



Exploration & Production

GENERAL SPECIFICATION

GS EP EXP 107

Commissioning execution

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1. Scope

2. Reference documents

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

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP ELE 031 Rev1	Design of earthing and bonding systems
GS EP EXP 101 Rev4	Precommissioning and Commissioning Specifications
GS EP EXP 103 Rev4	Precommissioning and Commissioning Technical Preparation
GS EP EXP 105 Rev3	Precommissioning Execution

3. Commissioning execution activities

3.1 Preamble

3.1.1 Specifications

The present **GS EP EXP 107** provides all the information, procedures, and support documents required to carry-out on-site commissioning activities in a planned, safe and efficient manner.

This specification will be read in conjunction with the:

- **GS EP EXP 101** "Precommissioning and Commissioning Specifications", which gives, in particular, the definition, rationale, and key principles of commissioning, thus allowing an easier approach to anyone having to execute commissioning activities.
- **GS EP EXP 103** "Precommissioning and Commissioning Technical Preparation", which covers all tasks to be completed prior to the actual start on site of commissioning execution.

3.1.2 Wording

The present specification is drafted in such a way that it can be implemented either by a COMPANY Entity, part of a project organisation or subsidiary, or by a CONTRACTOR, whose scope of work would include a part, or the totality, of the commissioning activities of a project.

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

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

- "Commissioning", "Commissioning Team", and "Commissioning personnel" designate any organisation and its members assigned, by contract or by a COMPANY internal arrangement, to carry out commissioning activities of equipment, part of plant, or plant
- "COMPANY/Operator" designates the client for whom the Commissioning performs commissioning activities, or the entity of whom Commissioning works on behalf, i.e.:
 - COMPANY, when the Commissioning is a CONTRACTOR
 - Operator, when the Commissioning is part of COMPANY.

3.2 General requirements

3.2.1 Standards and codes

Commissioning will comply with Project Management and/or COMPANY Specifications, Standards and Codes referenced in the contractual documentation.

Any waiver from the present Commissioning Specification on the technical content of Commissioning activities will be sought through the proper channel from DGEP/TDO/EXP, COMPANY entity responsible for the functional aspects of the Commissioning.

3.2.2 Safety

Commissioning activities will be carried out only by competent and experienced personnel.

Commissioning will be responsible for the safety procedures and Permit to Work applied on the equipment and areas under their responsibility.

Commissioning will comply with the COMPANY's safety rules and with the country's safety regulations.

Commissioning will be responsible for its internal safety organisation and control.

3.2.3 Organisation

The commissioning activities will be carried out by subsystem unless specified otherwise in the present document. The subsystems will have been defined during the preparation phase in accordance with the rules set in **GS EP EXP 103**, as well as the sequence of subsystems commissioning, established so that it meets the start-up priorities.

The transfers of responsibility from the Precommissioning to the Commissioning and from the CONTRATOR to the Project and/or the OPERATOR is described in GS EP EXP 101.

3.3 Scope of work

3.3.1 Introduction

The commissioning scope of work will comprise:

- Preparation activities, covered by **GS EP EXP 103**
- Execution activities, covered by the present specification.

The scope of work of the commissioning execution activities will include the following:

- Precommissioning witnessing
- Preliminary checks
- Functional tests
- Piping and Vessels Preparations
- Operational tests
- Support activities
- Documentation tasks.

These activities are defined hereafter.

3.3.2 Precommissioning witnessing

The Commissioning will perform witnessing of critical precommissioning activities, listed hereafter:

- Setting of PSV's
- Piping flushing and cleaning
- Gross Leak test
- Machinery cold alignments

- Electrical protection relays setting
- 20% of instrument calibrations, at random.

There is no specific witnessing procedure: the above tests will be attended by a suitably qualified Commissioning Engineer, and the relevant precommissioning test sheets countersigned, on the successful completion of the tests.

Witnessing matrix is defined in GS EP EXP 101.

3.3.3 Preliminary checks

The Commissioning will perform Preliminary Checks, as defined in chapter 4.

3.3.4 Functional tests

The Commissioning will perform Functional Tests, as defined in chapter 5.

3.3.5 Piping and Vessels Preparations

The Commissioning will perform Piping and Vessels Preparations, as defined in chapter 6.

3.3.6 Operational tests

The Commissioning will perform Operational Tests, as defined in chapter 7.

3.3.7 Support activities

Depending the contractual clauses and the project organisation, the Commissioning will perform, organise, or follow-up all the following support required to carry-out the previous commissioning activities:

- Logistics: housing, catering, offices, transportation means
- Material: spares, consumables, test equipment, temporary equipment, documentation
- Execution personnel: mobilisation, administration, organisation
- VENDORS: mobilisation, assistance
- Planning: forecast, program, histograms, man-hours
- Punch lists: follow-up, clearance.

3.3.8 Documentation tasks

3.3.8.1 Adaptation of **GS EP EXP 107**

The Commissioning will review the present specification and will adapt or amend all test sheets and report forms as required by the particularities of the project, and develop new test sheets, report forms, and procedures whenever relevant documents are not available in the specification. However, every new document will have to be submitted to COMPANY for approval.

3.3.8.2 Technical Data Base

The Technical Data Base, listing of all basic functions grouped by subsystem and compilation of other relevant information, will have been developed during the commissioning preparation

phase, in accordance with the rules given in **GS EP EXP 103**, and the assistance, if so wished, of the specific software developed by COMPANY.

During the execution phase, the Data Base will be used by the Commissioning as a working document, by recording the completion dates of each functional test and of all other commissioning activities listed in the Data Base.

3.3.8.3 Drawings up-dating

Commissioning will up-date the following documents transmitted at the ready for commissioning stage by the pre-commissioning CONTRACTOR:

- PID's
- TSLD's
- Single line diagrams
- Interconnecting diagrams
- Interlock logic diagrams
- ESD/F and G matrixes.

The up-dating will include all modifications carried-out on site during the commissioning execution phase, so that a set of "As-built" drawings is available at the time of the handover of each subsystem to the Operator.

3.3.8.4 Punch list

The subsystems punch lists once mutually agreed at the Ready for Commissioning stage between the Construction CONTRACTOR and the Commissioning will be continually updated during the commissioning operations by the Commissioning Personnel, by adding all newly discovered items and deleting cleared ones.

General principles are defined in GS EP EXP 101..

3.3.8.5 Commissioning report forms

The Commissioning will fill-up, sign, and obtain signatures of other parties whenever required, on all commissioning report forms, functional test sheets, operational test procedures, and any other activity support form.

The various Master Forms of commissioning support documents available in the present specification are numbered as follows:

- Three first digits refer to corresponding chapter, paragraph, subparagraph numbers of the specification
- 4th digit is the ordering number.

The commissioning functional test sheets are numbered as are the basic functions.

3.3.8.6 Commissioning dossier

The Commissioning will compile all documentation pertaining to the commissioning operations in a specific Commissioning dossier, arranged by subsystem, which will contain all the information required to demonstrate to the COMPANY/Operator that the subsystem has reached the "Ready Fr Start-Up" status.

This dossier will include the following:

1. Ready For Start-Up certificate
2. Subsystem definition drawings
3. Data Base print-out
4. Commissioning reports
 - Preliminary checks reports
 - Functional test sheets
 - Piping and Vessels Preparations reports
 - Operational test procedure
 - Mechanical reports
 - VENDORS reports
5. Punch list (final status at the End of the Commissioning)
6. As-built drawings
 - List of modifications

4. Preliminary checks

4.1 Introduction

4.1.1 Purpose

The preliminary checks, first task of site commissioning activities, are the cross-verification by the Commissioning that the Construction CONTRACTOR has achieved his full precommissioning scope of work. These checks are carried-out on a subsystem basis.

4.1.2 Principles

When the precommissioning scope of work is complete on a given subsystem, the Commissioning Site Leader (CSL) will receive the formal notification that this subsystem is "Ready For Commissioning" (RFC) together with the RFC Dossier of the subsystem.

Before signature of the RFC certificate, which formalises the transfer of responsibility for the operation and maintenance of that subsystem from the Construction CONTRACTOR to the Commissioning, the CSL will initiate the Preliminary Checks, consisting in:

- The assessment that all precommissioning tasks have been performed.
This will be achieved by a thorough review of the precommissioning status indexes, check lists, and test sheets included in the RFC Dossier. This work will be done under the responsibility of each discipline leader.
- The review of the "As-built" drawings, which will be carried-out at the same time.
- The verification on site that the subsystem equipment conforms with all project documents. This will be achieved by a thorough visual inspection of the subsystem facilities, by representatives of each discipline of the commissioning team:
 - Operations

- Mechanical
- Electrical
- Instruments.

Since the inspection is visual, no dismantling will usually be required. However, in some cases, e.g. the verification of the quality of a gasket, some elementary dismantling may be required.

Upon completion of their inspections, each discipline specialist will:

- Complete the relevant report forms
- Compile their punch list items in the ready for commissioning punch list.

Once the CSL is satisfied that the subsystem has reached the ready for commissioning status, his acceptance will be formalised by the signature of the subsystem RFC certificate and its attached RFC punch list, which will have been discussed and agreed upon with the Construction CONTRACTOR.

The Preliminary checks to be carried out on the installation shall be anticipated (for example through witnessing activities) in order to avoid re-tests and re-checks and to ensure a formal transfer from Precommissioning and Commissioning with continuous approach.

4.2 Operators preliminary checks

4.2.1 Piping

4.2.1.1 Review of documentation

The commissioning operators will review the piping precommissioning operations reported in the precommissioning dossier and make sure that:

- All pipework has been properly flushed and pressure tested, and that all related test sheets are filled-in and signed.
- All relevant piping check lists have been filled-in and signed.
- All as-built drawings are available.
- For sub-sea installations ensure that all pre-commissioning has been carried out satisfactorily and the relevant test records are available from the UFL group. All fluids must be agreed with the commissioning group.
- Ensure that the production wells and injection wells have been handed over from the drilling group to commissioning in a satisfactory condition and that the hand over documents are complete. The precise status of the Xmas trees must be known.

4.2.1.2 Review of facilities

The commissioning operators will work-out all lines and verify the operability and the conformity of the pipework with project specifications and drawings, the key document being the as-built PID's.

The following is a list of points that will be systematically addressed during this site survey:

4.2.1.2.1 Non-return valves, control valves, certain globe valves

Ensure these are installed with the flow direction arrow (stamped or tagged on the valve body) in the correct direction.

4.2.1.2.2 All valves

Check that packing followers are correctly tightened and that the valves open and close smoothly.

4.2.1.2.3 Sample connections

Are these correctly placed, i.e., not in a dead-end?

Are they of the type indicated on the P and P&ID, i.e., double valve, block and needle, etc.?

Is there room enough to insert the sample bottle?

Are sample coolers correctly piped-up?

4.2.1.2.4 Pump suction strainers

Can the strainer body be depressured and drained?

Can a drain hose be coupled to the drain connection without problem?

Is there enough room to insert a bucket or can underneath the drain point?

Can the strainer be pulled without problem?

4.2.1.2.5 Spectacle blinds

Can they be swung easily?

Are they installed in such a way that they can be swung without a shutdown, i.e., between double block and bleed valves.

4.2.1.2.6 Piping low points, high points and slopes

Check these are in accordance with the P&ID, that drains and vents are installed and equipped with plugs.

4.2.1.2.7 Pipe supports

Check spring hanger transit pins have been removed.

Check slipper pads are situated correctly in their guides.

Check pipe clamps are tight.

4.2.1.2.8 Stream traps

Ensure these are correctly installed and that they blow to a safe location. Check integrity of isolation and bypass valves.

4.2.1.2.9 Safety valves

If these vent to atmosphere, check that the exhaust line is adequately supported and drainable if there is low point. If paired safety valves with a key lock system are installed, check the lock system is in good order and that the keys are available and labelled.

4.2.1.2.10 Insulation

Check that piping insulation on hot and cold service lines is in good condition and has been completed, in some cases insulation may not be completed until just prior to start-up. Check that the insulation cannot become saturated with water during flushing operations or inclement weather.

4.2.1.2.11 Earthing

In some piping applications flanges are coupled by an earthing strap, check integrity of strap and connections.

4.2.1.2.12 Gaskets and joints

If soft metal ring joint flanges are installed, ensure that a check has been carried out, during Precommissioning, of flange face integrity. This type of flange/joint is often used in hot, high temperature service, such as catalytic reformer reactor inlet/outlet flanges. Where spiral wound gaskets ("metaflex", etc.) are employed, it is important to check that the correct rating has been employed.

If pipework is to be dismantled for flushing, this type of gasket is frequently replaced, temporarily, by an asbestos compound gasket. The correct gasket must be installed prior to handing over the system for start-up.

4.2.1.2.13 Blinds

At the ready for Commissioning stage a blind list must have been prepared by the Precommissioning team. If this is not the case, and blinds have been installed, it is most important to initiate a blind list at the earliest possible moment. The principal reasons for a blind list are as follows:

- To record where the blinds are situated and why
- To ensure that the blinds are removed prior to start-up.

In the case of spectacle blinds and certain other blinds, it may well be necessary that these remain in position at the time of start-up, however, a battery limits blind list will be issued prior to start-up in order that blind status may be readily checked.

The blind list (see attached form) will contain the following information:

- Line number (ex.: P&ID), size and service
 - Blind number
 - Blind size and rating, i.e., 150, 300, etc.
 - Date installed plus signature
 - Date removed plus signature.

It is often the case that blinds are installed, during Construction and Pre-commissioning, for hydrostatic tests, flushing, etc., and these are frequently forgotten if not correctly listed. It also happens that blinds without tags (handles) are installed, in this case it is extremely difficult to tell the difference between a blind and the edge of spiral wound metal gasket.

Therefore, blinds will always have a tag or handle clearly labelled for easy identification.

4.2.1.2.14 Accessibility

Check accessibility of valves and other equipment. Not accessible valves located in piperacks, will be equipped with chainwheels and chains, or extended spindles.

4.2.1.2.15 Safety

Check all safety aspects related to piping, i.e. protruding valves spindles.

4.2.1.2.16 Operability

Check operability aspects, such as the location of pressure gauges installed at pumps discharge, that must be readable while manoeuvring the discharge valves, the level gauges of capacities to be visible from the drain valves locations, etc.

[illegible]

4.2.2 Vessels

4.2.2.1 Classification

For the purpose of commissioning, the following items of equipment are considered as vessels:

- Towers: distillation columns, splitters, strippers, absorbers, etc.
- Drums: overhead receivers, HP and LP separators, oil/gas separators, knock-out drums, surge drums, flash drums, balance drums, instrument air driers, molecular sieves, settling drums, contactor drums (i.e. "Merox" process), desalters
- Boilers, Steam generators: all types
- Furnaces: all types including combustion type Inert Gas generators, Klaus process sulphur recovery units, etc.
- Storage tanks: all types
- Underground tanks/sumps: all types, steel or concrete
- Oily water separators
- Heat exchangers: shell and tube, kettle type, plate exchangers, vaporisers
- Pig receivers and launchers
- Desalination units.

4.2.2.2 Review of documentation

The commissioning operators will review the vessels precommissioning operations reported in the precommissioning dossier and make sure that:

- All vessels fabricated on site, or not tested at the MANUFACTURER's, have been pressure tested and that all related test sheets are filled-in and signed
- All vessels have been properly flushed, cleaned, and dried-out if applicable
- All internals have been correctly installed and checked off
- All relevant vessels check lists have been filled-in and signed
- All as-built drawings are available.

4.2.2.3 Review of facilities

4.2.2.3.1 Organisation

As a general rule the vessels will be opened for inspection at the RFC stage, and closed (by the construction team) immediately after the completion of the preliminary checks (if they are satisfactory).

However, in some cases, it may be necessary for construction purpose to close the vessels prior to RFC.

In this case, the preliminary checks relating to the internal inspection of the concerned vessels will be carried-out before closure even if the entire sub-system is not yet formally ready for commissioning.

Before entering any vessel, the person responsible will obtain a vessel entry permit which will include an atmospheric analysis, and the verification that suitable means of entry and exit are provided. Vessels which may contain toxic vapours, i.e., following the application of an internal lining medium such as epoxy resin, should be given special consideration.

If the vessel is in any way physically connected to a "live" system, it must be suitably blinded and a blind list provided.

Persons entering a vessel for inspection or rectification work may require the following items:

- Measuring tape
- Spirit level to check tray levels, etc.
- Intrinsically-safe low voltage lighting or flashlight
- Tools
- Notebook, pen, paintpen or chalk to tag defects.

Once the physical checks have been successfully performed, the vessels closure (manholes, access doors) will be carried-out by the Construction CONTRACTOR.

To do so, the Construction CONTRACTOR will issue the "Certificate For Vessel Closure" and obtain all required signatures according to the corresponding co-ordination procedure. The signers will be the following:

- CONTRACTOR
- Commissioning
- Certifying Authorities (if applicable)
- Operator/COMPANY.

For the Commissioning, the Superintendent in charge of vessels preliminary checks will be entitled to sign it after completion of the checks and clearance of the punch list items. It is therefore recommended to carry-out the vessels preliminary checks as close as possible to the closure operation.

In any case, the final approval for vessels closure will be given by the Operator/COMPANY.

4.2.2.3.2 External checks

The following checks will be carried-out by the commissioning operators on site on all vessels:

- Check maker's nameplate details are correct
- Check access ladders and platforms are correctly installed and in good order
- Check nozzles and manways are as shown on updated P&ID and engineering drawings
- Check integrity of insulation
- Ensure fire detectors, sprinklers, deluge systems, foam heads are correctly installed
- Carefully inspect the outer skin of pressure vessels to ensure that at no time has unauthorised welding taken place; sometimes scaffolding is temporarily tack welded in place by mistake. Most pressure vessels are marked "no welding" to avoid such mishaps but nevertheless one can never discount human error. If such a case is discovered, the vessel in question should be handled back to the construction team for rectification, i.e., stress-relieving, non-destructive testing, etc.

4.2.2.3.3 Internal checks

The following checks will be carried-out on site, based on equipment design drawings:

- **All vessels**

Verify the maker's nameplate and details are correct, and verify all nozzles are correctly sized and orientated.

In situations where manways are specified in baffles in particular vessels, a check will be made to ensure that these manways are actually installed with appropriate bolting and gaskets, as specified on the drawings.

Ensure all foreign bodies have been removed from the vessels and vessels skirts. This includes scaffolding, ladders, tools, etc.

It is not anticipated that any change will be required on any of the towers or vessels, nor to the drawings. However, absolutely no changes are to be made or approved in the field. Any changes to the design drawings or to the equipment must have prior approval by Project Group.

- **Towers, columns**

Verify all towers and vessels are clean and free of any debris, excess rust, etc. (for the most part this requires hand cleaning).

Check that manway gaskets are of proper size and materials, and that manway studs/bolts are properly tightened.

Verify types of trays and types of valves in tray decks.

Check tray support rings for welding and dimensions.

Make sure that tray valves are not corroded or stuck.

Check downcomers for proper vertical alignment and clearance between bottom of downcomer and deckplate.

Check tray overflow weirs for proper dimensions and welding/bolting.

Check bolting of tray segments to support rings - these must be tight, and in some cases, the underside nuts require tack welding. Verify this against the drawings.

Check tray decks, tray valves, and all internal bolting for proper materials of construction. Bolting must also be checked for proper size and installation of washers. Verify tower/vessel materials of construction.

Check each tray deck for horizontal deflection. Decks should be flat within a tolerance of plus or minus 0.5%, measured at four equidistant points with a spirit level.

Check that splash weirs are installed, and that they are properly secured by bolting or welding, per the drawings.

Verify that required tray gaskets are properly installed, and that they are of the proper materials.

Verify that all nozzles are open from the inside of the tower and that they are not plugged nor restricted with foreign articles, dirt, etc.

- **Reboiler Baffles**

Make sure that the reboiler feed nozzle is on the proper side of the baffle. Verify that reboiler return nozzle is on opposite site from reboiler feed nozzle. Verify against drawings.

Check appropriate design drawings of the involved tower or vessel and make sure of the baffle design details. As an example, perforated baffles must not be installed in the bottom or reboil section of a tower.

Check that proper size weep-holes are drilled in the bottom of the seal pans, according to the drawings.

Check for installation of vortex breakers, as per drawings.

- **Drums**

Check especially that wire mesh pads, vortex breakers, weirs, baffles and any other internals are in place and that they are securely attached and of the correct dimensions.

- **Boilers/Steam generators**

Check that steam drum internals such as cyclones, baffles, etc., have been securely installed. In boiler fireboxes check the integrity of the refractory brickwork, burner quorls, baffle walls and so on.

Waste heat steam drums are to be inspected for cleanliness, installation of flood nipples, proper installation, bolting, and materials of construction of steam distributors; check that nozzle openings are not plugged or restricted, etc. The inspection of waste heat steam drums will be based primarily on the VENDOR drawings.

Deaerator inspections are to include a physical inspection of the internals in the scrubbing section for installation of trays, gaskets, etc. There have been cases where trays have been found missing or dislodged, internal nozzles missing, gaskets missing, etc. The lower section of deaerators are to be inspected for proper internals, nozzle openings, cleanliness, etc.

- **Furnace and Ducting**

Ensure refractory brickwork and burner quorls are in good order. Check ductwork refractory condition (normally sprayed-on cement coatings such as "GUNNITE"). Ensure all wooden formwork used for castable refractory is removed and no obstructions are present in the ducting or stack. Check furnace tube hanger integrity. Ensure free movement of stack dampers, check furnace tube hydrostatic test has been completed.

- **Floating roof tanks**

Check roof integrity. Ensure articulated roof drainlines are in good order. Verify roof supports position on roof floor. Check correct installation of floating roof seals and their safety protection.

- **Cone roof/Flat roof tanks**

If a special lining has been applied on site, such as epoxy, check that the combined vacuum breaker/relief valve has not been affected, ensure nozzles and drain lines are clear. For tanks that are to contain demineralized water, an inspection report of the tank lining is required.

- **Underground tanks/sumps**

For steel tanks an external coating inspection report is required. Check integrity of reinforced concrete structures.

- **Shell and tube exchangers**

Exchangers delivered by sea may have had their tubes filled with grease or other preservatives, be certain this has been removed prior to the Ready for Commissioning hand-over.

- **Kettle-type exchangers/vaporizers**

Many of these exchangers have internal baffles or weirs, check that these are correctly installed following the Precommissioning documentation.

- **Pig receivers and launchers**

Check these are in good order and that the Precommissioning teams have carried-out all necessary checks, i.e. removal of preservatives, check door opening mechanisms, etc.

4.2.3 Safety equipment

Most safety equipment checks will be performed, as for the other subsystems, by the various discipline specialists, following the type of safety equipment (F&G detection, Halon release system, deluges network, etc.), and in accordance with the procedures, specific to each discipline, developed in the present chapter.

However Life Saving and Fire-fighting equipment does not belong to any of the usual discipline. Therefore, unless the Commissioning Team includes a safety specialist, the following preliminary checks will be performed by the commissioning operators:

- Verify accessibility to all safety equipment, particularly to life saving equipment in the case of offshore projects (lifeboats, life jackets, life rafts) and to all fire-fighting equipment (extinguishers, monitors, hydrants, deluge valves)
- Check escape ways are free from obstacles, clearly marked by escape signs, adequately illuminated, and that they allow escaping from any location
- Verify that the verifications and certifications documents and shop testing reports which are required for some specific equipment (life raft, survival crafts, life buoys) are available, and that the validity period of these certifications and inspections is not exceeded
- Verify that all equipment check lists are filled-in and signed.

4.3 Mechanical preliminary checks

These checks will be carried-out essentially on rotating equipment: pumps, compressors, gas turbines, turbo-expanders, diesel engines, and on miscellaneous mechanical equipment: cranes, hoists, HVAC units, etc.

They will be performed by suitably qualified rotating equipment specialists and mechanical commissioning supervisors.

4.3.1 Review of documentation

The commissioning mechanical specialists will review the mechanical precommissioning operations reported in the precommissioning dossier and make sure that:

- All rotating equipment has been cold aligned and that alignment records are available
- Couplings have been installed
- Suction and discharge piping have been correctly installed and freed of stresses according to VENDOR'S requirements or recommendations
- Suction strainers have been installed
- Fans and drivers have been correctly aligned and that fans pitch and clearance have been set
- All relevant check lists have been filled-in and signed
- All as-built installation drawings are available.

4.3.2 Review of facilities

The commissioning mechanical engineers in charge of the preliminary checks will thoroughly inspect visually all mechanical equipment. This inspection will be based on the following reference documents:

- Installation drawings
- PID's
- VENDOR'S drawings and manuals
- Data sheets.

The following is a list of points that will be systematically addressed during the site survey:

- Name plates
- External damage - painting - insulation
- Conformity to project standards and codes, VENDOR drawings, VENDOR recommendations, safety rules and good practice
- Ancillary equipment: condition, quality of installation
- Availability of lubricating and seal oil fluids in quantity and quality
- Free rotation of rotating equipment
- Connection of suction/discharge piping
- Piping supports in the vicinity of the equipment
- Safety protections installation and setting
- Coolant means installation and condition
- Seals, packings installation
- Removal of transport/shipping supports, bracings, and stops
- Removal of all rust preventives, oil, grease, etc., used to preserve the equipment during the construction phase.

The above is given as a guide line and is to be completed and adapted to each type of equipment by the specialist responsible for the preliminary checks.

4.4 Electrical preliminary checks

4.4.1 Review of documentation

The commissioning electrical engineers and supervisors shall review the electrical precommissioning operations reported in the precommissioning dossier and make sure that following documents are available:

- All relevant check list and test sheet (filled-in and signed).
- Precommissioning punch lists.
- FAT reports.
- All as-built drawings.

4.4.2 Review of facilities

The commissioning electrical engineers and supervisors shall carry-out a thorough visual inspection of the electrical equipment.

4.5 Instrument preliminary checks

4.5.1 Review of documentation

The commissioning instrument engineers and supervisors will review the instrument precommissioning operations reported in the precommissioning dossier and make sure that following documents are available:

- Calibration test sheets
- All relevant check lists and test sheet (filled-in and signed) including those dedicated to instrument cables (refer to electrical sheets CPX 10 and TPX 10) and to junction boxes (refer to electrical sheet CPX 31).
- Precommissioning punch lists.
- All as-built drawings

4.5.2 Review of facilities

The commissioning instrument engineers and supervisors will carry-out a thorough visual inspection of the instrument equipment, the following points being systematically addressed during the site survey.

4.5.2.1 ESD valves control panel

Check condition, installation, accessibility, conformity to project drawings and specifications. Check manually the operation of the "manual reset" solenoid valves.

4.5.2.2 Automatic valves

Check installation, verify that all connections are completed and satisfactory, that the valve is installed according to flow direction. Verify that the stem packing is properly tightened. Check the condition of the valve and of its associated equipment.

4.5.2.3 Flow measurement devices

Verify installation conforms to project specification. Check that they are properly sized and installed according to flow direction. Verify impulse piping. Check trace heating and insulation where applicable. Check drainage facilities.

4.5.2.4 Locally mounted instrument (pressure gauges, temperature indicators, gauge glasses, etc.)

Verify condition, installation, range, visibility, accessibility, rating, trace heating and insulation where applicable. Check drainage facilities.

4.5.2.5 Other equipment (pressure transmitter, magnetrols, thermocouples, etc.)

Check condition, installation, accessibility, conformity. When applicable, check valves, connections, isolation, drainage, insulation and trace heating, cable trays segregation.

4.6 Reports

4.6.1 Punch lists

Every commissioning discipline specialist carrying-out preliminary checks will record all anomalies discovered, but also suggestions, proposed modifications, and in general any type of comments in a Punch List Entry Form.

Once the preliminary checks of one subsystem are completed, the system leader will review the preliminary punch list thus compiled, and he will decide which items of the punch list will be retained for incorporation in the ready for commissioning punch list, in accordance with the project punch list procedure.

He will also initiate actions for those items that are not purely related to conformity of construction: requests of modification, specific studies, etc.

Follow-up inspections will later be required to ensure all deficiencies have been corrected.

A typical punch list entry & clearance forms are attached.

4.6.2 Task reports

One Preliminary Checks Task Report Form (see attached form) will be filled-in by discipline and by sub-system upon completion of the tasks, and filed in the Commissioning dossier.

The same form will be used for progress calculations.

4.7 Sub-sea preliminary checks

4.7.1 Review of documentation

The sub-sea commissioning group will review the sub-sea pre-commissioning dossiers presented from the UFL group and from the drilling group and ensure that:

4.7.1.1 UFL

- All sub-sea pipe and tubing has been pressure tested and that test sheets are properly filled-in and signed.

- All sub-sea production lines (and injection and service lines where applicable) have been cleaned and gauged and that test results are available. No objects are to remain in the lines after all pigging operations unless required and documented.
- All umbilical tubing has been pressure, tested and that test results are available.
- All umbilical tubing has been delivered with the correct cleanliness and that verification of the cleanliness is available.
- All sub-sea pipe and tubing has been delivered with the correct cleanliness and that verification of cleanliness is available.
- The chemicals and fluids in all sub-sea piping and tubing including the manifolds and Xmas trees is as per project requirements and that this has been verified during pre-commissioning by the commissioning group.
- All umbilical "quad" cables have been tested for continuity and insulation and that test results are available.
- All umbilical "quad" cables have been tested for damage using Time Domain Reflectometry techniques and that test results are available.
- Instruments located on UFL installed sub-sea equipment have been calibrated and that calibration test sheets are available.
- Valves located on UFL installed sub-sea equipment are in the correct positions as per pre start up and operational test requirements.
- All safety caps and plugs are in position and documented.
- All relevant check lists have been filled-in and signed.
- All as-built drawings are available. All standard parameters are documented by UFL.
- The punch list for each sub-system is updated.
- All UFL documentation will be integrated into the global Hand-over dossier with the manifolds or Xmas trees as applicable.

4.7.1.2 Drilling

- Applicable sub-sea wells have been handed over to the field operations group in accordance with the documentation requirements specified by field operations. These requirements will vary from project to project depending on the various contracts in place.
- All standard parameters are documented by drilling to the satisfaction of the field operations group. Standard parameters include, location, depth, PGB, wellhead, tubing hanger, Xmas tree, tree cap, insert choke, SCM, fluids, reservoir, tubing, TRSCSSV or Injection Valve, production packer, down hole gauges, down hole chemical injection valve, etc.
- The fluids and chemicals in the upper section of the tubing is specified in the Commissioning documentation. The fluids in the various Xmas tree sections is as per pre start up requirements. This will have been previously agreed between commissioning, drilling and field operations.
- All Xmas tree suspension drawings are available as part of the documentation above.
- All Xmas tree valve signature curves are available.

- All relevant check lists have been filled-in and signed.
- All as-built drawings are available.
- Any specific well details and/or special warnings for the individual well are documented by drilling and are known by commissioning.
- The punch list for each sub-system is updated.

4.7.1.3 Sub-sea control system

- For the onshore phase that the Operational Test Procedure (OTP) for the Sub-sea Control system is available and has been issued in the correct revision.
- For the onshore phase that the Operational Test Procedure (OTP) for the Sub-sea Hydraulic Power System is available and has been issued in the correct revision.
- The Sub-sea Control Unit (SCU) and the Sub-sea Power and Communications Unit are installed according to the relevant drawings and specifications. All pre-commissioning tests have been completed and all relevant check sheets are complete and available.
- The Sub-sea Hydraulic Power Unit is installed according to the relevant drawings and specifications. All pre-commissioning tests have been completed and all relevant check sheets are complete and available.
- For the offshore phase the commissioning group will verify that the SCU and HPU OTPs have been completed satisfactorily, that all relevant sections are complete, any punch list items are documented and that all the documentation is available.

4.7.2 Review of facilities

4.7.2.1 ROV inspection

The sub-sea commissioning group will mobilise a Remote Operated Vehicle (ROV) with the applicable interface tooling for the sub-sea installation. This ROV will be equipped with sufficient cameras and lighting to enable full sight of all ROV sub-sea intervention activities and all operations of valves from the sub-sea control system. The ROV and the ROV control centre based on the ROV vessel will have facilities for the transmission of live video to the offshore installation. The video monitor will be located adjacent to the sub-sea control interface in the central control room. The live pictures are to be available irrespective of the location of the ROV vessel/well.

The ROV will be mobilised to the sub-sea equipment and will verify:

- Condition of sub-sea installed equipment.
- Installation in accordance with the documentation provided by UFL and drilling.
- Position of all valves on manifold or Xmas tree will be viewed and the positions recorded in the relevant section of the Operational Test Procedure (OTP).

4.7.2.2 Sub-sea control system

The Sub-sea commissioning group will verify that:

- The SCU and SPCU are installed correctly and are in accordance with the required specifications and drawings.



- All links between the sub-sea control system and the central DCS system are fully operational.
- The HPU is installed correctly and is in accordance with the required specifications and drawings.
- For the offshore phase, that the hook-up at the riser balcony or hang off area has been completed, tested and is operational. All documentation is available.



		COMMISSIONING PUNCH LIST ENTRY FORM		PROJECT
SUBSYSTEM:			DISCIPLINE:	
EQUIPMENT:				Page of
Nb	Tag/Item	COMMENT	DECISION	
Carried-out by		Name	Date	Signature

FORM: 2611a



		PUNCH LIST CLEARANCE FORM		PROJECT LOGO	
DEFINITION / DESCRIPTION					
SUBSYS Nb	SUBSYSTEM NAME	ITEM NUMBER	DISCIPLINE		
DEFECT DESCRIPTION , CORRECTIVE ACTION					
PRIORITY	PUNCH LIST ACTIVITY	LOCATION	ISSUE DATE/ By		
VENDOR INFORMATION					
VENDOR ASSISTANCE	Vendor Name	Expected DATE	Material required description		
CLEARANCE					
ACTION by	NAME				
CLEARED by	NAME	DATE	SIGNATURE		
APPROVED by	NAME	DATE	SIGNATURE		
FUNCTION	NAME	DATE	SIGNATURE		

Form 2611b



	COMMISSIONING PRELIMINARY CHECKS			PROJECT																				
SUBSYSTEM:		DISCIPLINE:																						
<table border="1"> <thead> <tr> <th>ACTIVITY</th> <th>Carried-out by</th> <th>Date</th> <th>Signature</th> </tr> </thead> <tbody> <tr> <td>Review of the Precommissioning dossier</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Review of the as-built drawings</td> <td></td> <td></td> <td></td> </tr> <tr> <td>On-site conformity and operability checks</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Compilation of punch lists</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>					ACTIVITY	Carried-out by	Date	Signature	Review of the Precommissioning dossier				Review of the as-built drawings				On-site conformity and operability checks				Compilation of punch lists			
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COMMISSIONING																								

FORM: 2621

5. Functional tests

5.1 Introduction

5.1.1 Purpose of functional tests

The functional tests are the dynamic checking that each elementary electrical, instrument, and telecommunication function included in the plant design performs properly.

The purpose of this Commissioning specification is to provide Commissioning personnel with all the information required to conduct the functional testing activities in a planned, safe, and logical manner.

5.1.2 Principles

5.1.2.1 Basic functions

For commodity, an item or group of items of equipment that performs an elementary function of the plant is named a "Basic Function". A basic function is therefore the smallest equipment, on part of equipment, which may be considered independent from the following two points of view:

- Running in normal operation
- Energisation.

All possible types of basic functions are listed and defined in the present specification, by relevant discipline, i.e. electrical, instruments, and telecommunications.

5.1.2.2 Functional testing

A "Functional Test" is the live test applied to a given basic function, hence it is a single-discipline activity.

The present specification defines for each type of basic function, the scope of work of the functional test that will be applied to this basic function.

Every basic function of the plant, in the three above disciplines, will be subject to a functional test, be it part of field or package equipment.

Should a functional test fail, the Commissioning will repeat the test, after the fault has been fixed by whichever Party is contractually responsible -Engineering, CONTRACTOR, VENDOR, Construction CONTRACTOR, Main CONTRACTOR, Commissioning- until the test requirements are fully satisfied.

5.1.2.3 Tests reporting

Functional tests results will be reported on "Functional Test Sheets", which are available in this specification for every type of basic function.

There will be one functional test sheet by test, i.e. by basic function. The functional test sheets will be grouped by discipline and subsystems in the Commissioning Dossiers.

5.1.2.4 Technical data base

All basic functions, grouped by subsystem, discipline and type of basic function, are listed in the Technical Data Base.

The Data Base indicates, for each basic function, the type of Commissioning operation required, by reference to the task report form of this operation, and it also gives other relevant information (set points, drawings No., etc.).

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

The Data Base will be used during the Functional Testing of the plant as a follow-up and reporting tool.

The building of the Technical Data Base is covered by the Commissioning specification **GS EP EXP 103**.

5.1.3 Reference documents

For each subsystem the following documents, transmitted from Precommissioning, will be needed to allow functional testing to take place:

- Data Sheets
- Precommissioning punch lists
- Precommissioning check lists
- Precommissioning test sheets
- Status Index
- As-built drawings (marked up)
- As-built electrical cable schedule
- Marked-up TSLD's
- Instrument calibration sheets
- Test certificates for:
 - Air piping
 - Air tubing
 - Hydraulic tubing
- VENDOR documentation.

5.1.4 Test equipment

Functional tests require specific test equipment, which will have been defined during the Commissioning preparation.

5.1.5 Arrangement of the functional test specification

The present specification is split by discipline as follows:

- Subchapter 5.2: Electrical functional testing
- Subchapter 5.3: Instruments functional testing
- Subchapter 0: Telecommunications functional testing.

Each subchapter contains:

- The applicable methodology

- The list and coding of basic functions and the scope of testing
- The basic functions identification drawing(s)
- The support test sheets.

Are also included miscellaneous information depending on each discipline.

5.2 Electrical functional testing

5.2.1 Introduction

The purpose of the electrical functional testing is:

- to energise electrical equipment in order to check their proper operation, most of the time off-load, before multidiscipline on-load operational tests,
- to verify the ability of an equipment to be energized safely during the operational tests.

Functional testing comprises mainly the tests of the electrical protections and interlocks/interfaces with other equipment with or without energization.

The person who energises an equipment is responsible for it and has to ascertain that it can be done safely (through a lock out / tag out procedure). An energization procedure shall be issued by electrical commissioning leader and approved by COMPANY..

The HV dielectric tests could be detrimental to the life expectancy of equipment and shall not be repeated unduly.

In all cases the continuity of the circuits shall be visually checked before energization.

5.2.2 Methodology

For the purpose of functional testing, the electrical installation has been divided into 25 different equipment categories titled Basic Function Types and numbered P1 to P27.

Certain Basic Function Types have been further sub-divided using codes indicated by letters. This codification has been necessary due to various classifications within a Basic Function Type eg. Basic Function Type P1 (generator) has been further divided into P1 A and B.

A specific Commissioning functional test sheet has been designed for each appropriate equipment type as described by a Basic Function Type/Code e.g. FP1 A is the Commissioning functional test sheet for HV generators.

For each basic function installed, a functional test sheet will be completed by the electrical Commissioning Team.

Further Commissioning functional test sheets, not dedicated to a basic function type, have been designed for:

- General function test description (general sheet where function tests shall be described)
- Protection relays (general sheet attached to the manufacturer test sheets).
- ESD/PDC/PCS, inputs and outputs to MCC cubicles, inter-tripping signals between HV and LV circuit breakers, etc.
- Battery autonomy record sheet
- Battery charge / discharge record sheet

- Lighting circuits record sheet
- Trace heating circuits record sheet

These test sheets will be used during the preparation of the Commissioning and depending on the type of equipment, attached to the related functional test sheets.

For the testing of electrical protections on LV and HV switchboards the following shall apply:

- Commissioning team shall only carry out secondary current injection tests. They shall also check that the equipment conforms to the data sheet, especially characteristics of CT's.
- If for any reason the factory tests have not been performed or are not properly documented Commissioning team shall verify the conformity of CTs cabling and current ratios by primary current injection tests and the relays by secondary current injection tests.

A full list and master forms of all Commissioning test sheets are available in annexe 2.

In the case of offshore projects, for which a Commissioning phase may take place during the onshore fabrication period at the yards, the test sheets are applicable to both onshore and offshore operations.

The duplication of functional tests to be performed both onshore and offshore will be defined specifically for each project during the preparation phase.

The completion of the test sheets requires equipment tests, checks, calibrations, etc., after which the equipment is ready either for operational testing or putting into service, whichever is applicable.

Marked up drawings shall be carried out and all modifications shall be reported on a master file available during the commissioning phase.

5.2.3 List and coding of electrical basic functions

- **P1 - Generators**
 - A - HV generator
 - B - LV generator
- **P2 – Transformer**
 - A – Power transformer
 - B – LV/LV small power supply transformer
- **P4 - HV Switchboard**
- **P5 - LV Switchboard**
- **P12 – HV Motor**
- **P13 – LV Motor**
- **P14 – DC Motor**
- **P15 - Distribution Board**
- **P16 –Charger/Inverter system**
 - A – AC UPS
 - B – DC System

- **P18 – Lighting and small power**
- **P19 - Welding outlet**
- **P20 – Heater**
- **P22 – Trace Heating**
- **P25 - Navigation Aids**
- **P27 - Misc. Users**
 - Lifts
 - Hoists
 - Pedestal Crane
 - Package
 - ...

5.2.4 Functional test sheets related to a basic function

Form No.	Basic function type	Equipment description
FP00	Summary	Test sheet List
FP1A	P1	HV Generator
FP1B	P1	LV Generator
FP2A	P2A	Power Transformer
FP2B	P2B	LV / LV Small power supply transformer
FP4	P4	HV Switchboard / MCC
FP5	P5	LV Switchboard / MCC
FP12	P12	HV Motor
FP13	P13	LV Motor
FP14	P14	DC Motor
FP15	P15	Distribution Board
FP16A	PP16A	AC System
FP16B	PP16B	DC System
FP18	P18	Lighting and small power
FP19	P19	Power sockets Outlets
FP20	P20	Heaters
FP22	P22	Trace Heating (by circuit)
FP25	P25	Navigation Aids
FP27	P27	Miscellaneous User

5.2.5 Other specific functional test sheets

Form No.	Description
FTR-1	General record test sheet
FTR-2	Protection relay
FTR-3	Battery autonomy record sheet
FTR-4	Battery charge- discharge record sheet
FTR-5	Remote signalling report sheet
FTR-6	Lighting functional test record sheet
FTR-7	Heat tracing functional test record sheet

5.3 Instrument functional testing

5.3.1 Introduction

The purpose of this specification is to provide the Instrument Commissioning personnel with the information and support documents required to conduct the instrument functional testing with a procedure standard for all projects.

The purpose of the instrument functional testing is the dynamic verification that each individual instrument (other than local indicators) performs properly. It is therefore mainly the loop testing and logics testing.

5.3.2 Methodology

For the purpose of functional testing, the instruments have been divided into 3 different equipment categories titled Basic Function Types and numbered J01, J03 and J13.

Filling-in of identification and associated fields (e.g. loop tag, valve & motor type as per PID symbology, threshold values, regulation type) shall be automatically achieved from the instrument database through ICAPS.

The J01 basic function (Instrument loop) has been further sub-divided using codes indicated by letters.

This codification has been necessary due to various classifications within this basic function. J01 is therefore sub-divided in J01 A to J01 D and then G1 / G2 for subsea applications. Such forms can be amended as per project specifications, but new forms can also be issued to cover some specific instruments & loops, based on the same principles.

For each basic function of the plant, a functional test sheet will be completed by the Instrument Commissioning personnel.

A check list given in paragraph 5.3.4 describes the functional test to be carried out on each type of basic function.

In the case of offshore projects, for which a Commissioning phase may take place during the onshore fabrication period at the yards, the test sheets are applicable to both onshore and offshore Commissioning operations.

The duplication of functional tests to be performed both onshore and offshore will be defined specifically for each project during the preparation phase.

A full list and master forms of all Commissioning test sheets are available in paragraph 5.3.6.

5.3.2.1 Case of software modifications

With respect to process control and safety systems, the testing will sometimes imply software modifications (e.g. isolating some parts of the safety logic diagram or use of temporary links), which will not appear directly on the test sheets.

Therefore a detailed software rectification procedure will be applied to ensure no software rectification is carried out without adequate authorisation and back-up documentation updated accordingly. This procedure will be written by the Commissioning Instrument Engineer for each specific project, as it depends on the type of process and safety systems selected for that project.

A check list will be issued to ensure all temporary modifications have been removed at the end of the commissioning.

5.3.3 List and coding of instrument basic functions

- J1 - Instrument Loop
 - A - Digital loop
 - B - Analog loop
 - C - Control loop
 - D - ON/OFF valve
 - G - Subsea Loop/Subsea valve
- J3 - Data communication link
- J13 - Relief valve

5.3.4 Tests of basic functions

5.3.4.1 Function J1, instrument loop

5.3.4.1.1 Loop components test procedure

As a general rule, at this stage, the intent is not to carry out instruments calibration, but only to check the measured value. Therefore the number of points to be checked will be as per the project procedure.

As far as practicable, process will be simulated. Some examples are listed below:

- for pressure measurement, pressure calibrator & generator will be preferably used to weight balance
- for temperature measurement, oil bath will be used, but as temperature change is time consuming, another alternative can be acceptable: in a first step, check against the ambient temperature measured with an accurate thermometer and then use of a RTD/ thermocouple simulator

- for level displacement measurement, water will be used and corrections carried out if necessary in function of the service
- for gas detectors: reference gas samples will be used as per the thresholds selected for the project
- for fire detectors: appropriate sources (light, smoke,...) will be used

5.3.4.1.2 Functional test procedures

J01G - Subsea

- **Preliminary**
 - Preparation of functional test.
 - Check documentation is valid and up to date.
 - Record addresses.
 - Connect loop to terminal.
 - Check earth isolation of the loop.
 - Record simulator if used.
- **Analog/Digital input**
 - Apply appropriate source to the transmitter.
 - Check 0%, 50%, 100% and record readings.
 - Check and record setting and reset valve of alarms.
 - Check and record in output status.
- **Valve**
 - Check valve normal position.
 - Check remote operation of valve and record travel time.
 - Check indication setpoint and indication reading and record.
 - Check choke valve operation and record all parameters applicable.
- **Display**
 - Check operator interface for all change of status (mimic, group, alarm table, alarm response and printer) on SWCU (subsea control unit) and control video screen.

5.3.4.2 Function J3, data communication link

5.3.4.2.1 Principle

The functional tests corresponding to these functions will be done in conjunction with VENDOR representatives as a part of the power-up of each link and a dedicated test sheet will be completed. In addition to the connection of the communication link, some fault conditions will be simulated to ensure that the system reports the fault and operates the change over when applicable.

5.3.4.2.2 Test procedures

- Preparation of functional test sheet.
- Check documentation is valid and up to date.
- Record type of link and protocol used (RS232, MODBUS, Ethernet, etc.).
- Check continuity insulation and connection of the communication cable.
- Establish communication link.
- Check integrity of communication of primary and secondary link.
- Ensure no communication fault is reported.
- Simulate communication fault (cable and communication cards), ensure that the correct message is displayed and change over operates.

5.3.4.3 Function J13, relief valve

Although there is not real functional test for relief valves, a test sheet will be completed to record the data of installation after calibration.

5.3.5 Basic functions definition drawings

The appendix 3 gives the definition of the instrument basic functions.

5.3.6 Instrument functional test sheets

The appendix 4 gives the master forms of the instrument functional test sheets listed here below:

Form No.	Basic Function Type	Equipment Description
FJ01 A	J1A	Digital loop
FJ01 B	J1B	Analog loop
FJ01 C	J1C	Control loop
FJ01 D	J1D	ON / OFF valve
FJ01 G1	J1G1	Subsea loop
FJ01 G2	J1G2	Subsea valves
FJ03	J3	Data communication link
FJ13	J13	Relief valve

5.4 Telecommunications functional testing

5.4.1 Introduction

The purpose of the Telecommunications functional testing is to ensure that every elementary telecommunications system performs properly.

The present specification provides the Telecommunication Commissioning Engineer with the information and support documents required to conduct the functional testing of a number of

standard telecommunications equipment, and it gives guidelines and objectives for that of any other specific equipment.

5.4.2 Methodology

Telecommunication equipment, for the purpose of functional testing, has been divided into 22 different categories titled Basic Function types and numbered I.XY, where XY is a two-digit number.

Certain basic functions have been further divided using codes indicated by letters. Thus, I26 Radios is sub-divided in:

- I.26 - CI: HF/MF Radios
- I.26 - CII: UHF Walkie-Talkies
- Etc.

Whereas, for electrical and instrument disciplines, a specific functional test sheet is associated to every type of Basic Function, only 12 test sheets are available here for standard telecommunication equipment, as the rest of the equipment is subject to tests, very much specific to the type and brand of equipment purchased.

Therefore, for each type of basic function, a test procedure or only test objectives are indicated in paragraph 5.4.4, depending on the character of standardization of the basic function.

For those basic functions, the test of which depends upon the exact type of equipment, it will be a Commissioning Engineer's responsibility to issue a functional test procedure based on VENDOR'S documentation and to prepare the relevant functional test sheet.

5.4.3 List and coding of telecommunication basic functions

5.4.3.1 Public address system

I.02: PA Loudspeaker loop

I.03: PA Flashing Beacon loop

I.04: PA Control Unit and Acces Unit to MDF

I.20: PA Main Equipment

5.4.3.2 Telephone network

I.05: Telephone loop

I.06: Driller's Selective Intercom

I.07: Driller's Interphone Station

I.08: Driller's sound powered Telephone

I.13: Inter Control Room and Internal Control

I.21: Telephone PABX

5.4.3.3 Radio communication system

I.09: Radio Remote Control Units

I.22: Troposcatter Radio Link

I.23: Line of Sight Radio Link

I.26: MF/HF/VHF/UHF Radio Sets and associated equipment

5.4.3.4 Telex network and message switch system

I.11: Message Switching Terminals

I.24: Message Switch

5.4.3.5 CCTV system

I.14: CCTV various equipment

5.4.3.6 Meteorological equipment

I.12: Meteorological Display Units

I.25: Meteorological Main Equipment

5.4.3.7 Entertainment system

I.10: Entertainment Terminal and Accessories

I.27: Entertainment source racks

5.4.3.8 Fac Simile equipment

I.29: Fac Simile equipment.

5.4.4 Definitions and tests of basic functions

5.4.4.1 Function I.02, PA loudspeaker loops (including LS, cables and JB)

5.4.4.1.1 Description of the function

The PA system is designed to cover the whole or part of the plant by audible signals.

The I.02 function covers every loudspeaker loop from the PA main distribution frame.

See Associated Drawing in 5.4.5.

5.4.4.1.2 Test

Ensure coverage of the dedicated area is audible.

Measure the losses in the loop due to the cables, JB and LS transformers, and Alarm signal attenuation.

All the other testing will be included in operational test when all machines are running (A/C, generators, etc.).

Associated functional test sheet: I.02 - C1 and I.02 - C2.

5.4.4.2 Function I.03, flashing beacon loops (including Relay Boxes, JB Flashing Lights and Cables)

5.4.4.2.1 Description of the function

A system of flashing beacons is designed to cover areas of the plant where the noise levels are too excessive.

The I.03 function covers each one of the I.03 Flashing Beacon loops from the PA MDF.

See associated drawing in 5.4.5.

5.4.4.2.2 Test

To check relay box AC power protection is adequate, confirmation and testing of the dedicated circuit breaker is required.

Check MDF line fuse protection is adequate.

Ensure operation of the relay box dedicated to the loop by simulating the appropriate input signal.

When flashing lights are powered check flashing rate is adequate.

All other testing will be included in operational tests when the PA system is fully activated.

Associated test sheet: I.03 - C1.

5.4.4.3 Function I.04, PA control unit and access unit to MDF

5.4.4.3.1 Description of the function

The I.04 function covers each panel giving access to the public address operation via the PA - MDF.

See associated drawing in 5.4.5.

5.4.4.3.2 Test

Note: These checks will be carried out in conjunction with I.20 tests.

- Check power supply voltage.
- Simulate a system fault (open or short circuited loudspeaker loop).
- By pressing one by one the "zone select" pushbuttons, check the right zone or group of zones are properly addressed.
- Check the operation of the overriding positions.
- Check the "Prepare to abandon platform alarm".
- Check the "General platform alarm".
- Check the "Emergency Speech".
- Check operation of "system healthy" and "system engaged" light indications.
- Ensure AF output from consoles is correct (reference will be made to external AF source).

- On Override Control Units only:
 - Check Zener Barriers are operative
 - Check Audio path timers are properly set up.

Associated test sheet: I.04 - C1.

5.4.4.4 Function I.05, telephone loops (including field equipment, telephone instruments, bells, flashing lights to PABX MDF)

5.4.4.4.1 Description of the function

The telephone system gives a comprehensive coverage of all plant areas with telephone instruments which are fitted in different configurations to cope with background noise and safe area constraints.

The I.05 function covers each loop telephone sockets, telephone instruments and associated bells and flashing lights.

See associated drawing in 5.4.5.

5.4.4.4.2 Test

- Telephone sockets. Loop resistance will be checked on a random basis (1/10) and compared with pre-commissioning figures.
- Telephone instruments. To ensure each DTMF dial is operating satisfactorily:
 - Check class of service against restriction access plan.
 - Check recall function.
 - Ensure speech communication with all areas is satisfactory.
 - Check bell operation and level set up.
 - On "exploitation proof" instrument only, check the operation.
- External Bells. Check operation and power supply protection.
- Flashing Lights:
 - Check flash rate and operation of the flashing lights.
 - Check power supply protection.
- Check line overvoltage protection and lightning protection.

Associated test sheets: I.05 - C1/C4/C5.

5.4.4.5 Function I.06, Driller's selective intercom

5.4.4.5.1 Description of the function

This function covers all drillers intercommunications JB and associated stations and cables for a system of selective intercom facilities between several locations.

See associated drawing in 1.1.

5.4.4.5.2 Testing objectives

- To check power supply voltage and protection.
- To ensure all station features (keys, led) are working properly:
 - "Busy", "Clear" leds
 - Signal tone level
 - "Lamp test", "Call tone" keys.
- The selective intercom facilities are comprised within an I.06 Basic Function (see drawing). The performance of each I.06 Basic Function sequence ends at the operation of the selective intercom system.

(No associated test sheet).

5.4.4.6 Function I.07, Drillers interphone station

5.4.4.6.1 Description of the function

The function covers a system of voice communications from/to the drillmaster cabin and monkey board or drill floor. It covers the Interphone Station relay box and cables.

See associated drawing in 5.4.5.

5.4.4.6.2 Testing objectives

- To check the power supply voltage and protection
- To check "Busy", "Supply on", "Clear" leds and features
- To measure the signal tone level
- To verify the operation of keys (call tone, clear, station, etc.).

(No associated test sheet).

5.4.4.7 Function I.08, Drillers sound powered telephone

5.4.4.7.1 Description of the function

This function covers all Drillers sound powered telephone instruments, and associated JB and cables.

See associated drawing in 5.4.5.

5.4.4.7.2 Testing objectives

The system is designed to provide voice communication even in case of mains shutdown:

- To check power supply and protection
- To establish two way communication between stations
- To confirm sound powered broadcasts is possible when the stations are de-energized.

(No associated test sheet).

5.4.4.8 Function I.09, Radio remote control units

5.4.4.8.1 Description of the function

This function covers the remote control units of the UHF radio base-repeater station, the associated JB and cables.

5.4.4.8.2 Testing

- Measure audio input and output levels.
- Verify controls and command features (signalling).
- Measure the output audio performance.

Associated test sheet: I.09 - C2.

5.4.4.9 Function I.10, Entertainment terminals and accessories

5.4.4.9.1 Description of the function

The function covers the loudspeakers, sockets, bedhead units and associated sockets and cables.

5.4.4.9.2 Testing objectives

- To test the function of audio channels via loudspeakers and headphones.
- To carry-out listening and measurements test for cross talk between channels.
- To test the functions of volume control, clock and alarm.

(No associated test sheet).

5.4.4.10 Function I.11, Message switching terminals

5.4.4.10.1 Description of the function

The function covers the Video Display units, the printers and the associated JB and cables which are connected onto the Message Switching Equipment.

See associated drawing in 5.4.5.

5.4.4.10.2 Testing objectives

- To check
 - The power supply voltage and protection
 - Electrical characteristics of each item against specifications.
- Display format
- Variable intensity line underscore
- Data rate and automatic fallback facility
- Transmission modes
- Editing controls

- Machine functions - Key functions. Control/key combinations. Control/shifts combinations
- Keyboard indicator lamps
- Control panels
- Port facilities
- Optional terminal configuration (software) and main switching equipment:
 - Terminal check
 - Routing
 - Telex handling
 - Telex addressing.

(No associated test sheet).

5.4.4.11 Function I.12, Meteorological display units

5.4.4.11.1 Description of the function

The function covers the meteorological display units, the modems linked onto the processor and the associated JB and cables.

See associated drawing in 5.4.5.

5.4.4.11.2 Testing objectives

The following tests will be performed:

- Display selected functions
- Check display according to test on the processor unit in the main equipment
- Verify levels on the input/output of the modem.

(No associated test sheet).

5.4.4.12 Function I.13, Intercontrol room and internal control telephone systems

5.4.4.12.1 Description of the function

The function covers the telephone instruments, the associated selective encoder-decoder units, the bridges and interface up to the Radio Multiplexer. This equipment constitutes a system of selective hot telephone lines within the platform and to/from other platforms or onshore.

See associated drawing in 5.4.5.

5.4.4.12.2 Testing objectives

The Selective Calling Units are used in different configurations and the tests will be done accordingly.

- Selective Calling Units directly linked to MUX (Multiplexer)
 - To measure RX and TX AF levels
 - To measure Power supply voltage and protection
 - To check earthing

- Selective Calling Unit linked to MUX via Bridges and Attenuator Pads
 - To measure Power supply and protection for each type of equipment
 - To check earthing
 - To measure for each port Rx and TX AF levels from Selective Calling Unit input to Attenuator Pads output
 - To check monitoring facilities on the Attenuator Pads.

(No associated test sheet).

5.4.4.13 Function I.14 - Close circuit television (CCTV)

5.4.4.13.1 Description of the function

The function covers the Television circuits: cameras, control panel, television sets, recorder and remote transmission when installed.

5.4.4.13.2 I.14 - C1 - Cameras

- **Definition**

Each camera, connection cables and associated equipment in the control panel shall be a basic function.

- **Testing objectives**

- To energize
- To check operation of the Camera
- To check pan tilt zoom functions.

(No associated test sheet).

5.4.4.13.3 I.14 - C2 - Television set

- **Definition**

Includes the television set, connection cables, and the associated equipment of the control panel.

- **Testing objectives**

- To energize
- To adjust Television set
- To check operation of the basic function.

(No associated test sheet).

5.4.4.13.4 I.14 - C3 - Recorder

- **Definition**

Recording equipment and connection cables plus associated equipment in the control panel.

- **Testing objectives**

- To energize
- To check operation of the recorder
- To check the various possibilities of the recorder (selection, sequencing, etc.).

(No associated test sheet).

5.4.4.13.5 I.14 - C4 - Remote transmission

- **Definition**

Remote transmission loop associated equipment (TV sets, control panel, etc.).

- **Testing objectives**

- To check operation of the remote transmission.
- To adjust the different parameters.

(No associated test sheet).

5.4.4.14 Function I.20, Public address main equipment

5.4.4.14.1 Description of the function

The function covers the audio power amplifier, the main rack and MDF and associated cables.
See associated drawing in 5.4.5.

5.4.4.14.2 Test

- Test power supplies and protectors.
- Measure audio output power, signal/noise ratio, short circuit protection.
- Check grouping of loudspeakers lines.
- Test the line sensor function.
- Verify input levels of override and control units (remote and local).
- Test chime alarms tones.
- Check light indicators and keys.

Associated test sheets: I.20 - C1/C2.

5.4.4.15 Function I.21, Telephone PABX

5.4.4.15.1 Description of the function

The function covers the PABX cabinets, the operator switchboard and console, the associated disc drivers and printers.

See associated drawing in 5.4.5.

5.4.4.15.2 Testing objectives

- To check implementation is done in accordance with installation procedures and VENDOR documentation.

- To check and measure the power supplies and outputs of converter.
 - To initiate Main Processor Self-test.
 - To insert Main Control Sub-system cards.
 - To perform system test as detailed in manual:
 - Main Control Sub-System test
 - Disk interface card testing, etc.
 - To program:
 - System configuration
 - Circuit option
 - Access codes.
 - To program the circuit assignment:
 - Station service
 - Hunt group
 - Pick up group
 - Telephone directory
 - Call re-routing.
 - To check call handling facilities, functions of the operator keys.
- (No associated test sheet).

5.4.4.16 Function I.22, Troposcatter radio link

5.4.4.16.1 Description of the function

The function I.22 covers the troposcatter radio station: Tropo drive cabinet, transmit drive cabinet, quadruple receiver cabinet, tropo receive cabinet, power amplifier, antenna system, feeder pressurization unit, supervisory cabinet, the Multiplexer and the associated cables to the MDF.

5.4.4.16.2 Testing objectives

- To check that all equipment has been installed and that the power amplifier interlock is working.
- To check the wiring insulators and main voltages.
- To measure and record the modulator frequencies.
- To measure and record the Drive output frequency.
- To check that the Drive output level is within the specified tolerance.
- To record and check the functioning of the alarms.
- To measure the basic NPR (Noise Power Ratio) at IF and the combined improvement.
- To measure the receiver threshold characteristic.

- Calibration of chart recorders.
 - To record and check the functioning of the alarms.
 - To demonstrate the equipment switch on sequence.
 - To check the calibration of the forward RF Power meter.
 - To record the equipment meter readings.
 - To check the operation of the air and reverse power trips.
 - To check the operation of the main fail override characteristic.
 - To measure and record the base band level and attenuation frequency characteristic in an RF loop configuration.
 - To measure the WSWR of the feeder and antenna system.
 - To check the safety level of microwave electromagnetic radiation with respect to personnel is within the limits given in the recommendation by the Medical Research Council.
 - To check the pressurizer unit for physical damage, pressure leaks and correct pressure setting.
 - To measure the High Pass Filter performance.
 - To check the functioning of the control inputs.
 - To check that channel levels, signalling and pilot are correct and at correct frequencies.
- (No associated test sheet).

5.4.4.17 Function I.23, line of sight radio link

5.4.4.17.1 Description of the function

The function I.23 covers the antenna matching unit, the transmitter, the receiver, the change over unit, the multiplex cabinet and the associated JB and cables to MDF.

5.4.4.17.2 Testing objectives

- To check the power supplies.
- To test the antenna matching.
- To measure RF power, frequency, deviation and spurious.
- To measure sensitivity, signal to noise ratio and receiver mute.
- To measure receiver output level, frequency response and pilot level.
- To test change over operation and meter readings.
- To measure channel levels, signalling, crosstalk and pilot level.
- To test local Engineering order wires, Post and Telephone administration engineering order wires and supervisory.

(No associated test sheet).

5.4.4.18 Function I.24, Message switch

5.4.4.18.1 Description of the function

The function I.24 covers the Main Message switch unit, the radio operator room console, the associated video display unit and printers, the cables to the MDF.

See associated drawing in 5.4.5.

5.4.4.18.2 Testing objectives

- To check the power supply and protection.
- To perform:
 - Terminal and printer checks
 - Routing functions (multi-group-inlet card/mix addressing, re-transmission)
 - Telex Handling (delivery, reception, telex units, delayed delivery, etc.)
 - Telex Addressing (wild telex, group addressing, Flexigroup, etc.)
 - Message Handling (priority, code conversion, Personalized Address, Auxiliary, etc.).
- To check:
 - Message format and validation
 - User facilities (message acknowledgement, line edger)
 - Operational report (Message status, statistics report, balling report, etc.)
 - Storage control (Memory salutation)
 - Miscellaneous (Pilot lines, reject message, services messages).

(No associated test sheet).

5.4.4.19 Function I.25, Meteorological main equipment

5.4.4.19.1 Description of the function

The function I.25 covers the Meteorological Main Equipment and its local display, its sensor and associated JB and cables.

See associated drawing in 5.4.5.

5.4.4.19.2 Testing objectives

- To verify power supply and processor tests: control panel, leds, keys.
- To test the display switch function:
 - Barometer display
 - Air temperature display
 - Processed wind data display
 - Wind data display.
- To perform simulated input tests.

- To test the sensors to display system:
 - Barometric Pressure: calibration
 - Air Temperature: calibration, humidity, whirling hygrometer anemometer.
- To verify Meteorological Data Recording.
- To test the waves processor and display.

(No associated test sheet).

5.4.4.20 Function I.26, MF/HF/VHF/UHF radio sets and associated equipment, cables and MDF

5.4.4.20.1 Description of the function

The I.26 function covers each radio equipment and ancillaries in the MF/HF/VHF/UHF bands according to the purpose of the link.

See associated drawing in 5.4.5.

MF/HF/SSB Equipment I.26 - C1/C2

- **Definition**

This equipment provides communication between the platform and ships or coast stations.

- **Testing objectives**

- To check power supply and protection.
- To check earthing.
- To check electrical characteristics of the equipment against specifications for all modes A3h - A2a - A3j:
 - . TX output power
 - . TX Frequency
 - . TX Modulation
 - . RX Sensitivity.
- To check all front panel functions.
- To check RCU functions.
- To check Automatic Tuning unit by measuring the reflected power at different points covering the full frequency range.

(No associated test sheet).

Paging Slave Transmitter

- **Definition**

UHF transmitters associated with their encoders ensure the on site paging service. The access may also be from a telephone extension via the PABX.

See associated drawing in 5.4.5.

- **Testing objectives**

- To check power supply voltage and protection
- To check earthing.
- To check electrical characteristics against specifications for the Transmitter:
 - . TX output power
 - . TX frequency
 - . TX deviation
 - . Front panel indications.
- To check encoder AF output level.
- To check charging storage rack functions and power supply.
- To check RCU functions.

Associated test sheet: I.26 - C3.

VHF/FM Marine Stations I.26 - C4

- **Definition**

This equipment provides communication between platforms and vessels in the vicinity or hand portables.

See associated drawing in 5.4.5.

- **Testing objectives**

- To check power supply, voltage and protection
- To check earthing
- To check electrical characteristics against specifications:
 - . TX output for all equipped channels
 - . TX reflected power for two channels only (the lowest and the highest frequencies)
 - . TX output power high/low for one channel only
 - . TX frequency for all channels
 - . Deviation
 - . Spurious
 - . RX sensitivity for all equipped channels
 - . RX Audio power.
- To check all functions of the front panel.
- To check RCU functions.

(No associated test sheet).

UHF Base Stations I.26 - C7

- **Definition**

This equipment provides communications on site between hand portables allocated to personnel operating on the platform.

See associated drawing in 5.4.5.

- **Testing objectives**

- To check power supply voltage and protection.
- To check earthing.
- To check electrical characteristics of the equipment against specifications:
 - . TX output power/frequency
 - . TX reflected power
 - . TX deviation
 - . TX Spurious
 - . RX sensitivity
 - . RX audio output.
- To check all indications and functions on front panel.
- To check RCU functions.
- To check repeater functions (levels and switching).

(No associated test sheet).

Crane Radio Base Station I.26 - C8

- **Definition**

This equipment provides communication between the crane operator and VHF/FM or UHF handportables allocated to personnel.

- **Testing objective**

- To check power supply voltage and protection.
- To check earthing.
- To check electrical characteristics of both VHF and UHF transceivers against specifications:
 - . TX output power/frequency
 - . TX reflected power
 - . TC deviation
 - . TX Spurious
 - . RX sensitivity
 - . RX audio output and distortion.
- To check all indications and functions of front panel.

- To check operations of stem Mic/headset and footswitch.

(No associated test sheet).

VHF/UHF Handportables I.26 - C11

- **Definition**

This equipment provides communications between personnel operating in the plant and VHF/UHF base station remote control positions.

- **Testing objectives**

- To check TX and RF output power, frequency deviation and audio distortion on all channels.
- To check RX sensitivity, squelch operation.
- To check battery voltage of equipment under test.

(No associated test sheet).

5.4.4.21 Function I.27, Entertainment source racks

5.4.4.21.1 Description

The function I.27 covers the entertainment main equipment such as Amplifiers, video tape recorder, AM/TV modulator, distribution unit, Audio cassette recorder/player, etc.

See associated drawing in 5.4.5.

5.4.4.21.2 Testing objectives

- Physical inspection, wiring, enclosures, fixing supports.
- To measure gain and frequency response of the AM Distribution Amplifier matched onto his transformer.
- To measure the AM receiver performance: first and second outer modulation.
- To measure the cross modulation of the AM receiver.
- To check the performance of the UHF modulation on every channel:
 - Vision modulator
 - Sound modulator
 - Overall response.

(No associated test sheet).

5.4.4.22 Function I.29, Fac simile equipment

5.4.4.22.1 Description

The fac simile machine is connected onto a telephone extension line.

Tests shall be performed on the platforms between two locations then with an onshore fac simile.

5.4.4.22.2 Testing objectives

- To check power supply voltage and protection
- To check earthing
- To check electrical characteristics of the equipment against specifications
- To check all indications and functions on front panel.

(No associated test sheet).

5.4.5 Basic function definition drawings

The 0 gives the definition of the Telecommunications Basic Functions listed herebelow.

Basic Function Type	Title
I.02	PA Loudspeaker loop
I.03	PA Flashing light loop
I.04	PA Control unit or access unit
I.05	Telephone JB and associated field equipment
I.06	Driller's selective intercom
I.07	Driller's interphone
I.08	Driller's sound Powered Telephone
I.11	Message switching Terminals
I.12	Meteorological display unit
I.13	Inter-Control room/internal/control telephones
I.20	PA Main rule
I.21	PABX Telephone
I.24	MSS Main equipment
I.25	Meteorological main equipment
I.26 - C3	Paging slave transmitter
I.27	Entertainment main equipment

Systems Drawings	Title
SI.02	PA System
SI.05	Telephone network
SI.13	Intercontrol room/internal control telephones
SI.22/23	Tropo and line of sight line test
SI.24	Message switching system

Basic Function Type	Title
SI.25	Meteorological equipment
SI.26	UHF/VHF/HF radios (1) and (2)
SI.26 - C3	Paging system
SI.27	Entertainment system

5.4.6 Telecommunications functional test sheets

The 0 gives the master forms of the Telecommunications functional test sheets listed herebelow.

(Remainder: for Basic Function to which no functional test sheet is associated, the Commissioning Engineer will prepare test sheets adapted to the exact type of equipment of the Project matching the test objectives are defined in paragraph 5.4.4).

Test sheet reference	Basic function	Nb. of sheets
I.00	Multipurpose Telecommunication	1
I.02 - C1	PA loop - Coverage test	1
I.02 - C2	PA loop - Loop loss test	1
I.03 - C1	PA loop - Flashing beacons loop	1
I.04 - C1	Control and Access Unit Control panel	2
I.05 - C1	Telephone loop: Wallphone	2
I.05 - C4	Telephone loop: Flashing beacon	1
I.05 - C5	Telephone system test	1
I.09 - C2	Radio Remote Control Unit and associated radio	2
I.20 - C1	PA Amplifier	1
I.20 - C2	PA Alarm rack	2
I.26 - C3	Pager Receiver	2
I.26 - C12	Non directional beacon	1

5.5 Sub-sea functional testing

5.5.1 Introduction

The purpose of this specification is to provide the Sub-sea Commissioning personnel with the information and support documents required to conduct the instrument functional testing with a procedure standard for all projects. However project specific Operational Test Procedures (OTPs) will be prepared for all sub-sea projects. These will differ according to the sub-sea production and/or injection/utility solution selected for the project.

The purpose of the sub-sea functional testing is the dynamic verification that each individual component performs properly.

5.5.2 Methodology

In addition to the test sheets specified in section 5.3.4 for the sub-sea discipline, which will be mainly applicable for the onshore phase as outlined in 5.3.2, there will be detailed OTPs prepared for the Sub-sea Control System including the Hydraulic Power Unit.

5.5.2.1 SCU/SPCU

The onshore commissioning (function testing) of this equipment is not covered by standard forms as it is specific to the equipment selected for the project. The MANUFACTURERS procedure will therefore be followed. The functional testing will be recorded in the specific OTP in tabular format and all tests will be witnessed by the commissioning group.

5.5.2.2 Case of software modifications

The function testing can often result in necessary software modifications, which will not appear directly on the test sheets or in the OTP.

Therefore a detailed software rectification procedure will be applied to ensure no software rectification is carried out without adequate authorisation and back-up documentation updated accordingly. This procedure will be written by the Commissioning Sub-sea Engineer for each specific project. This is exactly the same as for the DCS software outlined in 5.3.2.1.

5.5.2.3 HPU

The onshore commissioning (function testing) of this equipment is covered by the standard forms in the different discipline sections. However again a specific OTP will be prepared for the onshore testing phase. This OTP will be prepared by the commissioning group and executed in parallel with the VENDOR at the onshore site.

The main difference between the sub-sea HPU and a topsides HPU is the sub-sea HPU normally operates at extremely high pressure. Another critical consideration is the absolute necessity to maintain the standard of cleanliness of the HPU and the hydraulic fluid (often water based).

5.5.2.4 Sub-sea global testing

Test sheets for the function testing of the sub-sea installed equipment are listed in 5.3.6 and are provided in 0.

Specific OTPs will be prepared for each item of sub-sea equipment such as manifold and Xmas tree. These are further described in section 0.

The following testing requirements and sequence are provided for guidance purposes:

Pre-operational checks. By VENDORS.

SPCU electrical hook-up (communications cables). By VENDORS.

Power up the SPCU cabinets. By VENDORS.

Preparatory works for SCU and SPCU. By VENDORS.

Subsea communication check. By commissioning and VENDORS.

Subsea instrument check. By commissioning and VENDORS.

Subsea instrument check: where applicable sand monitoring for production wells. By commissioning and VENDORS. Where applicable, metering system checks.

Valve control. By commissioning and VENDORS.

Choke control. By commissioning and VENDORS.

Production and Injection well shutdown. By commissioning and VENDORS.

All checks repeated from central DCS system.

6. Piping and Vessels Preparations

6.1 Introduction

Before undertaking introducing the feed into the plant, a number of specific process operations must be carried out on the pipework and vessels, which are grouped under the generic terminology of "Piping and Vessels Preparations".

These operations, the preparation and execution of which are an integral part of the commissioning activities, are the following:

6.1.1 Leak tests

General subsystems or circuits pressure tests carried out at the pipework maximum operating pressure, just before oil or gas-in.

Leak tests are systematically performed on any subsystem including pipework.

6.1.2 Dry-out

Removal of liquid water from facilities and achievement of a given water dew-point.

Drying-out is performed on all equipment internally protected by refractories and plant section designed to run at low temperatures, to avoid hydrates formation during the start-up phase.

6.1.3 Chemical loading

Filling-up of certain types of vessels with their packing.

6.1.4 Inerting

Removal of oxygen from all pipework and vessels due to contain hydrocarbons.

Should any of the above activities be unsuccessful, it will be repeated by the Commissioning, after the fault has been fixed by whichever Party is contractually responsible -Engineering CONTRACTOR, VENDOR, Construction CONTRACTOR, Main CONTRACTOR, Commissioning- until the specification requirements are fully satisfied.

The present specification is divided into five subchapters, each dealing with one of the above operations. It contains detailed procedures that will allow the Commissioning personnel to perform them properly as well as the requirements for support documentation.

6.2 Leak tests

6.2.1 Preamble

In no case are leak tests to be confused with pressure tests/hydrotest as defined in the Precommissioning specification (ref. GS EP EXP 105). The latter are carried out on spools during precommissioning in order to verify the integrity of welds and material. Leak tests are

carried out on entire systems, after flushing and cleaning operations, and completion of the installation, to prove the integrity of the following:

- Gaskets and other flange joints
- Valves packings
- Miscellaneous connections such as vents, drains, safety valves, instruments
- Connections between the system being tested and inter-related systems.
- Integrity of the critical valves ("functional seal" leak test)

Leak tests must also establish that any equipment associated with the system, which may have been previously dismantled for any reason, has been correctly reinstalled.

At last leak tests will also allow to detect passing valves.

6.2.2 Test specifications

6.2.2.1 Equipment to be leak tested

6.2.2.1.1 General rule

Every piping, vessel, process and utility equipment, and all their associated connections will be leak tested. A leak detection system by measurement of helium traced in nitrogen will be used especially in the following cases: presence of H₂S in gas, low temperature systems, confined areas.

6.2.2.1.2 Critical valves passing leak tests

A list of critical valves shall be defined under COMPANY approval, according to list as follows (but not limited to) :

- Emergency Shut Down Valves
- Blow down valves
- Any critical controlled or manual valves which could induce hazardous situation during operation if leaking (pig trap manual valves,).

These valves shall be tested according to a dedicated procedure (refer chapter 6.2.3.9) in order to check if the valves are passing or not.

6.2.2.1.3 Exceptions

Flares stacks and vents, heaters casings, sprinklers, halon piping and deluge network downstream the control valves, atmospheric storage vessels, ancillaries of packages previously run at the MANUFACTURER's.

6.2.2.2 Leak test pressure

6.2.2.2.1 General rule

Leak tests will be carried out at the equipment Maximum Normal Operating Pressure (if not defined, 90% of the design pressure shall be considered).

6.2.2.2.2 Exceptions

- Pumps will be isolated and tested at their maximum suction operating pressure.
- Centrifugal compressors will be isolated and tested at the compressor shutdown balance pressure.
- Systems working under vacuum will be leak tested at 10% below the set point of the pressure safety valves.

6.2.2.3 Tightness criterion

6.2.2.3.1 General rule

The leak test will be considered successful if, at the test pressure, the fall in pressure is equal or less than 0.05 b/hr.

6.2.2.3.2 Case of systems operating under vacuum

The test criteria will be a pressure increase equal or less than 0.02 b/hr.

6.2.2.3.3 Case of process gases with more than 100 ppm H₂S

The accepted fall in pressure will be reduced to 0.03 b/hr.

The achievement of the tightness criterion will be in any case complemented with a leak detection system by measurement of helium traced in nitrogen, the tightness criterion will be as follows: every tested point will have a leakage rate <50 SCF/year.

6.2.2.4 Systems test limits

6.2.2.4.1 General rule

The test limits will be the subsystem limits as indicated by the commissioning marked-up PID's which define the subsystems.

6.2.2.4.2 Exceptions

The subsystem may be divided into portions, in the case where the size of the subsystem makes the leaks search unmanageable.

The test limits will take into account the different levels of operating pressure inside a subsystem, hence there will be at least one test by level of operating pressure.

It may be practicable to carry out a single test encompassing the facilities of two or several subsystems, when those are of limited size, and operated at the same pressure.

Test subdivisions will be planned in such a way that no flanged joint is disturbed following the leak test.

As limit valves cannot be relied upon to be bubble tight, the installation of blinds will be preferred wherever possible. These system limits isolation blinds will have the appropriate thickness.

6.2.2.5 Pressure recording

The system will be provided with suitably-ranged, calibrated pressure gauges. These gauges must be correct to within 1%.

Preference will always be given to the use of permanently installed instruments provided they have been calibrated, that their accuracy is compatible with the test criteria, and that a recording means is available (DCS print-outs being acceptable).

If no recording mean is available by construction, the system will be fitted with a portable chart/pen recorder with either circular or ribbon type chart paper. Such instruments are powered by clockwork or low voltage DC batteries. The pressure recorder impulse line will be connected to any convenient point on the system, such as a vent or drain.

6.2.2.6 Relief systems

In all cases the system must be protected from overpressures which can easily occur due to human error, instrument failure, etc.

On all medium and high pressure systems the equipment must be protected by the normal system safety valves or a temporarily installed safety valve if the system in question does not comprise a safety valve.

For systems which normally operate at very low pressures, or under vacuum, the temporary installation of a barometric seal leg, capable of holding back the test pressure, is recommended.

This type of protection is required on vacuum systems as they are first subjected to a low pressure leak test.

6.2.2.7 Principle of fluid to be used

The principle is to test a system by using an inert fluid close as far as possible of the characteristic of the target fluid.

➤ Non-Hydrocarbon system

All "non Hydrocarbon" system shall be tested with the target fluid, as follows:

- water shall be used for Fire water, water services
- air shall be used for air services
- nitrogen shall be used for nitrogen services
- etc....

➤ Hydrocarbon system

For the system processing hydrocarbon or chemical, principle shall be defined as follows:

- oil system at low pressure (#150 series), assumed as single phase oil to be tested with water
- chemical product system, particularly those one blanketed by gas or nitrogen to be tested with nitrogen
- Sweet gas system (fuel gas, gas treatment), propane, single phase oil from #300 series and multi-phase oil to be tested with nitrogen.
- All system processing fluid with presence of H₂S to be tested with nitrogen traced with helium.

For technical reasons, nitrogen with traced helium shall be used for sweet gas system & multiphase oil, particularly in the case of high pressure (from #600 series).

6.2.3 Test procedures

6.2.3.1 Detailed procedure

Commissioning will issue, for each test, a detailed leak test procedure including:

- Marked up PID's and sketches showing test limits and isolations
- Step by step action check lists
- List of safety precautions.

These procedures will include in particular the specific points addressed hereafter.

6.2.3.2 Pressurization points

A suitable vent or drain line will be selected and a line connected from the pressurization system to the system to be tested. For pressures exceeding 3 b it is preferable to use suitably-rated, screwed piping but reinforced utility hoses may be employed if they conform with onsite regulations.

More than one pressurization point may be used for large volume systems.

When leak-testing water systems, the normal supply may be used.

6.2.3.3 Low pressure leak test typical procedure

This typical procedure applies to all systems the maximum operating pressure of which can be reached by the instrument air or service air supply, i.e. 6 to 7 b usually.

It is however acceptable that the systems having a maximum operating pressure of less than 10 b may be also tested at the instrument air pressure (i.e. even if the maximum operating pressure is not reached).

The test will be performed as follows:

- Line up the system to be tested (i.e. all system isolations fitted, all parts of the system connected, safety valves operational, all instrument valves opened, drain valves closed, etc.).
- Pressurize the system to its maximum operating pressure and place a new recorder chart on the pressure recorder. Ensure the chart is turning. The chart will be marked with the system number, date, and time of test start.
- Commence checking flanges, valve gland packings, vent plugs, etc., for leaks using soap solution. Pull-up flange bolts, etc., as required. If necessary, change gaskets or packings (after depressuring the system).
- When a stable pressure indication is achieved, mark the recorder chart. The test will be continued for at least 4 hours, preferably during daytime when ambient temperatures are relatively steady.
- Following a successful test, depressure the system and attach the pressure recording chart to the commissioning file documentation. Remove limit blinds as required and delete them from the blind list.

6.2.3.4 High pressure leak test typical procedure

Whenever the maximum operating pressure of the system is above the available air pressure (or 10 b, as accepted in preceding paragraph) other means of pressurization are required to perform the leak test.

Nitrogen shall be used (either from nitrogen cylinders or liquid nitrogen containers handled by a specialized CONTRACTOR) as the leak testing means.

This high pressure nitrogen test will be synchronized with the inerting of the system and of other lower operating pressure systems.

The test will be performed as follows:

- Carry out a low pressure air leak test as per procedure described in 6.2.3.3.
- If the maximum operating pressure is higher than 25 b, the test will be carried out by raising steps of pressure of around 20 b, to minimize nitrogen losses and for safety reasons.
- Start injecting nitrogen until the operating pressure on the 1st step of pressure is reached.
- Search for leaks with soap solution or an helium detector (if the nitrogen was traced with helium). Once leaks have been cured, ensure the pressure keeps steady (or decreases by less than 0.03 b/hr for the low-pressure steps) during at least one hour.
- If satisfactory, increase nitrogen pressure up to the next step and repeat the procedure until the system maximum operating pressure is reached. Then the test will be continued for at least four hours, and the pressure recorded.
- Following a successful test, depressurize the system and attach the pressure recording chart to the commissioning file documentation. Remove limit blinds as required and delete them from the blind list.

The opportunity will be taken to re-use the nitrogen for the following nitrogen leak test, and to inert the leak tested system.

With respect to inerting, the target for oil/gas production installations is to reach an O₂ content of less than 2%.

Following a pressure test carried out with nitrogen at 20 b g, the O₂ content will be around 1% (and lower for high pressures). Therefore the N₂ high pressure leak test should normally be sufficient for inerting purposes.

However if very low O₂ contents are necessary (this is often the case with catalysts where O₂ ≤ 0.2% is required) it may be necessary to inert partially the system before leak testing. A very simple calculation will give the O₂ concentration to be reached before starting the leak test.

6.2.3.5 Case of systems operating under vacuum

The leak tests will be carried out in two stages:

- 1st stage: using instrument air, by pressurizing the system up to 10% below the set point of the PSV
- 2nd stage: under normal operating vacuum conditions by running the installed vacuum system.

Typical procedure

If considered necessary install a barometric seal leg to protect the system from overpressure and isolate vacuum pressure gauges and transmitters.

Pressurize the system to the desired positive pressure using instrument air.

Soap test flange joints, valves, etc., and rectify leaks as necessary.

Following leak rectification carry out a four-hour hold-test using a suitably calibrated pressure gauge. If hold-test fails, the leaks must be found and rectified. If successful, depressure the system, remove the barometric seal leg and disconnect the air pressurization line, de-isolate pressure gauges and transmitters.

If a portable vacuum recorder is available it should be connected at this time. If not it may be possible to use the systems normal instrumentation to record the vacuum test. If neither are available a calibrated vacuum gauge must be installed at a convenient point in the system.

Ensure that the vacuum equipment for the system has been correctly commissioned and is ready for use. Following the normal operating procedures, start up the equipment after lining-up the system correctly (condensers must be also in line).

Note: This equipment could be liquid ring pumps, reciprocating vacuum pumps or steam/air ejectors or a combination of this equipment.

Pull a vacuum on the system which is equal to the normal operating vacuum. Shut down the vacuum producing equipment and isolate completely. Allow the vacuum to stabilize for one hour.

At the end of one hour, start recording the vacuum in the system, either by means of a recorder chart or by pressure gauge and graph. If the latter method is employed, readings must be taken every 15 minutes.

Whilst recording the vacuum, pay close attention to leak checking. Flange leaks are normally easy to find due to a high pitched squealing noise created by the air flowing into the system. Pinpoint leaks with shaving foam. Valve packings should be rigorously controlled for leaks.

During a vacuum test of four hours, and following rectification of leaks the loss of vacuum recorded must not exceed 15 mm Hg or 0.02 b per hour.

Always endeavour to carry out the test when the air temperature is stable.

When test is satisfactorily completed, attach all relevant test documentation to the commissioning file. In certain cases the vacuum may have to be "broken" with dry inert gas, process gas or dry air to maintain a positive pressure, thus preventing the ingress of wet air until start-up time. Special procedures will be issued in all cases.

6.2.3.6 Case of water systems at atmospheric pressure

These systems (chemical storages, open drains, oily water treatment plants, etc.) will be simply filled in with drinking water and visually searched for leaks.

6.2.3.7 Case of pressurized water systems

(Fire water and cooling water pumps, water injection network, deluge network, etc.).

These systems are not normally subjected to complicated leak tests and no pressure recording is necessary in this case, however, the following guidelines will be respected:

- Carry out a flange check to ensure all are bolted up tightly.

- Ensure all vents, drains, etc., are closed and capped or plugged.
- If the system is provided with pressure control instrumentation, ensure that this has been correctly commissioned and is ready to function.
- Check that the water supply pumps, i.e. cooling water or firewater pumps, are ready for service.
- Start the water supply pumps and slowly raise the system pressure to normal. If the system is empty at the start of the test, be careful not to overload the pumps. Normally it will be necessary to open only partially the pump discharge valve until the system is filled and under normal operating pressure.
- Ensure the pressure control system (if provided) functions correctly.
- Carry out visual checks of piping flanges, valves packings, etc., to check for leaks and rectify as required. If a leaking flange cannot be "pulled up", possibly due to a damaged gasket or flange face, the water supply pumps must be shut down, the system depressured and drained, and the leak rectified.

6.2.3.8 Flange taping/Soap testing

Systems operated above 10 b and critical systems (i.e. H₂S service) will have all flanged connections taped using commercial grade masking tape in widths suitable for various flange sizes and ratings. The flanges thus taped will first be scrupulously cleaned using, if necessary, a solvent to remove surface dirt and grease.

After application of the masking tape, a small hole will be punctured into the space between the flanges. The hole should be about 2 to 3 mm and preferably on top of the flanges for horizontal piping.

When the system has been pressurized a soap solution is applied to the hole in the flange tape and, if leaking, a bubble is formed.

Special soap solutions are obtainable for flange testing but if not available on the site a solution should be prepared using detergent washing-up liquid and suitable squeeze bottles.

When leak testing, systems which operate under vacuum joints may also be taped, and ordinary shaving foam used to indicate leaks. This foam is also useful for pin-pointing leaks on untaped joints, valve packings, etc.

6.2.3.9 Critical valves passing leak test typical procedure

In order to optimise the leak test operation, the critical valves passing leak test may be carried out at the end of the global leak test by partial depressurisation of the section downstream the critical valve to be leak tested.

The check may be carried by controlling the pressure drop upstream the critical valves or the leak measurement (external measurement or internal with using ultrasonic equipment).

At the end of the passing leak test, a particular attention should be paid to avoid a "wild" depressurisation of the section by opening the tested critical valve it self (by-pass or additional depressurisation point shall be used).

6.2.4 Reports

6.2.4.1 General rule

The leak tests will be organized by subsystem, hence all test procedures, drawings and reports related to the leak testing of a given subsystem will be filed in the corresponding commissioning dossier. The reports will also be complemented by a commissioning leak test form (see attachment).

6.2.4.2 Exception

The leak test may be organized by levels of pressure, which will not exactly match the subsystem limit. A specific Leak Test Report may therefore be compiled and handed separately to the Operator, to which reference will be made in every related subsystem commissioning dossier.

		COMMISSIONING PIPING AND VESSELS PREPARATIONS LEAK TEST TASK REPORT		PROJECT
SUB-SYSTEM:			LOCATION:	
EQUIPMENT Nb:		SKETCH Nb:		P&ID Nb:
CONDITIONS: Operating Pressure : Test Pressure : Test Fluid : Air ☐ Nitrogen ☐ Water ☐ Other: Tightness Criterion : Pressure Variation Tolerance: Test duration: Recording means: Adhesive tape: Y/N Soap solution: Y/N He tracing: Y/N Rotating Equipment Isolated:				
ATTACHMENTS: Test procedure: Y/N Sketches & drawings: Y/N Pressure record: Y/N				
TESTS RESULTS AND COMMENTS:				
		Name	Date	Signature
Carried-out by				
Accepted	COMMISSIONING			

FORM: 4241

6.3 Dry-out

6.3.1 Preamble

At the end of construction, and following commissioning tasks such as water flushing, water will always be present in petroleum processing equipment.

Whenever this water may subsequently lead to an operational problem, or if equipment may be damaged, it is necessary to perform a drying-out operation.

There are several different reasons for drying-out depending upon the type of equipment and its normal service: removal of moisture from the lining of heaters and vessels, prevention of hydrates formation in process equipment, prevention of corrosion in sealines, etc.

The dry-out operations are an integral part of the Commissioning, hence the Commissioning Team will:

- Establish the dry-out requirements, based on the Engineering recommendations and specifications, and on the VENDORS requirements
- Prepare all specific procedures required to carry out dry-out operation
- Carry-out, or supervise if they are sub-contracted, the operations.

6.3.2 Dry-out of fired heaters

An internal lining is fitted to all fired heaters, the main purpose of which is to avoid heat loss through the heater casing.

Before being brought into service, it is required to expell any moisture from the lining.

The main types of heater lining are as follows:

- Refractory brickwork
- Refractory lining
- Ceramic fibers.

They all necessitate a drying-out operation achieved by progressively heating the lining with the heater burners, in accordance with dry-out temperature curves.

The dry-out procedure will always be provided by the heater MANUFACTURER, as will the dry-out temperature curves. As the drying is of primary importance to the quality of the performance and of the life time of the heater, the MANUFACTURER's procedure and VENDOR representative's recommendations will be exactly followed.

The fuel-gas required to perform the operation will be supplied by the Operator, unless stated otherwise in contractual documents.

6.3.3 Dry-out of refractory-lined vessels

In some processing plants, certain vessels are lined with refractory. These will be reactors which will subsequently be filled with a patented catalyst.

As in fired heaters, it is necessary to remove absorbed moisture to prevent expansion damage. It may also be required to remove excess moisture to prevent adverse reactions with the catalyst which could cause future problems.

This type of dry-out is generally stipulated by the catalyst SUPPLIER who is often the patent holder for the unit design; therefore, specific procedures will be supplied and are not further discussed herein.

6.3.4 Dry-out of petroleum processing equipment

6.3.4.1 Introduction: hydrates formation

Hydrates are solid chemical compounds which can form inside gas processing equipment when light hydrocarbons and free water are present.

Hydrate deposits can accumulate until equipment, such as control valves, off gas lines, gas trunklines, etc., become totally blocked causing expensive downtime.

Chemically speaking, hydrates are generally defined as a gas molecular inclusion inside a dodecahedronic construction of water molecules. Hydrate formations visually resemble ice crystals but are quite different from the point of view of chemical construction.

For a gas, the dew point is, at a given pressure, the temperature at which the first drop of liquid forms when decreasing the temperature. If there is water vapour in the gas, the first drop may contain free water.

Hydrate formation requires the presence of free water. This shows the importance of the water dew point in hydrocarbon gases whenever there is a risk of hydrate formation.

Hydrate formation depends also on:

- The gas composition
- The temperature
- The pressure.

The attached figures 7.4.4.1.a and b show the hydrate formation area according to the gas conditions.

Whenever the operating conditions are within the hydrate formation area it is necessary to eliminate the risks of free water so as to avoid hydrate formation.

The real solution is to eliminate water from the gas until the water dew point is far below the operating conditions (this is the purpose of gas drying units such as ethylene glycol plants or molecular sieves).

Because of the hydrate formation risk during start-up operations, it may be necessary to perform a drying-out operation. This means that water will be removed until the water dew point is below the operating temperature.

Drying out operations tend to be expensive and therefore will be undertaken only if there is a high risk of hydrate formation and consequent operational problems. In low-risk applications a temporary injection of a suitable hydrate inhibitor, such as methanol, will normally be adequate.

Engineering's recommendation will therefore be followed.

The type of equipment most frequently requiring water removal is gas transmission pipelines (in some cases LPG pipelines are also considered), refrigeration loops, and low temperature systems.

The following procedures will describe the principles of the drying-out methods used.

- On pipelines and sealines
- On process equipment.

As previously said, it will be a Commissioning responsibility to issue detailed procedures in line with these guidelines and perform them on site, or supervise the performance of a specialized SUBCONTRACTOR.

Pressure - Temperature curves for prediction hydrate formation

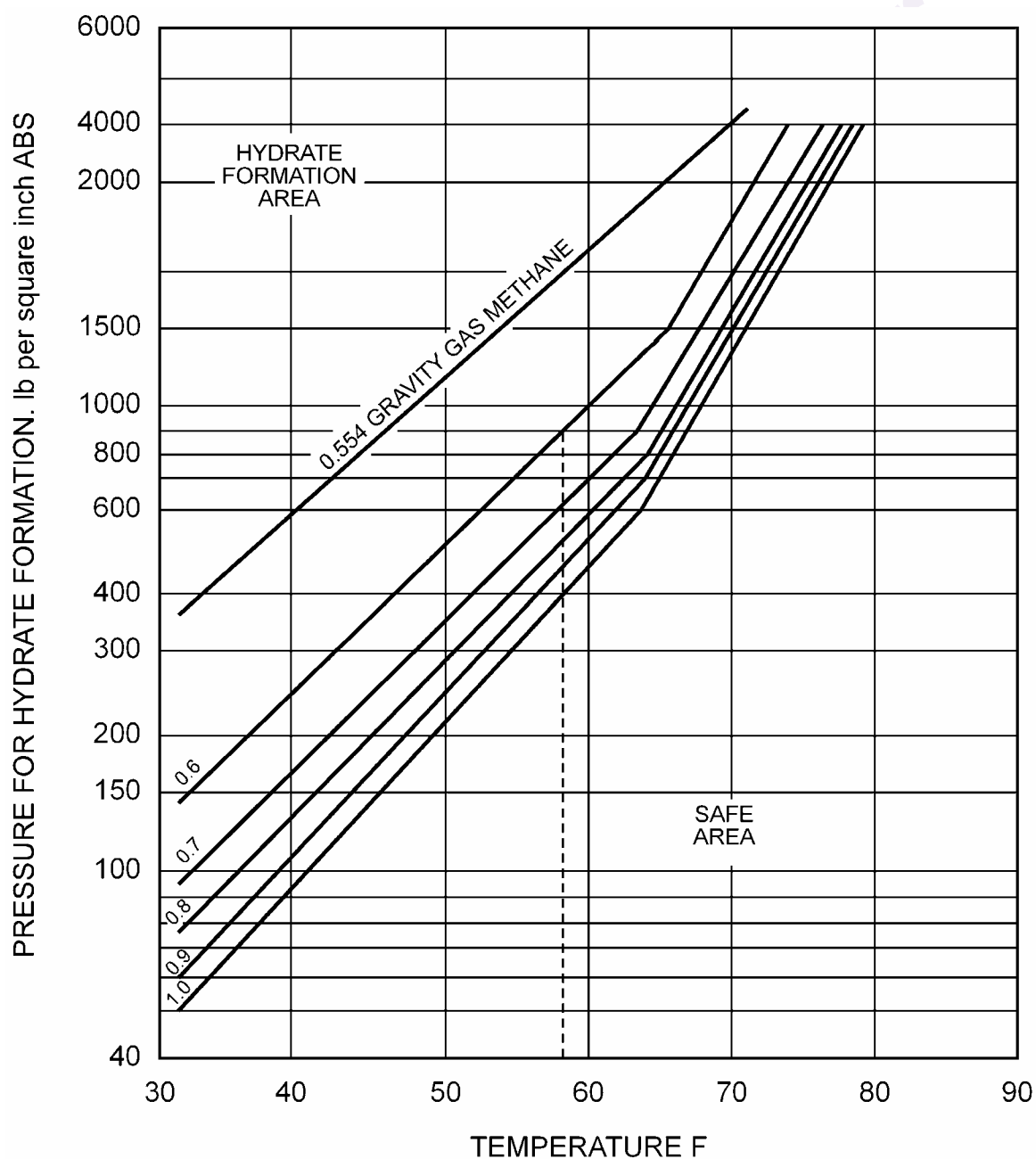
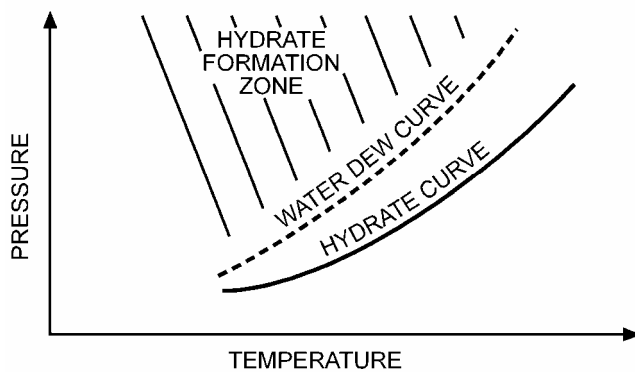
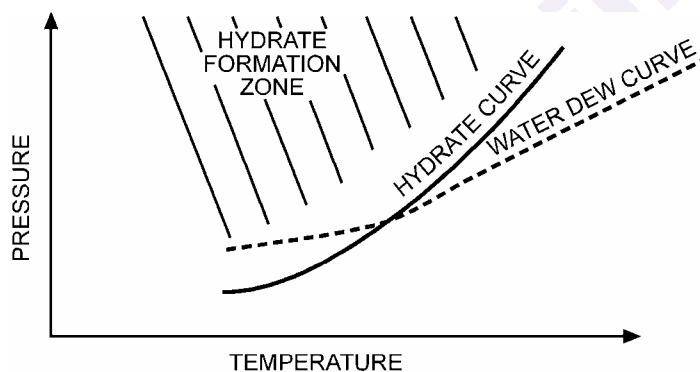


Figure 7.4.4.1.a

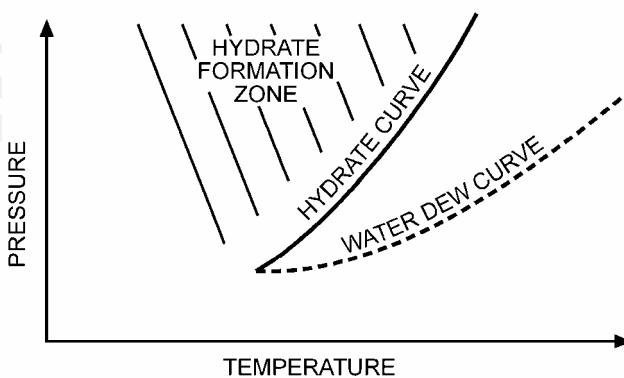
Comparative locations of the gas water dew curve and the gas hydrate - Forming curve



Case A - Wet Gas - Low water content



Case B - Wet Gas - Medium water content



Case C - Wet Gas - High water content

Figure 7.4.4.1.b

6.3.4.2 Pipelines/Sealines dewatering and drying-out

Pipelines are generally handed over full of water following the hydrostatic test which takes place after construction. Normally pipeline draining is not feasible, with the possible exception of surface run lines. Certainly it is normally impossible where subsea lines are concerned.

The water in the pipeline is therefore expelled by pigging the line in the normal flow direction, pigs being propelled by either compressed air or inert gas. This stage may well form a part of an overall procedure.

After the hydrostatic test water has been expelled, sufficient water will remain in the pipeline to cause hydrate formation problems. Water remains in low points, valve bodies, etc. and more importantly, in the interstices of the pipewall as a film of water, typically having a film thickness of 50 to 100 microns depending upon the pipewall roughness. Even in relatively short-length gas pipelines a considerable amount of free water will therefore remain, generally 60/100 g/m².

Two main methods are commonly used for pipelines dewatering and drying-out:

- The "Vacuum dry-out" method. As this method is also used for other types of systems, its description will be found in paragraph 6.3.4.3.4
- The "methanol swabbing" method.

Briefly the process consists of charging methanol to the pipeline at the production end (i.e. offshore platform) pig launcher, the pipeline prior to charging methanol having been injected with nitrogen to prevent the formation of explosive mixtures. Methanol batches are contained between cupped pigs and slowly propelled through the pipeline, normally at not more than 10 km/hr and 7 b pressure, thus absorbing residual water. At the pipeline reception point the methanol/water mixture arrives at the terminal pig receiver from which it is routed to temporary storage tanks. Samples of the mixture indicate the success of the operation.

Depending upon the situation the methanol swabbing slugs may be followed by process gas to complete a "gas in" operation. Otherwise the pipeline is generally left pressurized with nitrogen ready for a safe start-up when required.

As these operations require the availability of many equipment (tanks, pumps, pig trains, vacuum equipment) and of specialized personnel, they will be subcontracted to a specialized COMPANY, who will be supervised by the Commissioning.

6.3.4.3 Process systems dry-out

6.3.4.3.1 Methods

The various methods used for drying-out process equipment are as follows:

- Dry air sweeping
- Nitrogen sweeping
- Loop circulation with dryers using air, nitrogen and even process gases
- Vacuum dry-out.

6.3.4.3.2 Dry air sweeping

Principle

The maximum quantity of gaseous water that can be contained in a defined volume of air is perfectly known, when the temperature and pressure of the air are known. When the quantity of

water in the air reaches this maximum the air is said to be saturated with water. Non-saturated air will, in the presence of water, absorb more water until saturation.

Dry air does not mean that there is no water in the air, but generally that the ambient air has been dried by some means and is far below saturation.

Note: Any unfavourable changes in the conditions of saturated air (decrease of temperature or increase of pressure) will condense water. Therefore saturated air is at its water dew point limit.

Dry air is swept through the equipment involved.

The dry air becomes saturated with water and is exhausted to atmosphere. As more and more air is swept through the equipment, more water is "picked up" and removed, thus the system is progressively dried.

Operating conditions

The quantity of water removed for a determined drying air volume depends on:

- The initial air water dew point. The lower the dew point, the greater the amount of water removed
- The air temperature. The higher the temperature, the higher the amount of water in saturated air
- The pressure. The lower the air pressure, the higher the amount of water in saturated air
- The flow. The quantity of water removed increases with the air flow.

The air water dew point that can be obtained depends on the initial dew point of the drying air, and on the time spent for drying.

Therefore, for successful dry-out, the following conditions are required:

- The dew point of the air used for drying-out must be as low as possible
- The temperature of this air must be as high as possible
- The pressure must be as low as possible
- The air flow must be as high as possible.

Operating procedure

Determine the dry air source. If the system to be dried has a high volume, the possibility of using a temporary heating system may be studied.

Carefully drain all free water from the system at all low point drains.

Line up the system so that all dead ends are included in the dry-out.

Commence dry air injection venting the exhaust air from drains, bleeds, etc., start by using vent points as close as possible to the air injection point, progressively moving to vents further along the system (there is little point in sweeping with saturated air). Do not forget dead ends, control valve bypass lines, etc.

The dry-out is considered complete when the air water dew point reaches its target at all sample points (dew point target to be decided upon depending on the type of installation).

The water dew point that can be obtained with this method will depend on the dried air water dew point. With normal instrument air, a water dew point of -15°C is possible. If air dryers are

used, water dew points as low as -60°C can be achieved which will greatly speed up the operation.

Dew point measurement is normally carried out by laboratory personnel. However, simple portable dew point measuring apparatus is available which can be used by operators. This may be much more convenient in field situations. The Laboratory will nevertheless be called upon to conduct final dew point checks on critical equipment.

6.3.4.3.3 Nitrogen or inert gas sweeping

Drying-out operations carried out by sweeping with nitrogen or inert gas are identical to sweeping with air.

With a standard inert gas generator it is possible to obtain water dew points of -30°C . However, some inert gas generators can deliver inert gas with a water dew point $< -60^{\circ}\text{C}$ and therefore better performances can be obtained. Using pure nitrogen it is possible to reach -80°C .

6.3.4.3.4 Drying-out by loop circulation

The basic principle is to circulate the drying fluid with a compressor first through dryers, then through the system to be dried out, cooler exchangers, suction drum and back to the compressor suction.

(See figure 7.4.4.3.4).

The water is removed in the dryers that will be alternatively in service and in regeneration. Some water may be drained at the suction drum (depending on the after cooler temperature). This drying method whose principle is similar to air or nitrogen sweeping is very efficient and dew points as low as -100°C can be reached (depending on the dryer performance). It is used on cryogenic systems, and as it is part of every start-up operation it will be described in details in the operating manual. Commissioning teams having to perform this type of operation will therefore comply with the procedure given in the operating manual.

Note: A cooling exchanger can be inserted at the compressor discharge in some cases.

The method can also be used in other process systems provided the necessary equipment is available.

6.3.4.3.5 The vacuum dry-out method

Principle

This method is most frequently employed in processing units which comprise refrigeration or cryogenic processes, and for pipelines drying-out.

The system pressure is reduced to below atmospheric pressure and a vacuum is created. This reduction in pressure reduces the boiling point of water, hence even at ambient temperatures the water boils. The water vapour is then withdrawn to atmosphere.

Operations

Two methods are normally employed to obtain the required system vacuum:

- Vacuum Pumps (normally reciprocating but may be of other types)
- Vacuum Ejectors (normally operated by compressed air or steam).

Depending upon unit design the vacuum equipment may form a part of the system. If the system is not provided with the required equipment, vacuum dry-outs will most often be



performed by specialist CONTRACTORS who provide all the necessary equipment, fittings and so on.

The major responsibility of the commissioning team is to first ensure the system in question is completely blinded or otherwise isolated from related systems. This will prevent equipment, not designed for vacuum operations, from being damaged. **In all cases** ensure the equipment of the system involved is designed to withstand vacuum.

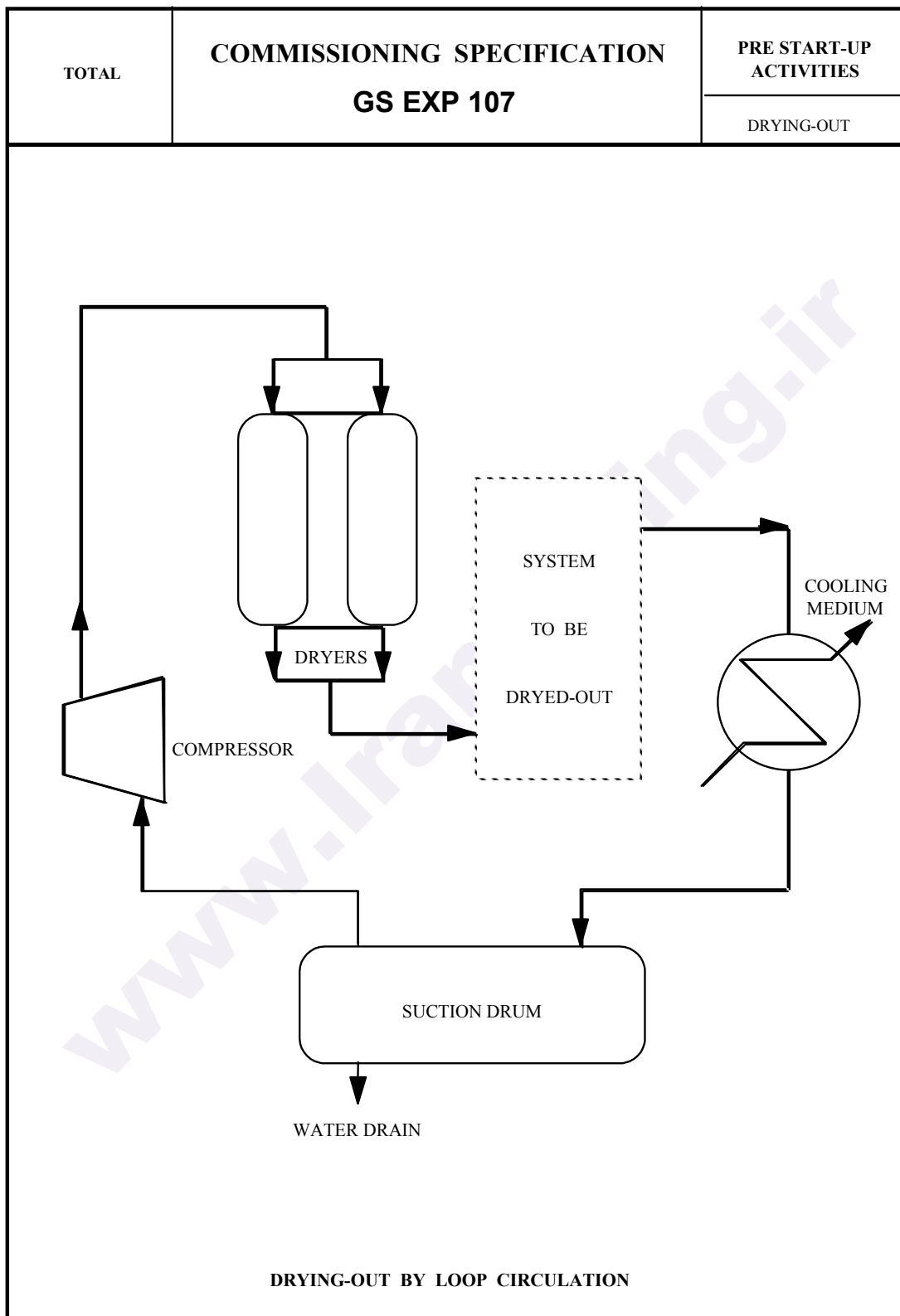


Figure 7.4.4.3.4

As a preliminary, a thorough leak test will take place before the drying-out.

The operation generally falls into three phases (see figure 7.4.4.3.5):

- 1st phase: A vacuum is pulled on the system, which removes the air contained in the system. When the vacuum is sufficient, any free water in the system will begin to boil.
- 2nd phase: The system vacuum is held constant until the water has completely evaporated. This is known as the "hold" phase.
- 3rd phase: The maximum possible vacuum, using the equipment to hand, is achieved thus ensuring complete removal of water vapour. When satisfied that this phase is complete, and depending upon operational requirements, a dry gas is then "backed-in" and the vacuum is broken. This gas may be process gas, dry nitrogen or other inert gas, or dry air. Air will obviously not be used where the risk of forming an explosive mixture is prevalent. In all cases a positive pressure is to be maintained in the system to prevent the ingress of humid air.

The detailed operating procedures will be issued by the Commissioning, or if the work has been subcontracted, by the CONTRACTOR himself who will be supervised by the Commissioning.

6.3.5 Reports

The drying-out procedures, with support drawings and sketches, all reports and results will be filed in the corresponding subsystem Commissioning Dossier.

Each drying-out operation will also be supported by a specific commissioning dry-out report form (see attachment).

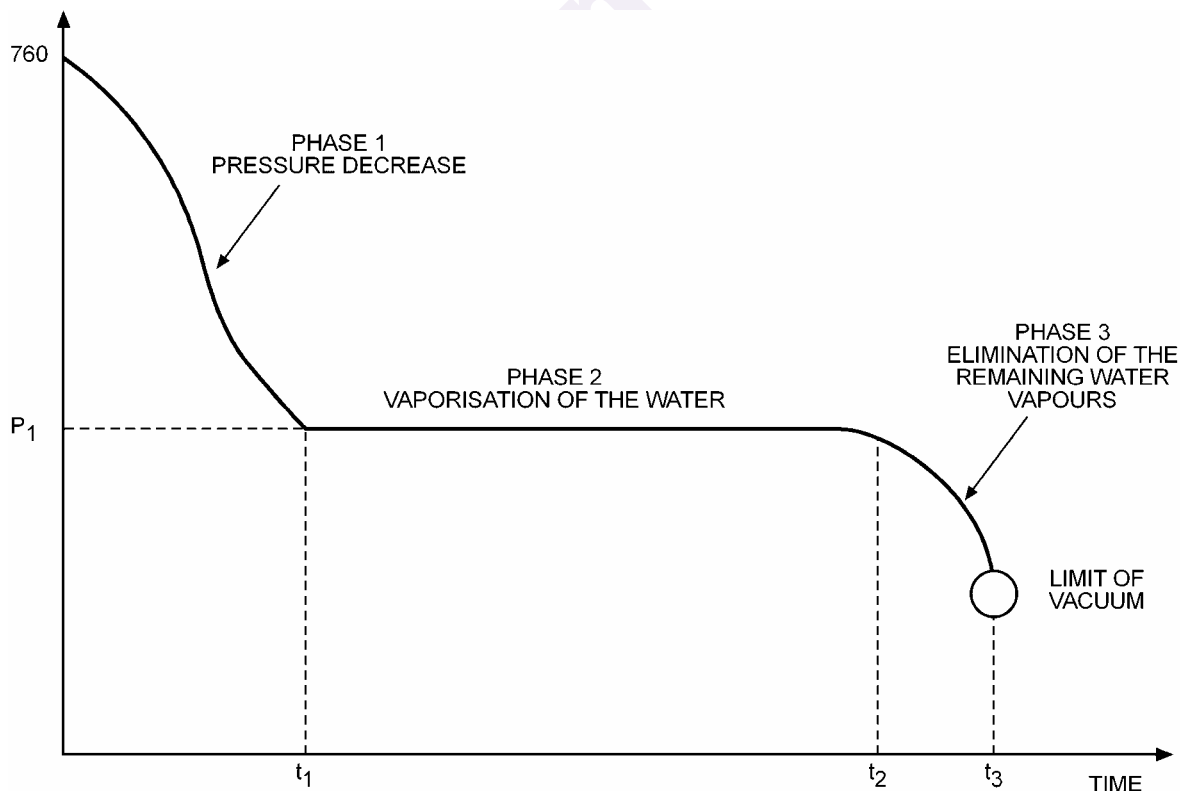


Figure 7.4.4.3.5



		COMMISSIONING PIPING AND VESSELS PREPARATIONS DRYING - OUT REPORT		PROJECT
SUB-SYSTEM:			LOCATION:	
EQUIPMENT Nb:		SKETCH Nb:		P&ID Nb:
DRYING - OUT METHOD: OPERATION DESCRIPTION: Temporary means:				
ATTACHMENTS: Test procedure: Y/N Sketches & drawings: Y/N Temperature curves: Y/N Analysis: Y/N				
SAFETY PRECAUTIONS:				
RESULTS AND COMMENTS:				
		Name	Date	Signature
Carried-out by				
Accepted	COMMISSIONING			

FORM: 4451

6.4 Chemicals loading of vessels

6.4.1 Preamble

This specification addresses the loading of process vessels with Raschig/Pall Rings-type packings, molecular sieves and desiccants, ion exchange and demineralization resins.

Whenever such type of material must be loaded on site, a loading procedure will be required from the patented SUPPLIER, and for some products one of his representative will attend the loading operation.

As part of the commissioning activities, the preparation and supervision of these operations will be carried out by the Commissioning personnel.

However, in case the representative of the VENDOR is not available on site, the Commissioning will issue his own detailed procedures and carry out the operation, in line with the guidelines given hereafter.

6.4.2 Preliminary inspection

It is of primary importance to inspect the vessel before loading. The inspection will concentrate on the following points:

- Conformity of the vessel to the project drawings and specifications, but also to the patented SUPPLIER drawings and specifications.
- Quality of the internals: if some internals are installed during or after the loading operation on they will be inspected at their storage location. The inspection of the internals will consist in verifying that:
 - The material conforms to specification (mesh, trays, distributors, joints, baskets, etc.).
 - They are in conformity with the drawings (shape, size, holes, etc.).
 - They are installed in accordance with the drawings. Special attention will be paid to the internals arrangement (distribution pipes/boxes, for instance), the horizontality of trays, the position of the joints, the tightening of bolts and nuts.
 - Whenever the trays have to conform to a leak specification, they will be leak tested, by establishing a water level on the trays, that will be surveyed during a certain period of time.
- Cleanliness. The equipment must be perfectly clean and rust free. This is also applicable to the vessel itself.
- Coating. If internal coating is required check the coating quality.
- In the same way the product to be loaded will be inspected to assess its condition, storage conditions and conformity.

6.4.3 Loading preparation

The loading preparation includes:

- The organization of transportation and lifting of the material to be loaded
- The preparation and installation of the equipment necessary to perform the operation: platforms, funnels, hoppers, loading socks, ladders, lighting, ventilation means, safety

protective equipment, e.g. breathing protections, rain protections if necessary, rope, buckets, etc.

One person will be nominated **Loading Leader** and will be responsible for the loading preparation and operation.

6.4.4 Loading operation

6.4.4.1 Methods

There are several ways of loading, the three most common ways of loading are the following:

- Hand loading
- Sock loading
- Loading with vessel full of water.

As a general rule, free fall in the vessel of the material to be loaded is forbidden. It will be accepted only if requested by the MANUFACTURER's representative or if clearly specified in the MANUFACTURER's procedures.

6.4.4.2 Hand loading

The material will be lowered inside the vessel either by hand (buckets) or by a crane (hopper with a manual sliding valve at the bottom) and spread by hand by the personnel inside the vessel.

This way of loading can be used on any type of product, but the process is rather slow and therefore it is applicable only when small quantities are concerned.

6.4.4.3 Sock loading

A funnel will be installed at the top opening of the reactor. It is recommended to equip this funnel with a slide valve. A canvas tube is clamped on the funnel outlet and inserted in the reactor. This tube is known as "sock". To overcome the problem of sock plugging large diameter socks (10 cm and above) will be used. Fire-fighting hoses are perfectly suitable.

Two hoppers will be used to carry the material to be loaded from the ground level to the vessel top (one hopper is filled up on the ground while the other one is used to transfer the material). Their content will be dropped into the funnel. The personnel inside the vessel will hand control the flow of the product (on the sock) to avoid free fall and spray it by moving the sock around.

The sock will be shortened regularly according to the level increase, but always with no excessive drop of the material. This is an effective method for loading as Experience shows that several tons or m³ can be loaded per hour.

6.4.4.4 Loading with vessel full of water

This method is applicable mainly for ceramic rings and Raschig/Pall rings packings. It will be strictly forbidden for any product that can be affected by water (all catalysts, desiccants, resins, molecular sieves).

Fill the vessel with water and charge the rings or packing via the top nozzle. In this way the material sinks gently into place without fear of cracking.

If this method is adopted make sure the vessel concerned can withstand the water load and the pressure of the static head of water.

6.4.4.5 Special precautions during loading

Some fragile material may not withstand direct stepping. In this case people inside the vessels will stand on boards or plates that will be rearranged as often as necessary to match the level increase.

It is of utmost importance not to forget anything inside the vessel (helmets, boards, rags, tools, etc.).

It is therefore necessary that a strict control be made at the vessel entry to ensure that all that was introduced in the vessel will be recovered at the end of the operation. Several methods can be used: numbering, marking, listing, etc.

Safety precautions have to be defined and strictly applied. They will differ following the type of product and vessel. The safety precaution will be listed at the preparation stage and all necessary material supplied accordingly.

If the material is to be loaded to a given height in the vessel, or if there is an interface level between two different products, the level on the vessel walls will be chalk marked early enough to avoid trespassing it.

6.4.5 Completion works

When the loading operation is completed all vessel top internals will be installed (tray, distributors, etc.) and where satisfactory the vessel will be closed using new gaskets/joints.

A loading sketch will be issued. This loading sketch will indicate the actual levels of the material(s) and the quantities loaded (weight and/or volume). To establish the loading sketch, an engineering drawing of the vessel will be used.

6.4.6 Reports

The loading procedures, with support drawings and sketches, all reports and results will be filed in the corresponding subsystem Commissioning Dossier.

Each loading operation will also be supported by a specific Commissioning loading report form (see attachment).

		COMMISSIONING PIPING AND VESSELS PREPARATIONS VESSELS CHEMICALS LOADING		PROJECT	
SUB-SYSTEM:			LOCATION:		
EQUIPMENT Nb:		SKETCH Nb:		P&ID Nb:	
MATERIAL TO LOAD: Type: Product reference: Weight to load: Volume to load: Support material 1: Quantity: Support material 2: Quantity: Samples: Y/N					
LOADING PROCEDURE:					
Temporary means:					
ATTACHMENTS: Test procedure : Y/N Drawings : Y/N Analysis : Y/N					
SAFETY PRECAUTIONS:					
RESULTS AND COMMENTS:					
		Name	Date	Signature	
Carried-out by					
Accepted	COMMISSIONING				

FORM: 4561

6.5 Inert gas purging

6.5.1 Preamble

Inert gas purging is most frequently required to remove air from petroleum processing equipment in order to avoid the risk of forming an explosive mixture of oxygen and gas.

In some cases inert gas purging is employed to avoid the ingress of air into equipment containing sensitive catalysts, or wet air into equipment which must be kept as dry as possible, such as refrigeration units.

Air contains 21% oxygen (O_2) and therefore when mixed with a petroleum gas all the essential ingredients of an explosive mixture are provided.

The preparation and execution of the inerting of all oil and gas process equipment prior to oil or gas-in is a Commissioning responsibility.

Commissioning will especially select the best adapted inerting method and issue detailed procedures with support drawings and sketches.

6.5.2 Types of inert gas

There are several gases which are considered as "inert" but for all practical purposes only three are discussed herein.

These are as follows:

6.5.2.1 Nitrogen (N_2)

This is usually supplied as a gas in high pressure bottles but may also be obtained in liquid form for subsequent vaporisation and compression. Nitrogen can also be supplied by molecular sieves and cryogenic units (i.e. "Air Liquide" type). Impurities consisting of traces of other gases such as oxygen (O_2) and carbon dioxide (CO_2) may remain in the nitrogen in concentrations ranging from 1000 ppm to 1% depending on the manufacturing process.

High purity N_2 is obtainable upon request but is hardly ever used in the petroleum industry except as a "standard" calibration gas for laboratory use.

6.5.2.2 "Inert gas" (N_2/CO_2 mixture)

This is generally produced in combustion-type units which may be portable or permanent installations.

A typical inert gas analysis would be $N_2 + CO_2$ in proportions of 88% N_2 and 12% CO_2 .

This gas normally contains minute traces of carbon monoxide (CO) and hydrogen (H_2), O_2 content must be 0.5%.

6.5.2.3 Steam

Steam is commonly used in the petroleum industry for purging air from lines and vessels.

Steam has the advantage of being easy to produce with relatively simple equipment and may often be logistically cheaper than inert gas generators or other sources of inert gas. Temporary steam producing units with various output rates are readily available.

6.5.3 Inert gas purging operations

6.5.3.1 Methods

Four different methods can be considered:

- Continuous flow or "sweeping"
- Pressurization/depressurization
- Water displacement
- Steam-out.

6.5.3.2 Continuous flow or "sweeping"

This method will generally be used for small, low-volume systems such as piping systems up to 4" line diameter. The principle involved is injecting sufficient quantities of inert gas to create a turbulent flow in the piping which pushes the air ahead of it thus displacing it.

When sweeping piping with inert gas (henceforth inert gas will be the term employed to describe either nitrogen, or inert gas manufactured on site unless otherwise stated) a high flow rate is required and has to be turbulent. Laminar flow is to be avoided since it will result in poor purging and possible hazard.

The Reynolds number has to be higher than 4000 to create the turbulent flow required. As a general guideline a velocity of 10 feet per second is an acceptable mean value.

It may be deduced from this that continuous sweeping of large diameter piping is unsuitable due to the very high flow required to produce the ideal velocity.

When considering inert gas purging, the system in question must be studied from a practical viewpoint. Most installations are unable to furnish very large flows of inert gas, due to unit design, and there is little point in concerning oneself with complicated velocity calculations if the equipment to provide sufficient inert gas does not exist.

Proceed as follows:

- Assuming the system to be at atmospheric pressure, close all unnecessary vents and drains and install plugs and caps except on vents and drains which are to be used for O₂ sampling.
- Ensure the system to be purged is isolated from associated systems, either by valves or blinds. If blinds are to be installed complete a system blind list.
- Select an inert gas injection point or points and a vent point at the farthest end of the system. If the inert gas arrives via utility hose, ensure the hose is in good condition and that the injection point valve is open before opening the inert gas header valve. Sufficient injection points should be used to achieve the maximum flow available.
- Open injection point valves and begin the purge. Ideally the atmosphere in the piping should be analysed when the inert gas volume used is approximately three times the system volume. Before testing simultaneously close inert gas injection valves and vent valves to maintain the system under positive inert gas pressure.
- Sample for O₂ at several points, especially on complicated piping systems, i.e., fuel gas headers. Check for dead ends.

- When O₂ analyses are satisfactory, stop the purge whilst maintaining system pressure at approximately 0.1 to 0.2 b g or as required. A suitably-calibrated pressure gauge must be installed where easily visible and used to control the system pressure which may require "topping-up" from time to time.

Important notes

- This method must not be used for critical equipment requiring very low O₂ results. It is normally suitable when criteria are not severe i.e. O₂ maximum content 2%.
- A secondary problem with this method is that it may prove to be somewhat wasteful of inert gas and where logistical problems arise the following method may be preferable, even for relatively small system.

6.5.3.3 Pressurization/Depressurization method

This is the preferred method of inert gas or nitrogen purging for reasons of economy and safety and is used for both vessels and associated piping:

- Assuming the system to be at atmospheric pressure, close all unnecessary vents and drains and install plugs and caps except on vents and drains which are to be used for O₂ sampling and venting.
- Ensure the system to be purged is isolated from associated systems, either by valves or blinds. If blinds are to be installed complete a system blind list.
- After ensuring that the inert gas supply is available, check the integrity of pressurizing hose (if used) and system pressure gauges. Gauges should be situated so as to be easily visible from the injection point valves.
- Pressurize the system to between 1 and 2 b g (15 and 30 psig) depending upon the system design pressure. **Never exceed system design pressure** even if safety valves are in service.
- Let the system stand for approximately 30 minutes to allow the gases to become homogenous. Following this 30 minute period, depressure the system as rapidly as possible via the largest diameter vent or vents on the system.
- Repeat this operation but stop depressuring at about 0.1 to 0.2 b g in order to take an O₂ analysis sample. The O₂ at this point should, theoretically, be in the region of 4 to 5%. Samples must be taken from several points, depending upon the magnitude of the system, and averaged.
- According to the O₂ content requirement, repeat the pressurization/depressurization operation until the specification is met.
- When O₂ analyses meet the ongoing specification, proceed to maintain the system under a positive inert gas pressure.

Notes:

- It is better to pressurize/depressurize **5 times** up to 1 or 2 b g each time, than to pressurize/depressurize **once** up to 5 b g. In the first case the theoretical final oxygen content is $2^5 = 32$ times less than the original one. In the second case the theoretical final oxygen content is only $5 + 1 = 6$ times less.

- Purging can be speeded up by pulling a vacuum on the system before pressurizing. However, attention must be paid to the equipment design before this operation may be considered.
- Under no circumstances should a vacuum be applied indiscriminably to equipment without first checking that the equipment is capable of withstanding vacuum conditions.

6.5.3.4 Water displacement purging

This is an extremely simple and economical method of purging but is only applicable where the equipment to be purged is capable of supporting its own weight when water-filled and when the presence of residual free water will not consequently affect the plant operation or cause corrosion problems.

In certain applications inhibited water may be required, i.e. the system contains stainless steel equipment, etc. This should be taken into account when deciding which will be the safest, most economic, and rapid method of purging to be employed.

Special procedures to suit particular cases will be issued but the general procedure is outlined as follows:

- The system is assumed to be under atmospheric pressure and isolated by valves or blinds from all other associated systems. If blinds are to be installed, a system blind list must be completed. All system drains must be closed and the system high point vents must be open. Ensure adequate vents are available to ventilate the system whilst filling with water so as to avoid overpressuring. Adequate venting also ensures pockets of air not trapped.
- Connect the water supply system to the system to be purged and commence filling. Do not fill too rapidly. When the system is full, check any dead end points for trapped air. Close vents.
- Connect the inert gas supply to the highest point or points on the system. Check that the unit drain system can dispose of the volume of water to be dumped. Begin inert gas injection whilst simultaneously opening one low point drain.

Warning

The flow of inert gas into the system and the flow of water out of the system must be regulated so that the system is always under a positive pressure. If care is not taken to do so, there is a high risk of pulling both the system and the inert gas supply system under a vacuum and equipment damage may subsequently result.

This will also prevent air from being accidentally drawn into the system.

- Gradually increase the inert gas injection rate and draining rate. When water draining ceases and inert gas begins to issue from the drains, close all drains and allow the system pressure to build up to at least 0.2 to 0.3 barg then stop nitrogen injection.
- Analyse the system atmosphere for O₂ content. Normally this should be very low if the procedure has been correctly followed.

6.5.3.5 Steam-out

The use of steam for purging of petroleum processing equipment is widely accepted due to its overall economy and ease of operation.

In some processing installations certain vessels and systems may be provided with permanent steam-out lines and this greatly assists in purging operations.

Petroleum processing installations do not always have steam raising facilities and in this case temporary steam generators will be used. Notwithstanding this, the general procedure is identical. No specific procedure is given herein but the following points will be noted by the commissioning team if steam is to be used for purging:

- Steam is obviously unsuitable for purging equipment which must remain "dry".
- Following steam-out the system is normally "gassed up" by backing in process gas a fuel gas. Inert gas could equally be used. In all cases it is most important to ensure an adequate supply of gas is available, otherwise, during cooling, the system may be pulled under a vacuum and damage to the equipment may result.
- Steam injection lines will preferably be in suitably-rated screwed piping. If flexible hoses are used, ensure they are adequately armored and passed for steam service. Air and water hoses **must not** be used.
- Always ensure the system equipment is capable of withstanding the steam temperature.

6.5.4 Inerting criterion

The content to be achieved depends upon the type of installation.

It will therefore be determined on a case by case basis.

For traditional oil and gas processing plants, the maximum acceptable O₂ content shall be no more than 2%.

6.5.5 Safety aspects

Inert gas is dangerous. It will always be remembered that an atmosphere containing less than 21% oxygen does not support life. "Entry Permit" procedure is applicable should vessel entry be necessary.

Always carry out a careful scrutiny of flexible hoses used in purging operations.

If an inert gas distribution system is used, it is normal practise to turn closed any spectacle blinds following use of the injection point. Failure to do so may result in petroleum products entering the inert gas distribution system.

Steam is potentially very dangerous and can cause severe burns.

About two thirds of the total heat in steam is taken up in the change of state from boiling water to steam, and hence when steam condenses, two thirds of its total heat is given up to the body on which it condenses. This is what makes steam such an effective heating fluid, and this is also what makes it very dangerous if it condenses on the human body. Hence to get a part of the body in a jet of steam is many times worse than in a corresponding flow of hot air at the same temperature.

The following precautions will be observed:

- When blowing steam from drains or vents makes sure that everyone is clear of the area. Also a minimum of personnel will be present on site during the operation.
- Ensure piping insulation is as complete as possible before introducing steam.
- Personnel must always be adequately clothed when working in the proximity of steam lines. Shorts and tee-shirts will be forbidden.



6.5.6 Reports

The inert gas purging procedures, with support drawings and sketches, all reports and results will be filed in the corresponding subsystem Commissioning Dossier.

Each purging operation will also be supported by a specific Commissioning Inerting report form (see attachment).



		COMMISSIONING PIPING AND VESSELS PREPARATIONS INERTING REPORT		PROJECT																					
SUB-SYSTEM:			LOCATION:																						
EQUIPMENT Nb:		SKETCH Nb:		P&ID Nb:																					
INERTING METHOD: Fluid: Criterion: Volume:																									
OPERATION DESCRIPTION:																									
ATTACHMENTS: Procedure: Y/N Sketches & Drawings: Y/N																									
RESULTS: <table border="1" style="width: 100%;"> <thead> <tr> <th>Location</th> <th>O₂ Content</th> <th>Location</th> <th>O₂ Content</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>						Location	O ₂ Content	Location	O ₂ Content																
Location	O ₂ Content	Location	O ₂ Content																						
COMMENTS:																									
		Name		Date																					
Carried-out by																									
Accepted	COMMISSIONING																								

FORM: 4661

6.6 Sub-sea Piping and Vessels Preparations

6.6.1 Introduction

The Piping and Vessels Preparations detailed in this chapter are also applicable to sub-sea installations, however due to the nature of the equipment they are not carried out as sequentially as those for traditional topsides systems. Each project will require different Piping and Vessels Preparations dependent on the sub-sea configuration, type of produced product (oil or gas) and the operating conditions such as water depth and temperature.

6.6.1.1 Leak tests

Leak tests for sub-sea piping and tubing are carried out during the commissioning phase.

The leak tests for sub-sea production lines are normally carried out using inhibited water with dyes visible by ROV. These tests are carried out after the line pigging and gauging operations.

The leak tests for the tubing within the control umbilicals are normally carried out using fresh water within the chemical lines and ALWAYS the operating fluid within the hydraulic control lines.

The leak tests will be carried out in accordance with the OTP procedures prepared by the commissioning group.

6.6.1.2 Drying out

See section 6.3 of this document.

6.6.1.3 Chemical loading of vessels

Not applicable to sub-sea. Any loading of glycol or methanol will be carried out in accordance with section 6.4 of this document, by the topsides commissioning group.

6.6.1.4 Inert gas purging

See section 6.5 of this document.

7. Operational tests

7.1 Introduction

7.1.1 Definition and purpose of operational tests

Once all basic functions of a subsystem have been functionally tested (refer to chapter 5), **the subsystem will be subject, wherever applicable, to an operational test.**

This operational test consists of bringing the subsystem equipment into operation under conditions as close as possible to normal, during a significant period, not only to live test the automated devices, controls, normal and shutdown sequences, but also to reveal possible mechanical or electrical faults (watertightness, vibrations, overheating, overloading, etc.) which may occur during prolonged normal use.

The purpose of the operational tests is therefore to prove that the main equipment is mechanically sound, and that each subsystem, as a whole, is **ready for normal operation.**

The operational tests are the key commissioning activity: the establishment of relevant procedures, the tests preparation and their execution, the engineering of temporary facilities

wherever required to allow operational testing, the organisation and the supply of all required means, are part of the commissioning scope of work.

Should a step of an operational test be unsuccessful, the Commissioning will repeat the test, after the fault has been fixed by whichever Party is contractually in charge -Engineers CONTRACTOR, VENDOR, Construction CONTRACTOR, Main CONTRACTOR, Commissioning- until the test requirements are fully satisfied.

7.1.2 Principles

7.1.2.1 Equipment subject to operational tests

As a general rule, will be subject to an operational test:

- All subsystems including a major mechanical equipment.

Typical examples:

- Fire water pumps
- Air and process compressors
- Power generators.
- Sub-sea production/injection

- A number of subsystems which, although they do not include major rotating equipment, perform a vital function of the plant.

Typical examples:

- ESD/F&G
- Hydraulics
- Deluges.

7.1.2.2 Contents of the operational tests

A typical operational test will comprise the three following steps:

- The mechanical preparation of the equipment, and the overall preparation of the subsystem to the test
- The first start-up, then the tuning or de-bugging, if required, of the subsystem.
- The demonstration to COMPANY/Operator of the proper functioning of the main equipment and of the whole subsystem.

7.1.2.3 Procedures

The above scope of work will be carried-out in accordance with operational test procedures (OTP's), issued during the commissioning preparation phase as per a standard format. All OTP's will be approved by the COMPANY/Operator.

7.1.2.4 Test fluids

The operational tests, as a general rule, take place before oil and gas-in, hence:

- The process equipment will be tested in recycle, with substitute fluids, water or diesel for pumps, inert gas or air for compressors. Sub-sea hydraulic systems will be tested with operational fluids.
- Reasonable temporary recycle facilities, if required, will be engineered and built to allow operational testing.

When running the equipment with a substitute fluid is impossible, the operational test will take place with the normal process fluid, oil or gas, but all operations related to the oil or gas in and to the oil or gas export will always remain an Operator's responsibility.

In this case, the equipment will therefore be brought under gas or oil by the Operator, then operationally tested in recycle by the Commissioning.

For the specific case of gas-driven equipment such as gas-turbines, the operational test will be carried-out by the Commissioning, but the operation of the fuel gas will be ensured by the Operator, to whom the fuel-gas system will have been previously handed-over.

For specific equipment, like turbo-expanders, that cannot be run in recycle, the operational tests will be limited to the mechanical preparation of the equipment.

This also applies to all minor mechanical equipment that does not deserve a full operational test: it will simply be mechanically prepared for start-up, i.e. lubricated essentially.

7.1.3 Scope of the specification

The exact content of each operational test depends on the type and brand of equipment, process, control system, etc., of the plant. It cannot then be specified.

The Commissioning Team will therefore have to work-out a procedure specific to each subsystem to be tested.

The scope of the present specification, as a consequence, will be limited to providing:

- A list of the equipment/subsystems to be tested operationally
- Guidelines on the extent of testing
- A procedure format.

7.2 Scope of test

7.2.1 List of operational tests

If the commissioning activities are covered by a contract, the list of operational tests to be carried-out by the CONTRACTOR will normally be found in the contractual scope of work.

If the contract does not stipulate the list of operational tests, or if the commissioning activities are not covered by a contract (cases of commissioning performed by COMPANY/Operator) at least all subsystems including the following equipment will be subject to operational testing:

- Air compressors
- Diesel oil distribution
- Hydraulic units

- HVAC
- Water makers
- Cranes/lifts
- Inert gas generator
- Seawater lift pumps
- Chlorination packages
- Cooling water loop
- Jockey and fire water pumps
- Hot oil loop
- Heaters
- UPS
- Main power and emergency generators
- Power distribution control
- F&G detection
- Deluges, hydrants and monitors
- Chemicals injection pumps
- Life-boats davits
- Telephones, public address, radios
- Glycol regeneration
- Freon and propane loop
- Oil export booster and pipeline pumps
- Main process pumps
- Drain pumps
- Process compressors
- Effluent water treatment
- Water injection plant
- Turbo-expanders
- Dehydration package
- Mud pumps
- Draw works
- Power swivel

- ESD system
- Wells control cabinets.
- Sub-sea production and injection systems

During the commissioning preparation phase, the exact list of operational tests will be established by the Commissioning and approved by the Operator/COMPANY.

7.2.2 Operational tests of process and utilities

The three phases of the operational test, namely:

- The test preparation
- The start-up and tuning
- The demonstration

are detailed herebelow, for these systems including process and/or rotating equipment.

7.2.2.1 Test preparation

7.2.2.1.1 Mechanical preparation

Since the equipment of the subsystem will have already been made ready for start-up from the instrument, electrical, and telecommunication points of view during the functional testing phase of the commissioning, the mechanical preparation of the rotating equipment of the system will be the first task of the operational test.

Detailed procedures and support forms will be established to cover this phase, which will address all points listed herebelow, whenever relevant to the concerned equipment:

- Visual inspection
- Cleanliness
- Removal of preservation
- Freedom of rotation
- Final alignment checks
- Lubrication
- Lube, seal, and hydraulic oils filling
- Lube, seal and hydraulic oils flushing
- Oils quality analysis
- Couplings of driver and driven unit
- Filling of consumables
- Filters and oil cartridges inspection
- Connection of temporary facilities
- Running and verification of all auxiliaries
- Cranking tests.

A number of typical mechanical preparation check lists are available in paragraph 7.4. They will be completed or amended to match the particularities of the equipment to be prepared, and specific forms will be issued, on the basis of the VENDOR'S documentation, for those not available here.

7.2.2.1.2 Subsystem preparation

In parallel with the main equipment mechanical preparation, the subsystem itself will be made ready for testing, including:

- The leak test of temporary facilities that may have been erected to allow test of the equipment in recycle
- The loop filling-up with the test fluid (if the test is carried-out with the hydrocarbon process fluid, this operation will be ensured by the Operator)
- The lining-up of all circuits and instrumentation
- The running and supply of all utilities
- The preparation of safety equipment
- The pressurisation of the system
- The preparation of test equipment, spares and special tools
- The installation, if required, of blinds and jumpers.

This phase, specific to the subsystem to be tested, will be covered by a detailed procedure.

7.2.2.2 Start up and tuning

Once the subsystem is ready for its first start-up, it will be started-up following a detailed step by step procedure, most generally available for the major rotating equipment from the MANUFACTURER.

This second phase of the operational test is essentially devised for planning and resources purposes, as the major equipment is seldom 100% ready for demonstration to the Operator right from the first try. Some allowance must therefore be considered to troubleshoot and debug the equipment.

Therefore, the equipment will be started a first time and run during a significant period to discover any mechanical defect and fix all discovered problems such as oil leaks or main sequences faults.

7.2.2.3 Demonstration

Core of the operational test, and always witnessed by an Operator's representative, the demonstration phase will be aimed at proving that the main equipment is mechanically sound and the subsystem ready for normal operation.

This demonstration will be performed in accordance with a step by step procedure, that will include the following verifications, wherever relevant for the concerned equipment.

- Actual dynamic verifications that all sequences and interlocks of the main equipment, of its auxiliaries, and of the whole subsystem (or subsystem, if they are interlocked), perform properly:
 - Start/stop normal sequences
 - Hot/cold start
 - Emergency shutdown
 - Depressurisation
 - Air/motor/battery/hydraulic starts
 - Automatic/manual modes
 - Remote/local modes
 - Duty/stand-by modes
 - Auxiliaries changeover
 - Synchronisation.
- Actual dynamic verifications that the control system of the main equipment and the whole subsystem performs properly:
 - Pressure/speed/level/flow/temperature controls
 - Data gathering
 - Remote/local controls.

For generators:

 - Load sharing.

For compressors:

 - Anti-surge.
- Actual verifications that the main equipment is mechanically sound, by taking all required readings during several hours after stabilisation, of:
 - Noise
 - Equipment, bearings, gearbox vibrations
 - Lube oil/coolant flows, temperatures, pressures
 - Bearings, combustion chambers, exhaust temperatures

and by carrying out a thorough survey of:

 - Seals integrity
 - Fuel and oil leaks
 - Piping vibrations
 - Strainers and filters dp's
 - Oil consumption
 - Signs of mechanical wear
 - (After test) hot alignment and final inspection.

- Actual verification of the equipment performance:
 - By taking process or electrical readings during several hours after stabilisation, at various loads
 - By plotting of actual performance against theoretical characteristics.

A number of typical mechanical/process readings record forms are given in paragraph 6. They will be completed or amended to match the particularities of the equipment to be test run, and specific forms will be issued, for those not available here.

- Actual dynamic verifications that the key process and equipment alarms and trips function properly:
 - ESD pushbuttons
 - F&G detection
 - High/low levels
 - High/low pressures
 - High/low temperatures
 - Overspeeds.

However, it is not recommended for major items of equipment, e.g. turbo-compressors, to initiate numerous shutdowns and restarts, as it affects the lifetime of the equipment.

Hence only all critical protections will be tested with actual equipment shutdown. The other protections will be tested with the trip action by-passed.

7.2.3 Operational tests of ESD/F&G systems

In several countries, official regulations enforce the ESD/F&G systems tests, which are usually attended by the relevant authorities. In this case, the test procedures will be devised to comply with the local regulations. Where no specific regulation exists, the following will apply.

7.2.3.1 Systems architecture

ESD/F&G systems can be technically divided into:

- Input loops
- Logic unit (PLC or relays)
- Output loops.

The configuration of the system, the logic part of it essentially, is specific to the installation. The main configuration cases are:

- Master/slave
- Coincidence
- Two out of three voting system.

ESD systems are designed so that they include a hierarchy of effects. Assuming the highest ESD level (total plant shutdown and depressurisation) is named level 1, each of levels 2, 3, and 4 will affect less equipment than the respective higher levels.

These systems most often apply a cascade principle, where each level will activate lower levels in addition to its specific outputs.

7.2.3.2 System test

Each input and output loop, and the system logic will have been tested during the functional test phase of the commissioning. The ESD and F&G operational tests will consist in testing the whole system, from the input elements (transmitter, detector, pushbutton, etc.) until the activated equipment (ESD valve, blowdown valve motor trip, etc.).

Considering the system architecture, these operational tests will be organised as follows:

7.2.3.2.1 ESD systems

The shutdown levels will be tested, starting by the lowest level, to end by the highest one.

For each category of inputs that give identical effects, one input will be selected at random, and the shutdown will be initiated. It will then be verified that all expected outputs of this shutdown level thus triggered have been activated and that the connected equipment has performed as expected.

The other inputs of this category will also be tested systematically but without resetting all equipment that was operated by the previous test. It will only be made sure that at least one output from each lower shutdown activated by the tested shutdown level has actually been activated.

As the ESD tests will be performed before the plant start-up it will be impossible to check the action on non-running equipment e.g. electrical motors. In this case one will make sure that the trip element of the equipment concerned is activated e.g.: trip relay for electrical motors.

If an ESD test is necessary with the plant in operation, it will be performed after handover and the Operator will be in charge of the test.

All categories of inputs will be tested in the same way, thus ensuring the proper functioning of all inputs and outputs, and of the shutdown logic in all its possible configurations.

The reference document will be the ESD matrix Logic Diagram.

7.2.3.2.2 F&G systems

The procedure applied to test operationally the F&G systems will be exactly that used for ESD, but for the following points:

- Detectors being grouped by loops, only one detector by loop will be selected at random to initiate a given range of actions (then, for each category of loops giving the same effects, one will be tested in real, the other simulated, as for ESD).
- Halon CO₂ or will not be actually released, the test consisting only in activating the last solenoid valve, disconnected from the halon or CO₂ bottle.
- The deluge valves will be activated, the fire pumps started up and the deluges actually released, but the two latter effects only once per area. The platform or facilities will therefore be systematically deluged once, the continuing tests also activating the deluge valves, but with their block valves closed.
- The reference document will be the F&G matrix Logic Diagram.

7.2.4 Operational tests of lifting equipment

The load testing of lifting equipment is assimilated to an operational test, consequently it will follow the requirements of the present specification.

In particular, an operational test procedure will be issued by the commissioning during the preparation phase, which will cover the following aspects:

- Preparation tasks in accordance with pre-test check lists, a number of which are available in chapter 6. They will be completed or amended to match to specificity of the equipment to be prepared.
- No-load test, so as to verify the equipment operates satisfactorily and to adjust all safety protections.
- Load test, that will take place with attendance, as required, of local authorities, certifying authorities, and COMPANY. The load test report will be completed and signed by all relevant parties.

7.3 Procedures format

During the preparation phase of the commissioning activities, the operational test procedures (OTP's) will be established by the Commissioning personnel.

These procedures will be issued to COMPANY/Operator for their comments and approval.

The following format will be followed:

- Test summary, including:
 - Aim of the operational test
 - Test description
 - Temporary installations
 - Special precautions.
- Planning and manpower, including:
 - Planning tasks
 - Manpower estimate
 - Test duration estimate
 - Position in commissioning sequence
 - VENDOR assistance.
- Test requirements, including:
 - Precommissioning achievements
 - Commissioning achievements
 - Status of other subsystems
 - Special tool and test equipment
 - Consumables
 - Spares
 - Safety
 - Utilities.

- Test preparation, including:
 - Blind list
 - Jumpers list
 - Mechanical preparation tasks.
- Start-up and tuning, including:
 - Start-up step by step procedure.
- Test procedure, including:
 - Operational test report form
 - Step by step demonstration tests
 - Process data recording
 - Equipment data recording.
- Post-test conditions, including:
 - Reinstatement tasks
 - Preservation
 - Subsystem status.

7.4 Typical report forms

The 0 gives the Master Forms of the support documents listed herebelow:

Title	Form No.
Operational Test Report	5300
Centrifugal Pumps Pre-test Check list	5220
Centrifugal Pumps Record Sheet	5221
Reciprocating Pumps Pre-test Check list	5222
Reciprocating Pumps Record Sheet	5223
Centrifugal Compressor Pre-test Check list	5224
Centrifugal Compressor Record Sheet	5225
Reciprocating Compressor Pre-test Check list	5226
Reciprocating Compressor Record Sheet	5227
Diesel Engines Pre-test Check list	5228
Diesel Engines Record Sheet	5229
Life-boat Davits Pre-test Check list	5241
Life-boat Davits Record Sheet	5242
Hoist/Monorail/Gantry crane Pre-test Check list	5243
Hoist/Monorail/Gantry crane Load Test Sheet	5244

Title	Form No.
Platform Crane Pre-test Check list	5245
Platform Crane Load Test Sheet	5246
Lift Pre-test Check list	5247
Lift Load Test Sheet	5248

7.5 Sub-sea operational tests

7.5.1 Introduction

Once all component parts of a sub-sea subsystem have been pre-commissioned, functionally tested and prepared for start up, the Operational Test Procedure will take place. In the case of sub-sea systems this will be after the hook-up at the riser hang-off area. This signifies that further pre-commissioning will have taken place after the hook up.

At this time the status will be as follows:

- The OTP has been prepared in the correct revision and has been accepted by field operations. The responsibility split between operations and commissioning is defined, agreed and incorporated in the procedure. This is particularly important in the case that methanol is required for hydrate inhibition during Xmas tree commissioning.
- The topsides process systems are ready to receive hydrocarbon fluids.
- All SPS sub-sea (wet) equipment has been handed over as described in earlier chapter.
- All UFL equipment has been handed over as described in earlier chapter.
- All hook-up work at the hang-off area for the control umbilical is complete, has undergone the necessary testing and is documented.
- All hook-up work at the riser(s) hang-off area is complete, has undergone the necessary testing and is documented.
- The sub-sea HPU has been fully commissioned during the onshore phase and is operational and available but that the control lines to the sub-sea subsystem are not yet pressurised.
- The sub-sea control system has been fully commissioned during the onshore phase and is operational and available but that the electrical supply to the sub-sea control module(s) has not yet been energised. The interface with the topsides DCS and ESD systems has been fully commissioned and is operational.
- The necessary chemical injection systems on topsides are fully commissioned, are filled with the requisite chemical, are operational and available. The distribution system is either de-pressurised or (more likely) isolated at the hang-off area. This may be a methanol system.
- The visual verification (by ROV) of the status of the sub-sea equipment to be commissioned has been carried out and documented as described in earlier chapter.

- The ROV is operational and available to commissioning on a 24 hour/day basis. The ROV vessel and its ROV pilots and COMPANY supervisor have all necessary intervention tools available on board.
- Live video from the ROV is available in the central control room, adjacent to the sub-sea control system operator station.
- Radio or telephone contact is established between the commissioning rep. on board the ROV vessel and the sub-sea commissioning group on the installation.
- The OTP and all necessary documents are available on the ROV vessel.

7.5.2 OTP procedure

The OTP's will comply with section 7.1.2.3. of this document.

The OTP format will comply with section 7.3. of this document. In addition to this format the following sections will be added:

- Reference documents. These documents will be available on the offshore installation and the ROV vessel.

Valve and sensor test records are provided in 0.



Appendix 1 Electrical basic functions



Exploration & Production

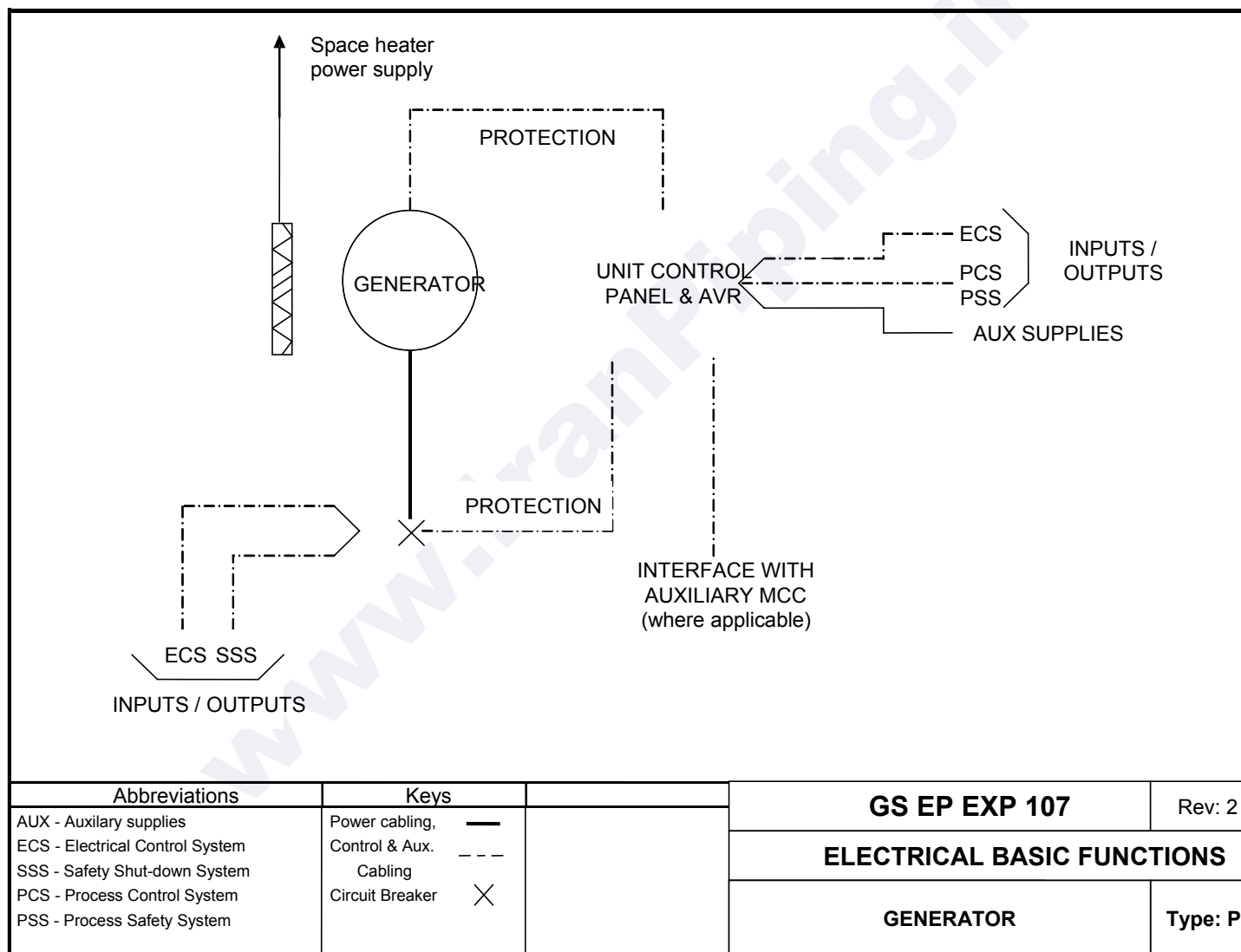
General Specification

Date: 09/05

GS EP EXP 107

Rev: 03

Appendix 1



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Exploration & Production

General Specification

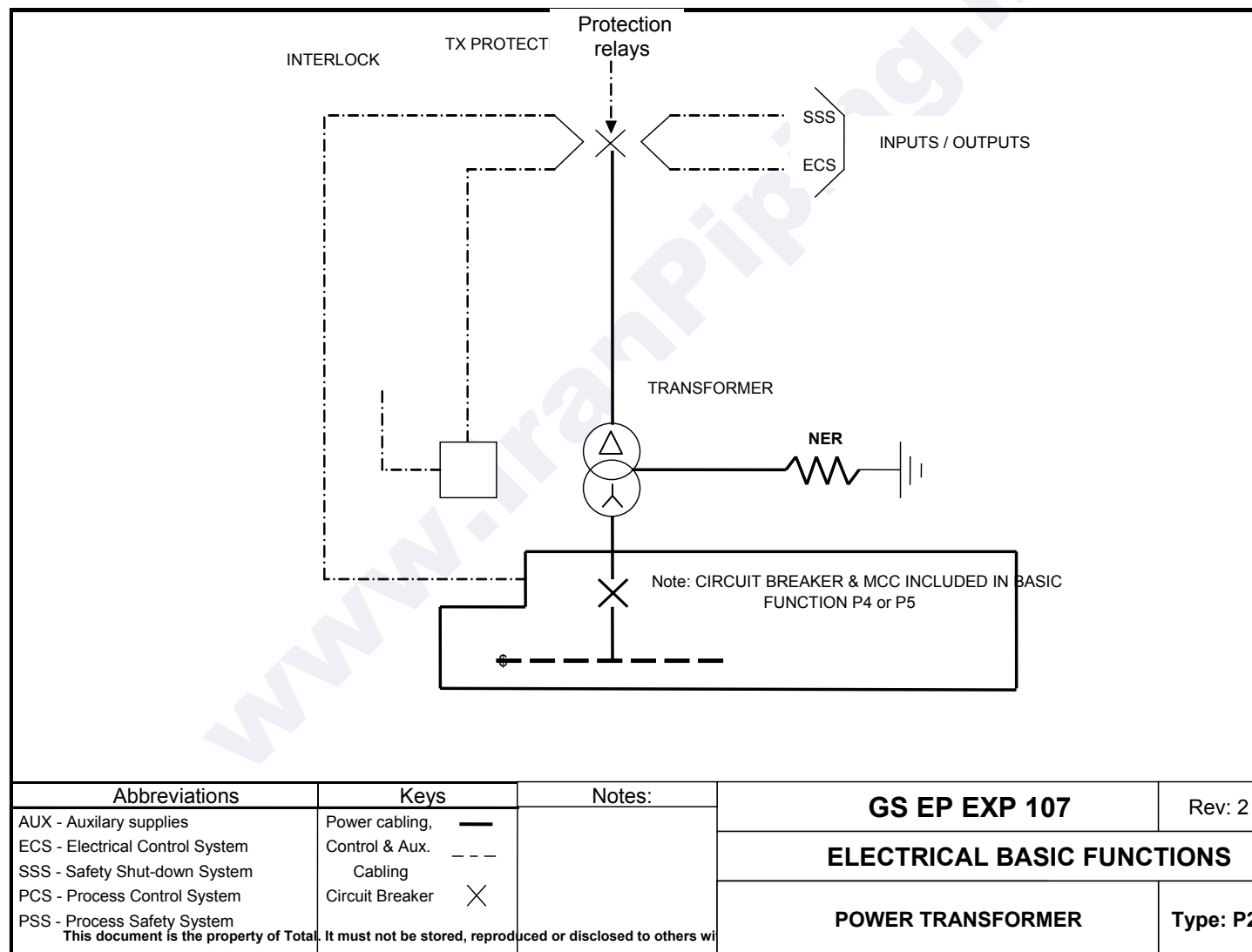
Date: 09/05

GS EP EXP 107

Rev: 03

Appendix 1

PDC INPUTS / OUTPUTS





Exploration & Production

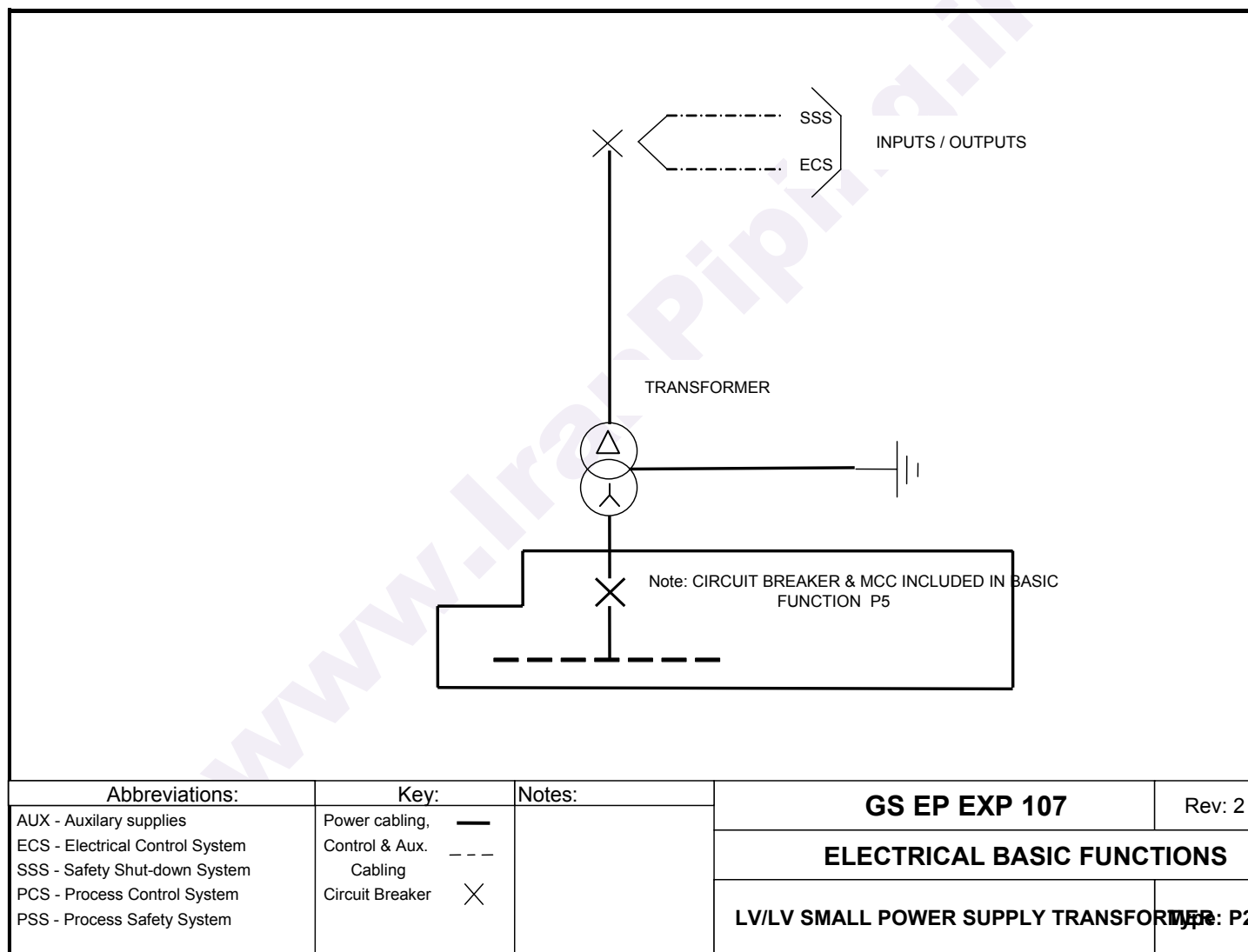
General Specification

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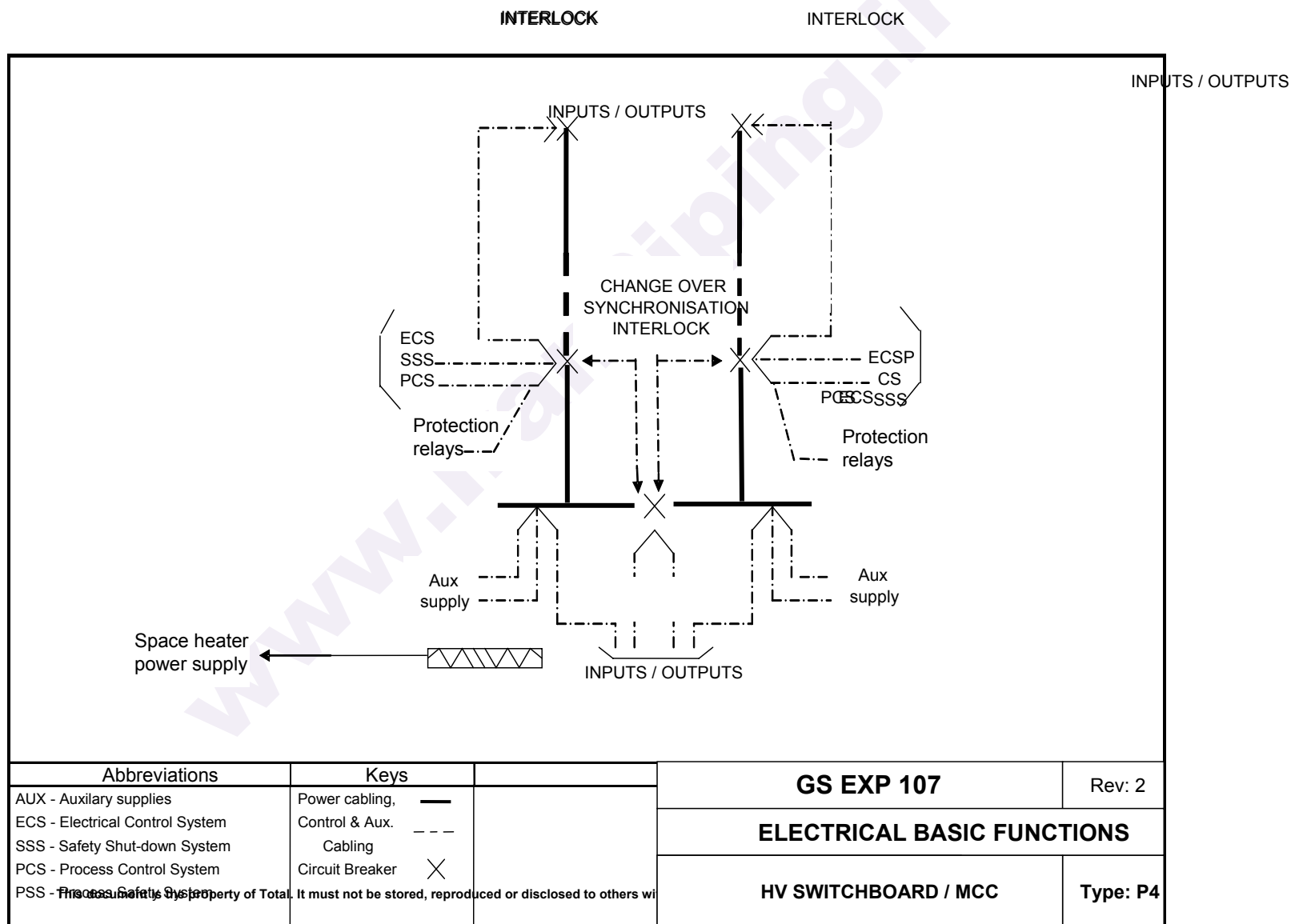
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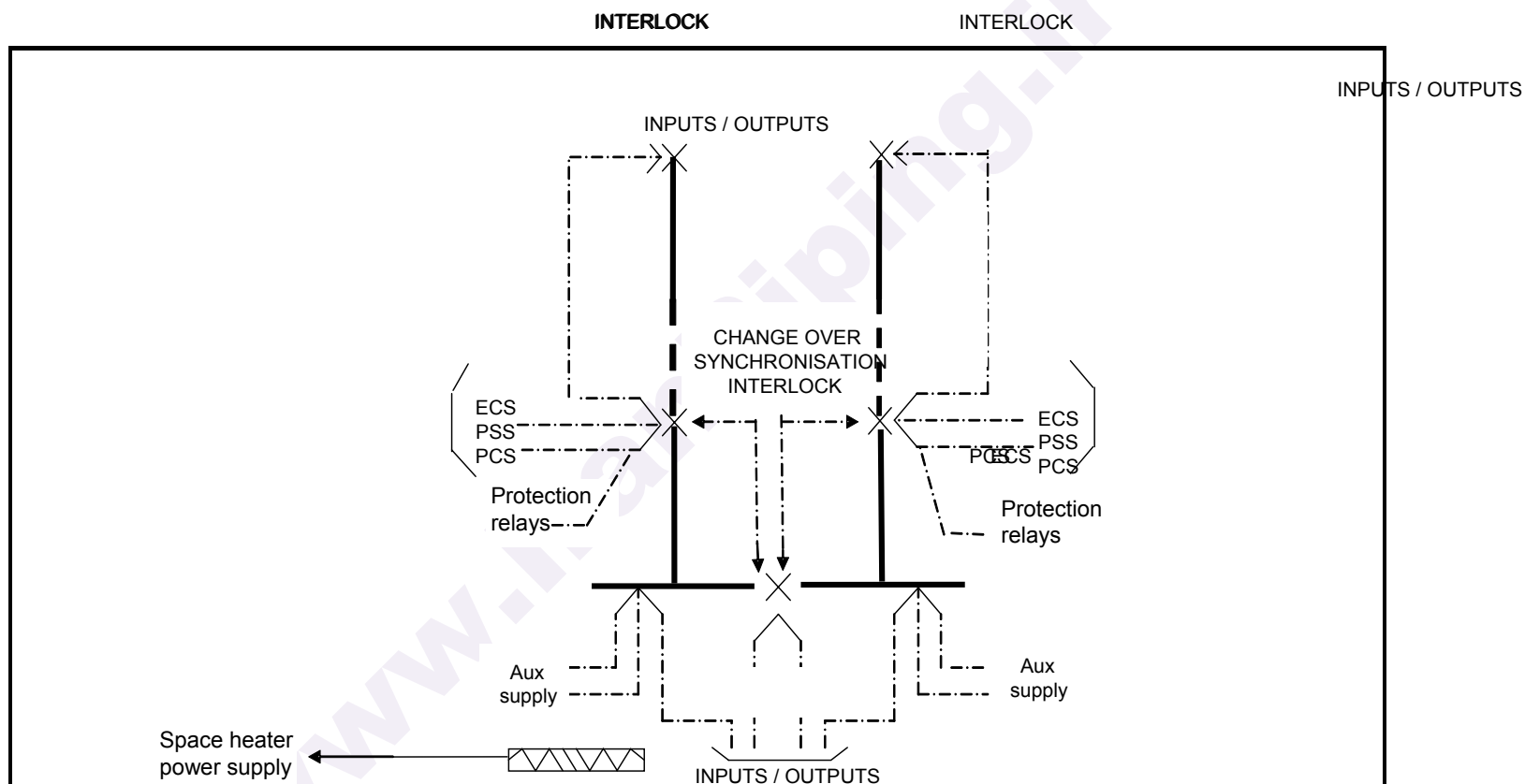
Date: 09/05

GS EP EXP 107

Rev: 03

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Abbreviations	Keys	GS EXP 107		Rev: 2
AUX - Auxiliary supplies ECS - Electrical Control System SSS - Safety Shut-down System PCS - Process Control System PSS - Process Safety System	Power cabling, — Control & Aux. Cabling - - - Circuit Breaker X	ELECTRICAL BASIC FUNCTIONS		
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Exploration & Production

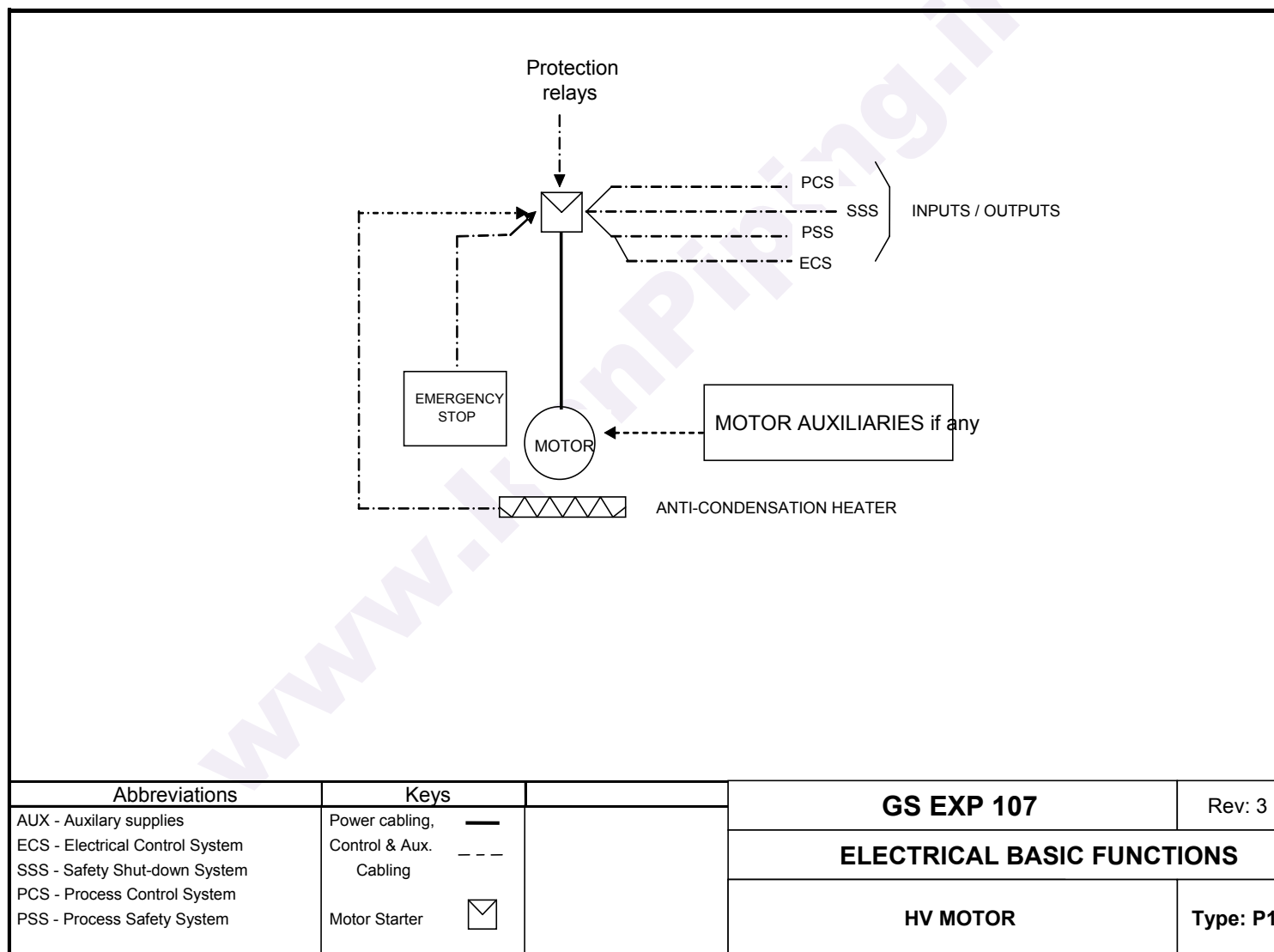
General Specification

Date: 09/05

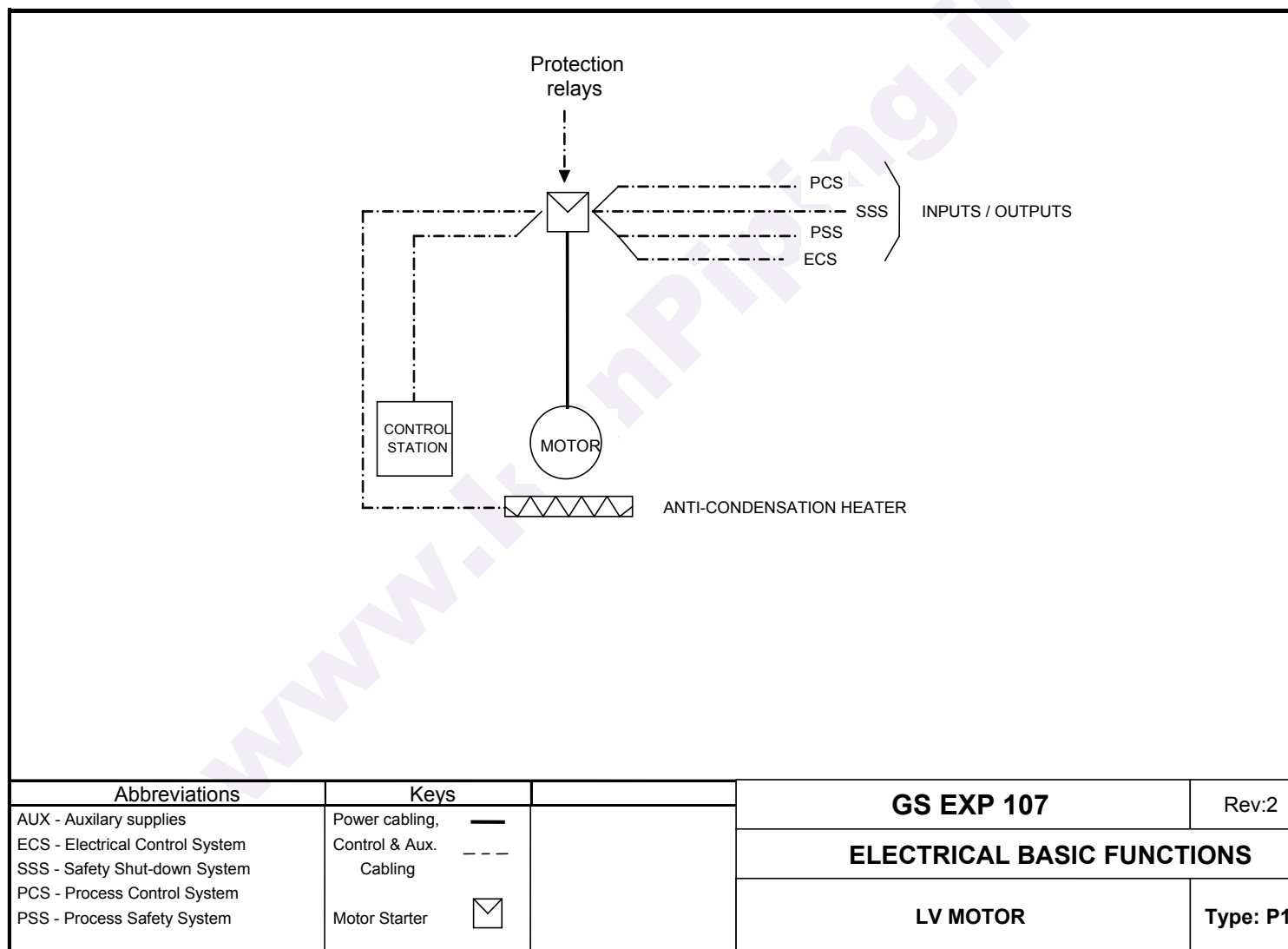
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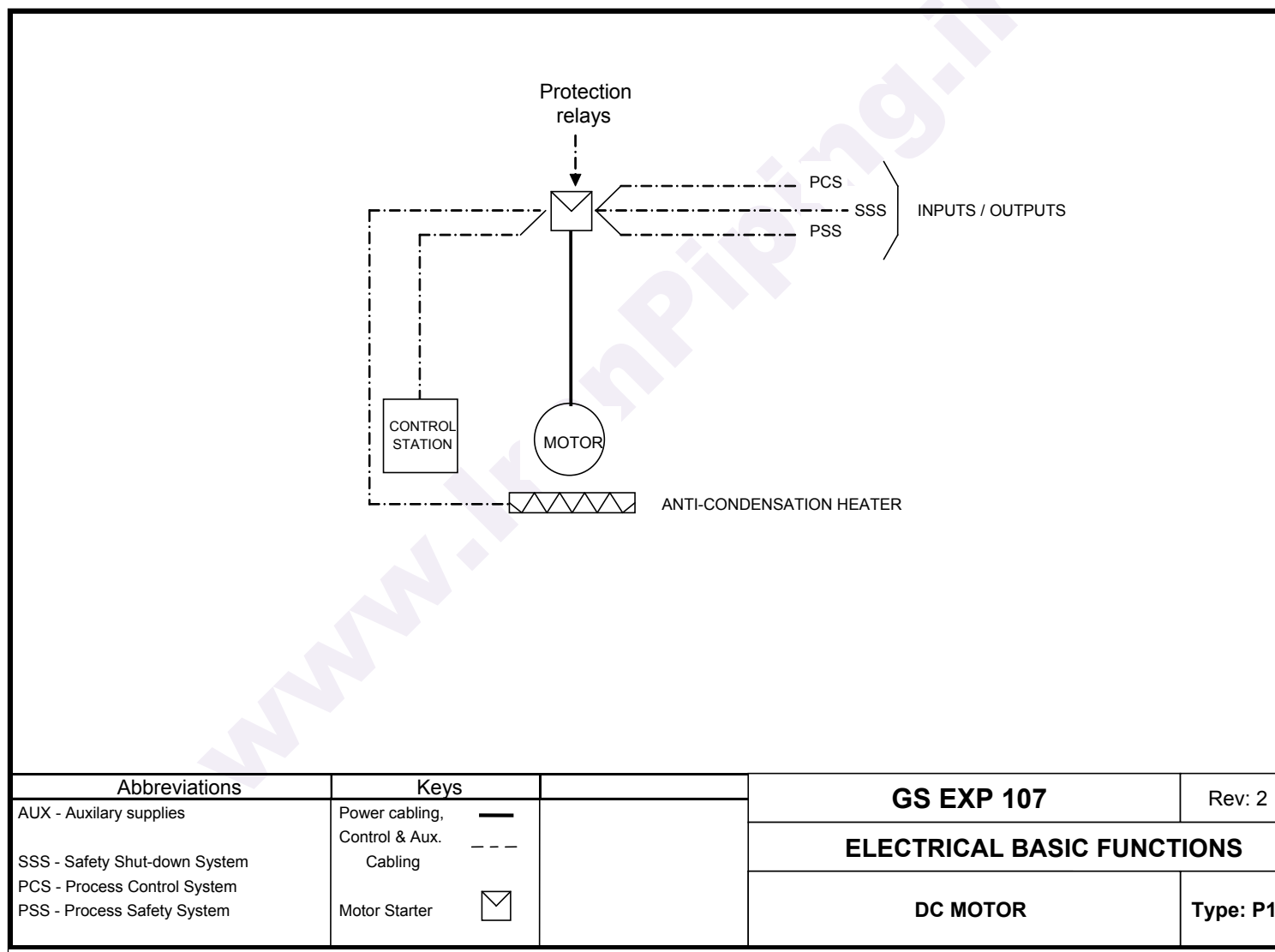
General Specification

Date: 09/05

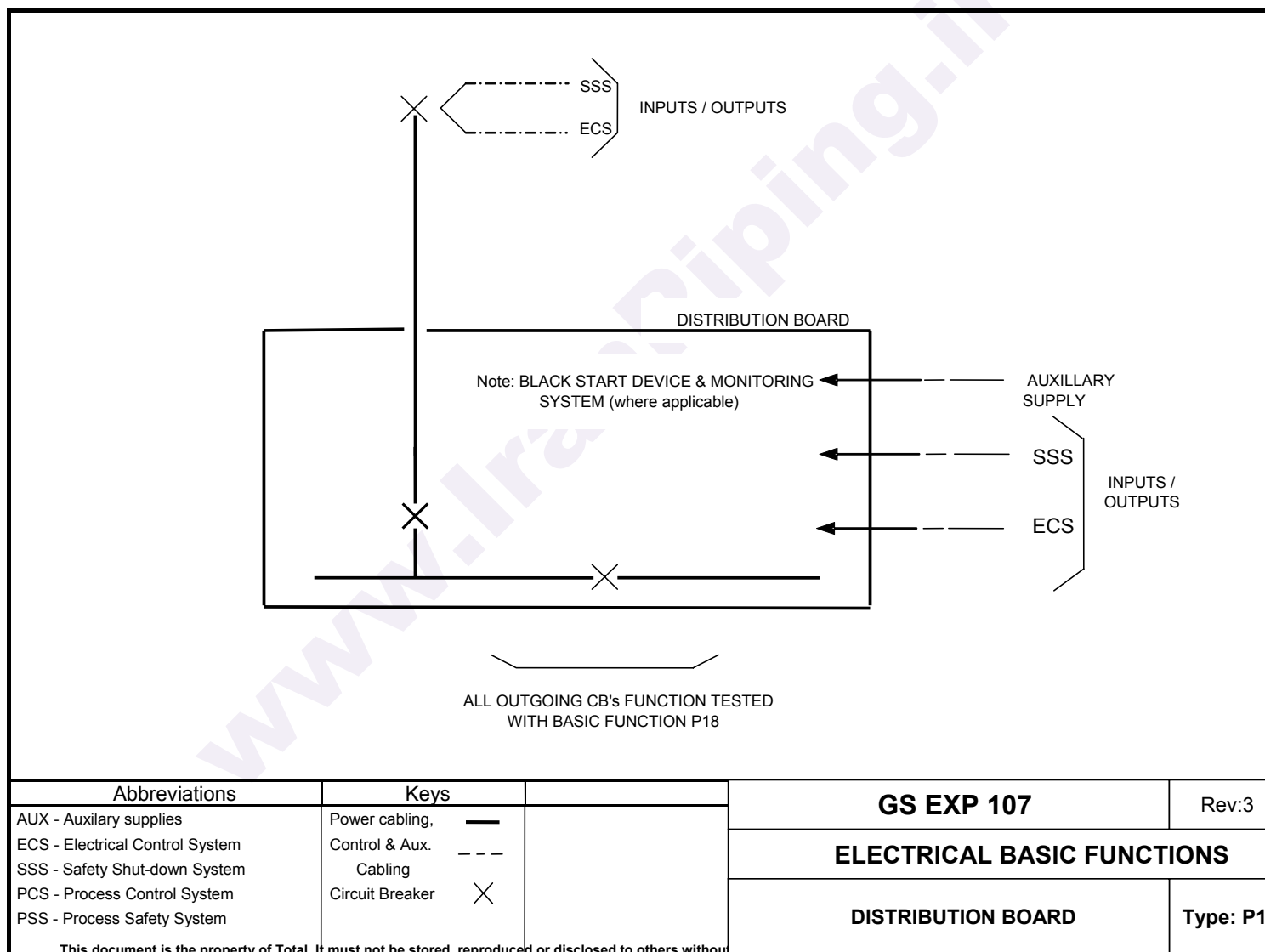
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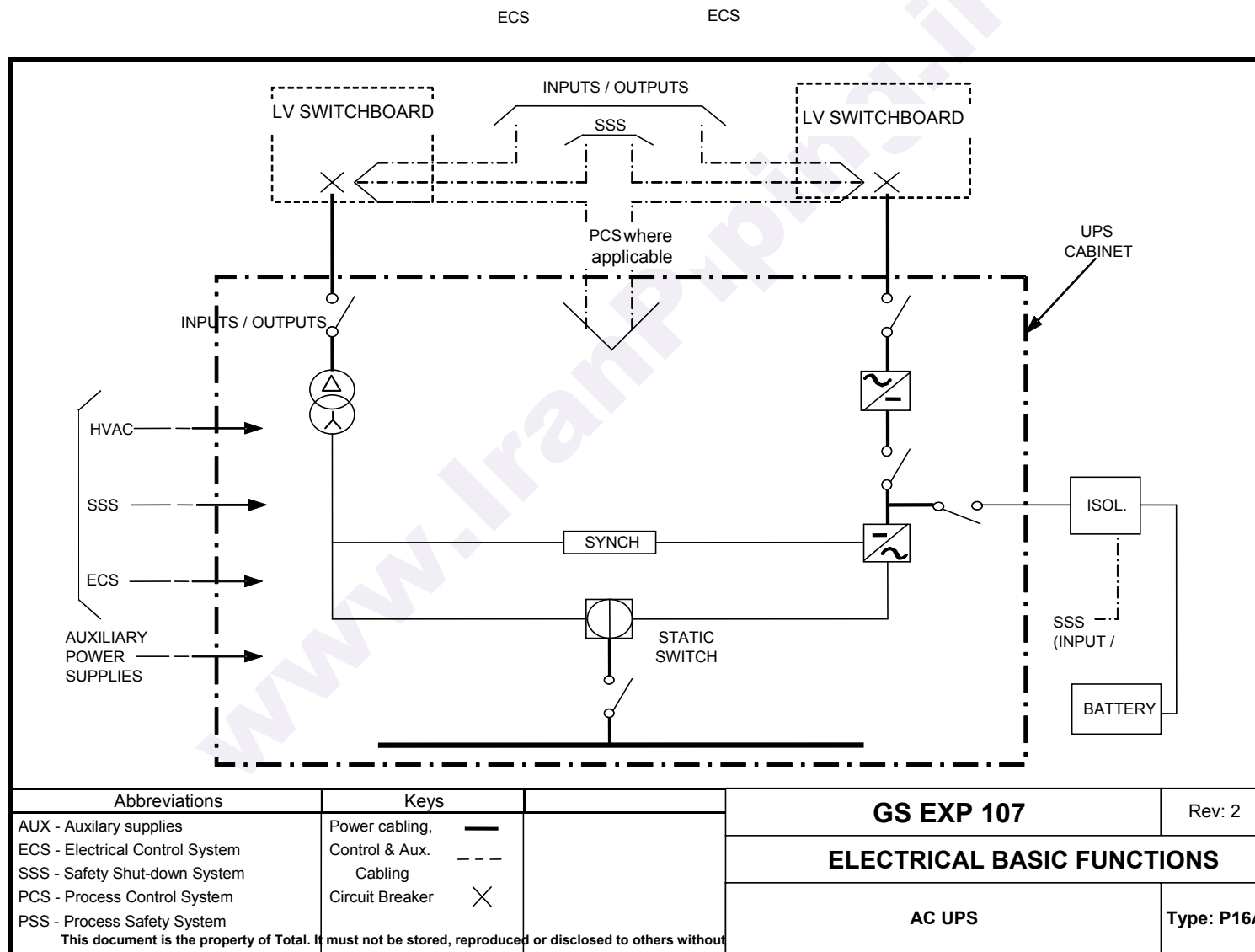
General Specification

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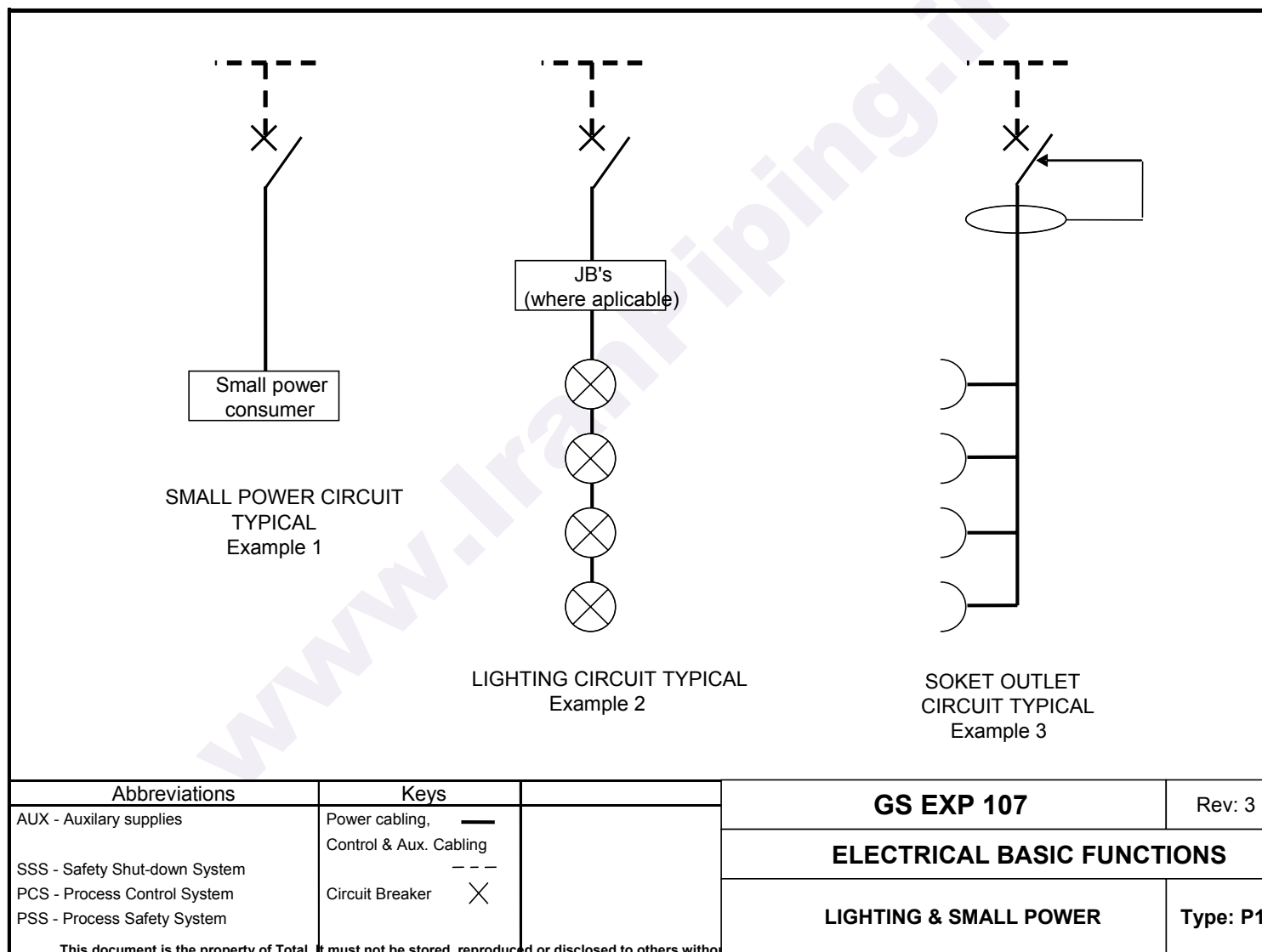
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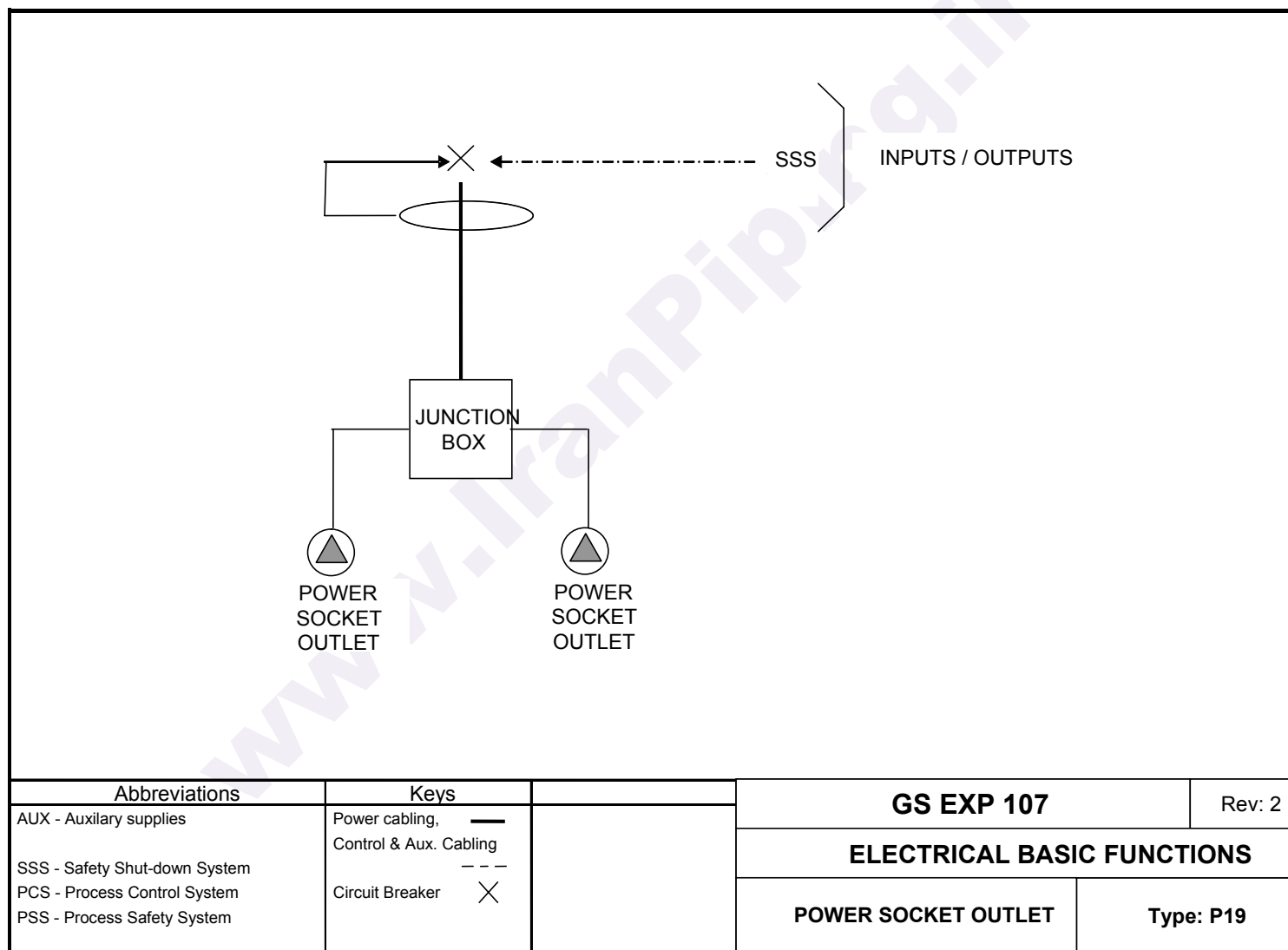
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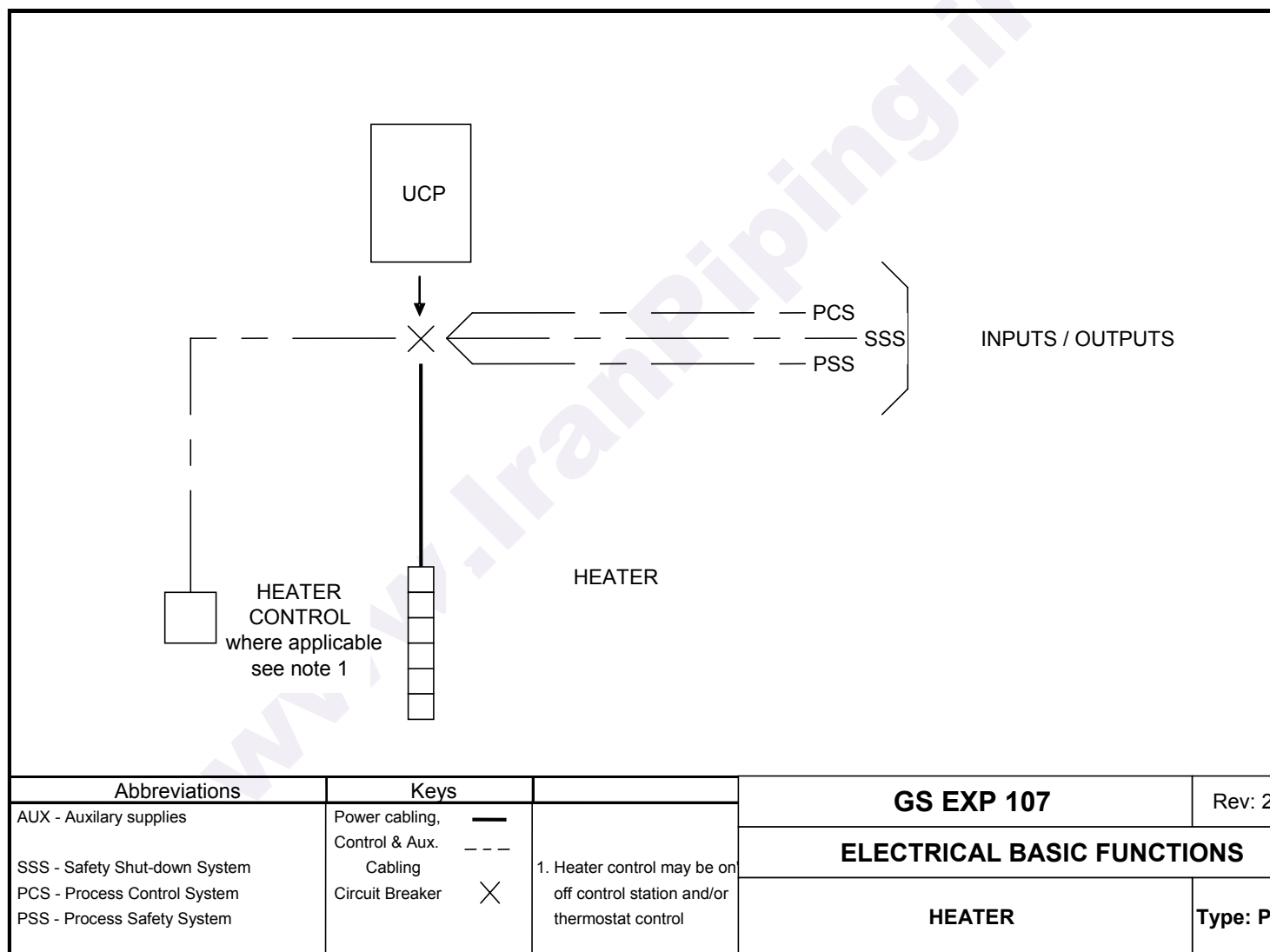
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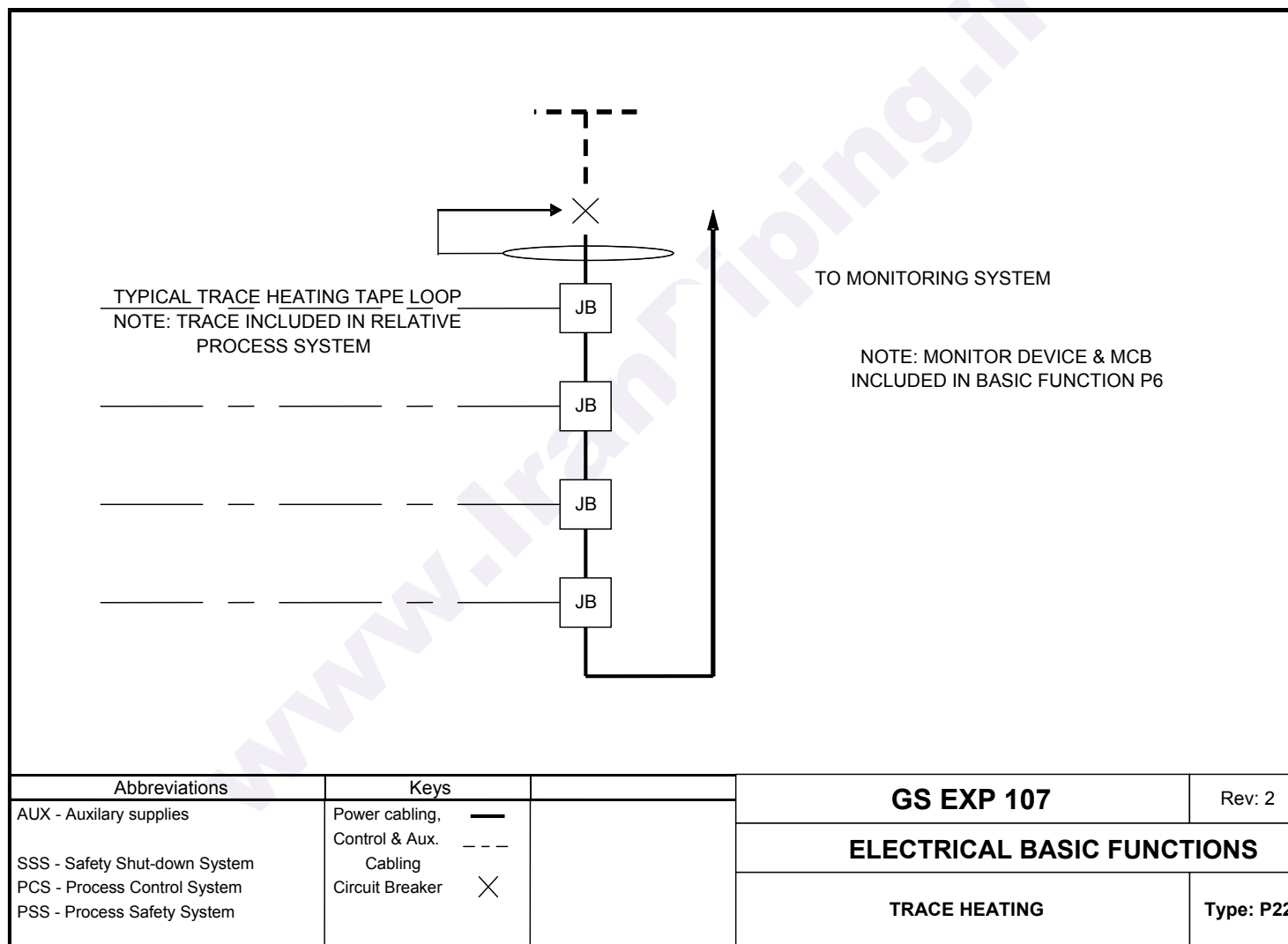
General Specification

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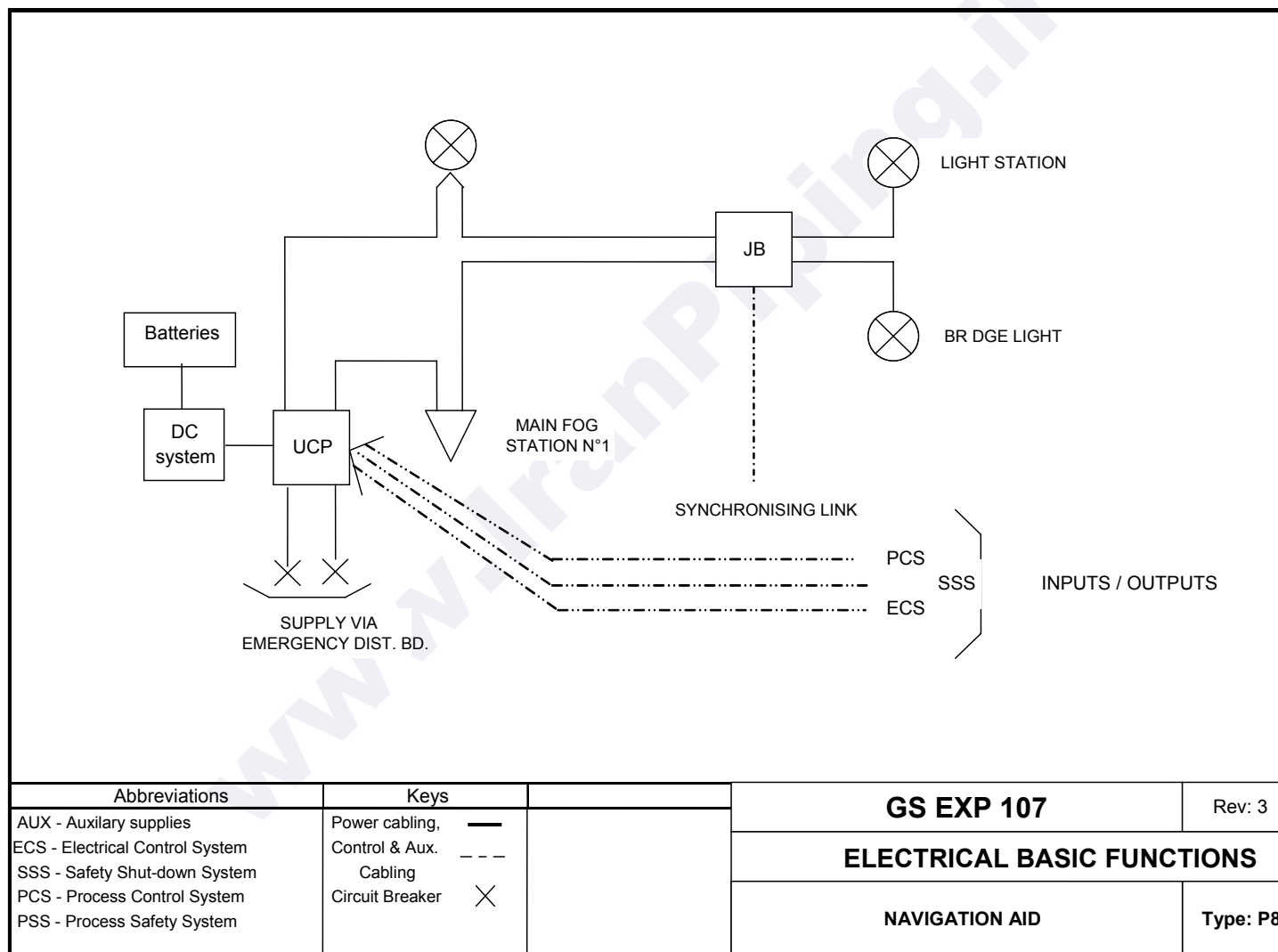
General Specification

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Date: 09/05

Rev: 03

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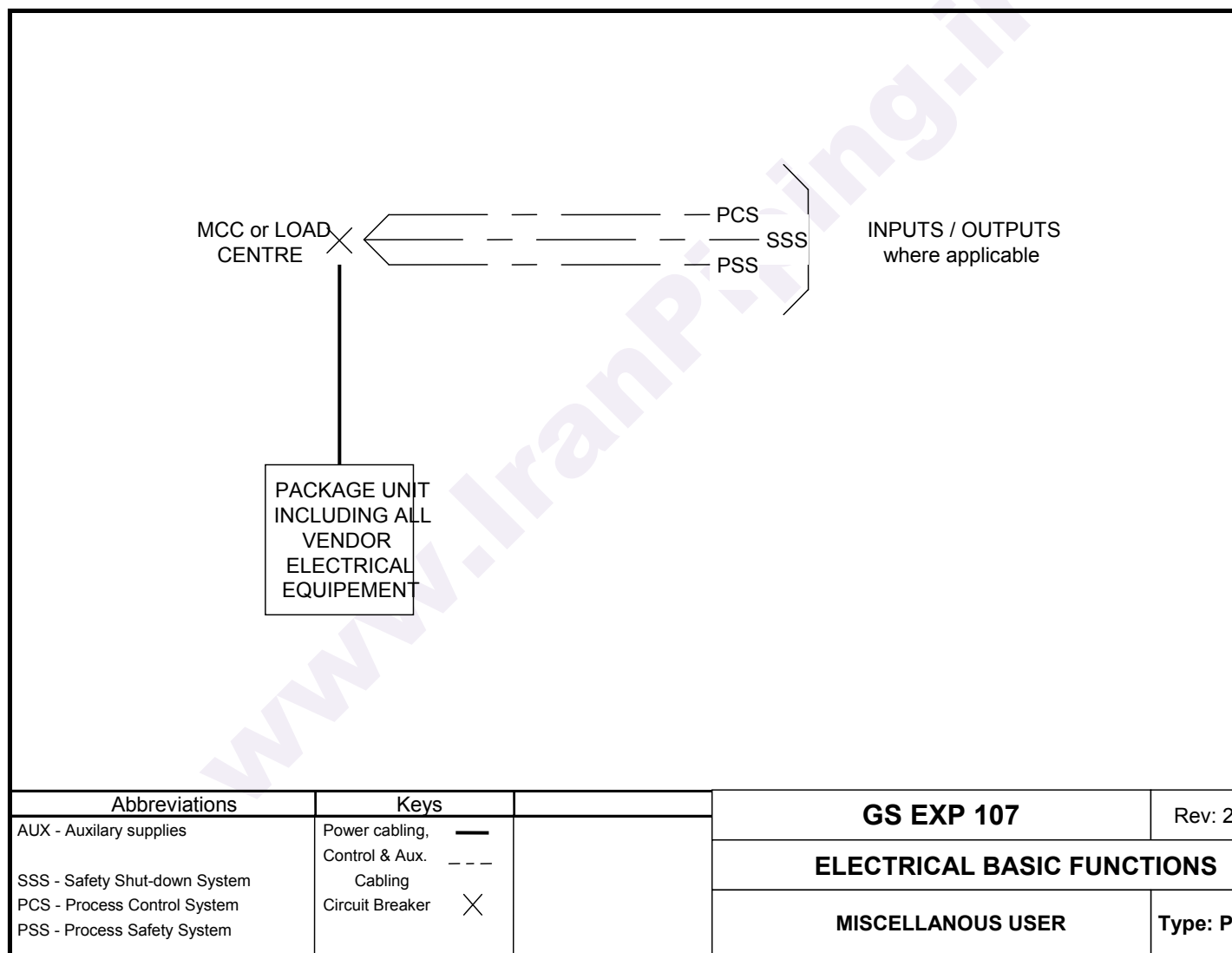
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Appendix 2 Electrical functional test sheets



		ELECTRICAL LIST OF COMMISSIONING FUNCTIONNAL TEST SHEET FORMS		DATE janv-05
				SHEET 1 OF 1
FORM	DESIGNATION	DATE	REMARKS	
FP00	TEST SHEET LIST	nov-04		
FP1A	HV GENERATOR	nov-04		
FP1B	LV GENERATOR	nov-04		
FP2A	POWER TRANSFORMER	nov-04		
FP2B	LV/LV SMALL POWER SUPPLY TRANSFORMER	nov-04		
FP3			NOT USED	
FP4	HV SWITCHBOARD / MCC	nov-04		
FP5	LV SWITCHBOARD / MCC	nov-04		
FP6			NOT USED	
FP7			NOT USED	
FP8			NOT USED	
FP9			NOT USED	
FP10			NOT USED	
FP11			NOT USED	
FP12	HV MOTOR	nov-04		
FP13	LV MOTOR	nov-04		
FP14	DC MOTOR	nov-04		
FP15	DISTRIBUTION BOARD	nov-04		
FP16A	AC UPS	nov-04		
FP16B	DC SYSTEM	nov-04		
FP17			NOT USED	
FP18	LIGHTING AND SMALL POWER	janv-05		
FP19	POWER SOCKET OUTLETS	nov-04		
FP20	HEATER	nov-04		
FP21			NOT USED	
FP22	TRACE HEATING	nov-04		
FP23			NOT USED	
FP24			NOT USED	
FP25	NAVIGATION AIDS	nov-04		
FP26			NOT USED	
FP27	MISCELLANEOUS USER	nov-04		
FTR-1	GENERAL RECORD TEST SHEET	nov-04		
FTR-2	PROTECTION RELAY	nov-04		
FTR-3	BATTERY AUTONOMY RECORD SHEET	nov-04		
FTR-4	BATTERY CHARGE - DISCHARGE RECORD SHEET	janv-05		
FTR-5	REMOTE SIGNALLING REPORT SHEET	nov-04		
FTR-6	LIGHTING FUNCTIONNAL TEST RECORD SHEET	janv-05		
FTR-7	HEAT TRACING FUNCTIONNAL TEST RECORD SHEET	janv-05		
FTR-8	DISTRIBUTION BOARD OUTGOING FUNCTIONNAL TEST F	janv-05		

FORM N° : FP00 - Sh. 1/1 - Janv-05



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET HV GENERATOR	PROJECT Rev --- Date --- / --- / ---
BASIC FUNCTION N° :		SUBSYSTEM :
DESCRIPTION :		LOCATION :
EQUIPMENT N° :		TASK N° :
DWG N°		
NAMEPLATE DATA		
MANUFACTURER:	RATING	kVA
SERIAL NUMBER:	VOLTAGE	V
EX TYPE OF PROTECTION	FULL LOAD CURRENT	A
TEMPERATURE RISE	SPEED	RPM
INSULATION CLASS	FREQUENCY	Hz
EXCITER	A	POWER FACTOR
EXCITER	V	
FUNCTION TEST REQUIREMENT	RESULT	INITIALS
Check precommissioning activities of the generator and related equipment have been carried out (check list and test sheet).		
Check equipment for cleanliness.		
Check generator heater operation. Heater must be energised 72 hours prior to insulation resistance tests.		
Disconnect neutral point from earth if any and check proper earthing of the generator frame.		
Measure insulation resistance value of cable and stator windings at 5000V. Minimum value: 150 Mohm.	UVW - E = Mohm	
Reconnect neutral point to earth .		
Measure insulation resistance value of exciter stator at 500V. Minimum value: 10 Mohm.	Mohm	
Measure insulation resistance value of diode bridge assembly at 500V. Minimum value: 1MOhm	Mohm	
Energise control of HV incomer and put the incomer in test position.		
Perform secondary injection test on protection relays and metering and record on attached sheet FTR-2.		
Check protection setting according relay protection study		
FORM N° : FP1A - Sh. 1/2 - Nov 04		



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET HV GENERATOR	PROJECT rev --- Date --- / --- / ---
EQUIPMENT n°		SUBSYSTEM :

FUNCTION TEST REQUIREMENT	RESULT	INITIALS
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5		
Carry out functional tests of circuit breaker as indicated on attached sheet FTR-1		
Check commissioning test sheets FP27 of unit control panel and AVR are signed.		
Check commissioning test sheets FP13 of auxiliary motors (such as fan coolers, cooling water pumps...) and their associated feeders.		
Put HV motor auxiliaries ready to operate.		
Carry out run test according to vendor procedures and record parameters on attached sheets:	■	■
No load test		
Load test		
Load Impacts		
Synchronisation		
Load sharing (active and reactive)		
Speed and voltage droop		
Perform a 24h full load test . Record parameters.		

COMMENTS :

Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			

FORM N° : FP1A - Sh. 2/2 - Nov. 04



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET LV GENERATOR	PROJECT Rev --- Date --- / --- / ---
BASIC FUNCTION N° :		SUBSYSTEM :
DESCRIPTION :		LOCATION :
EQUIPMENT N° :		TASK N° :
DWG N°:		
NAMEPLATE DATA		
MANUFACTURER:	RATING	kVA
SERIAL NUMBER:	VOLTAGE	V
EX TYPE OF PROTECTION	FULL LOAD CURRENT	A
TEMPERATURE RISE	SPEED	RPM
INSULATION CLASS	FREQUENCY	Hz
EXCITER	A	POWER FACTOR
EXCITER	V	
FUNCTION TEST REQUIREMENT	RESULT	INITIALS
Check precommissioning activities of the generator and related equipment have been carried out (check list and test sheet).		
Check equipment for cleanliness.		
Check generator heater operation. Heater must be energised 72 hours prior to insulation resistance tests.		
Disconnect neutral point from earth if any and check proper earthing of the generator frame.		
Measure insulation resistance value of cable and stator windings at 1000V. Minimum value: 100 Mohm.	UVW - E = Mohm	
Reconnect neutral point to earth if any.		
Measure insulation resistance value of exciter stator at 500V. Minimum value: 10 Mohm.	Mohm	
Measure insulation resistance value of diode bridge assembly at 500V. Minimum value: 1MOhm	Mohm	
Energise control of generator incomer and put incomer in test position.		
Perform secondary injection test on protection relays and metering and record on attached sheet FTR-2.		
Check protection setting according relay protection study		
FORM N° : FP1B - Sh. 1/2 - Nov 04		



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET LV GENERATOR	PROJECT rev --- Date --- / --- / ---
EQUIPMENT n°		SUBSYSTEM :

FUNCTION TEST REQUIREMENT	RESULT	INITIALS
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5		
Carry out functional tests of generator incomer as indicated on attached sheet FTR-1		
Check commissioning test sheets FP27 of unit control panel and AVR are signed.		
Carry out run test according to vendor procedures and record parameters on attached sheets:	■	■
No load test		
Load test		
Load Impacts		
Synchronisation (if applicable)		
Load sharing (active and reactive)		
Speed and voltage droop		
Perform a 4h full load test. Record parameters on attached sheet.		

COMMENTS

Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name Signature			

FORM N° : FP1B - Sh. 2/2 - Nov 04



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET POWER TRANSFORMER	PROJECT rev --- Date --- / --- / ---
BASIC FUNCTION N° :		SUBSYSTEM :
DESCRIPTION :		LOCATION :
EQUIPMENT N° :		TASK N° :
DWG :		
DATA		
SERIAL NO.	MANUFACTURER	COOLING TYPE
PRIMARY VOLTS	PRIMARY AMPS	
SECONDARY VOLTS	SECONDARY AMPS	
VECTOR GROUP	RATING	kVA
FUNCTION TEST REQUIREMENT		
Check precommissioning activities of the transformer have been carried out (check list and test sheet).	RESULT	INITIALS
Check equipment for cleanliness.		
Measure I.R value of earthing resistor disconnected (if any) at 1000V (Minimum value: 100 Mohm).		
Measure I.R value of HV windings and cables at 5000V (Minimum acceptable value: 150 Mohm)	Mohm	
Measure IR value of LV winding and bus duct (if any) at 1000V (Minimum acceptable value 100 Mohm).	Mohm	
Check dielectric level (if any)		
Energise controls of transformer feeder and secondary side incomer		
Put feeder and incomer in test position.		
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5		
Perform secondary injection test on protection relays and metering and record on attached sheet FTR-2.		
Check protection setting according relay protection study		
Check operation of protection devices on transformer:	■	■
For breathing transformer: Buccholz relay		
Winding temperature		
Dielectric oil level		

FORM N° : FP2A - Sh. 1/2 - Nov 04



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET POWER TRANSFORMER	PROJECT Rev --- Date --- / --- / ---
EQUIPMENT n°		SUBSYSTEM :

FUNCTION TEST REQUIREMENT	RESULT	INITIALS
For sealed transformer: DMC (DGPT)		
For ONAF transformers : Cooling fans		
For On Load Tap Changer: Voltage regulator		
Control box (if any)		
Check electrical interlock and intertripping operations.		
Energise transformer. Check secondary side voltage according to tap positions.	■	
TAPS N°		
Step %		
SEC V		
Carried out a 24 hours test. Monitor temperature & dielectric level on attached sheet.		

COMMENTS :

Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name Signature			

FORM N° : FP2A - Sh. 2/2 - Nov 04



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET TRANSFORMER LV/LV Small power supply	PROJECT rev --- Date --- / --- / ---
BASIC FUNCTION N° :		SUBSYSTEM :
DESCRIPTION :		LOCATION :
EQUIPMENT N° :		TASK N° :
DWG :		

DATA			
SERIAL NO.	MANUFACTURER	COOLING TYPE	
PRIMARY VOLTS V	PRIMARY AMPS A		
SECONDARY VOLTS V	SECONDARY AMPS A		
VECTOR GROUP	RATING kVA		

FUNCTION TEST REQUIREMENT	RESULT	INITIALS
Check precommissioning activities of the transformer have been carried out (check list and test sheet).		
Check equipment for cleanliness.		
Measure IR value of LV winding and cable at 1000V (Minimum acceptable value 100 Mohm).	Mohm	
Energise controls of supply feeder and put feeder in test position		
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5		
Check protection devices rating and settings in accordance with relay protection study.		
Energise transformer.		
Check secondary side voltage according to tap positions:	■	
TAPS N°		
Step %		
SEC V		
Carried out a 12 hours test without load . Monitor temperature		

COMMENTS :

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			

FORM N° : FP2B - Sh. 1/1 - Nov 04



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET HV SWITCHBOARD		PROJECT Rev --- Date --- / --- / ---
	BASIC FUNCTION N° :		SUBSYSTEM :
DESCRIPTION :		LOCATION :	
EQUIPMENT N° :		TASK N° :	
DWG :			
DATA			
MANUFACTURER:	RATED VOLTAGE V	BUS BAR RATING A	
SERIAL N°:	FAULT LEVEL kA/s		
TYPE:	IP RATING		
NOTE : Functional tests for generator switchboard to be carried out in conjunction with generator operational test.			
FUNCTION TEST REQUIREMENT		RESULT	INITIALS
Check precommissioning activities have been carried out (check list and test sheet)			
Check equipment for cleanliness.			
Measure IR value of bus bars including circuit breakers at 5000V. Minimum value : 200 Mohm		Mohm	
Measure IR value of distribution polarities buses at 500 V. Minimum value: 10 Mohm		Mohm	
Check polarity of bus wiring in each cubicle.			
Energise anti-condensation heater and check hygrostat working (On-Off) and that the system is heating correctly.			
Test bus tie breaker(s) operation .			
Test all electrical intertripping and interlocking sequences according attached sheet FTR-1			
Perform secondary injection test on protection relays and metering and record on attached sheet FTR-2.			
Check protection devices rating and settings in accordance with relay protection study.			
Test over pressure vents limit switches and relevant CB tripping of Arcing resistant switchgear assembly,			
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5			
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	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET HV SWITCHBOARD	PROJECT Rev --- Date --- / --- / ---
EQUIPMENT n°		SUBSYSTEM :

FUNCTION TEST REQUIREMENT	RESULT	INITIALS
Carry out all manual and automatic changeover sequences with temporary supply (when required)		
Test synchronisation schemes when applicable.		
Check earthing transformers have been commissioned and connected to the switchboard		
Check presence of Warning posts, safety tool kit.		
Check bus tie is opened.		
Energise		
Phase out incoming supplies.		
Phase out switchboard across bus sections.		
Check meters and indicators		

COMMENTS :

Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			

FORM N° : FP4 - Sh. 2/2 - Nov 04



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET LV SWITCHBOARD	PROJECT rev --- Date --- / --- / ---
BASIC FUNCTION N° :		SUBSYSTEM :
DESCRIPTION :		LOCATION :
EQUIPMENT N° :		TASK N° :
DWG :		
DATA		
MANUFACTURER	RATED VOLTAGE V	BUS BAR RATING A
SERIAL NO.	FAULT LEVEL kA/s	
TYPE	IP RATING	
NOTE : Functional tests for generator switchboard to be carried out in conjunction with generator operational test.		
FUNCTION TEST REQUIREMENT	RESULT	INITIALS
Check precommissioning activities have been carried out (check list and test sheet)		
Check equipment for cleanliness.		
Measure IR value of bus bars including circuit breakers at 1000V. Minimum value : 100 Mohm	Mohm	
Measure IR value of distribution polarities buses at 500 V. Minimum value: 10 MOhm	Mohm	
Check polarity of bus wiring in each cubicle.		
Energise anti-condensation heater and check hygrostat working (On-Off) and that the system is heating correctly.		
Test bus tie breaker(s) operation .		
Test all electrical intertripping and interlocking sequences according attached sheet FTR-1		
Perform test by "secondary injection" on protection relays and metering devices and record on attached sheets FTR-2.		
Check protection devices rating and settings in accordance with relay protection study.		
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5		
Check presence of Warning posts, safety tool kit.		
FORM N° : FP5 - Sh. 1/2 - Nov 04		



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET LV SWITCHBOARD	PROJECT Rev --- Date --- / --- / ---
EQUIPMENT n°		SUBSYSTEM :

FUNCTION TEST REQUIREMENT	RESULT	INITIALS
Ensure all HV/LV intertrips and interlocks are tested.		
Ensure bus tie is open		
Test synchronisation device is ok.		
Energise switchboard incoming supplies.		
Phase out incoming supplies.		
Phase out switchboard across bus sections.		
Carry out all manual and automatic changeover sequences.		
For switchboard with emergency supply, carry out all automatic changeover sequences upon loss of main supply.		
Check meters and indicators		

COMMENTS :

Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			

FORM N° : FP5- Sh. 2/2 - Nov 04



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET HV MOTOR		PROJECT Rev --- Date --- / --- / ---	
	BASIC FUNCTION N° :		SUBSYSTEM :	
DESCRIPTION :		LOCATION :		
EQUIPMENT N° :		TASK N° :		
DWG :				
DATA				
MANUFACTURER	RATING	kW	SC/FLC	
FRAME SIZE	VOLTAGE:	V	TYPE OF PROTECTION	
SERIAL NO.	CURRENT	A	INSULATION CLASS:	
DUTY	RPM		TEMP. RISE CLASS:	
FUNCTION TEST REQUIREMENT		RESULT		INITIALS
Check precommissioning activities have been carried out (refer to check list and test sheet).				
Check equipment for cleanliness.				
Measure Insulation resistance of motor windings and supply cables at 5000V. Minimum value 150 Mohm.		UVW - E =		Mohm
Measure Insulation resistance value of motor anti-condensation heater at 500 V. Minimum value 10 Mohm				Mohm
Energise motor anti-condensation heater and check related voltage & current at terminal box.		V	A	
Energise control of HV motor feeder and put the feeder in test position.				
Perform secondary injection test on protection relays and metering and record on attached sheet FTR-2.				
Check protection setting according relay protection study				
Carry out functional test of circuit breaker in local and remote configurations as indicated on attached sheet FTR-1				
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5				
Check commissioning test sheets of motor auxiliaries (such as fan coolers, cooling water pumps...) and their associated feeders.				
Put HV motor auxiliaries ready to operate.				
Energise start and stop (impulse) motor uncoupled to check direction of rotation.				

FORM N° : FP12 - Sh. 1/2 - Nov 04



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET HV MOTOR	PROJECT rev --- Date --- / --- / ---								
EQUIPMENT n°		SUBSYSTEM :								
Perform a 4 (four) hours no load (uncoupled) test of the motor and record results in following table.										
Starting current	A									
Run up time	s									
Time period (minutes)	0	30	60	90	120	150	180	210	240	
Ambient temp °C										
Bearing temp. DE °C										
Bearing temp. NDE °C										
Current A										
Winding temp. readings from R.T.D's	1									
	2									
	3									
	4									
	5									
	6									
Vibration measurements. D.E	V									
	H									
Vibration measurements. N.D.E	V									
	H									
COMMENTS										
Testing & measurement instruments used										
Type	Serial n°	Calibration certificate	Validity							
	Carried out by	Commissioning SPDT	Certifying Authority							
Date										
Name										
Signature										

FORM N° : FP12 - Sh. 2/2 - Nov 04



**ELECTRICAL
COMMISSIONING FUNCTIONAL TEST SHEET
LV MOTOR**

PROJECT

rev ---
Date --- / --- / ---

BASIC FUNCTION N° :	SUBSYSTEM :
DESCRIPTION :	LOCATION :
EQUIPMENT N° :	TASK N° :

OWG :

DATA			
MANUFACTURER	RATING	kW	SC/FLC
FRAME SIZE	VOLTAGE:	V	TYPE OF PROTECTION
SERIAL NO.	CURRENT	A	INSULATION CLASS:
DUTY	RPM		TEMP. RISE CLASS:

FUNCTION TEST REQUIREMENT	RESULT	INITIALS
Check precommissioning activities have been carried out (refer to check list and test sheet).		
Check equipment for cleanliness.		
Measure Insulation resistance value of motor windings and cables at 1000 V (Minimum value: 100 Mohm).	UVW - E = Mohm	
Measure Insulation resistance value of motor anti-condensation heater at 500 V. Minimum value 10 Mohm	Mohm	
Energise motor anti-condensation heater and check related voltage & current at terminal box.	V A	
Energise control of motor starter and put starter in test position.		
Perform secondary injection test on protection relays and metering and record on attached sheet FTR-2.		
Check protection setting according relay protection study		
Carry out functional test of circuit breaker in local and remote configurations as indicated on attached sheet FTR-1		
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5		
Energise start and stop (impulse) motor uncoupled to check direction of rotation.		
If required, perform a 1 hour no load (uncoupled) test of the motor and record results in following table.		
Starting current	A	

FORM N° : FP13 - Sh. 1/2 - Nov 04



 TOTAL	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET LV MOTOR	PROJECT rev --- Date --- / --- / ---
EQUIPMENT n°		SUBSYSTEM :

Time period (minutes)	0	15	30	45	60				
Ambient temp °C									
Bearing temp. DE (if any) °C									
Bearing temp. NDE (if any) °C									
Current A									
Voltage drop									

Winding temp. readings from R.T.D's	1								
	2								
	3								
	4								
	5								
	6								

COMMENTS

Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name Signature			

FORM N° : FP13 - Sh. 2/2 - Nov 04

Appendix 2

	ELECTRICAL	PROJECT	
	COMMISSIONING FUNCTIONAL TEST SHEET	rev --- Date --- / --- / ---	
	DC MOTOR		
BASIC FUNCTION N° :	SUBSYSTEM :		
DESCRIPTION :	LOCATION :		
EQUIPMENT N° :	TASK N° :		
DWG :			
DATA			
MANUFACTURER	RATING kW	SC/FLC	
FRAME SIZE	VOLTAGE: V	TYPE OF PROTECTION	
SERIAL NO.	CURRENT A	INSULATION CLASS:	
DUTY	RPM	TEMP. RISE CLASS:	
EXCITER TYPE:	VOLTAGE V	FIELD CURRENT A	
FUNCTION TEST REQUIREMENT	RESULT	INITIALS	
Check precommissioning activities have been carried out (refer to check list and test sheet).			
Check equipment for cleanliness.			
Measure Insulation resistance value of motor windings and cables at 1000V (Minimum value: 100 Mohm).	UVW - E = Mohm		
Measure Insulation resistance value of motor anti-condensation heater at 500 V. Minimum value 10 Mohm	Mohm		
Energise motor anti-condensation heater and check related voltage & current at terminal box.	V A		
Energise control of motor starter			
Perform secondary injection test on protection relays and metering and record on attached sheet FTR-2.			
Check protection setting according relay protection study			
Carry out functional test of circuit breaker in local and remote configurations as indicated on attached sheet FTR-1			
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5			
Energise start and stop (impulse) motor uncoupled to check direction of rotation.			
COMMENTS			
Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity
	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			
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Appendix 2

	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET DISTRIBUTION BOARD (LIGHTING -SMALL POWER- HEAT TRACING)	PROJECT rev --- Date --- / --- / ---
BASIC FUNCTION N° :		SUBSYSTEM :
DESCRIPTION :		LOCATION :
EQUIPMENT N° :		TASK N° :
DWG :		

DATA			
MANUFACTURER	RATED VOLTAGE	V	BUS BAR RATING
SERIAL NO.	FAULT LEVEL	ka/s	PROTECTION Eex
TYPE	IP RATING		

FUNCTION TEST REQUIREMENT	RESULT	INITIALS
Check precommissioning activities have been carried out (check list and test sheet)		
Check equipment for cleanliness.		
Measure IR value of bus bars including circuit breakers at 500V. Minimum value : 10 Mohm	Mohm	
Measure IR value of distribution polarities buses at 500 V. Minimum value 10MOhm	Mohm	
Check polarity of bus wiring		
Energise anti-condensation heater and check hygrostat working (On-Off) and that the system is heating correctly.		
Check protection devices rating and settings in accordance with relay protection study, if any		
Test earth leakage protection operation		
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5		
Energise switchboard incoming supply and phase out.		
Check meters and indicators		
Check phase balancing		

COMMENTS :

Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name Signature	This document is the property of Total. It must not be stored, reproduced or disclosed to others without written authorisation from the Company.		

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	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET AC UPS		PROJECT rev --- Date --- / --- / ---	
	BASIC FUNCTION N° : DESCRIPTION : EQUIPMENT N° : DWG N° :		SUBSYSTEM : LOCATION : TASK N° :	
DATA				
MANUFACTURER SERIAL N°:		RATING FREQUENCY	kVA Hz	INPUT OUTPUT
				V V
FUNCTION TEST REQUIREMENT		RESULT	INITIALS	
Check precommissioning activities of the UPS have been carried out (check list and test sheet).				
Check equipment for cleanliness.				
Energise control of UPS feeders				
Full test feeder breaker operations in test position.				
Test breakers interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5				
Check protection setting on all upstream feeder protective devices.				
Carry out detailed tests of UPS system as per manufacturer's test procedure and record on attached manufacturer test sheets.				
These tests include as minimum:		■	■	
Output voltages adjustment				
Permanent insulation monitor test (if any)				
Alarms checking				
Remote input/output signals				
Parallel operation				
Automatic and manual transfer sequences				
Test UPS interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5				
Perform battery charge / discharge tests according to Manufacturer's instructions and record on attached sheet FTR-4				
Perform battery autonomy test at rated power and record results on attached sheet FTR-3				
Testing & measurement instruments used				
Type	Serial n°	Calibration certificate	Validity	
Carried out by		Commissioning SPDT	Certifying Authority	
Date				
Name				
Signature				

FORM N° : FP16A - Sh. 1/1 - nov 04

Appendix 2

	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET		PROJECT rev --- Date --- / --- / ---
	DC SYSTEM		
	BASIC FUNCTION N° : _____		
DESCRIPTION : _____		SUBSYSTEM : _____	
EQUIPMENT N° : _____		LOCATION : _____	
DWG N° : _____		TASK N° : _____	
DATA			
MANUFACTURER		RATING	INPUT
SERIAL NO.		OUTPUT	
FUNCTION TEST REQUIREMENT		RESULT	INITIALS
Check precommissioning activities of the DC system have been carried out (check list and test sheet).			
Check equipment for cleanliness.			
Energise control of DC system feeders			
Full test feeder breaker operations in test position.			
Test breakers interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5			
Check protection setting on all upstream feeder protective devices.			
Carry out detailed tests of DC system as per manufacturer's test procedure and record on attached manufacturer test sheets.			
These tests include as minimum:			
Output voltages adjustment			
Permanent insulation monitor test (if any)			
Test DC system interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5			
Perform battery Charge / discharge tests as appropriate according to Manufacturer's instruction and record on attached sheet FTR-4			
Perform battery autonomy test at rated power and record results on attached sheet FTR-3			
Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity
	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			

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Appendix 2

	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET LIGHTING & SMALL POWER	PROJECT Rev --- Date --- / --- / ---	
BASIC FUNCTION N° :		SUBSYSTEM :	
DESCRIPTION :		LOCATION :	
EQUIPMENT N° :		TASK N° :	
DWG :			
DATA			
CIRCUITS N°			
1	Check precommissioning activities have been carried out (refer to check list and test sheet).		
2	Check equipments for cleanliness.		
3	Measure Insulation resistance value of equipments and feeder cable at 500V. Minimum value: 10 Mohm		
4	Energise		
5	Test earth leakage protection operation (if any)		
Record results on attached sheet FTR-8			
FOR LIGHTING CIRCUITS ONLY			
6	Measure full load current of each lighting circuit	A	
7	Switch of power supply of self contained battery back-up fittings and record time that lamps remains illuminated.		
8	Test automatic switching device (if any)		
Record results on attached sheet FTR-6			
COMMENTS			
Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity
	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			

FORM N° : FP18 - Sh. 1/1 - Janv 05

Appendix 2

	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET POWER SOCKET OUTLET		PROJECT Rev --- Date --- / --- / ---																														
	BASIC FUNCTION N° : DESCRIPTION : EQUIPMENT N° : DWG :		SUBSYSTEM : LOCATION : TASK N° :																														
<table border="1"> <thead> <tr> <th colspan="3">DATA</th> </tr> </thead> <tbody> <tr> <td>VOLTAGE:</td> <td>CUBICLE N°:</td> <td>IP RATING:</td> </tr> <tr> <td>RATING: A</td> <td>N° OF OUTLETS:</td> <td></td> </tr> <tr> <td colspan="2">SUPPLIED FROM SWITCHBOARD:</td> <td></td> </tr> </tbody> </table>				DATA			VOLTAGE:	CUBICLE N°:	IP RATING:	RATING: A	N° OF OUTLETS:		SUPPLIED FROM SWITCHBOARD:																				
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FORM N° : FP19 - Sh. 1/1 - Nov 04																																	



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General Specification

Date: 09/05

GS EP EXP 107

Rev: 03

Appendix 2

	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET HEATER		PROJECT Rev --- Date --- / --- / ---																																				
	BASIC FUNCTION N° : DESCRIPTION : EQUIPMENT N° : DWG :		SUBSYSTEM : LOCATION : TASK N° :																																				
DATA																																							
MANUFACTURER:	VOLTAGE	V	IP RATING:																																				
SERIAL N°:	RATING	kW																																					
TYPE OF HEATER:	FLC	A																																					
TAG NO. OF ASSOC. UCP/CONTROL:																																							
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FORM N° : FP10 - Sh. 1/1 - Nov 04

Appendix 2

	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET TRACE HEATING		PROJECT Rev --- Date --- / --- / ---																																
	BASIC FUNCTION N° : _____ SUBSYSTEM : _____ DESCRIPTION : _____ LOCATION : _____ EQUIPMENT N° : _____ TASK N° : _____ DWG : _____																																		
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COMMENTS 																																			
<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: center;">Testing & measurement instruments used</th> </tr> <tr> <th style="text-align: center;">Type</th> <th style="text-align: center;">Serial n°</th> <th style="text-align: center;">Calibration certificate</th> <th style="text-align: center;">Validity</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>				Testing & measurement instruments used				Type	Serial n°	Calibration certificate	Validity																								
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	Carried out by	Commissioning SPDT	Certifying Authority																																
Date																																			
Name Signature																																			

FORM N° : FP22 - Sh. 1/1 - Nov 04

Appendix 2

	ELECTRICAL		PROJECT
	COMMISSIONING FUNCTIONAL TEST SHEET		Rev --- Date --- / --- / ---
NAV AIDS			
BASIC FUNCTION N° :		SUBSYSTEM :	
DESCRIPTION :		LOCATION :	
EQUIPMENT N° :		TASK N° :	
DWG :			
DATA			
MANUFACTURER:	VOLTAGE		
SERIAL NUMBER:	RATING	CLASSIFICATION	
FUNCTION TEST REQUIREMENT		RESULT	INITIALS
Check precommissioning activities have been carried out (refer to check list and test sheet).			
Check commissioning test sheets FP16B of DC navigation aids system are signed.			
Check commissioning test sheets FTR-3 and FTR-4 of battery navigation aids system are signed.			
Measure Insulation resistance value of equipment and feeder cable at 1000V. Minimum value: 50 Mohm		Mohm	
Energise control of Navaids feeder and put feeder in test position.			
Full test feeder breaker operation in test position.			
Energization			
Carry out functional test of navigation aids in local and remote configurations as indicated on attached sheet FTR-1			
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FTR-5			
Test NavAids systems according to Manufacturer's commissioning procedure and attach			
<u>Marine navigation lights</u> : Check lighting , intermittent lighting device and automatic change over device are OK			
<u>Aircraft obstruction lights</u> : check lighting			
<u>Fog horn</u> : Check U signal , check manual , remote and automatic (if any) control			
Measure current value at feeder breaker :		A	
COMMENTS :			
Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity
Carried out by		Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			
FORM N° : FP25 - Sh. 1/1 - Nov.04			

Appendix 2

	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET		PROJECT Rev --- Date --- / --- / ---
	MISCELLANEOUS USER		
BASIC FUNCTION N° :		SUBSYSTEM :	
DESCRIPTION :		LOCATION :	
EQUIPMENT N° :		TASK N° :	
DWG :			
DATA			
SWITCHBOARD			
CIRCUIT REF.			
BREAKER RATING	A		
NOMINAL CURRENT:	A		
FUNCTION TEST REQUIREMENT		RESULT	INITIALS
Check precommissioning activities have been carried out (refer to check list and test sheet).			
Check equipment for cleanliness.			
Measure Insulation resistance value of equipment and feeder cable at 1000V. Minimum value: 100 Mohm		Mohm	
Energise control of equipment feeder			
Full test feeder breaker operation in test position.			
Check protection setting			
Test interface trips and signals (remote alarms & status) as indicated on attached Sheet FPR-5			
Energize			
Test control and safety functions according to manufacturer's procedure and as indicated on attached sheet FPR-1.			
Measure current value at feeder breaker :		A	
Attach test procedure, if any			
COMMENTS			
Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity
Carried out by		Commissioning SPDT	Certifying Authority
Date			
Name Signature			

FORM N° : FP27 - Sh. 1/1 - Nov 04

Appendix 2

[illegible]



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET PROTECTION RELAY	PROJECT Rev --- Date --- / --- / ---
BASIC FUNCTION N° :		SUBSYSTEM :
DESCRIPTION :		LOCATION :
EQUIPMENT N° :		TASK N° :
DWG :		

RELAY DATA			
MANUFACTURER:		SERIAL NUMBER:	
RELAY TYPE:		AUXILIARY SUPPLY:	
LOCATION:	SWITCHBOARD:	CUBICLE:	

CURRENT TRANSFORMERS			
TAG	NUMBER OF	RATIO	LOCATION

VOLTAGE TRANSFORMERS			
TAG	NUMBER OF	RATIO	LOCATION

TEST RESULTS (refer to manufacturer's procedure)					
ANSI FUNCTION	SETTING	INJECTION	TRIP VALUE	TIME DELAY	
				SETTING	TRIP value

COMMENTS

Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity

Date	Carried out by	Commissioning SPDT	Certifying Authority
Name			
Signature			

FORM N° : FTR-2 - Sh. 1/1 - Nov 04



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET BATTERY AUTONOMY	PROJECT rev --- Date --- / --- / ---				
BASIC FUNCTION N° :		SUBSYSTEM :				
DESCRIPTION :		LOCATION :				
EQUIPMENT N° :		TASK N° :				
DWG N°						
BATTERY DATA						
MANUFACTURER	SERIAL N°	TYPE				
RATED VOLTAGE	V	BATTERY CAPACITY Ah				
NUMBER OF CELLS		RATED AUTONOMY min				
BATTERY AUTONOMY TEST						
FLOATING 'BATTERY VOLTAGE	V	TEST LOAD kW				
Time	0'	15"	30"	45"	1'	1'30"
BATTERY VOLTAGE						
DISCHARGE CURRENT						
Time	2'	3'	4'	5'	6'	7'
BATTERY VOLTAGE						
DISCHARGE CURRENT						
Time	8'	9'	9'	10'	15'	20'
BATTERY VOLTAGE						
DISCHARGE CURRENT						
Time	25'	30'	35'	40'	45'	50'
BATTERY VOLTAGE						
DISCHARGE CURRENT						
Time	55'	60'	70'	80'	90'	100'
BATTERY VOLTAGE						
DISCHARGE CURRENT						
Time	110'	120'				
BATTERY VOLTAGE						
DISCHARGE CURRENT						
BATTERY STOPPING VOLTAGE :		DESIGN :	MEASURED :			
COMMENTS						
Testing & measurement instruments used						
Type	Serial n°	Calibration certificate	Validity			
	Carried out by	Commissioning SPDT	Certifying Authority			
Date						
Name						
Signature						

FORM N° : FTR-3 - Sh. 1/1 - Nov 04

Appendix 2

[illegible]

Appendix 2

	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET BATTERY CHARGE / DISCHARGE Record sheet (continuation sheet)		PROJECT	
			Rev --- Date --- / --- / ---	
SUBSYSTEM :			TASK N°	
TEST TYPE: Charge ☐ Discharge ☐			Duration: h	Sheet --- of - Time:

CELL TAG N°	CELL Voltage	Electrolyte Temperature		Specific gravity	
		Initial	Final	Initial	Final

COMMENTS

Testing & measurement instruments used			
Type	Serial n°	Calibration certificate	Validity

	Carried out by	Commissioning SPDT	Certifying Authority
	Date		
Name			
Signature			

FORM N° : ETR-4 - Sh. 2/2 - Janv-05



	ELECTRICAL COMMISSIONING FUNCTIONAL TEST SHEET REMOTE SIGNALLING RECORD SHEET	PROJECT Rev --- Date --- / --- / ---																																																																																																								
BASIC FUNCTION N° :		SUBSYSTEM :																																																																																																								
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FORM N° : FTR-5 - Sh. 1/1 - Nov 04

Appendix 2

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Appendix 2

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Appendix 2

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Appendix 3

Instrument basic functions

www.IranPiping.ir



Exploration & Production

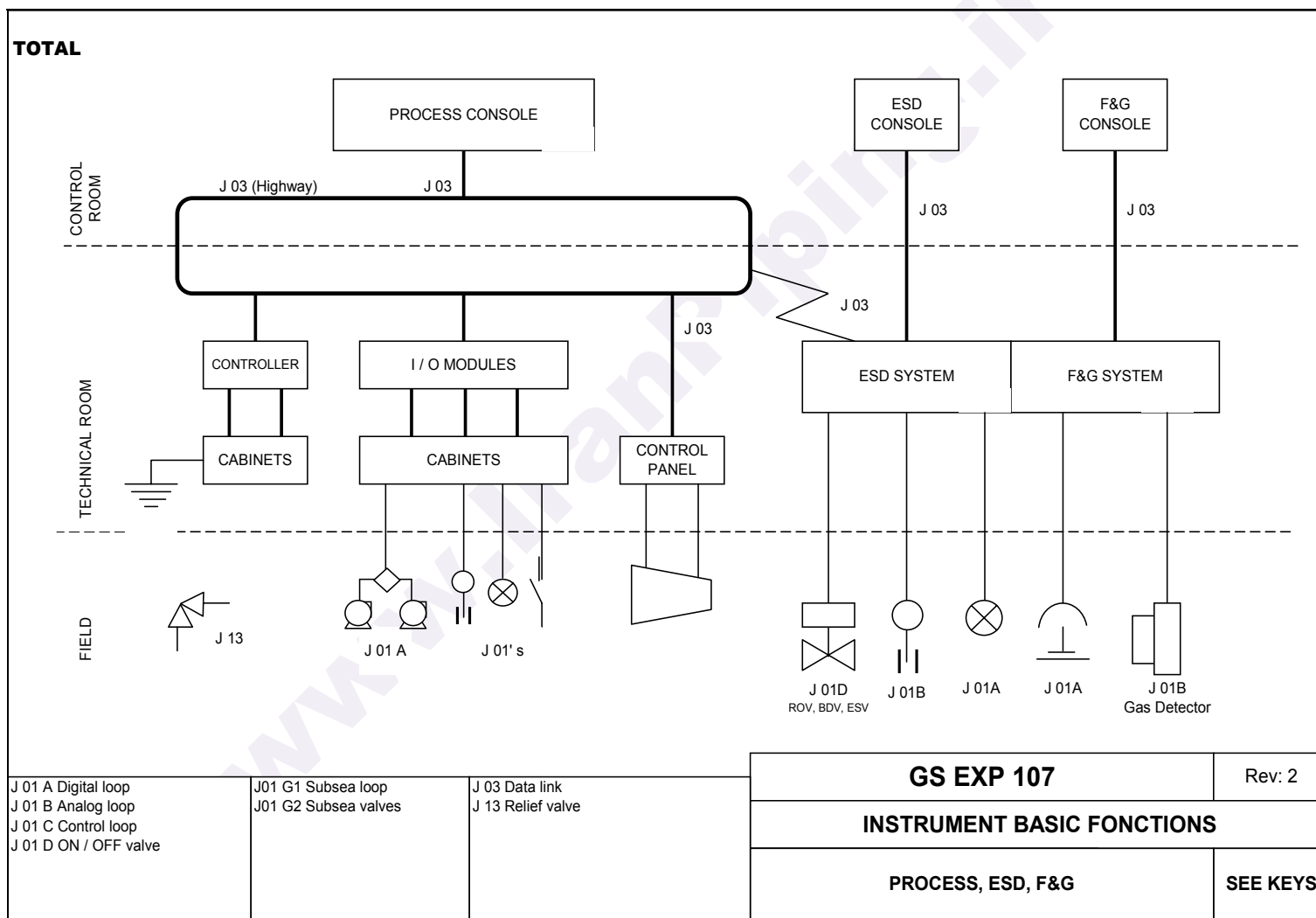
General Specification

Date: 09/05

GS EP EXP 107

Rev: 03

Appendix 3





Appendix 4

Instrument functional test sheets

www.IranPiping.ir



		COMMISSIONING FUNCTIONAL TEST SHEET				PROJECT	
		INSTRUMENT				Task:	
		J01 - A : DIGITAL LOOP				Loop tag:	
Basic Function		System / Subsystem				TSLD-Rev:	
When relevant loop type as per PID Symbol Instrument (e.g.Motor type I)							
Associated tags		Yes	No	N A	Comment		
	Normal state versus faulty process conditions						
	Equipment status						
	Priority selector for motors in duty/stand-by configuration						
	Line monitoring output						
	Associated ESD level tag				Note 1		
	Safety level tripped						
	Associated outputs						
Note 1 : When checking the trip condition, report this test on the Safety Logic Diagram by highlighting for instance the corresponding input of the relevant safety level to avoid repeating this test twice							
Note 2 : This form might be amended as per the project ICSS Standard if necessary							
Punch list raised		YES ☐		NO ☐			
		CARRIED OUT BY		CONTRACTOR		COMPANY	
DATE							
NAME							
SIGNATURE							
FORM: FJ01A							

Appendix 4

	COMMISSIONING FUNCTIONAL TEST SHEET				PROJECT																																																																																																																																																																									
	INSTRUMENT				Task:																																																																																																																																																																									
	J01 - B : ANALOG LOOP				Loop tag:																																																																																																																																																																									
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FORM: FJ01B



Exploration & Production

General Specification

Date: 09/05

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Appendix 4

		COMMISSIONING FUNCTIONAL TEST SHEET						PROJECT		
		INSTRUMENT						Task:		
		J01 - C : CONTROL LOOP						Loop tag:		
Basic Function		System / Subsystem						TSLD-Rev:		
Associated tags						Yes	No	N A	Comment	
	Unit								Transmitter A	
	Scale									
	Value of the threshold 1									
	Value of the threshold 2									
	Value of the threshold 3								Transmitter B	
	Value of the threshold 4									
	Value of the threshold 1									
	Value of the threshold 2									
	Value of the threshold 3									
	Value of the threshold 4									
	Normal state versus faulty process conditions									
	Associated outputs (e.g. start motor)									
	Loop type								Can be direct/reverse	
	Valve 1 : Fail safe type								splitrange/redundant	
	Valve 2 : Fail safe type								Can be Open/Closed	
	Valve 1 : Stroke limitation (mechanical stop)								or locked	
	Valve 2 : Stroke limitation (mechanical stop)								Can be Open/Closed	
	Controller in manual mode					0%	25%	50%	75%	100%
	Control valve 1 position									
	Control valve 2 position									
	Output limitation	Valve 1	Yes	No	Valve 2	Yes	No			
	Air supply	Valve 1		bar	Valve 2		bar			
Note 2 : This form might be amended as per the project ICSS Standard if necessary										
Punch list raised		YES ☐		NO ☐						
		CARRIED OUT BY		CONTRACTOR		COMPANY				
DATE										
NAME										
SIGNATURE										
FORM: FJ01C										



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Date: 09/05

GS EP EXP 107

Rev: 03

Appendix 4

		COMMISSIONING FUNCTIONAL TEST SHEET INSTRUMENT JO1 - D : ON / OFF VALVE				PROJECT	
						Task:	
Basic Function		System / Subsystem		TSLD			
Valve type as per PID Symbol Instrument							
Associated tags		Yes	No	N A	Note		
	Line cleaning (e.g. Air instrument blowing)						
	Local reset						
	Remote command : Solenoid valve 1 energized						
	Remote command : Solenoid valve 2 energized						
	Local indication of the valve position						
	Open limit switch						
	Closed limit switch						
	Pressure transmitter on control line						
	Local closing command						
	Local opening command						
	Opening time sec. restriction adjusted						
	Closing time sec. restriction adjusted						
	interlock function						
	Fail safe position on loss of electrical signal				O=Open C=Closed		
	Fail safe position on loss of power fluid				O=Open C=Closed		
	Timer checking				Value:		
	Number of operations on accumulator						
	ESD signal and solenoid valve test facility						
	Solenoid valve override indication on ICSS						
	Local indication of deenergization of the solenoid valve						
	Partial stroke checking						
Note : This form might be amended as per the project ICSS Standard if necessary							
Punch list raised		YES ☐		NO ☐			
		CARRIED OUT BY		CONTRACTOR		COMPANY	
DATE							
NAME							
SIGNATURE							

FORM: FJ01D



	COMMISSIONING FUNCTIONAL TEST SHEET				PROJECT	
	INSTRUMENT				Task:	
	J01 - G1: SUBSEA LOOP				Loop tag:	
Basic Function		System / Subsystem		TSLD-Rev:		

CABINET : _____ PID N° : _____ CAL _____

ASSOCIATED TAGS _____ UNIT: _____

LOOP TYPE : OPEN ☐ CLOSED ☐

SWCU ADDRESSES :

TAG / ASS. TAGS	ADDRESS *	CHANNEL *	SIGNAL TYPE *	SETTING

INPUT : ANALOG ☐ DIGITAL ☐

	0%	50%	100%	SETTING
CONSOLE				
ALARM SETTING HIGH / HIGH HIGH				
ALARM RESET				
ALARM SETTING LOW / LOW LOW				
ALARM RESET				

CONDITIC NORMAL OPEN ☐ CLOSED ☐ TRIP/ALARM: OPEN ☐ CLOSED ☐

OUTPUT CONTROL/TRIP ☐ ALARM ☐

FAILSAFE POSITION OPEN ☐ CLOSED ☐

CONDITIC NORMAL OPEN ☐ CLOSED ☐ TRIP/ALARM: OPEN ☐ CLOSED ☐

DISPLAY :

MIMIC *	GROUP *	ALM TABLE *	ALM RESN *	PRINTER *
SWCU *				
PCS *				

OBSERVATIONS : Use continuation sheet if required

SIMULATOR USED :
* TO BE AMMENDED TO CORRESPOND TO SPECIFIC PROJECT SYSTEM.

Punch list raised	YES ☐	NO ☐	
	CARRIED OUT BY	CONTRACTOR	COMPANY
DATE			
NAME			
SIGNATURE			

FORM: FJ01G1



Exploration & Production

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Appendix 4

	COMMISSIONING FUNCTIONAL TEST SHEET			PROJECT	
	INSTRUMENT			Task:	
	J01 - G2: SUBSEA VALVES			Loop tag:	
Basic Function		System / Subsystem		TSLD-Rev:	
CABINET : PID N° :				CAL :	
ASSOCIATED TAGS :				UNIT:	
LOOP TYPE : OPEN ☐ CLOSED ☐					
SWCU ADDRESSES :					
TAG / ASS. TAGS		ADDRESS *	CHANNEL *	SIGNAL TYPE *	TEST RESULTS *
HS *					
ZSC *					
ZSO *					
XL *					
PT *					
PT *					
VALVE TAG : ESV..... FAILSAFE POSITION :					
INFERRED VALVE POSITION :					
TAG : PT		OPEN	CLOSED		
INDICATION SETPOINT					
INDICATION READING					
CHOKE VALVE : HV.....					
TAG	0%	50%	100%	ALARM SETTING	ALARM READING
HS *					
PT *					
PT *					
ZI *					
DISPLAY :					
	MIMIC *	GROUP *	ALM TABLE *	ALM RESN *	PRINTER *
SWCU *					
PCS *					
OBSERVATIONS : Use continuation sheet if required					
SIMULATOR USED :					
* TO BE AMMENDED TO CORRESPOND TO SPECIFIC PROJECT SYSTEM.					
Punch list raised	YES ☐	NO ☐			
	CARRIED OUT BY	CONTRACTOR	COMPANY		
DATE					
NAME					
SIGNATURE					
FORM: FJ01G2					

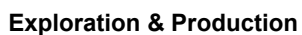


	COMMISSIONING FUNCTIONAL TEST SHEET		PROJECT	
	INSTRUMENT		Task:	
	J03 : Data link		Loop tag:	
Basic Function		System / Subsystem		TSLD-Rev:
Link Type 				
	TAG	Master/Slave		
Equipment 1				
Equipment 2				

Equipment N				
Correct communication (data, alarms, commands,...) Yes ☐ No ☐ Link fault Alarm ☐ Change over Yes ☐ No ☐ NA ☐				
Note : This form might be amended as per the project ICSS Standard if necessary				
Punch list raised		YES ☐	NO ☐	
	CARRIED OUT BY	CONTRACTOR	COMPANY	
DATE				
NAME				
SIGNATURE				

FORM: FJ03

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Appendix 4



COMMISSIONING FUNCTIONAL TEST SHEET
INSTRUMENT
J13 : RELIEF VALVES

PROJECT

Task:

Basic Function

System / Subsystem

TAG

Serial N°

Setting

Certification date**Installation date**

Block device removed

P&ID

Punch list raised

YES

NO

CARRIED OUT BY

CONTRACTOR

COMPANY

DATE _____

NAME _____

SIGNATURE

FORM: FJ13



Appendix 5

Telecommunication basic functions



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Appendix 5



GS EXP 107

TELECOMMS BASIC FONCTIONS

Abbreviations:

Key:

Notes:

Rev: 1

Type: I. 02

Type: I. 03

Type: I. 04

Type: I. 05

Type: I. 06

Type: I. 07

Type: I. 08

Type: I. 11

Type: I. 12

Type: I. 13

Type: I. 20

Type: I. 21

Type: I. 24

Type: I. 25

Type: I. 26 - C3

Type: I. 27

Type: S.I. 02

Type: S.I. 05

Type: S.I. 13

Type: S.I. 22 / 23

Type: S.I. 24

Type: S.I. 25

Type: S.I. 26 / 1

Type: S.I. 26 / 2

Type: S.I. 26 / C3

Type: S.I. 27

P.A. LOUDSPEAKERS LOOP

P.A. FLASHING LIGHT LOOP

P.A. CONTROL UNIT OR ACCES UNIT

TELEPHONE J.B ASSOCIATED FIELD EQUIPEMENT

DRILLER SELECTIVE INTERCOM

DRILLER'S INTERPHONE

DRILLER'S SOUND POWERED TELEPHONE

MESSAGE SWITCHING TERMINALS

METEOROLOGICAL DISPLAY UNIT

INTERCONTROL ROOM / INTERNAL CONTROL TELEPHONES

P. A MAIN RACK

PABX TLEPHONE

M.S.S MAIN EQUIPEMENT

METEOROLOGICAL MAIN EQUIPEMENT

PAGING SLAVE TRANSMITTER

ENTERTAINMENT MAIN EQUIPEMENT

PUBLIC ADDRESS SYSTEM

TELEPHONE NETWORK

INTERCONTROL ROOM / INTERNAL CONTROL TELEPHONES

TOPO & LINE OF SIGHT LINE TEST

MESSAGE SWITCHING SYSTEM

METEOROLOGICAL EQUIPEMENT

UHF, VHF, HF RADIOS (1)

UHF, VHF, HF RADIOS (2)

PAGING SYSTEM

ENTERTAINMENT SYSTEM



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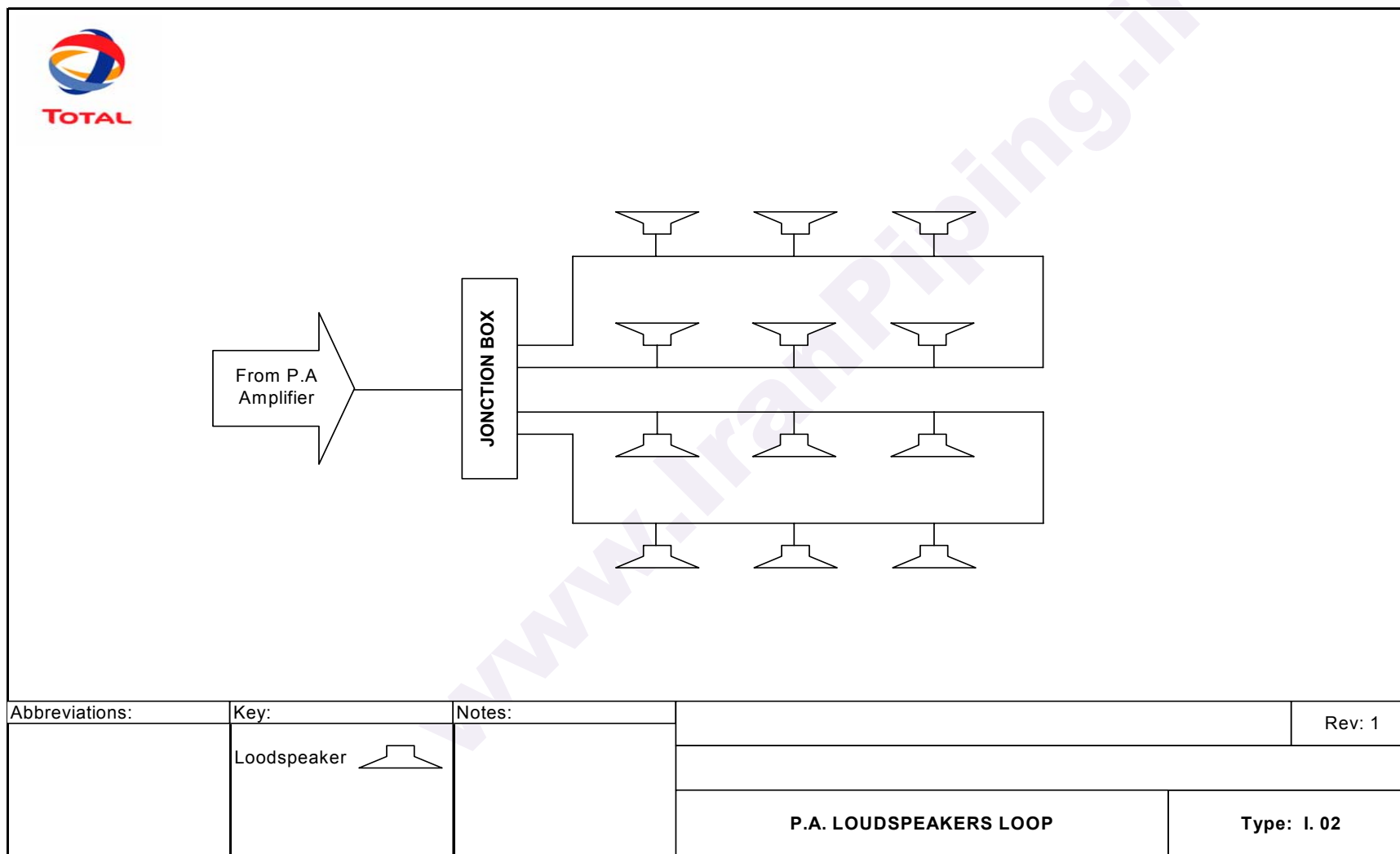
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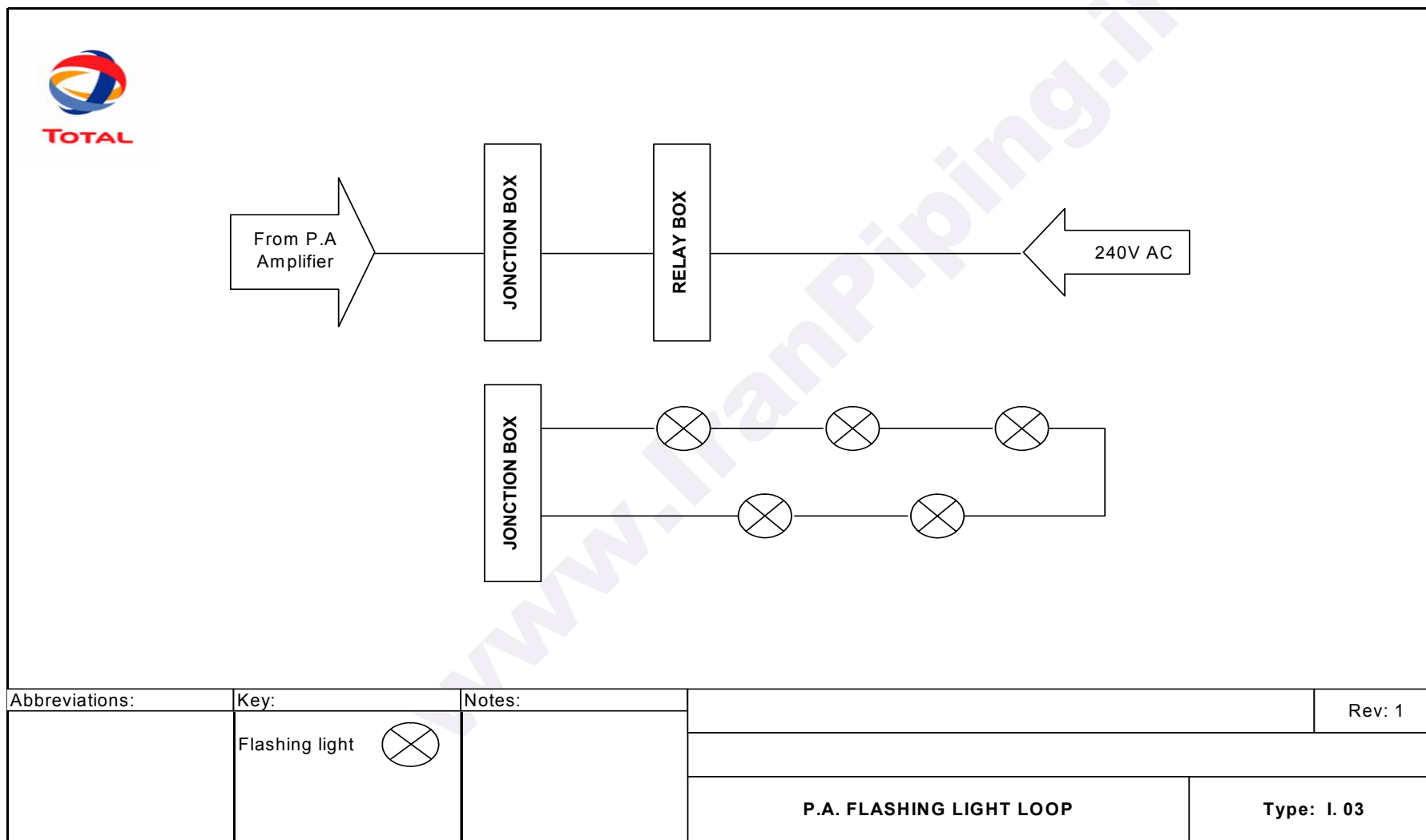
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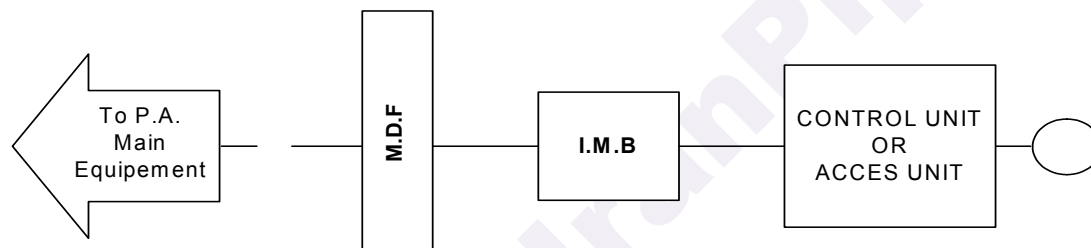
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Abbreviations:	Key:	Notes:	Rev: 1	
			P.A. CONTROL UNIT OR ACCES UNIT	Type: I. 04



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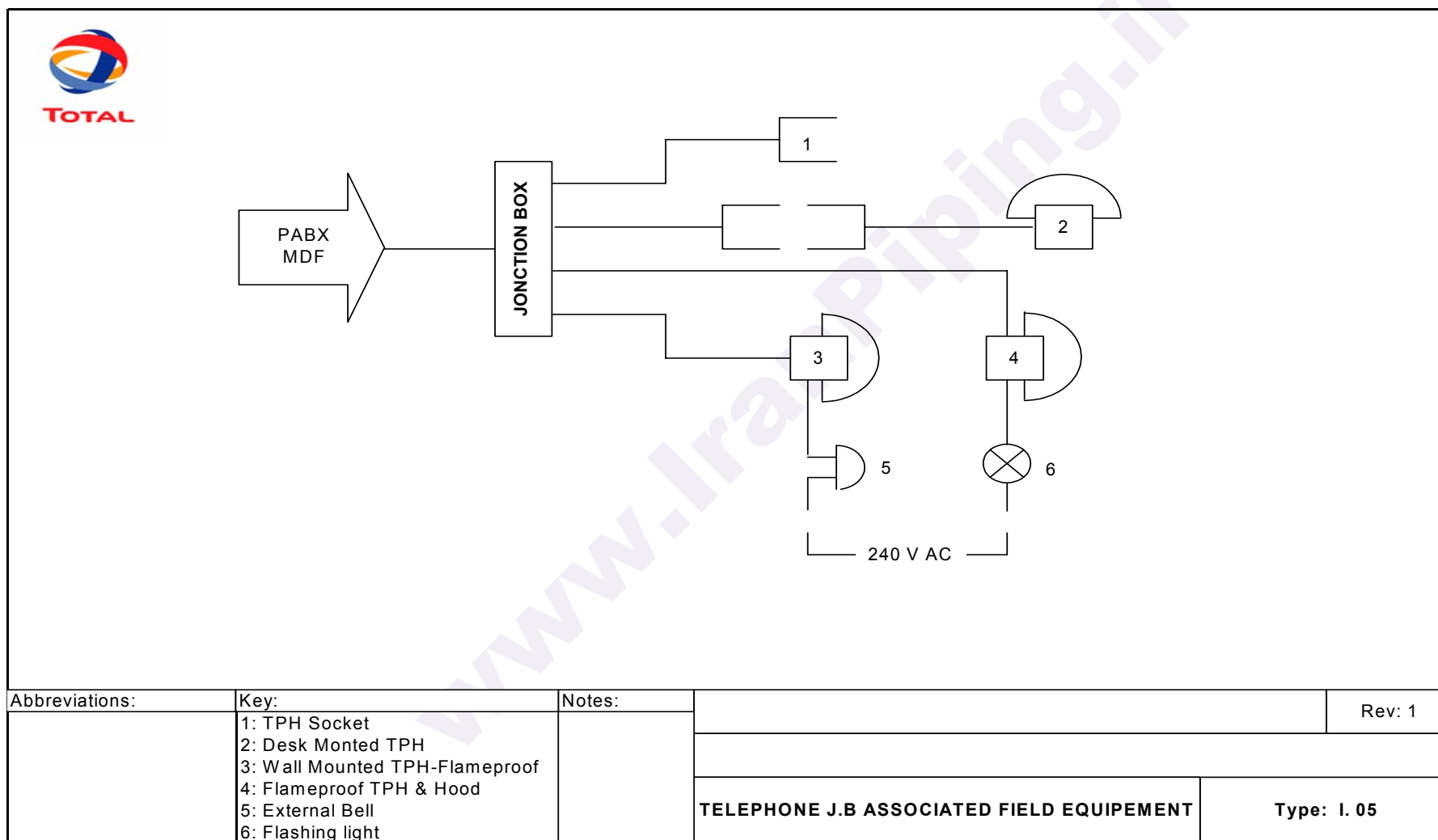
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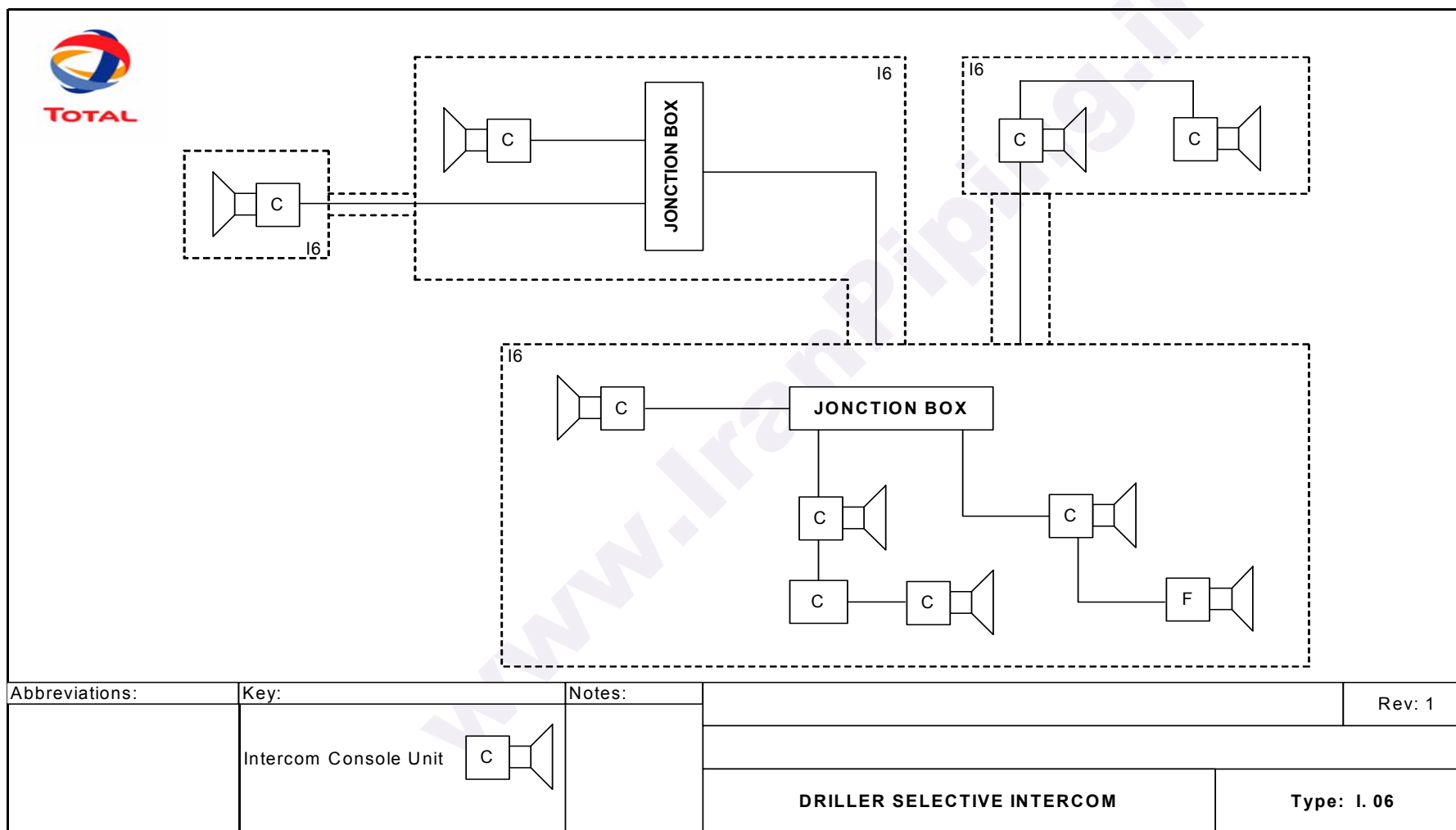
General Specification

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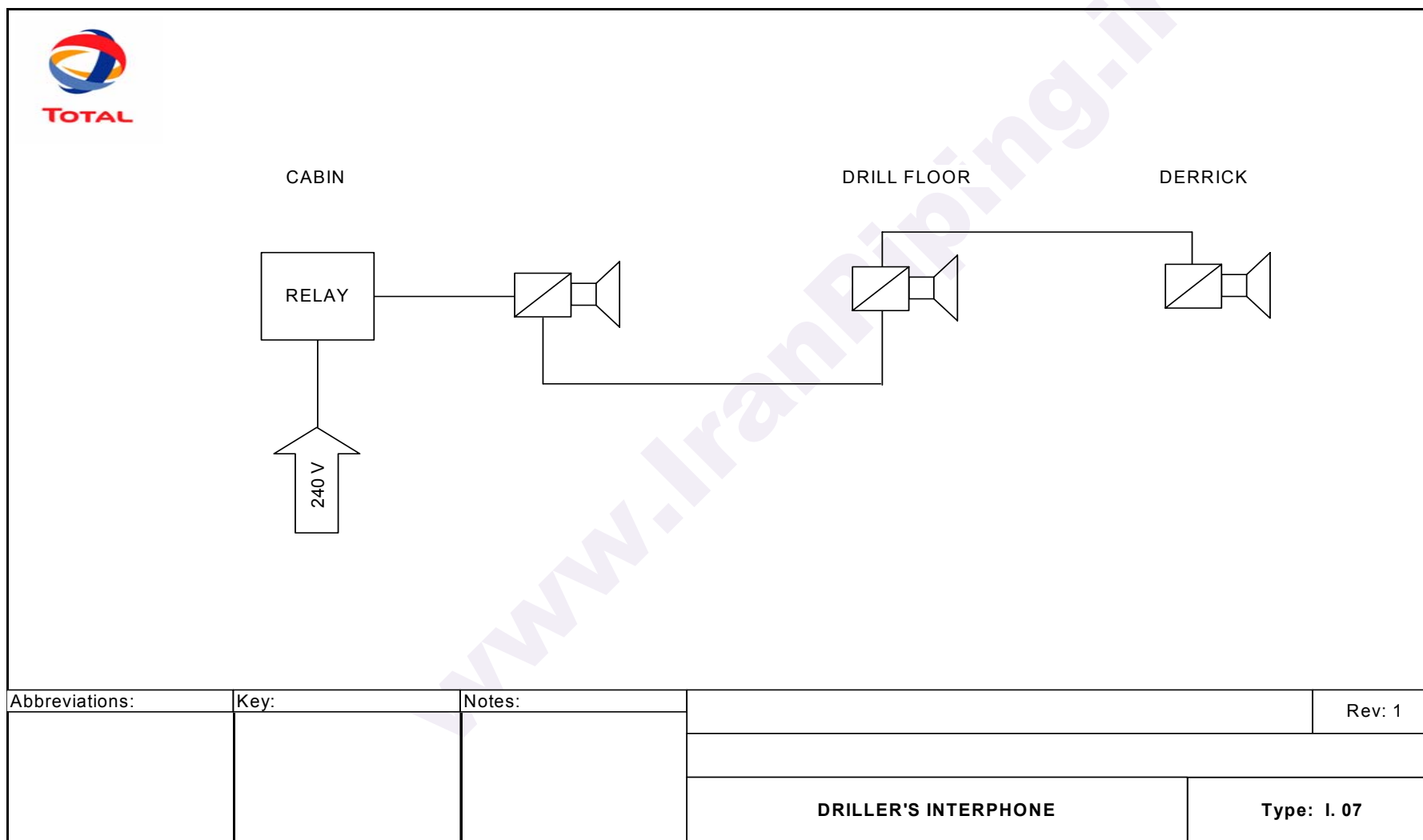
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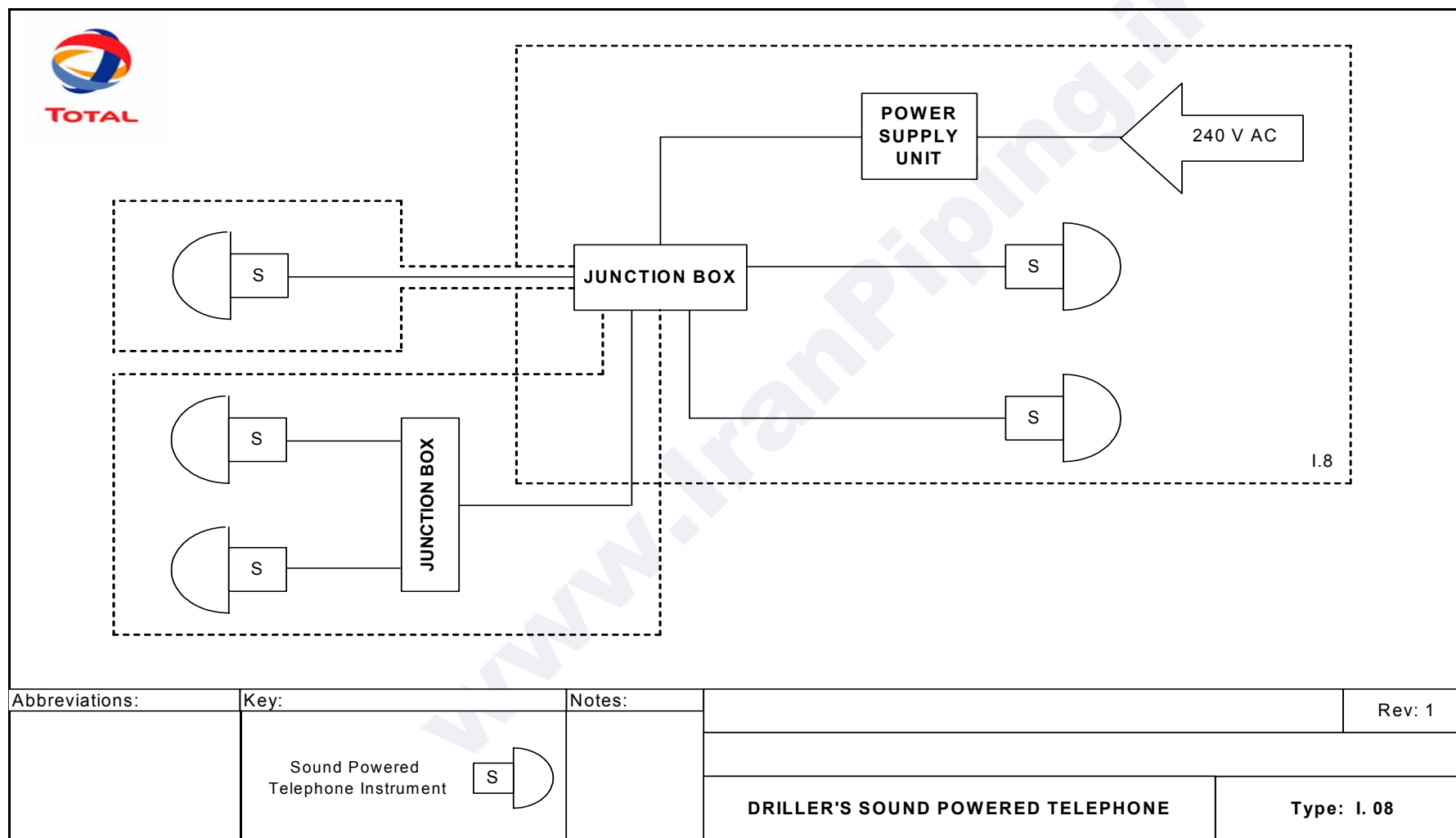
General Specification

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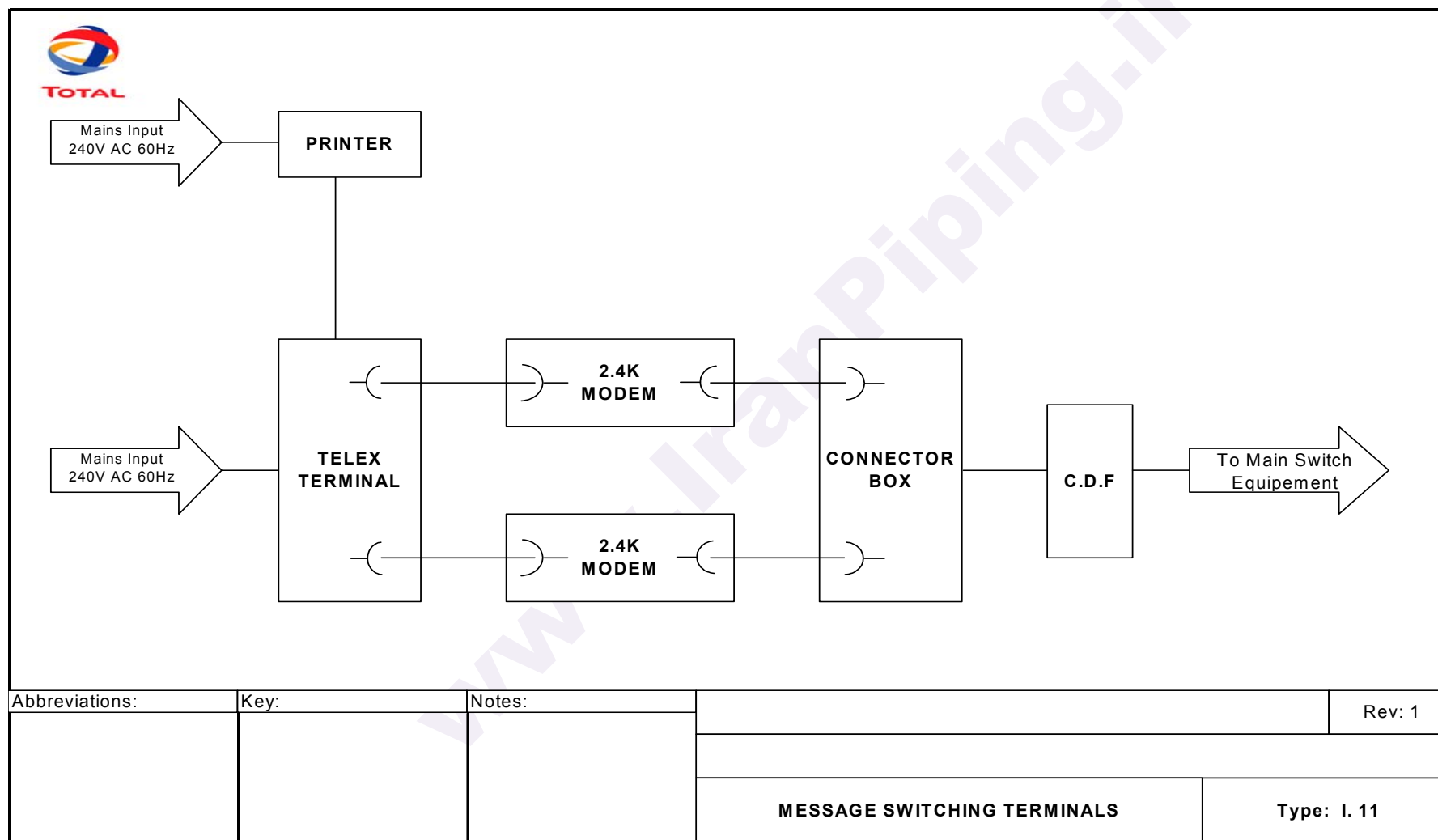
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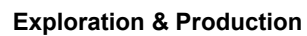
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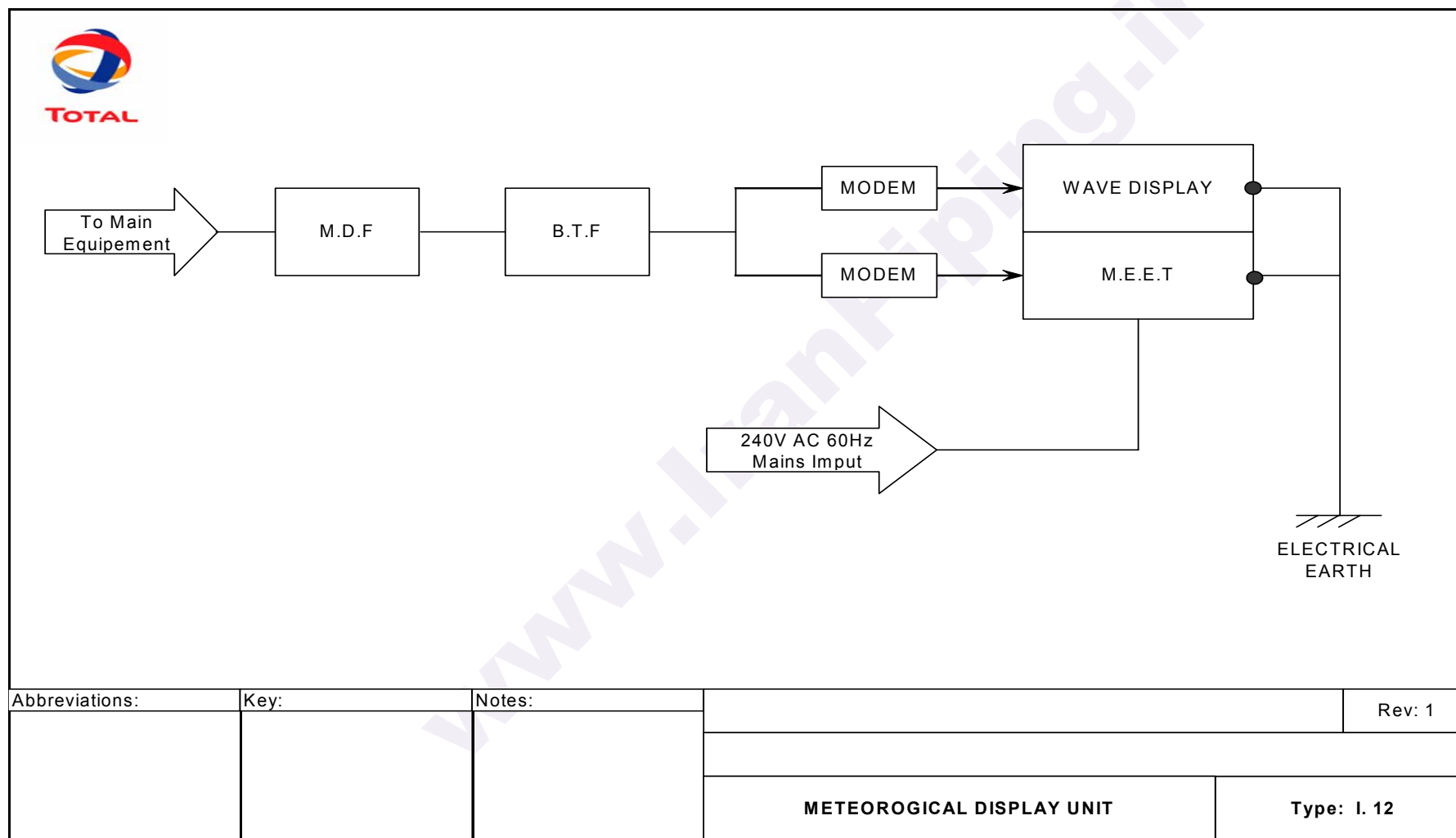
General Specification

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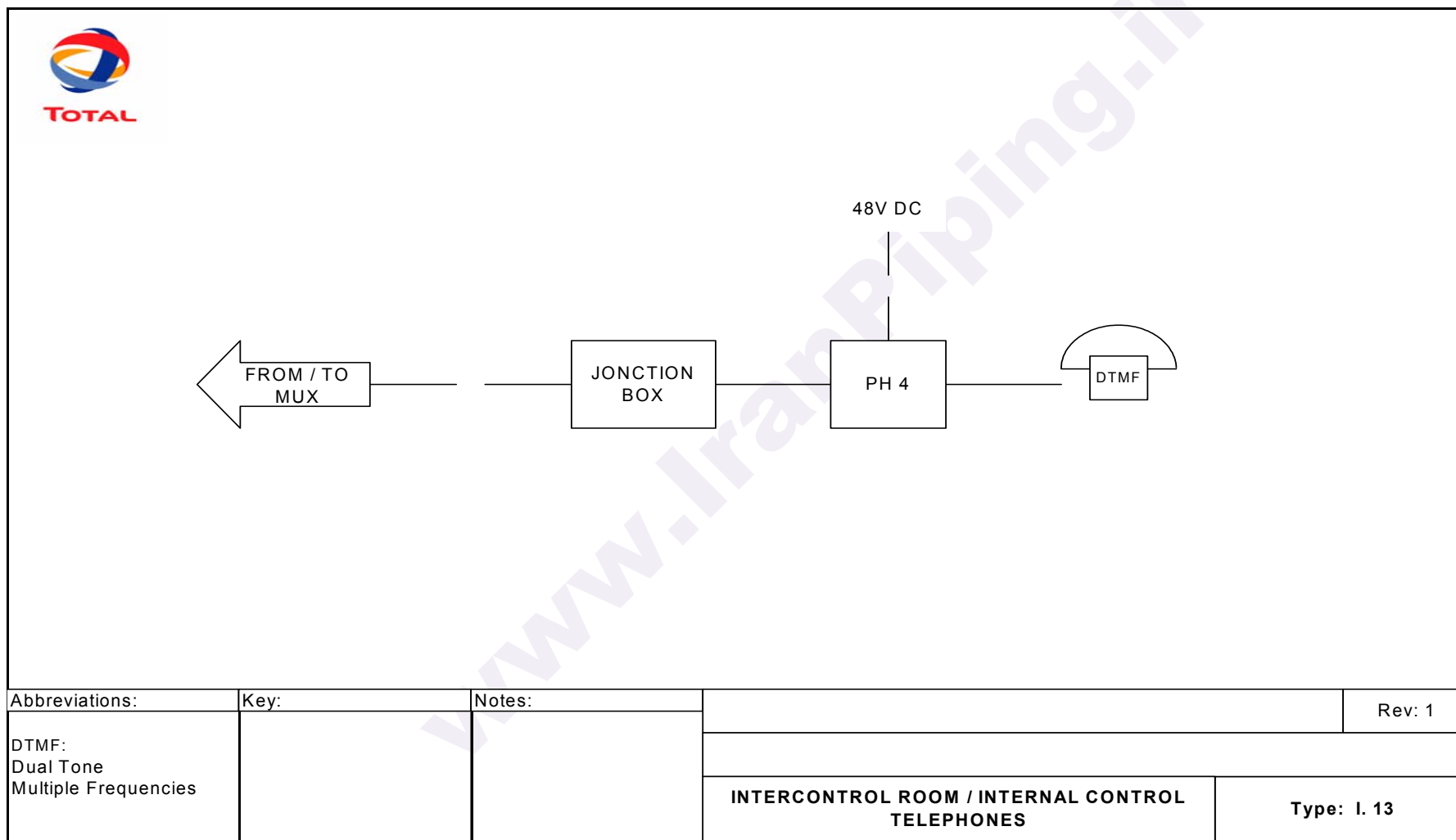
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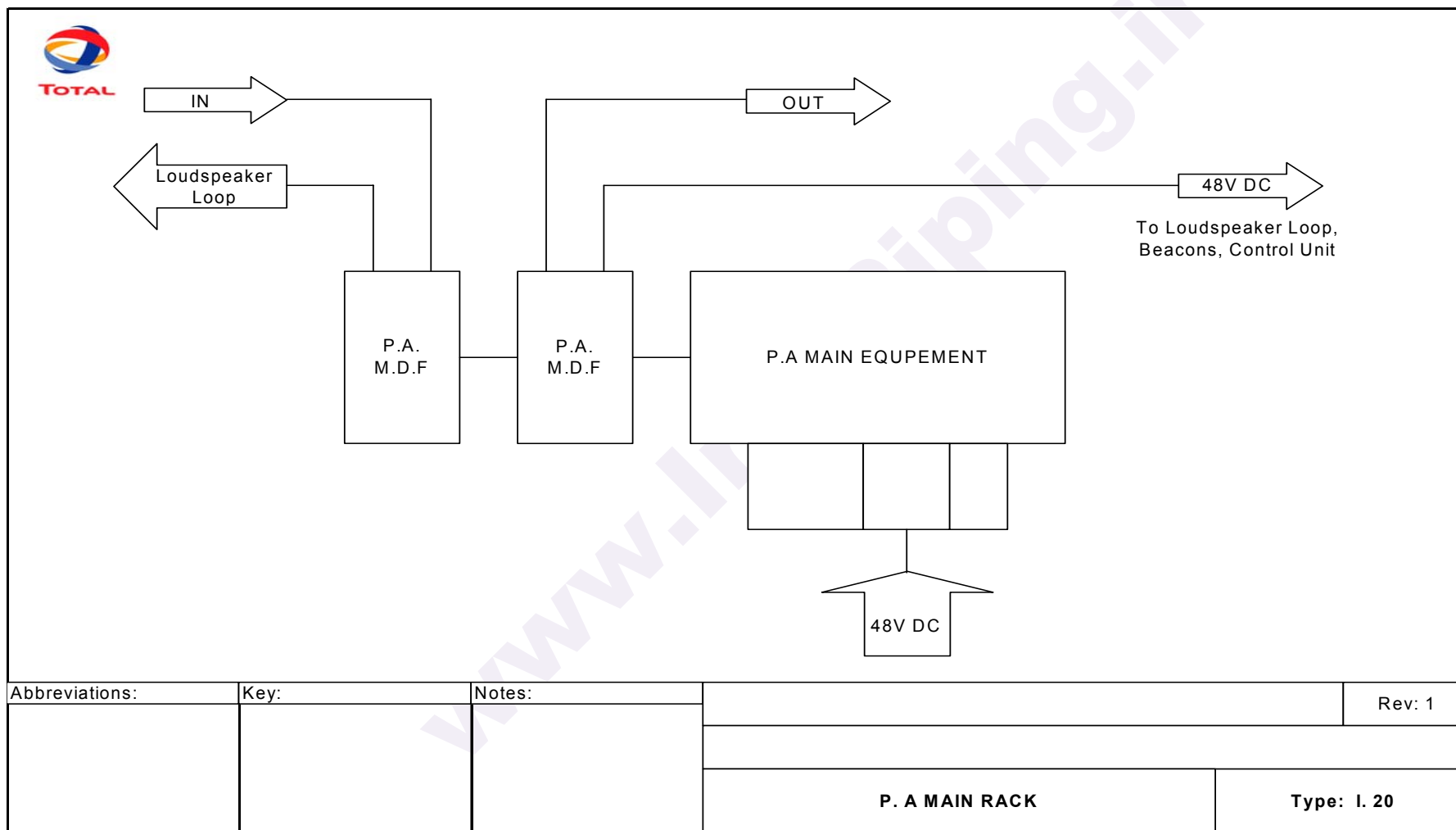
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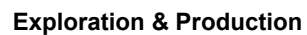
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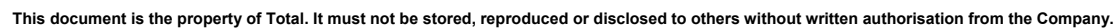
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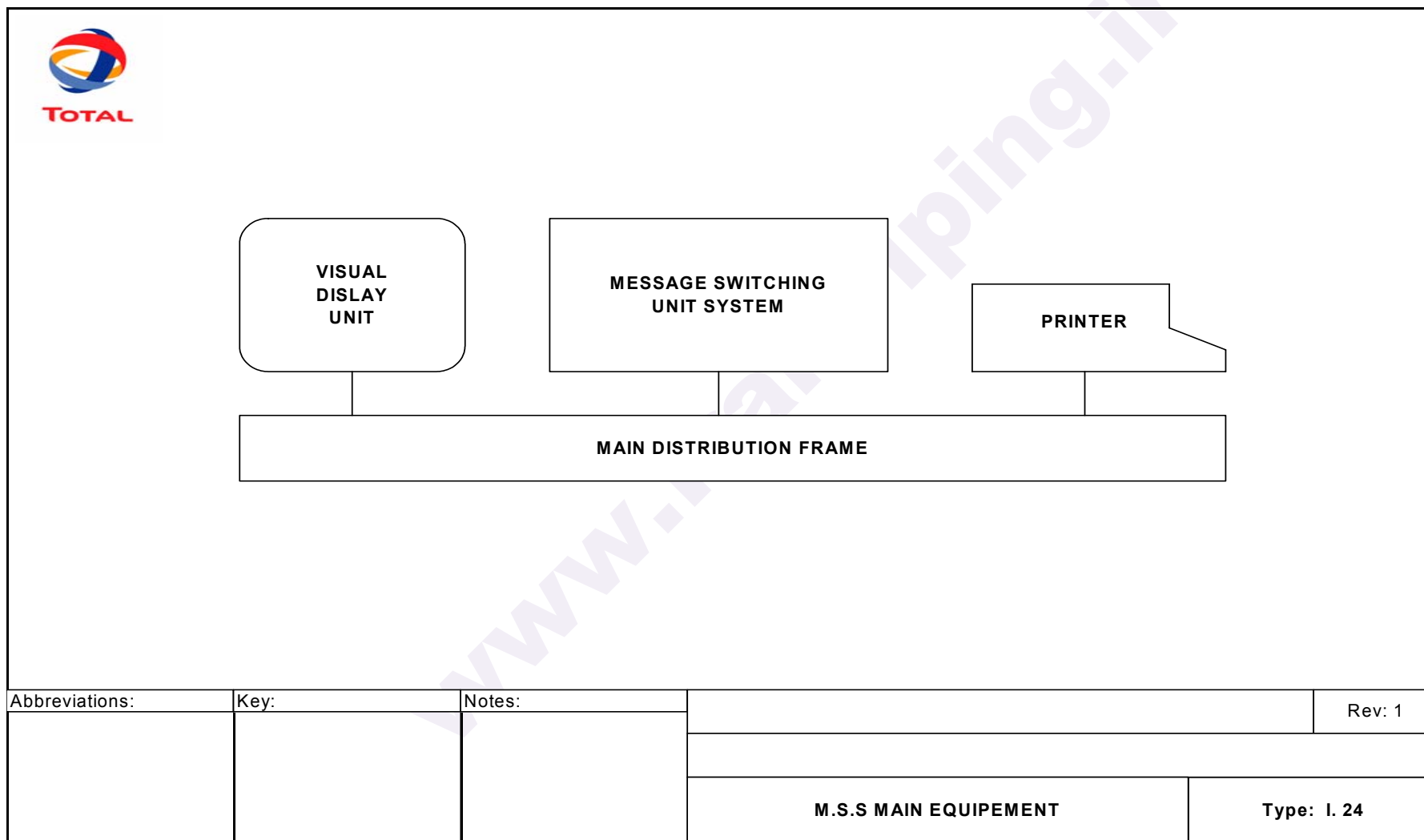
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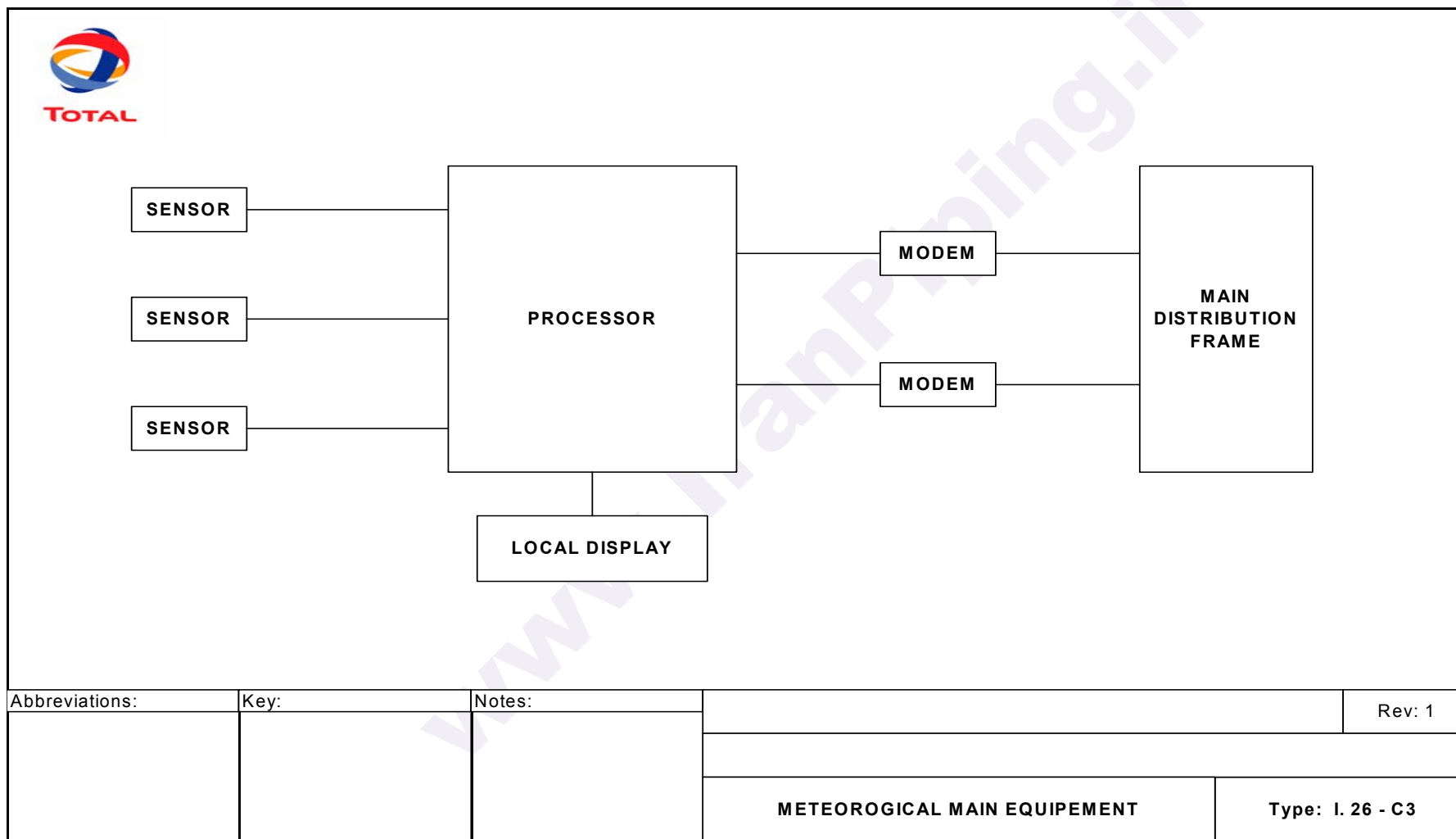
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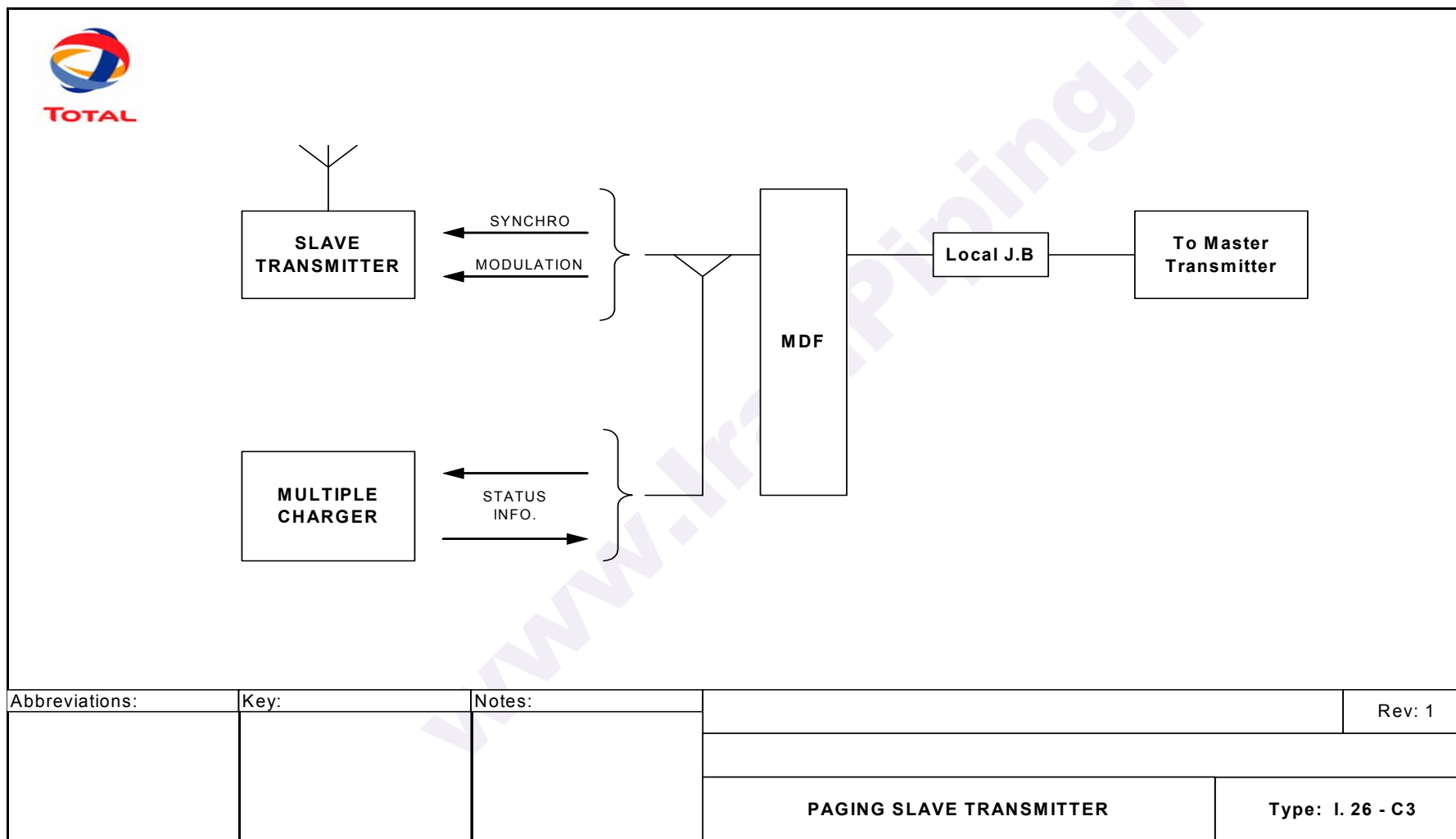
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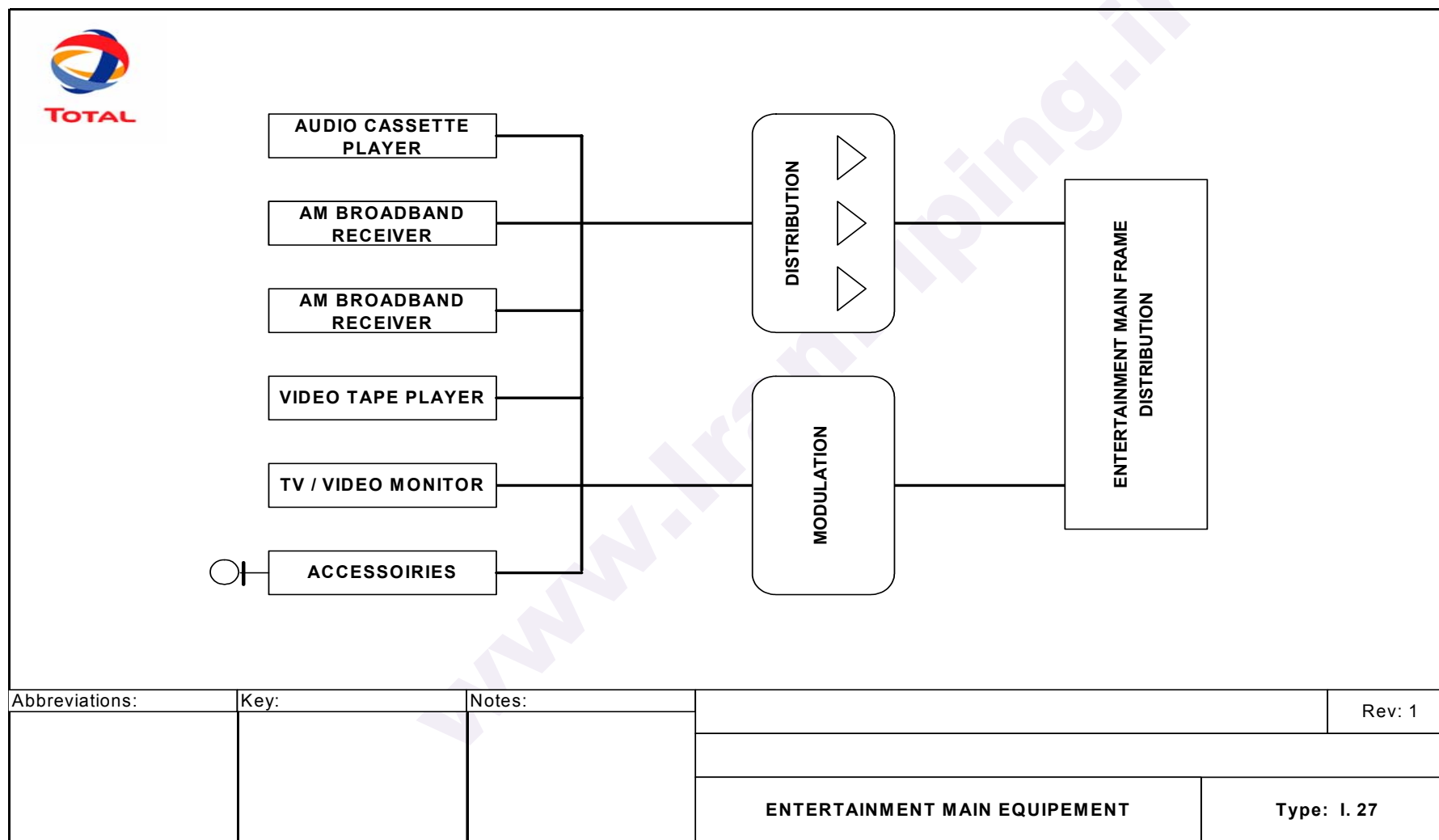
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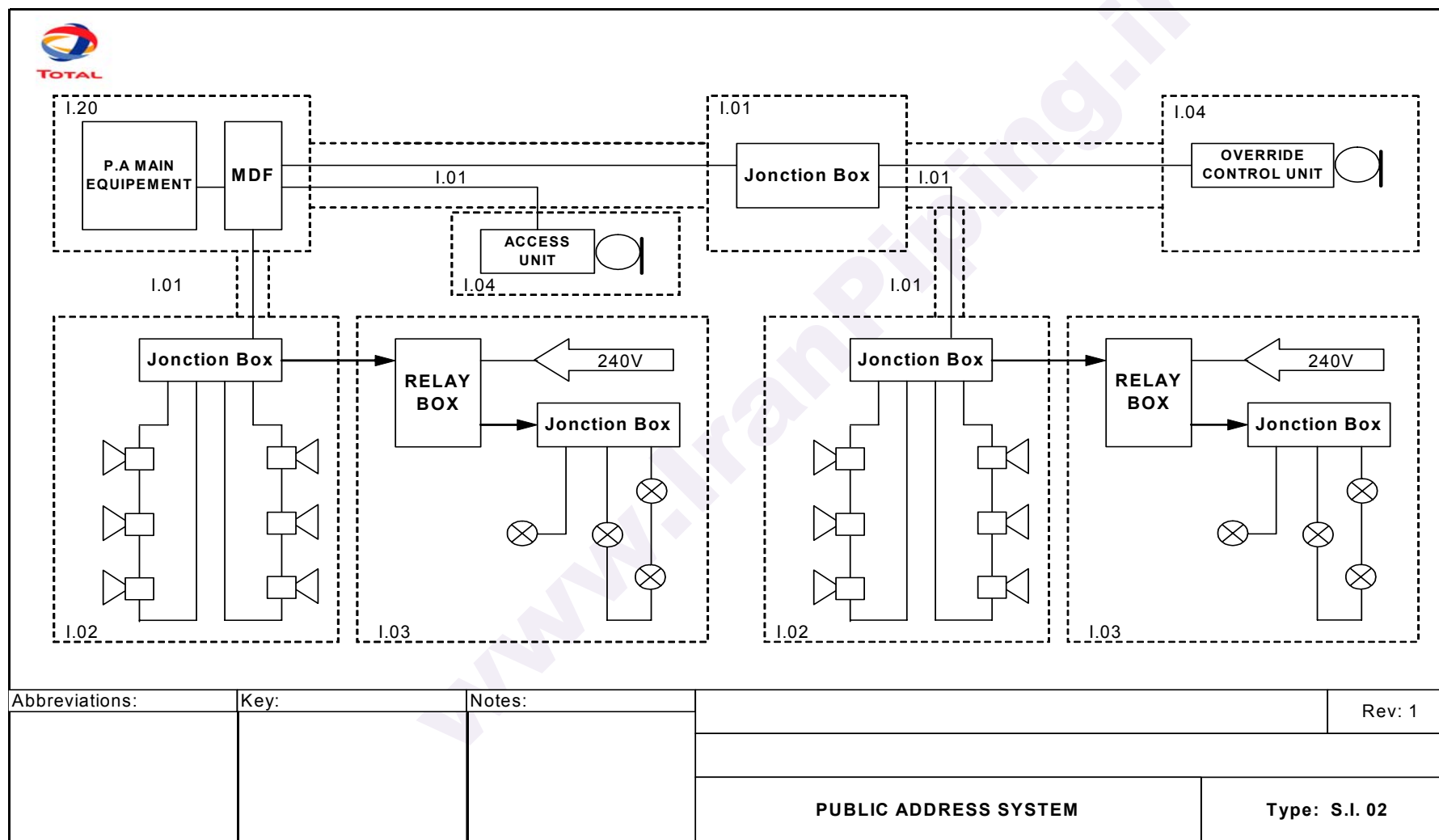
General Specification

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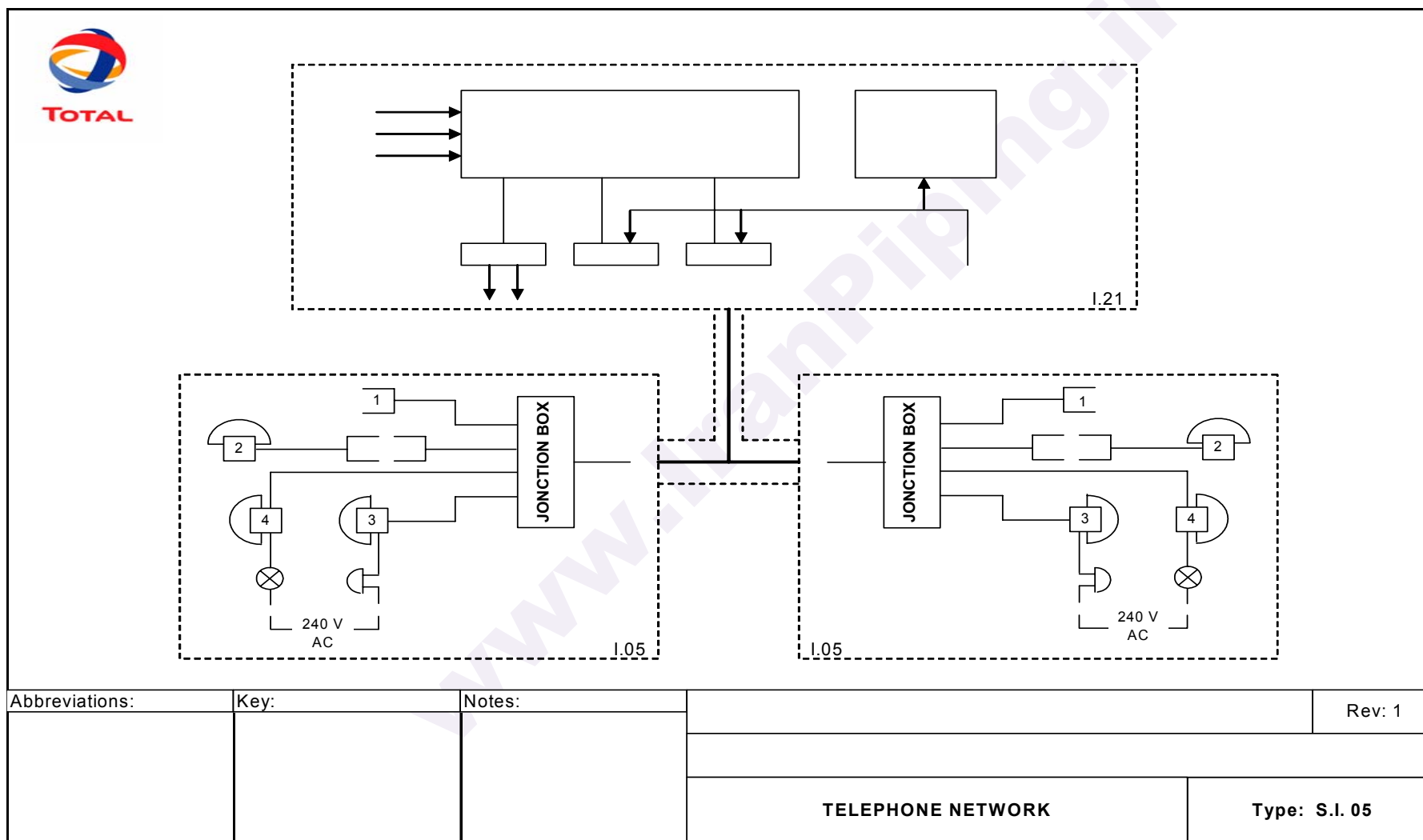
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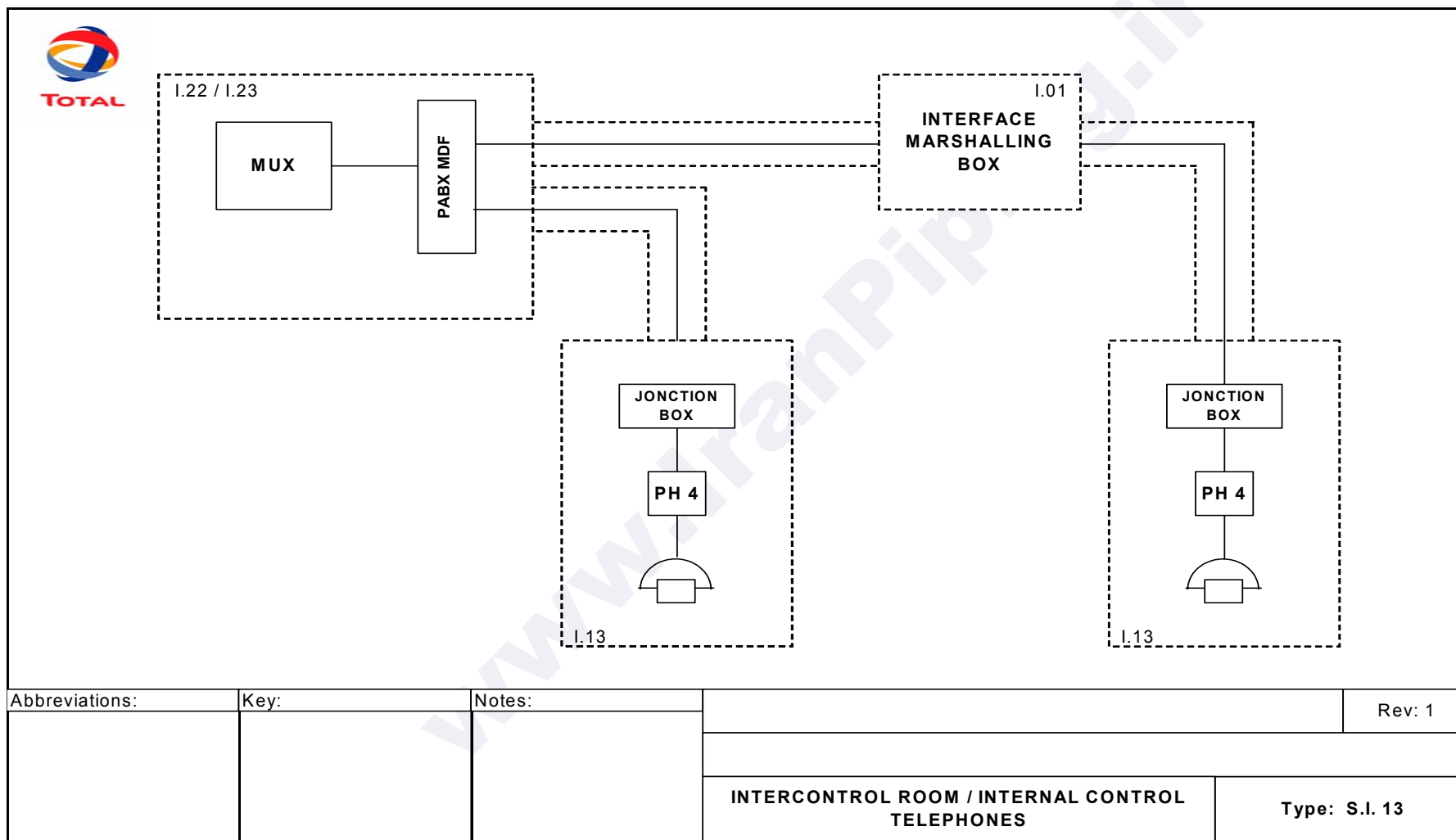
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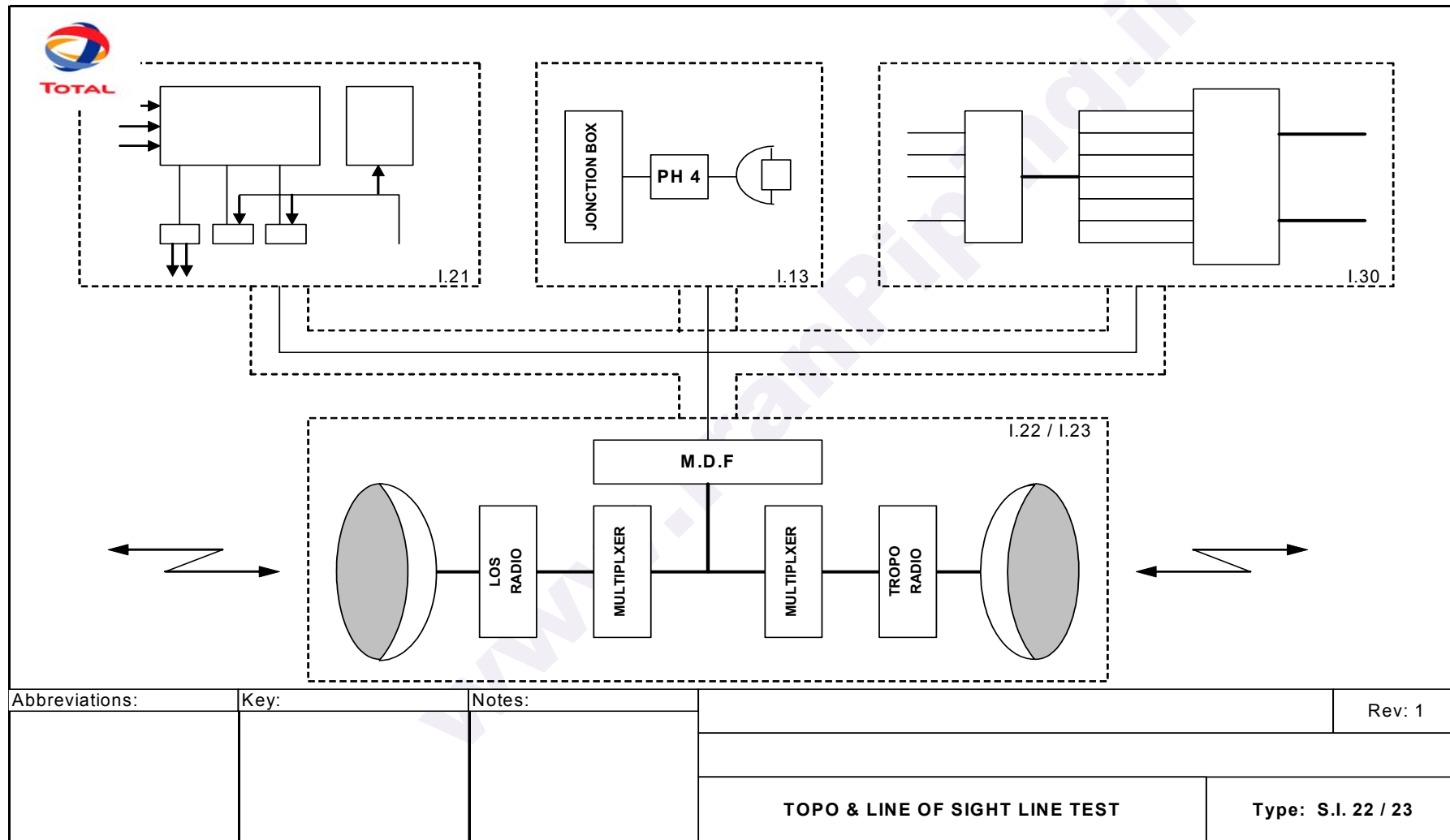
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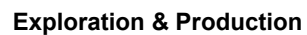
Date: 09/05

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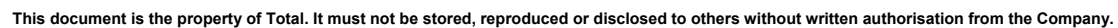
General Specification

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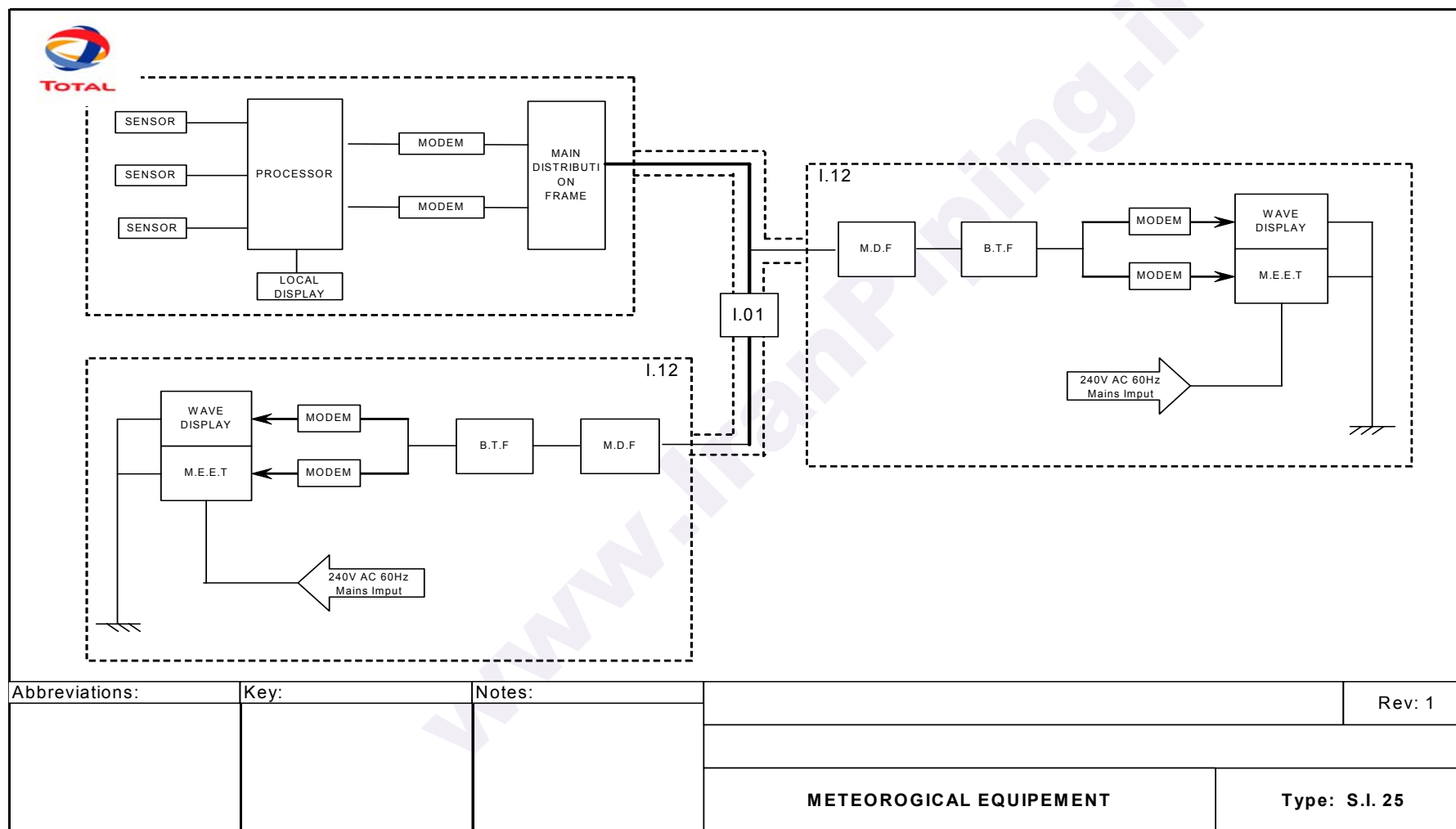
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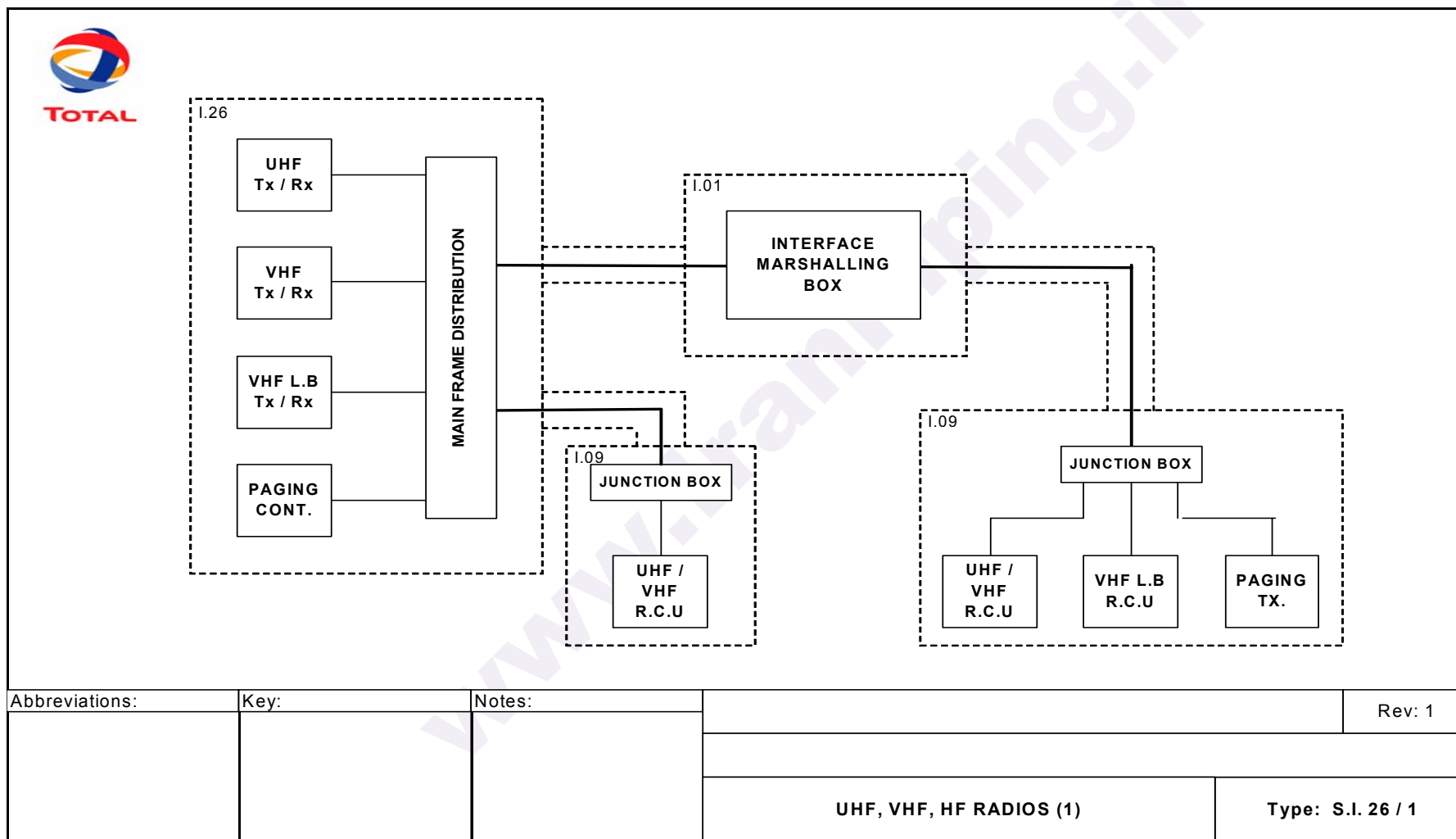
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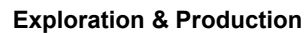
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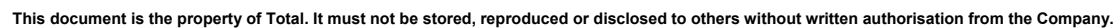
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Date: 09/05

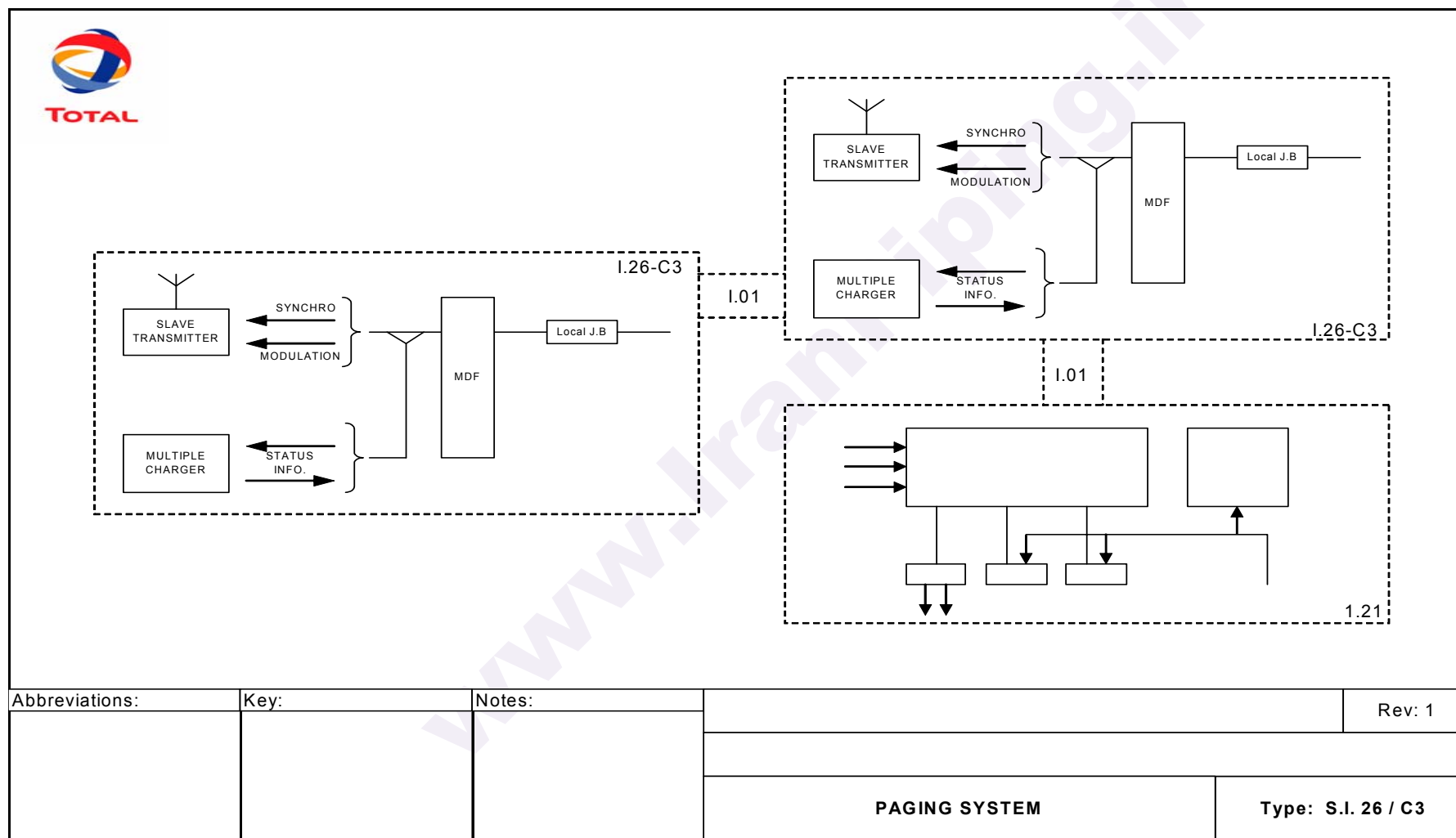
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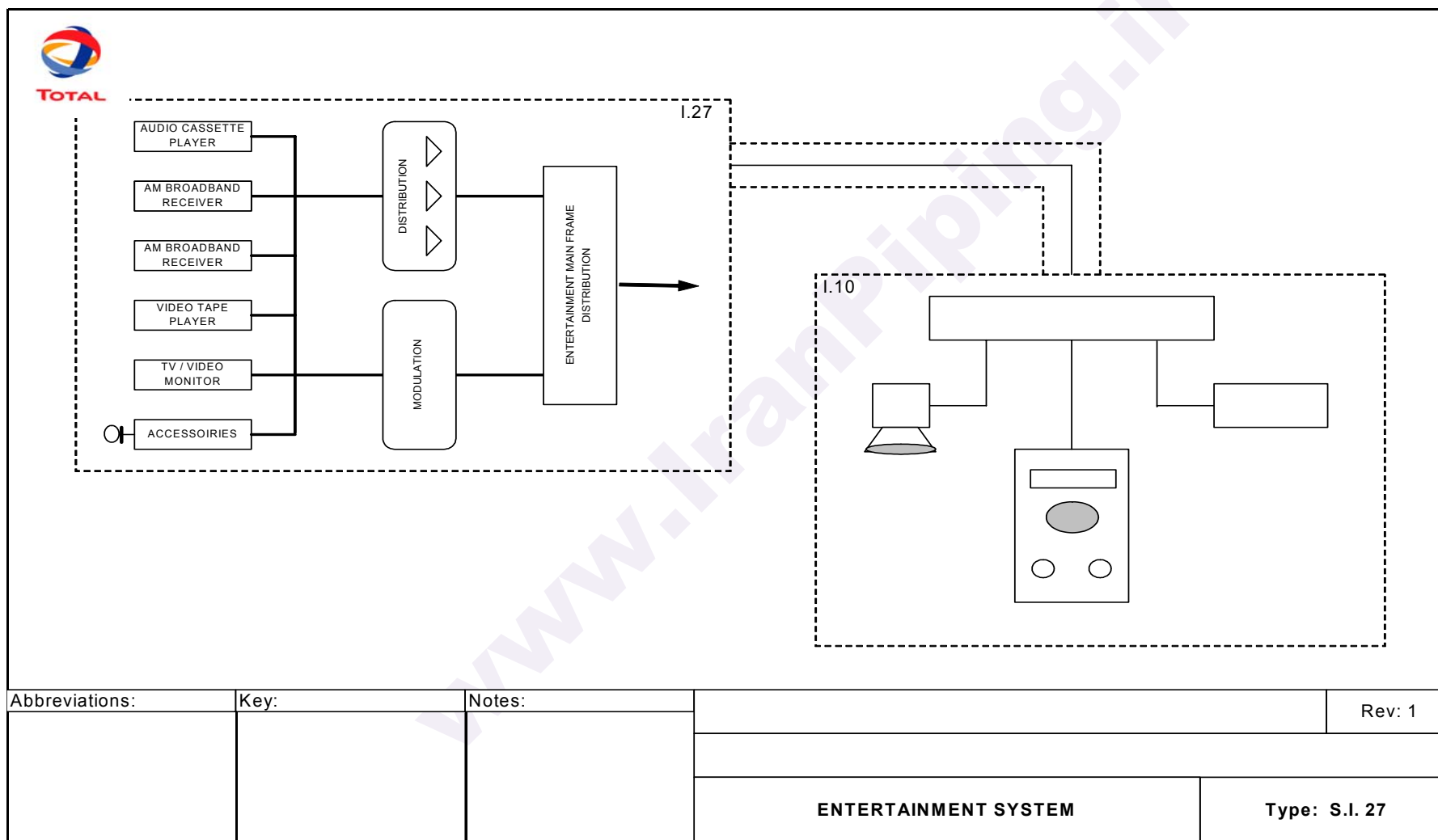
General Specification

Date: 09/05

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Appendix 5



Abbreviations:	Key:	Notes:	Rev: 1	
			ENTERTAINMENT SYSTEM	Type: S.I. 27



Appendix 6

Telecommunication functional test sheets



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS MULTIPURPOSE TESTSHEET		PROJECT													
			BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :											
			DESCRIPTION :		LOCATION :											
			DWG :		TASK N° :											
			EQUIPMENT N° :		REV :											
UNIT TYPE : TEST EQUIPMENT TYPE & SERIAL NUMBER : www.IranPiping.ir																
<table border="1" style="width: 100%;"> <tr> <td></td> <td>Carried out by</td> <td>Commissioning SPDT</td> <td>Certifying Authority</td> </tr> <tr> <td>Date</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Name Signature</td> <td></td> <td></td> <td></td> </tr> </table>						Carried out by	Commissioning SPDT	Certifying Authority	Date				Name Signature			
	Carried out by	Commissioning SPDT	Certifying Authority													
Date																
Name Signature																
FORM N° : I00			SHEET OF													



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS P.A. LOOP - COVERAGE TEST -				PROJECT																																																																	
BASIC FUNCTION N° : EQUIPMENT N° :				SUBSYSTEM :																																																																		
DESCRIPTION :				LOCATION :																																																																		
DWG :				TASK N° :																																																																		
EQUIPMENT N° :				REV :																																																																		
 UNIT TYPE : TEST EQUIPMENT TYPE & SERIAL NUMBER : Audio Generator : Decibel meter (dBA) : <table border="1"><thead><tr><th rowspan="2">LOOP REF</th><th rowspan="2">TAG N°</th><th rowspan="2">NOISE LEVEL (dBA)</th><th colspan="2">SIGNAL LEVELS</th><th rowspan="2">S/N (dB)</th><th rowspan="2">REMARKS RE TAPPING</th></tr><tr><th>1KHz (dBA)</th><th>480 Hz (dBA)</th></tr></thead><tbody><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table>						LOOP REF	TAG N°	NOISE LEVEL (dBA)	SIGNAL LEVELS		S/N (dB)	REMARKS RE TAPPING	1KHz (dBA)	480 Hz (dBA)																																																								
LOOP REF	TAG N°	NOISE LEVEL (dBA)	SIGNAL LEVELS		S/N (dB)				REMARKS RE TAPPING																																																													
			1KHz (dBA)	480 Hz (dBA)																																																																		
 <table border="1"><tr><td></td><td>Carried out by</td><td>Commissioning SPDT</td><td>Certifying Authority</td></tr><tr><td>Date</td><td></td><td></td><td></td></tr><tr><td>Name Signature</td><td></td><td></td><td></td></tr></table>							Carried out by	Commissioning SPDT	Certifying Authority	Date				Name Signature																																																								
	Carried out by	Commissioning SPDT	Certifying Authority																																																																			
Date																																																																						
Name Signature																																																																						



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS P.A. LOOP - LOOP LOSS TEST -	PROJECT																																													
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :																																													
DESCRIPTION :		LOCATION :																																													
DWG :		TASK N° :																																													
EQUIPMENT N° :		REV :																																													
UNIT TYPE : TEST EQUIPMENT TYPE & SERIAL NUMBER : Audio Generator : Voltmeter : <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 20px;"> <thead> <tr> <th style="width: 15%;">LOOP REF</th> <th style="width: 20%;">LS TAG N°</th> <th style="width: 20%;">OUTPUT (V)</th> <th style="width: 20%;">RETURN (V)</th> <th style="width: 25%;">LOSS (dB)</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>			LOOP REF	LS TAG N°	OUTPUT (V)	RETURN (V)	LOSS (dB)																																								
LOOP REF	LS TAG N°	OUTPUT (V)	RETURN (V)	LOSS (dB)																																											
	Carried out by	Commissioning SPDT	Certifying Authority																																												
Date																																															
Name																																															
Signature																																															



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS P.A. LOOP - FLASHING BEACONS -	PROJECT																																													
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :																																													
DESCRIPTION :		LOCATION :																																													
DWG :		TASK N° :																																													
EQUIPMENT N° :		REV :																																													
UNIT TYPE : TEST EQUIPMENT TYPE & SERIAL NUMBER : Avometer : DC power supply : Stop watch : serial n° : serial n° : serial n° : <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 15%;">LOOP REF</th> <th style="width: 15%;">TAG N°</th> <th style="width: 15%;">FLASHING RATE</th> <th style="width: 15%;">PROTEC. FUSE (mA)</th> <th style="width: 40%;">REMARKS</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>			LOOP REF	TAG N°	FLASHING RATE	PROTEC. FUSE (mA)	REMARKS																																								
LOOP REF	TAG N°	FLASHING RATE	PROTEC. FUSE (mA)	REMARKS																																											
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; height: 30px;"> </td> <td style="width: 25%;">Carried out by</td> <td style="width: 25%;">Commissioning SPDT</td> <td style="width: 30%;">Certifying Authority</td> </tr> <tr> <td style="text-align: center;">Date</td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td style="text-align: center;">Name Signature</td> <td> </td> <td> </td> <td> </td> </tr> </table>				Carried out by	Commissioning SPDT	Certifying Authority	Date				Name Signature																																				
	Carried out by	Commissioning SPDT	Certifying Authority																																												
Date																																															
Name Signature																																															



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS CONTROL & ACCESS UNIT CONTROL PANEL	PROJECT																				
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :																				
DESCRIPTION :		LOCATION :																				
DWG :		TASK N° :																				
EQUIPMENT N° :		REV :																				
UNIT TYPE :																						
TEST EQUIPMENT TYPE & SERIAL NUMBER :																						
Equipment manual																						
Voltmeter	:	serial n° :																				
Signal generator	:	serial n° :																				
<table border="1"><tr><td>Input level "Mic. in"</td><td>:</td><td>dBm,</td><td>Ohm</td></tr><tr><td>Output level to AMP</td><td>:</td><td>dBm,</td><td>Ohm</td></tr><tr><td>Output distortion</td><td>:</td><td>%</td><td></td></tr><tr><td>Noise level</td><td>:</td><td>- dBm</td><td></td></tr><tr><td>S/N ratio</td><td>:</td><td>dB</td><td></td></tr></table>			Input level "Mic. in"	:	dBm,	Ohm	Output level to AMP	:	dBm,	Ohm	Output distortion	:	%		Noise level	:	- dBm		S/N ratio	:	dB	
Input level "Mic. in"	:	dBm,	Ohm																			
Output level to AMP	:	dBm,	Ohm																			
Output distortion	:	%																				
Noise level	:	- dBm																				
S/N ratio	:	dB																				
Functions :																						
a) Check "System Healthy" led & indicators.																						
b) Press "Zone 1", verify led flashing sequence, then :																						
c) Press "PTT", listen the "paging chime", verify the "Mic. ready" led on.																						
<table border="1"><tr><td>Paging chime level</td><td>:</td><td>dBm,</td><td>Ohm</td></tr><tr><td>Frequency & sequence description</td><td>:</td><td></td><td></td></tr></table>			Paging chime level	:	dBm,	Ohm	Frequency & sequence description	:														
Paging chime level	:	dBm,	Ohm																			
Frequency & sequence description	:																					
d) Confirm only "Zone 1" loops are activated.																						
e) Repeat for others loops.																						
f) Momentarily, press "General Platform Alarm" button, check flashing sequences.																						
g) Check that a continuous tone is generated, check the 48V DC output to beacons.																						
<table border="1"><tr><td>GPA tone level</td><td>:</td><td>dBm,</td><td>Ohm</td></tr><tr><td>Frequency & sequence description</td><td>:</td><td></td><td></td></tr><tr><td>Voltage to beacons</td><td>:</td><td>Volt</td><td></td></tr></table>			GPA tone level	:	dBm,	Ohm	Frequency & sequence description	:			Voltage to beacons	:	Volt									
GPA tone level	:	dBm,	Ohm																			
Frequency & sequence description	:																					
Voltage to beacons	:	Volt																				
h) Momentarily, press "Pre Abandon Platform Alarm", verify flashing sequences, 48V DC still present to beacons.																						
FORM N° : I04C1		SHEET 1 OF 2																				



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS CONTROL & ACCESS UNIT CONTROL PANEL	PROJECT
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :
		REV
PAP Alarm level : dBm, Ohm - " - Frequency : Hz Tone sequence & description : i) Press "Cancel button", verify that both alarm tone & indicators are cancelled. j) Press "Emergency Speech" and "PTT" buttons, both are held down, the "Emergency Speech" will illuminate, verify the attenuation of the tone during speech. Verify the speech is on all zones. Emergency Speech tone level : dBm, Ohm - " - Frequency : Hz Sequence description : Attenuation during speech : All zones activated : Yes / No k) Verify the "GP Alarm" is attenuated during speech, speech is heard over the tone. l) Release "E/S" and "PTT" buttons, ensure alarm tone reverts to normal level. m) Press "Cancel" button, alarm tone ceases. n) Press "PAP Alarm" and check the time out timer : Time out timer : minutes o) Verify the "mute relays" operation		
Others remarks :		
	Carried out by	Commissioning SPDT
Date		
Name		
Signature		



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS TELEPHONE LOOP - WALL PHONE -	PROJECT																																																						
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :																																																						
DESCRIPTION :		LOCATION :																																																						
DWG :		TASK N° :																																																						
EQUIPMENT N° :		REV :																																																						
TEST ITEM : Wall Phone EX(d). UNIT TYPE : TEST EQUIPMENT TYPE & SERIAL NUMBER : <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Labels, tag</td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> </tr> <tr> <td>Location</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Earthing glands</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Surface finish</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Remarks</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> FACILITIES a) From the telephone under test, dial the operator number, check : <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Directory number</td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> </tr> <tr> <td>Two way speech</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> b) Clear down, from another tel (X), dial the telephone under test, check : <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Directory number</td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> </tr> <tr> <td>Two way speech</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>			Labels, tag						Location						Earthing glands						Surface finish						Remarks						Directory number						Two way speech						Directory number						Two way speech					
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FORM N° : I05C1		SHEET 1 OF 2																																																						



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS TELEPHONE LOOP - WALL PHONE -	PROJECT
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :
TEST ITEM : Wall Telephone (Cont D)		REV
c) Press the "Recall" button, check the interrupted dial tone, dial your number. Confirm the busy tone.		
Dial tone		
Busy tone		
b) Replace receiver check the bell rings, Pick up the receiver, check the call is returned to (X)		
Bell rings		
Return call		
Others remarks :		
	Carried out by	Commissioning SPDT
Date		
Name		
Signature		



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS TELEPHONE LOOP - FLASHING BEACON -	PROJECT																																																		
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :																																																		
DESCRIPTION :		LOCATION :																																																		
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UNIT TYPE :																																																				
TEST EQUIPMENT TYPE & SERIAL NUMBER :																																																				
Voltmeter : serial number :																																																				
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	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS TELEPHONE SYSTEM TEST	PROJECT
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :
DESCRIPTION :		LOCATION :
DWG :		TASK N° :
EQUIPMENT N° :		REV :

MOD.	EXT	TAG	COS	COR	MDF	CIRCUIT ROUTE		MAIN EQUIP.		
					term	J.B.	TERM	Shelf	Slot	Circ.
STATUS	Description		Type			Pair	Cable			
OK/NO			FWDC							
			BEACON							
			HOOD							

MOD.	EXT	TAG	COS	COR	MDF	CIRCUIT ROUTE		MAIN EQUIP.		
					term	J.B.	TERM	Shelf	Slot	Circ.
STATUS	Description		Type			Pair	Cable			
OK/NO			FWDC							
			BEACON							
			HOOD							

MOD.	EXT	TAG	COS	COR	MDF	CIRCUIT ROUTE		MAIN EQUIP.		
					term	J.B.	TERM	Shelf	Slot	Circ.
STATUS	Description		Type			Pair	Cable			
OK/NO			FWDC							
			BEACON							
			HOOD							

MOD.	EXT	TAG	COS	COR	MDF	CIRCUIT ROUTE		MAIN EQUIP.		
					term	J.B.	TERM	Shelf	Slot	Circ.
STATUS	Description		Type			Pair	Cable			
OK/NO			FWDC							
			BEACON							
			HOOD							

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS R.C.U. AND ASSOCIATED RADIO	PROJECT	
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :	
DESCRIPTION :		LOCATION :	
DWG :		TASK N° :	
EQUIPMENT N° :		REV :	
UNIT TYPE :			
a) Console :			
Serial number		Selective decoder code	
Tag number		Type of signalling	
Model		Selective encoder	
b) Associated radio :			
Serial number		TESTED see BF I.26, page :	
Tag number			
Model			
TEST EQUIPMENT TYPE & SERIAL NUMBER			
Radiocommunication analyser	:	Serial number	:
Code generator	:	Serial number	:
AF generator	:	Serial number	:
Voltmeter	:	Serial number	:
Distorsionmeter	:	Serial number	:
a) Signalling			
Command signals	DC (V)	Freq. (Hz)	level (dBm)
Relay access			
Repeater on-off			
Frequencies change			
b) RF loop test			
RF frequency	:	MHz	
Modulation	:	KHz, with an audio signal of 1 KHz	
FORM N° : I09C2		SHEET 1 OF 2	



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS R.C.U. AND ASSOCIATED RADIO	PROJECT																																																						
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :																																																						
		REV																																																						
Level on line (receive) : dBm, 600 Ohm Level on loudspeaker : dBm, ref 0 dB Distorsion : % Noise level : - dBm, 600 Ohm Audio frequency response : <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <th>Freq. (Hz)</th> <th>250</th> <th>500</th> <th>1000</th> <th>1500</th> <th>2000</th> <th>2300</th> <th>3000</th> <th>3400</th> </tr> <tr> <td>Line level (dBm)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>LS level (dBm)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> c) Sensivity : Description of code : Code : RF frequency : MHz Modulation : % KHz RF level : dBm d) Speech (transmit line) Speech level on line : dBm Noise level : - dBm Frequency response : <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <th>Freq. (Hz)</th> <th>250</th> <th>500</th> <th>1000</th> <th>1500</th> <th>2000</th> <th>2300</th> <th>3000</th> <th>3400</th> </tr> <tr> <td>Line level (dBm)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Distorsion (%)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>			Freq. (Hz)	250	500	1000	1500	2000	2300	3000	3400	Line level (dBm)									LS level (dBm)									Freq. (Hz)	250	500	1000	1500	2000	2300	3000	3400	Line level (dBm)									Distorsion (%)								
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	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS P.A. AMPLIFIER	PROJECT
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :
DESCRIPTION :		LOCATION :
DWG :		TASK N° :
EQUIPMENT N° :		REV :

UNIT TYPE :

TEST EQUIPMENT TYPE & SERIAL NUMBER :

Voltmeter :
 Distorsionmeter :
 Audio generator :

a) Distorsion

Input signal :	level :	dBm,	Ohm
	frequency :	Hz	
Output signal :	level :	dBV,	Ohm
	distorsion :	%	

b) Frequencies response

Frequency (KHz)	0.2	0.5	1	1.5	2	5	10
Level (dB)			0				

Frequency (KHz)	0.2	0.5	1	1.5
Level (dB)			0	

c) Noise level

Noise level :	dBm	Ohm
Signal level :	dBm	Ohm
(average level 1-2 KHz)		
S/N ratio :	dB	

d) Max. load

Frequency response :	Hz-	KHz
Distorsion :	%	
Power :		

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			

Appendix 6

	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS P.A. ALARM RACK	PROJECT _____
BASIC FUNCTION N° : EQUIPMENT N° : _____		SUBSYSTEM : _____
DESCRIPTION : _____		LOCATION : _____
DWG : _____		TASK N° : _____
EQUIPMENT N° : _____		REV : _____

UNIT TYPE : _____

TEST EQUIPMENT TYPE & SERIAL NUMBER :

Voltmeter	:		Serial n°	:	
Audio generator	:		Serial n°	:	
Stop watch	:		Serial n°	:	

a) Precom review

Remarks : _____

b) Input/Output

Control unit input	:	dBm,	Ohm
Override control unit input	:	dBm,	Ohm
Output to amplifier (voice)	:	dBm,	Ohm

Note : The S/N ratio are done during terminals functional tests.

c) Alarms tones

ALARMS	Level (dBm)	Sequence (pis stick off)
Pre-Abandon Platform Alarm		Continuous 600 Hz
General platform Fire & Gas Alarm		Intermittent 1000 Hz 15.on/15.off
Toxic Gas Alarm		Two tone sound

d) Noise output level

	dBm,	Ohm
--	------	-----

e) Faults

f) Others

Status loop line :	Level in :	dBm,	Ohm
Power supplies :	Level out :	dBm,	Ohm
Stations faults :	Two way speech :	Yes/No	
	Time out timers :		

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			

FORM N° : I20C2
 SHEET OF _____



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS PAGER RECEIVER	PROJECT														
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :														
DESCRIPTION :		LOCATION :														
DWG :		TASK N° :														
EQUIPMENT N° :		REV :														
UNIT TYPE :																
<table border="1"><tr><td>Serial number</td><td></td></tr><tr><td>Type approval</td><td></td></tr><tr><td>Tag number</td><td></td></tr><tr><td>Model</td><td></td></tr></table>		Serial number		Type approval		Tag number		Model		<table border="1"><tr><td>Frequency (MHz)</td><td></td></tr><tr><td>Code</td><td></td></tr><tr><td>Type of code</td><td></td></tr></table>	Frequency (MHz)		Code		Type of code	
Serial number																
Type approval																
Tag number																
Model																
Frequency (MHz)																
Code																
Type of code																
TEST EQUIPMENT TYPE & SERIAL NUMBER																
Audio Generator	:	Serial number :														
Code Generator	:	Serial number :														
RF generator	:	Serial number :														
Spectrum analyser	:	Serial number :														
1) Sensivity																
Frequency	:	MHz														
Position of the pager	:	vertical, the clip is at 0 deg :														
Sensivity	:	dBm (test bed), uV/m														
2) Capture																
Generator 1																
RF frequency	:	MHz														
Modulation	:	30 %, KHz, with the code signal as above.														
RF level	:	dBm														
Generator2																
RF frequency	:	MHz														
Modulation	:	60 %, KHz, with an audio signal of 400 Hz.														
RF level	:	dBm														
Capture	:	dB														
FORM N° : I26C3		SHEET 1 OF 2														



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS PAGER RECEIVER	PROJECT
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :
		REV

3) Selectivity

Generator 1

RF frequency : MHz

Modulation : 30 %, KHz, with the code signal .

RF level : dBm

Generator2

RF frequency : MHz

Modulation : 30 %, KHz, with an audio signal of 1000 Hz.

RF level : dBm

Selectivity : dB

4) Parasite responses

Frequencies (MHz)	Level (dBm)	Protection (dB)

5) Spurious

Frequencies (MHz)	Level (dBm)	Protection (dB)

	Carried out by	Commissioning SPDT	Certifying Authority
Date			
Name			
Signature			



	COMMISSIONING FUNCTIONAL TEST SHEET TELECOMMUNICATIONS NON DIRECTIONAL BEACON	PROJECT																																																																																			
BASIC FUNCTION N° : EQUIPMENT N° :		SUBSYSTEM :																																																																																			
DESCRIPTION :		LOCATION :																																																																																			
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Signature																																																																																					



Appendix 7

Typical OTP forms



		OPERATIONAL TEST PROCEDURE		PROJECT
SUB-SYSTEM:		DESCR:	LOCATION:	PAGE: OF:
Step	TASK DESCRIPTION	DATE COMPLETED	NAME AND SIGNATURE	
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FORM: 5300



	OPERATIONAL TEST RECORD SHEET CENTRIFUGAL PUMP						PROJECT		
SUB-SYSTEM:		TAG:		DESCR:		LOCATION:			

DESIGNATION	UNIT	NORMA L VALUE	VALUES RECORDED DURING TEST							
			1	2	3	4	5	6	7	8
SUCTION PRESSURE										
DISCHARGE PRESSURE										
INLET TEMPERATURE										
OUTLET TEMPERATURE										
DISCHARGE FLOW										
SHUT IN DISCHARGE PRESSURE										
MECHANICAL: BEARING TEMPERATURE AND VIBRATION READINGS										
BEARING DESIGNATION	UNIT	NORMA L VALUE	1	2	3	4	5	6	7	8
THRUST BEARING TEMPERATURE										
VIBRATION										
ELECTRICAL:										
	UNIT	NORMA L VALUE	1	2	3	4	5	6	7	8
MOTOR SPEED										
MOTOR VOLTAGE										
MOTOR INTENSITY										
ELECTRICAL POWER										

		Name	Date	Signature
Carried-out by				
Accepted	COMMISSIONING			
	COMPANY			

FORM: 5221



		PRE-OPERATIONAL TEST CHECK LIST RECIPROCATING PUMP		PROJECT
SUB-SYSTEM:		TAG Nb:	DESCR:	LOCATION:
Nb	CHECK LIST ITEM	COMMENT		
1	Precommissioning tasks completed			
2	Commissioning functional tests completed			
3	Driver running tests completed			
4	Alignment verified			
5	Seals packings tight			
6	Oil levels completed			
7	Required overrides installed			
8	Measurements and safety devices on line			
9	Flow dampeners on line			
10	Configuration established			
11	Stroke adjuster to zero			
12	Level in suction vessel established			
REMARKS:				
		Name	Date	Signature
Carried-out by				
Accepted	COMMISSIONING			
	COMPANY			

FORM: 5222



	OPERATIONAL TEST RECORD SHEET RECIPROCATING PUMP				PROJECT		
SUB-SYSTEM:		TAG:		DESCR:		LOCATION:	

DESIGNATION	UNIT	NORMA L VALUE	VALUES RECORDED DURING TEST							
			1	2	3	4	5	6	7	8
SUCTION PRESSURE										
DISCHARGE PRESSURE										
INLET TEMPERATURE										
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BEARING DESIGNATION	UNIT	NORMA L VALUE	1	2	3	4	5	6	7	8
THRUST BEARING TEMPERATURE										
VIBRATION										
ELECTRICAL:										
	UNIT	NORMA L VALUE	1	2	3	4	5	6	7	8
MOTOR SPEED										
MOTOR VOLTAGE										
MOTOR INTENSITY										
ELECTRICAL POWER										

		Name	Date	Signature
Carried-out by				
Accepted	COMMISSIONING			
	COMPANY			

FORM: 5223



		PRE-OPERATIONAL TEST CHECK LIST CENTRIFUGAL COMPRESSOR (sheet 1 of 2)		PROJECT	
SUB-SYSTEM:		TAG Nb:		DESCR:	
				LOCATION:	
Nb	CHECK LIST ITEM			COMMENT	
A	LUBE OIL/SEAL OIL				
1	Commissioning Functional Tests completed				
2	Lube oil/seal oil systems flushed and cleaned				
3	Oil level and quality satisfactory				
4	Oil reservoir heaters in operation				
5	Oil cooling system running				
6	Circuits and safety devices lined-up, filters fitted				
7	Compressor casing pressure verified				
8	Seal oil regeneration system ready to run				
B	COMPRESSOR				
1	Commissioning Functional Tests completed				
2	Driver running tests completed				
3	Driver, gearbox and piping alignments verified				
4	Gearbox oil level completed				
5	Compressor body drained				
REMARKS:					
		Name		Date	
Carried-out by				Signature	
Accepted	COMMISSIONING				
	COMPANY				

FORM: 5224



		PRE-OPERATIONAL TEST CHECK LIST CENTRIFUGAL COMPRESSOR (sheet 2 of 2)		PROJECT	
SUB-SYSTEM:		TAG Nb:		DESCR:	
				LOCATION:	
Nb	CHECK LIST ITEM			COMMENT	
6	Lube oil/seal oil running				
7	Circuits and safety devices lined-up				
8	Anti-surge verified				
9	Test fluid pressure verified				
REMARKS:					
		Name		Date	
Carried-out by				Signature	
Accepted	COMMISSIONING				
	COMPANY				

FORM: 5224



	OPERATIONAL TEST RECORD SHEET CENTRIFUGAL COMPRESSOR				PROJECT																																																																																																																																																																																									
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FORM: 5225



		PRE-OPERATIONAL TEST CHECK LIST RECIPROCATING COMPRESSOR		PROJECT
SUB-SYSTEM:		TAG Nb:	DESCR:	LOCATION:
Nb	CHECK LIST ITEM	COMMENT		
1	Commissioning Functional Tests completed			
2	Driver running tests completed			
3	Driver, gearbox and piping alignments verified			
4	Crankcase clean and oil levels completed			
5	Crankcase explosion doors verified			
6	Suction filter and lube oil filters verified			
7	Forced feed lubricant container oil level checked			
8	Piston rod packing checked			
9	Test plugs tight			
10	Clearance pockets checked			
11	Required overrides installed			
12	Measurements and safety devices on line			
13	Pulsation dampeners on line			
14	Water cooling system running			
15	Configuration established			
REMARKS:				
		Name	Date	Signature
Carried-out by				
Accepted	COMMISSIONING			
	COMPANY			

FORM: 5226



	OPERATIONAL TEST RECORD SHEET RECIPROCATING COMPRESSOR	PROJECT																																																																																																																																																
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FORM: 5227



		PRE-OPERATIONAL TEST CHECK LIST DIESEL ENGINES		PROJECT
SUB-SYSTEM:		TAG Nb:	DESCR:	LOCATION:
Nb	CHECK LIST ITEM	COMMENT		
1	Commissioning Functional Tests completed			
2	Crankcase clean, oil level and quality satisfactory, oil heaters in operation, explosion doors fitted			
3	Preservatives removed from cylinders			
4	Fuel injectors inspected and cleaned			
5	Cooling water system in operation. Radiator, fans, pump checked, corrosion inhibitor injected			
6	Fuel pump checked			
7	Turbo - charger checked. Oil level and quality satisfactory			
8	Governor inspected. Oil level and quality satisfactory. Linkage correct			
9	Starter system verified			
10	Fuel system tests completed, day tank filled, fuel filters fitted, air purged			
11	Air intake lines and filters clean			
12	Automatic air louvres operational			
13	Water make-up ready			
REMARKS:				
		Name	Date	Signature
Carried-out by				
Accepted	COMMISSIONING			
	COMPANY			

FORM: 5228



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FORM: 5229



		PRE-OPERATIONAL TEST CHECK LIST LIFEBOAT DAVITS		PROJECT	
SUB-SYSTEM:		TAG Nb:		DESCR:	
				LOCATION:	
Nb		CHECK LIST ITEM		COMMENT	
1		Commissioning Functional Tests completed			
2		Load tests calculations available			
3		NDT clearance confirmed			
4		Reeving of wire ropes satisfactory			
5		Load test beam and weights inspected			
6		Weights certification available			
7		Slings, shackles, various test equipment covered by adequate certification			
8		No-load operation of the davit satisfactory			
REMARKS:					
		Name		Date	
Carried-out by					
COMMISSIONING					
COMPANY					

FORM: 5241

Appendix 7

		OPERATIONAL TEST RECORD SHEET LIFEBOATS DAVITS		PROJECT _____																															
SUB-SYSTEM:		TAG:		DESCR:																															
				LOCATION:																															
DATA <table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">WORKING LOAD ⚡</td> <td style="width: 10%; text-align: right;">kg</td> <td style="width: 40%;"></td> </tr> <tr> <td>TEST LOAD = (Working Load x 110 %)</td> <td style="text-align: right;">kg</td> <td></td> </tr> <tr> <td>FALL</td> <td style="text-align: right;">m</td> <td></td> </tr> <tr><td> </td><td></td><td></td></tr> <tr><td> </td><td></td><td></td></tr> <tr><td> </td><td></td><td></td></tr> </table> TEST RESULTS (with Test Load) <table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">LOWERING TIME</td> <td style="width: 10%; text-align: right;">sec</td> <td style="width: 40%;"></td> </tr> <tr> <td>LOWERING SPEED</td> <td style="text-align: right;">m/s</td> <td></td> </tr> <tr> <td>RAISING TIME</td> <td style="text-align: right;">sec</td> <td></td> </tr> <tr> <td>RAISING SPEED</td> <td style="text-align: right;">m/s</td> <td></td> </tr> </table> LIMIT SWITCH OPERATION ACCEPTABLE ☐ NOTES : ⚡ WORKING LOAD = WEIGHT OF LIFEBOAT & REGULATION LOOSE EQUIPMENT + WEIGHT OF MAX (UNITS kg) No PERSONS (AT 75 kg EACH) REMARKS 						WORKING LOAD ⚡	kg		TEST LOAD = (Working Load x 110 %)	kg		FALL	m											LOWERING TIME	sec		LOWERING SPEED	m/s		RAISING TIME	sec		RAISING SPEED	m/s	
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		Name		Date																															
Carried-out by				Signature																															
Accepted	COMMISSIONING																																		
	COMPANY																																		

FORM: 5242



		PRE-OPERATIONAL TEST CHECK LIST HOIST, MONORAIL, GANTRY CRANE		PROJECT	
SUB-SYSTEM:		TAG Nb:		DESCR:	
				LOCATION:	
Nb	CHECK LIST ITEM			COMMENT	
1	Commissioning Functional Tests completed				
2	Load tests calculations available				
3	NDT clearance confirmed				
4	Test weights inspected				
5	Weights certification available				
6	Slings, shackles, various test equipment covered by adequate certification				
7	No-load operation satisfactory				
REMARKS:					
		Name		Date	
		Signature			
Carried-out by					
Accepted	COMMISSIONING				
	COMPANY				

FORM: 5243



	OPERATIONAL TEST RECORD SHEET HOIST, MONORAIL, GANTRY CRANE			PROJECT																																																																																		
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FORM: 5244



		PRE-OPERATIONAL TEST CHECK LIST PLATFORM CRANE		PROJECT
SUB-SYSTEM:		TAG Nb:	DESCR:	LOCATION:
Nb	CHECK LIST ITEM	COMMENT		
1	Commissioning Functional Tests completed			
2	Reeving of wire ropes satisfactory			
3	Oils levels and qualities checked			
4	Hydraulic circuits tested satisfactorily			
5	All crane utility supplies available			
6	Test weights, slings, shackles, various test equipment covered by adequate certification			
7	Test equipment and special tools available			
8	All safety precautions enforced			
9	No-load operation satisfactory and all safety protections tested			
REMARKS:				
		Name	Date	Signature
Carried-out by				
Accepted	COMMISSIONING			
	COMPANY			

FORM: 5245

Appendix 7

		OPERATIONAL TEST RECORD SHEET PLATFORM CRANE			PROJECT _____																																																																																																																										
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FORM: 5246



		PRE-OPERATIONAL TEST CHECK LIST LIFT		PROJECT
SUB-SYSTEM:		TAG Nb:	DESCR:	LOCATION:
Nb	CHECK LIST ITEM	COMMENT		
1	Commissioning Functional Tests completed			
2	Reeving of wire ropes satisfactory			
3	Tests weights, slings, shackles, various test equipment covered by adequate certification			
4	Test equipment and special tools available			
5	All safety precautions enforced			
6	No-load operation satisfactory and all safety protections tested			
REMARKS:				
		Name	Date	Signature
Carried-out by				
Accepted	COMMISSIONING			
	COMPANY			

FORM: 5247



	OPERATIONAL TEST RECORD SHEET LIFT			PROJECT																																																						
SUB-SYSTEM:	TAG:	DESCR:	LOCATION:																																																							
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