals where necessary, with Vendor if required	X	
Check instrument accessibility for removal, maintenance, routine field adjustment	X	
Calibrate all F&G detectors, synchronise with F&G panel		X
Test marshalling relay boxes, programmable logic controllers, sequential operators and all numeric control systems		X
Carry out loop testing		X
Test shutdown systems, interlocks, and sequencers + alarms		X
Conduct Operational Tests		X
Piping		

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 72 of 97

Appendix 1

Check condition of equipment, quality of installation, and compliance with Project drawings, manufacturer's instructions, safety rules, specifications and good practice.	X	
Check condition and quality of installation of gaskets and bolts types	X	
Install and check spring hangers, pipe anchors and guides	X	
Alleviate any excess piping stresses that may be imposed on pipes, compressors or pump flanges	X	
Install safety valves or temporary spool pieces during construction	X	
Remove all temporary supports, protections, bracings, sea fastening stops, that were installed to prevent equipment damage during shipping, storage and erection	X	
Check packing and packing materials and lubrication of valves; repack and lubricate if necessary	X	
Carry-out passing test of all critical valves before installation	X	
Remove all critical valves prior to hydro test and flushing activities	X	
Carry out integrity test (hydro test) of piping	X	
Carry out piping water or air flushing operations	X	
Perform chemical cleaning where applicable	X	
Set or check pipe anchors, guides, spring hangers and supports after hydro test. Provide cold and hot setting data	X	
Clean strainers after flushing	X	
Witness flushing and cleaning		X
Carry out Gross Air Leak Test (GALT)	X	
Provide and install all strainers, both temporary and permanent, spectacle blinds and temporary blanks required for start-up	X	
Supply and install line identification tags and signs, stencil lines for identification	X	
Test, set, and tag all safety valves, then carry out safety valves final installation	X	
Remove as necessary and transport all safety valves to and from test facilities	X	
Supply car seals or locking devices for block valves and safety equipment	X	
Provide list and location of all blinds installed	X	X
Check and record position of all car sealed valves		X
Install car seals or locking devices on block valves and safety equipment		X
Carry-out passing test of critical valves during leak testing		X
Fill in hydraulic unit and network with appropriate oil		X
Perform drying-out where applicable		X
Carry out Tightness test (HP leak testing)		X
Carry out inerting		X

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 73 of 97

Appendix 1

Define, temporary blanks required for start-up		X
Install corrosion probes		X
Check steam tracing for tightness and continuity		X
Carry out oil and gas-in under control of Company		X
Buildings and structures		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Obtain certificate for occupancy and use, if required		X
Conduct Operational Tests as applicable		X
Air fin coolers		
Check condition of equipment, quality of installation, and compliance with Project drawings, manufacturer instructions, safety rules, specifications and good practice	X	
Clean inside of the hood and remove all extraneous particles around the air fin cooler	X	
Set and align fan and driver if applicable. Set V belts, and fan blades pitch. Check fan ring clearance	X	
Check satisfactory operation of louvers and variable pitch assembly		X
Start up fans and check vibrations, motor loading, and proper operation of auto-variable fans		X
Conduct Operational Tests		X
Furnaces, ductwork and stacks		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Perform hydrostatic test on completed furnace coils	X	
Empty water from coil and air blow if necessary	X	
Issue furnace dry-out procedure based on vendor / manufacturer recommendations		X
Check mechanical operation of soot blowers, dampers, air pre-heaters and burners louvers		X
Prepare furnace and fuel systems for dry-out operation. Ensure tubes are vented adequately		X
Dry out the furnace following the approved procedure		X
After drying-out, clean stack and duct, open manholes and other openings for inspection. Check operation of dampers and registers. Close stack and duct after inspection		X

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 74 of 97

Appendix 1

Obtain and charge liquid heat transfer media, if required		X
Conduct light-off, drying, and purging		X
Conduct Operational Tests		X
Vessels - Towers, reactors and drums		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Install all tower, reactor and drum internals (not already installed in fabrication shop)	X	
Clean out all vessels	X	
Properly close up all vessel internal man ways and openings after final inspection or after loading of chemicals, catalysts, etc. is completed	X	
Carry out vessels and tower final inspection	X	X
Issue to Contractor written authority to close up each vessel		X
Perform tray leakage test and levelling adjustments as required in all tower, reactor and drum internals		X
Cure and dry out castable linings		X
Inspect all towers and drums for cleanliness and dryness before loading catalysts, etc.		X
Load all chemicals after cleaning and dry-out, (including hot oil, amine, glycol, freon, inhibitors, etc.), desiccants, catalysts, tower packing's		X
Carry out air blowing if required		X
Inspect after final loading. Obtain samples of all catalysts loaded		X
Conduct Operational Tests as applicable		X
Tankage		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Install appurtenances	X	
Hydrostatic test tank and internal piping, and clean inside tank	X	
Close man ways	X	
Strap tank and issue record	X	
Carry out tank final inspection	X	X
Issue to Contractor written authority to close up each vessel		X

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 75 of 97

Appendix 1

Organise independent calibration of product tanks for custody transfer where required by government regulations		
Conduct Operational Tests as applicable		X
Shell and tube exchangers		
Check condition of equipment, quality of installation, and compliance with Project drawings, manufacturer's instructions, safety rules, specifications and good practice	X	
Pumps		
Check condition of equipment, quality of installation, and compliance with Project drawings, manufacturer's instructions, safety rules, specifications and good practice	X	
Set and cold align pumps and drivers	X	
Couple pumps to drivers	X	
Install temporary strainers in suction piping	X	
Check that piston seal packaging followers, if any, are correctly tightened	X	
Check discharge flow dampers are correctly charged and installed	X	
Check pump gear box oil levels		X
Run-in pump in recycle, check pump and motor operation and do any required dowelling of the pump driver – check for vibration		X
Charge the lube oil, seal oil, and oil cooling systems	X	
Carry out lube and seal oil systems flushing, circulate oil until test patches are clean	X	
Check oil for presence of chips after no load run		X
Check gears, bearings and parts for signs of wear and damage		X
Make final hot alignment check		X
Conduct Operational Tests		X
Gas turbines, compressors and expanders		
Check condition of equipment, quality of installation, and compliance with Project drawings, manufacturer's instructions, safety rules, specifications and good practice	X	
Install all piping and make piping corrections as required by VENDOR's tolerances. Set and cold align units	X	
Fill lube and seal oil systems	X	
Carry out lube and seal oil systems flushing, circulate oil until test patches are clean	X	
Drain lube and seal oil systems then refill with new oil, if required	X	
Clean chemically suction and inter stage piping and lube/seal oil piping	X	

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 76 of 97

Appendix 1

Disassemble above piping for cleanliness inspection as required		X
Run in driver (uncoupled) (except for expanders)		X
Couple driver and driven unit		X
Run in compressor in recycle on air or inert gas, if possible and/or suitable, on gas after gas-in otherwise. Check operation		X
Check hot alignment		X
Carry out comprehensive vibration tests		X
Check equipment stacks / exhausts skin temperature according to project safety specifications		X
Run unit on stream		X
Check plant noise levels		X
Check equipment noise levels		X
Conduct Operational Tests		X
Diesel engines		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Set and cold align units	X	
Clean lube oil piping	X	
Fill lube oil system	X	
Drain lube oil system then refill with new oil, if not required		X
Test run Diesel engines and their accessories uncoupled		X
Couple diesel engines to driven equipment		X
Test run coupled unit and verify all operating parameters		X
Carry out noise measurement tests		X
Check equipment stacks / exhausts skin temperature according to safety specifications		X
Conduct Operational Tests		X
Check alignment after operational test		X
Miscellaneous mechanical equipment (lube oil, vacuum equipment, weigh scale, materials lifting and handling equipment, ...)		

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 77 of 97

Appendix 1

Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Fill-in lube and hydraulic oil systems of lifting equipment		X
Load test all pad eyes	X	
Test lifting equipment in presence of Insurance Inspector or appropriate governmental authority		X
Test vacuum equipment- check all joint for leaks		X
Calibrate all solids weighing and measuring devices in their field-installed operating positions. Show that equipment meets specified tolerance for accuracy over full range of operating conditions		X
Conduct Operational Tests		X
Sub-sea		
Check condition of equipment, quality of installation, and compliance with Project drawings, vendor's and manufacturer's instructions, safety rules, specifications and good practice	X	
Pressure testing of Production manifold	X	
Pressure testing of Production Xmas tree	X	
Pressure testing of Injection Xmas tree	X	
Pressure tests and gauging of Sub-sea production lines	X	
Cleaning of Sub-sea injection lines chemical to cleanliness specification	X	
Pressure testing of Sub-sea control umbilical	X	
Sub-sea control system integrated testing at VENDOR	X	
Electrical testing of sub-sea control umbilical	X	
Sub-sea hydraulic power system testing	X	X
Pressurisation of the production/injection flow lines	X	X
Sub-sea control system integrated testing at onshore site		X
Sub-sea control system integrated testing offshore		X
Sub-sea verification of status of manifolds and Xmas trees including fluid status		X
Leak testing of flow lines and control umbilical lines.		X
Energise sub-sea control umbilical		X
Instrument communication checks		X
Instrument checks		X
Pressurisation of the control umbilical hydraulic and chemical lines		X
Sub-sea choke valve testing		X

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 78 of 97

Appendix 1

Sub-sea valve testing (includes signature curves) (Commissioning activity under control of Field Operations)		X
Sub-sea valve sequence testing. (Preservation and flow assurance)		X
Sub-sea shutdown testing including control from PCS and SSS (Commissioning activity under control of Field Operations)		X
ROV override testing (Commissioning activity under control of Field Operations)		X
Sub-sea valve tightness testing (Commissioning activity under control of Field Operations)		X
Flow testing hydraulic and chemical lines (Commissioning activity under control of Field Operations)		X
SCSSV testing		X
Conduct Operational Tests as applicable		X
HVAC equipment		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Check alignment of motors/fans and drives	X	
Check that tension on drives is correct	X	
Check that fans and motors rotate manually and run freely	X	
Check that anti-vibration mountings are correctly installed	X	
Check that sealing compound of fire dampers is installed correctly	X	
Check that linkage and blades of dampers operate correctly and freely	X	
Check that dampers actuators operate correctly		X
Check that airflow direction in pre-heaters is correct	X	
Carry out ductwork leak tests		X
Energize and run unit. Test sequences and interlocks. Check vibrations		X
Carry out airflow and balancing tests		X
Control and adjust rooms temperature and pressurisation		X
Conduct Operational Tests		X
Living quarters equipment		
Check condition of equipment, quality of installation, and compliance with Project drawings, vendor's and manufacturer's instructions, safety rules, specifications and good practice	X	
Pressurise water pipes (hot and cold) and test taps, sinks, toilets, showers		X

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 79 of 97

Appendix 1

Energise specific (kitchen) electrical appliances and check functions with reference to electrical procedures		X
Leak test Fresh Water Maker system		X
Energise and test run unit		X
Verify conformity to specifications of the water quality		X
Conduct Operational Tests as applicable		X
Life saving equipment, survival craft and life raft		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Check especially that Survival Craft, Life raft, Life buoys, and Life jackets certification and shop testing conform and agree to offshore regulations and are acceptable to the applicable legislation	X	
Check that all Survival Craft and Life raft survival equipment has been installed i.e. radio, tools, spare parts, lamp, emergency radio beacon	X	
Check that all Survival Craft and Life raft instructions for use are clearly marked	X	
Check that the Life raft painter line is attached to a strong part of the installation and has an adequate length	X	
Check davit and launching apparatus	X	
Check that the Survival Craft security belt has been installed and hammer is ready to use (if using this system)	X	
Carry out Survival Craft motor test and functional launching test		X
Organise Survival Craft sea trials with VENDOR		X
Carry out Survival Craft sea trials		
Check Life Buoys storage locations	X	
Check Life Jackets storage locations within individual cabins and on decks and that they are clearly marked	X	
Check that all Escape Routes signs are clearly marked to indicate escape ways and muster points (such as arrows, numbers, display boards and routes)	X	
Check that escape ways are safe and secure	X	
Conduct Operational Tests		X
Fire-fighting equipment		
Check storage locations of all extinguishers	X	
Function test of extinguishing agent skids with real release		X
Conduct Operational Tests of Deluge System, Hydrants, Monitors, Foam, etc ...		X

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 80 of 97

Appendix 1

Conduct specific tests as required by local Authorities		X
Telephones (include interphones, intercoms, fax, telex, switchboard, etc.)		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Check especially that EX equipment has been installed in classified areas	X	
Energise and carry out equipment functional tests		X
Test actual operation of all equipment		X
Conduct Operational Tests as applicable		X
Public address		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Energise and carry out PA loops functional tests		X
Test actual operation of loudspeakers and flashing beacons, including check and adjustment of operational features on field such as: range/coverage, visibility, etc.		X
Conduct Operational Tests as applicable		X
Radios (include Marine and Aero VHF, MF/UHF SSB, NDB, UHF local network, Tropo-scatter and line of sight radio links, Multiplex, Radio paging, satellite earth stations, etc.)		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Check connections of antennas, feeders, radio transceivers and associated equipment	X	
Energise and carry out one in-station test per radio equipment		X
Test radio systems operation		X
Perform antenna's final alignement		X
Conduct Operational Tests as applicable		X
Meteorological equipment		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Carry out the calibration of sensors	X	

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 81 of 97

Appendix 1

Energise and test the operation of each loop		X
Test the System test processing		X
Test logging equipment		X
Conduct Operational Tests as applicable		X
Telemetry (MTU and RTU's)		
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications and good practice	X	
Energise and test data transmission		X
Carry out instrument interface tests		X
Conduct Operational Tests as applicable		X
CCTV systems		
Check condition of equipment, quality of installation, and compliance with MANUFACTURERS instructions, safety rules, Project drawings, specifications and good practice	X	
Check free operation of cameras and pan-and-tilt equipment	X	
Energise and check proper functioning of equipment		X
Test System test, scanning, sequencing, etc.		X
Conduct Operational Tests as applicable		X

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 82 of 97

Appendix 2

Appendix 2 Company Pre-commissioning Witnessing Requirement

PRE-COMMISSIONING Witnessing Matrix			
ACTIVITY DESCRIPTION	COMPANY CONTROL POINTS		
	H	W	M
ELECTRICAL			
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURER instructions, safety rules, and specifications.			X
Perform preliminary tests with equipment de-energised, including: – Insulation resistance measurements – Di-electrical tests – Loops and circuits continuity tests – Earthing resistance measurements		X	X X X
Carry out breakdown test of oil samples, and fill transformers with oil and		X	
Fill batteries with electrolyte.		X	
Attend Factory Acceptance Tests	X		
INSTRUMENTATION			
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURER instructions, safety rules, specifications.			X
Remove in-line instruments before hydraulic tests.			X
Carry out preliminary cleaning of hydraulic tubing lines and check the cleanliness conformity.		X	
Air Sub-header flushing		X	
Perform required pressure tests on: – Instrument take-off piping – Air piping – Air tubing – Hydraulic tubing			X
Reinstall instruments after pressure tests and flushing of the process lines.		X	
Calibrate all instruments other than F & G detectors prior to installation			X

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 83 of 97

Appendix 2
PRE-COMMISSIONING Witnessing Matrix

ACTIVITY DESCRIPTION	COMPANY CONTROL POINTS		
	H	W	M
Check continuity of transmission and identification of indication, control and alarm signals. – Perform continuity and insulation tests for instrument cables. – Perform continuity and tightness tests for pneumatic tubing.			X
Install sealing fluids where required			X
Checking of the earthing network			X
Attend Factory Acceptance Tests	X		

PIPING

Check quality of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications (painting and insulation needed). Verify especially gaskets and bolt types.			X
Produce NDT clearance	X		
Carry out piping water or air flushing operations.	X		
Carry out preliminary cleaning and hydrostatic testing of pipes.	X		
Perform chemical cleaning where applicable.		X	
Remove all temporary supports, protections, bracing, sea fastening stops, which were installed to prevent equipment damage during shipping, storage and erection.			X
Alleviate any excess piping stresses that may be imposed on pipes, compressors or pump flanges.			X
Provide and install all strainers, both temporary and permanent, spectacle blinds and temporary blanks.			X
Check packing and packing materials and lubrication of valves; repack and lubricate if necessary.			X
Supply and install line identification tags and signs, stencil lines for identification.			X
Set or check pipe anchors, guides, spring hangers and supports after hydrotest. Provide cold and hot setting data.			X
Install safety valves or temporary spool pieces during construction.			X
Remove as necessary and transport all safety valves to and from test facilities.			X
Test, set and tag all safety valves, then carry out safety valves final installation.		X	

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 84 of 97

Appendix 2
PRE-COMMISSIONING Witnessing Matrix

ACTIVITY DESCRIPTION	COMPANY CONTROL POINTS		
	H	W	M
Supply car seals or locking devices for block valves and safety equipment.			X
Carry-out leak test of critical valves.	X		

VESSELS

Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURER instructions, safety rules, specifications			X
Clean all vessels internally		X	
Carry out vessels final inspection	X		
Properly close up all vessel internal man ways and openings after final inspection or after loading of chemicals, catalysts, etc. is completed		X	
Attend Factory Acceptance Tests as applicable	X		

TANKAGE

Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications			X
Install appurtenances			X
Clean inside tank			X
Carry out tank final inspection	X		
Close man ways			X
Attend Factory Acceptance Tests as applicable	X		

PUMPS

Check condition of equipment, quality of installation, and compliance with project drawings, MANUFACTURERS instructions, safety rules, specifications			X
Set and cold align pumps and drivers			X
Couple pumps to drivers			X
Install temporary strainers			X
Check that piston seal packaging followers, if any, are correctly tightened			X
If discharge flow dampers are fitted (normally nitrogen filled bladder type) check these are correctly charged and installed			X
Attend Factory Acceptance Tests as applicable	X		

PRE-COMMISSIONING Witnessing Matrix

ACTIVITY DESCRIPTION	COMPANY CONTROL POINTS		
	H	W	M

COMPRESSORS

Check condition of equipment, quality of installation, and compliance with Project drawings, VENDOR's instructions, safety rules, specifications			X
Install all piping and make piping corrections as required by MANUFACTURER's tolerances. Set and cold align units			X
Attend Factory Acceptance Tests as applicable	X		

DIESEL ENGINES

Check condition of equipment, quality of installation, and compliance with Project drawings, VENDOR's instructions, safety rules, specifications.			X
Set and cold align units			X
Clean lube oil piping			X
Fill lube oil system		X	
Attend Factory Acceptance Tests as applicable	X		

LIFTING EQUIPMENT

Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications			X
Attend Factory Acceptance Tests as applicable	X		

HVAC EQUIPMENT

Check condition of equipment, quality of installation, and compliance with Project drawings, VENDOR's instructions, safety rules, specifications			X
Check alignment of motors/ fans and drivers			X
Check that tensions on drivers are correct			X
Check that fans and motors rotate manually and run freely			X
Check that anti-vibration mountings are correctly installed			X
Check that sealing compound of fire dampers is installed correctly			X
Check that linkage and blades of dampers operate correctly and freely			X
Check that airflow direction in pre heaters is correct			X
Attend Factory Acceptance Tests as applicable	X		

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 86 of 97

Appendix 2
PRE-COMMISSIONING Witnessing Matrix

ACTIVITY DESCRIPTION	COMPANY CONTROL POINTS		
	H	W	M

LIFE SAVING EQUIPMENT, LIFEBOATS AND LIFERAFTS

Check condition of equipment, quality of installation, and compliance with Project drawings, VENDOR's instructions, safety rules, specifications		X	
Check especially that lifeboat, Liferaft, Life Buoys, and Lifejacket certification and shop testing conform and agree to offshore regulations and are acceptable to the applicable legislation		X	
Check that all lifeboat and Liferaft survival equipment has been installed i.e. radio, tools, spare parts, lamp, emergency radio beacon		X	
Check that all lifeboat and Liferaft instructions for use are clearly marked			X
Check that all Liferaft painter line is attached to a strong part of the installation and has an adequate length		X	
Check launching apparatus			X
Check that the lifeboat security belt has been installed and hammer is ready to use (if using this system)			X
Check Life Buoys storage locations			X
Check Life Jackets storage locations within individual cabins and on decks and that they are clearly marked			X
Check that all Escape Routes signs are clearly marked to indicate escape ways and muster points (such as arrows, numbers, display boards and routes)		X	
Check that escape ways are safe and secure		X	
Attend Factory Acceptance Tests as applicable	X		

ALL FIRE FIGHTING EQUIPMENT

Check storage locations of all extinguishers		X	
Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications	X		

TELEPHONES

Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications			X
Check especially that EX equipment has been installed in classified areas	X		

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 87 of 97

Appendix 2
PRE-COMMISSIONING Witnessing Matrix

ACTIVITY DESCRIPTION	COMPANY CONTROL POINTS		
	H	W	M

PUBLIC ADDRESS

Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety rules, specifications			X
Attend Factory Acceptance Tests as applicable	X		

BUILDINGS AND STRUCTURES

Check condition of equipment, quality of installation, and compliance with Project drawings, MANUFACTURERS instructions, safety, rules, specifications		X	
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SUBSEA SPS EQUIPMENT

Qualification and Verification Tests All new Units and parts thereof, shall be qualified in accordance with the requirements of relevant ISO standards, API, specifications, and Company specifications.	X		
Unit Factory Acceptance Test (FAT) Set of tests required to prove that the components of a Unit and the Unit itself, satisfy all specified functional and performance requirements. Unit FAT shall be performed at the Unit manufacturing site	X		
Extended Factory Acceptance Test (EFAT) or System FAT Test that shall include interface, pressure and functional tests of all Units within a System to prove that the System will perform satisfactorily in service and meet all specified system and detailed requirements- Includes: - X-Mas tree system, Wellhead and IWOC system (Installation and Workover Completion) - Structures and manifold system - Subsea production control system	X		
System test Test to verify and demonstrate the capability of the Systems to function and be operated as an integrated Subsea Station. Typical system tests are: - X-Mas tree testing on template slot No. 1. - X-Mas tree testing on all other template slot. - Tie-in System. - Production control system.	X		

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 88 of 97

Appendix 2
PRE-COMMISSIONING Witnessing Matrix

ACTIVITY DESCRIPTION	COMPANY CONTROL POINTS		
	H	W	M
Integration Tests (IT) Tests to verify all external interfaces between Systems and units supplied by Contractor and systems supplied by different Contracts, such as interfaces with flow lines, umbilical's, ROV and Dummy BOP. The Integration Test program shall include: - ROV access check with dummy ROV and all relevant tools - X-Mas tree System stack-up test - Tie-in of flow line - Tie-in of service umbilical - Function test of all valves and monitoring functions at actual location - Any other activity to ensure proper fit, function and integrity between the Subsea Station and external interfaces (equipment and services) as required.	X		
Shallow water test Test to verify and demonstrate the following operations: - Running and retrieving X-Mas tree system - Making up of connection to between tree and manifold - Running and retrieving control POD and choke valve insert - Running of ROT system - Interface accessibility of functional tests by use of ROV, and ROV installation tasks - Testing of back-up system such as manual overrides.	X		

Subsea SURF : Umbilicals, SSIV cables and Flying leads

Tests on all electrical cables, fiber optic cables and hydraulic and chemical tubes	X		
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Subsea SURF Installation: Production, Service, Water injection, Export lines, etc ...

Flooding (control the filling medium)	X		
Cleaning (verifying that the pipe cleanliness is acceptable)	X		
Gauging	X		
Hydrostatic Testing (verifying the integrity of the system/item tested)	X		
Flexibles Annulus test (FAT)	X		
Contingency integrity test ("structural integrity test" in case damage is suspected)	X		
Back Seal Test of spools and jumpers (indication of connection status)	X		

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 89 of 97

Appendix 2

PRE-COMMISSIONING Witnessing Matrix			
ACTIVITY DESCRIPTION	COMPANY CONTROL POINTS		
	H	W	M
Combined global leak test including flexible jumper – production, gas lift & service ((check if the system tightness is acceptable)	X		
Flexible jumper annulus vacuum test (check the acceptance the leak proofness of the annulus)	X		
Final gauging (Final gauging of flexible, riser, spools, flow lines, ...)	X		

SURF: GAS EXPORT SYSTEM			
All witness points as per above case SURF: FLOWLINES, PIPELINES, RISER, as applicable	X		
SSIV Spools Back Seal Test (Indication of connection status)	X		
MEG Swabbing (verifying that the line is empty and that residual water amount is acceptable)	X		
Inerting (check that the residual oxygen amount in the system is acceptable)	X		

DRAWINGS & DOCUMENTATION			
Compile OPERCOM™ Dossiers		X	
Red line Mark up on Discipline Master Dossiers		X	
Red line Mark up on VENDOR's Dossiers		X	

Appendix 3 Company Commissioning Witnessing Requirement

COMMISSIONING Witnessing Matrix

ACTIVITY DESCRIPTION	COMPANY CONTROL POINTS		
	H	W	M

ELECTRICAL

Energise and test control system.	X		
Perform all functional tests, including: - Adjustments and testing of protective devices - Check-out and adjustments of electrical instruments - Operation of safety devices		X	
Energise and test emergency and instrument power system	X		
Start up and test emergency power plant	X		
Carry out preliminary load test (when possible)		X	
Energise sub stations		X	
Carry out batteries discharge tests			X
Test battery chargers, inverters, UPS		X	
Check direction of rotation of electrical motors. (Modify connections if wrong direction of rotation)			X
Perform 4 hour no load run on motors. Test motor's ancillary equipment		X	
Check temperature rise of High Voltage motors, bearings, transformers, relays, when loaded (if possible)	X		
Check operational of manual and auto controls			X
Check normal and emergency lighting intensities			X
Black re-Start demonstration	X		
Attendance to Operational Tests	X		

INSTRUMENTATION

Calibrate all F&G detectors, synchronise with F&G panel.			X
Test marshalling relay boxes, programmable logic controllers, sequential operators and all numeric control systems		X	
Carry out loop testing			X
Test functions of hydraulic control cabinet (Wellhead Safety Cabinet) and associated valves and instruments	X		

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 91 of 97

Appendix 3

Test shutdown and process control system, interlocks and sequencers	X		
Black re-Start demonstration	X		
Attendance to Operational Tests	X		

VESSELS

Carry out vessels final inspection.	X		
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TANKAGE

Carry out tank final inspection.	X		
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PIPING

Install car seals or locking devices on block valves and safety equipment.			X
Fill in hydraulic unit and network with appropriate oil.		X	
Perform drying-out where applicable.			X
Carry out Leak test		X	
Carry out Service Test	X		
Carry out Flange Gasket Test		X	
Carry out Flange Witness Joint	X		
Carry out inerting		X	
Provide list and location of all blinds installed.			X
Attendance to Operational Tests	X		

PUMPS

Check pump gearbox oil levels			X
Run-in pump in recycle, check pump and motor operation and do any required doweling of the pump driver	X		
Check oil for presence of chips after no load run		X	
Check gears, bearings and parts for signs of wear and damage			X
Make final hot alignment check		X	
Attendance to Operational Tests	X		

COMPRESSORS

Clean chemically suction and interstage piping and lube/seal oil piping			X
Disassemble above piping for cleanliness inspection as required			X
Fill lube and seal oil systems		X	

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 92 of 97

Appendix 3

Carry out lube and seal oil systems flushing, circulate oil until test patches are clean		X	
Drain lube and seal oil systems then refill with new oil, if required		X	
Run in driver (uncoupled) except for expanders.		X	
Couple driver and driver unit			X
Run in compressor in recycle on air or inert gas, if possible and/or suitable, on gas after gas-in otherwise. Check operation	X		
Check hot alignment		X	
Carry out comprehensive vibration tests		X	
Check equipment noise levels			X
Attendance to Operational Tests	X		

DIESEL_ENGINES

Test run Diesel engines and their accessories uncoupled		X	
Couple diesel engines to driven equipment			X
Test run coupled unit and verify operating parameters		X	
Check alignments after operational test		X	
Carry out noise measurement tests			X
Attendance to Operational Tests	X		

LIFTING EQUIPMENT

Fill-in lube and hydraulic oil systems of lifting equipment		X	
Calibrate all solid weighing and measuring devices in their field-installed operating positions. Show that equipment meets specified tolerance for accuracy over full range of operating conditions		X	
Test lifting equipment in presence of Certifying Authority	X		
Attendance to Operational Tests	X		

HVAC EQUIPMENT

Check that dampers actuators operate correctly			X
Carry out ductwork leak tests		X	
Energise and run unit. Test sequences and interlocks. Check vibrations		X	
Carry out airflow and balancing tests		X	
Control and adjust room temperature and pressurisation		X	
Attendance to Operational Tests	X		

Pre-commissioning and Commissioning Specification

Rev.: 05

Effective date: 10/2012

Page: 93 of 97

Appendix 3
FIRE FIGHTING EQUIPMENT

Function test CO ₂ skids without actual release		X	
Function test of Deluge System, Hydrants and Monitors		X	
Carry out specific test as required by local Authorities	X		
Attendance to Operational Tests	X		

TELEPHONES

Energise and carry out equipment functional tests		X	
Test actual operation of all equipment	X		

PUBLIC ADDRESS

Energise and carry out PA loops functional tests.		X	
Test actual operation of loudspeakers, flashing and non-directional beacons, including check and adjustment of operational features on field such as: range/coverage, visibility, etc.		X	
Attendance to Operational Tests	X		

LIFE BOAT

Carry out lifeboat motor test and functional test	X		
Carry out lifeboat real launching from Davit's	X		
Carry out lifeboat real free fall launching	X		
Organise lifeboat sea trials with VENDOR	X		

SURF installation: Production, Service, Water injection, Export lines, etc ...

Functional Testing	X		
Operational Tests	X		
Leak testing	X		

DRAWINGS & DOCUMENTATION

Compile OPERCOM TM Dossiers		X	
Red line Mark up on Discipline Master Dossiers		X	
Red line Mark up on VENDOR's Dossiers		X	

General: Operational Tests

General Specification		GS EP EXP 101
Pre-commissioning and Commissioning Specification		
Rev.: 05	Effective date: 10/2012	Page: 94 of 97

Appendix 3

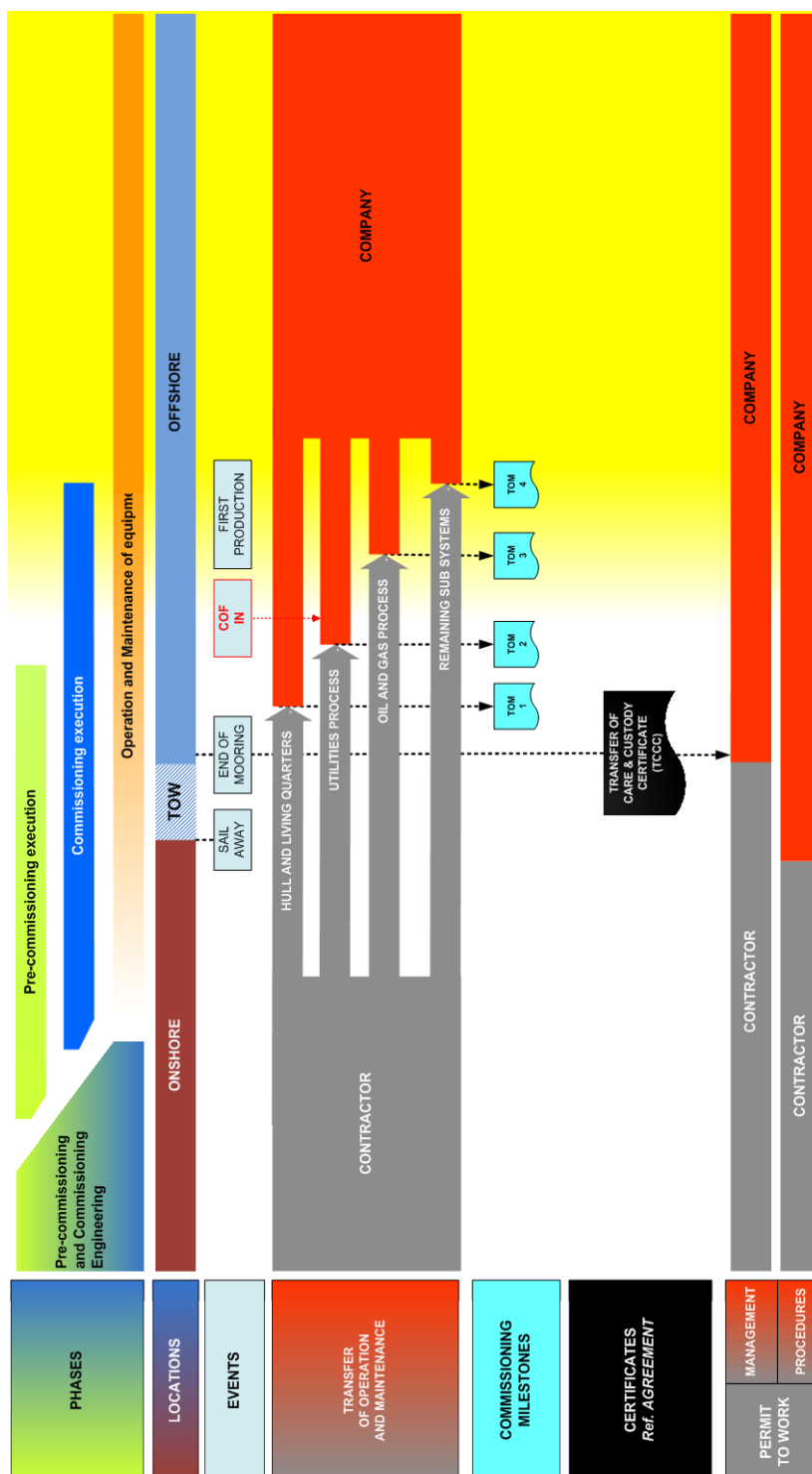
Operational Test as per approved procedures on utility equipment. (use of Contractor Authorised Fluids)	X		
Operational Test as per approved procedures on process equipment. (use of Company Only Fluids)	X		

General: Piping & Vessels Preparations			
- Leak testing	X		
- Dry out	X		
- Chemical Loading	X		
- Inerting	X		

General: Pre start-up activities			
- Plant depressurisation demonstration	X		
- ESD Highest level demonstration	X		
- Black start procedure demonstration	X		
- Deluge demonstration	X		
- Prepare Abandon test	X		
- Gas in	X		

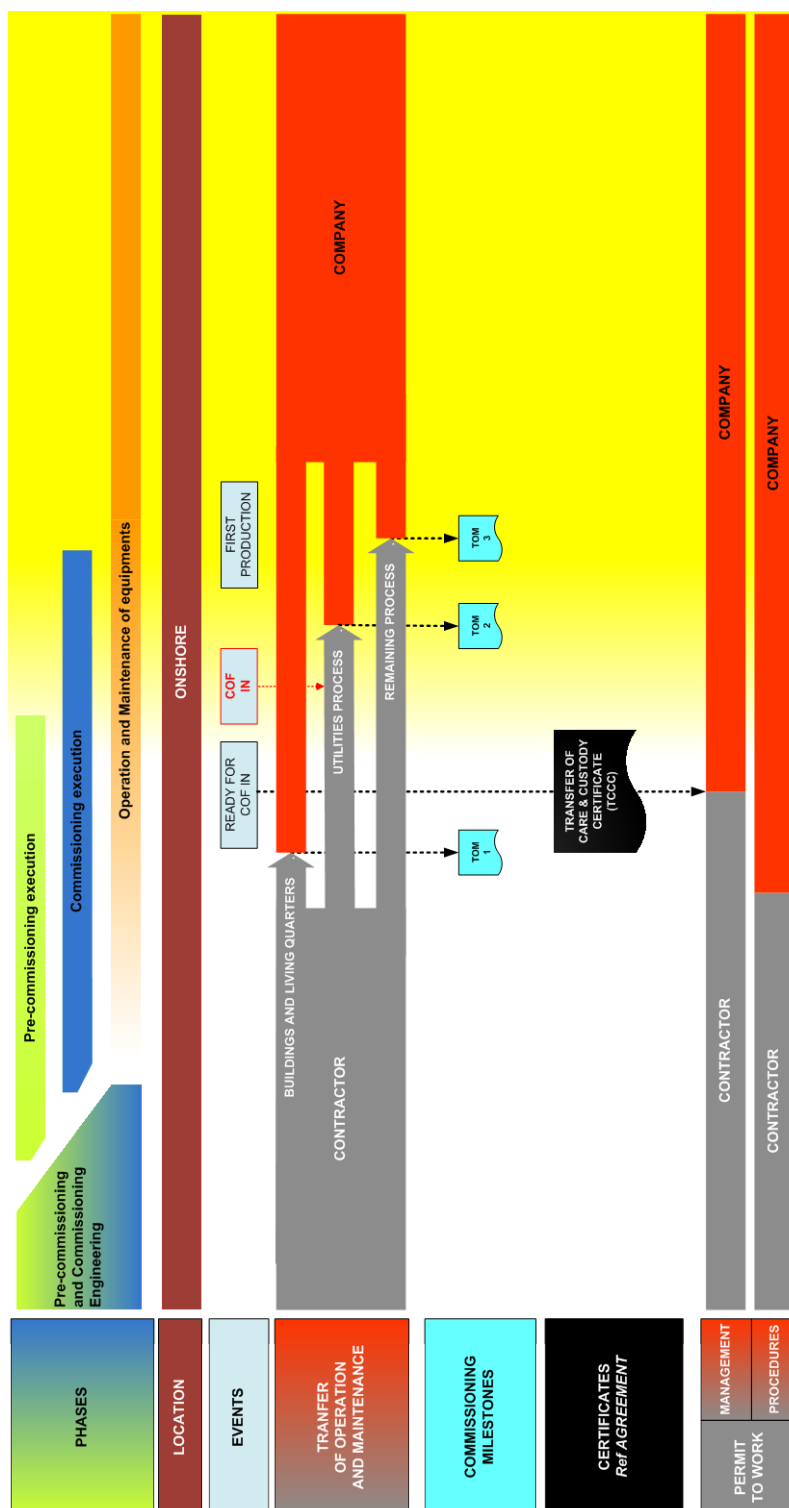
Appendix 4 Transfer of Operation & Maintenance: 1/3

Typical Case for FPSO Project



Appendix 5 Transfer of Operation & Maintenance: 2/3

Typical Case for Onshore Plant Project



Appendix 6 Transfer of Operation & Maintenance: 3/3

Typical Case of Modifications on Existing Facilities Project

