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Technical Specifications (In-Cash Procurement)

T9 Transformer upgrade

Technical specification for the procurement and installation of T9 substation, T9 auxiliary transformer and various related works

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1 Purpose

This specification outlines the minimum requirements related to the electrical works linked with the upgrade of the T9 22kV/15kV transformer and all related equipment including, a prefabricated substation, and HV cables, auxiliary transformer

All documents and information attached to this specification shall be considered part of it and must be fulfilled with by the prospective contractor.

All deviations from this specification shall be clearly identified as such in a single document entitled “Exceptions to the Technical Specification”.

2 Definitions and acromyms

The following acronyms may be found in this document:

IDM: ITER Document Management

PPSPS: Individual Health Protection and Safety Plan (Plan Particulier de Sécurité et de Protection de la Santé)

PMAE: Environmental Management Plan

PRE: Environmental Requirements

RUN: Roads and underground networks

PTW: Permit to work

A list of ITER abbreviations used throughout the ITER Project can be found at IDM: https://user.iter.org/?uid=2MU6W5

3 References

The list of applicable document for OHS is available in the PGC Annex 0 (42FYPZ)

- Provisions for Implementation of the Generic Safety Requirements by the External Interveners (ITER_D_SBSTBM).
- ITER internal regulation (https://user.iter.org/default.aspx?uid=27WDZW)
- PGC Annex 0 - List of the applicable annexes to the PGC SPS Volume 1 (https://user.iter.org/default.aspx?uid=42FYPZ)
- PGC Annex 1 - Specific measures for preventing the spread of Covid-19 on the worksite (https://user.iter.org/default.aspx?uid=36M2XY).
- ITER Site Development Plan (UYRHXW v1.1)
- Quality Assurance for ITER Safety Codes (ITER_D_258LKL)
- Procurement Requirements for Producing a Quality Plan (ITER_D_22MFMW)
- ITER Procurement Quality Requirements (ITER_D_22MFG4)ITER Organization Environmental Management System doc 1: PMAE v1 (ITER_D_97W4PN)
- Environmental requirements (ITER_D_97WRFP)
- Alert procedure on ITER construction site (ITER_D_7LB8NY). Information spread by PGC volume 1.
- Work Permit Procedure https://user.iter.org/default.aspx?uid=3E8289
- Procurement Quality Requirements (ITER_D_22MFG4)
- Requirements for Producing a Quality Plan (ITER_D_22MFMW)

- ITER Site access Procedure (ITER_D_S3893D)
- PGC SPS Vol. 1 - IO&F4E (ITER_D_T6V4RP)
- CAD instructions for companies (ITER_D_9PNNM4)
- Contractor Safety Management Procedure (Q2GBJF) (only valid for HQ, storage Area)
- Storage Areas Access Procedure (ITER_D_V9TVBS)
- Requirements for Producing a Contractors Release Note (ITER_D_22F52F)
- Procedure for the management of Deviation Request (ITER_D_2LZJHB)
- Procedure for management of Nonconformities (ITER_D_22F53X)
- IO cabling rules https://user.iter.org/default.aspx?uid=335VF9

4 Codes and standards

- French Labour code Regulatory Part, Part IV : Health and safety at work
- French order of 19 April 2012 related to standards interesting electrical installations in buildings receiving workers

- Decree 2010-1017 obligation of the contracting authority
- Decree 2010-1016 obligation of the employers
- Decree 2010-1118 operation on (or in the vicinity) an electrical installation and the authorization
- Decree 2010-1018 various provisions relating to the prevention of electrical hazard in workplace
- NFC 13200: HV Electrical Standard
- NFC 15100: LV Electrical Standard
- NF C 33-226 (2016) Insulated cables and their accessories for power systems - Cross-linked polyethylene cables of rated voltages from 6/10(12) kV up to 18/30(36) kV with fixed gradient for distribution networks
- IEEE Std. 32 Standard requirements, terminology and test procedure for neutral grounding devices
- IEC 61869 Instrument transformers
- IEC 60060 High voltage test techniques
- IEC 60529 Degrees of protection provided by enclosures (IP Code)
- NF EN 50181 Bushing above 1kV up to 52kV and from 250A to 3.15kA for Dry type transformers
- IEC 62271-1 High-voltage switchgear and controlgear. Part 1: Common specifications
- IEC 62271-200 High-voltage switchgear and controlgear. Part 200: AC metal enclosed switchgear and controlgear for rated voltage above 1 kV and up to and including 52 kV.
- IEC 60076 Power transformers
- IEC 60296 Fluids for electro-technical applications. Unused mineral insulating oils for transformers and switchgears

- EN 1990: Eurocode 0, Safety, serviceability and durability of structures
- EN 1991: Eurocode 1, Actions on structures
- EN 1992-1: Eurocode 2 -1, Design of concrete structures
- French building code DTU 13.12: Calculating superficial baseplates
- French building code DTU 13.3: Calculating and designing paving

5 Estimated duration

The duration of the contract is 40 weeks.

6 Site Conditions

6.1 Outdoor Ambient Conditions

Elevation (meters above sea level)	315
Temperature range (°C)	-20 to +40
Monthly average of hottest month (°C)	≤ 22
Average annual temperature (°C)	12
Maximum Wind Speed (km/h)	166.6
Mean annual relative humidity	80%
Maximum ice coating (mm)	≤ 20
Maximum insulation (W/m2)	≤ 1000
Pollution Level (as per IEC 60071)	1 (light)

6.2 Seismic Conditions

According 22 October 2010 French order which is applicable for NSC buildings, as part of this specification, Importance class is 1. Therefore there are no specific or additional requirements for design purpose.

7 Work description-Responsibilities

The Contractor's performance shall include all supplies and services necessary for the Works (equipment, specialized tools, qualified labour, energy, diesel supply, transportation and various handling, detailed construction designs and drawings, project organization, etc.).

All the document or component shall be validated by IO before any order or execution works.

The responsibilities between the Parties is summarised in Table 1 (below) and is further detailed in the following sections.

Activity	IO	Supplier
A-Design-supplies		
Requirement-preliminary arrangement	R	A
Design and execution study	A	R
Supplies of the material and delivery including auxiliary transformer and prefabricated substation	A	R
B-Site works		
Permit to work	R	A
Site installation works (civil works and electrical works)	A	R
C-Final acceptance		
Legal inspection (if necessary)	R	/////
As-built	A	R
Final Acceptance	A	A

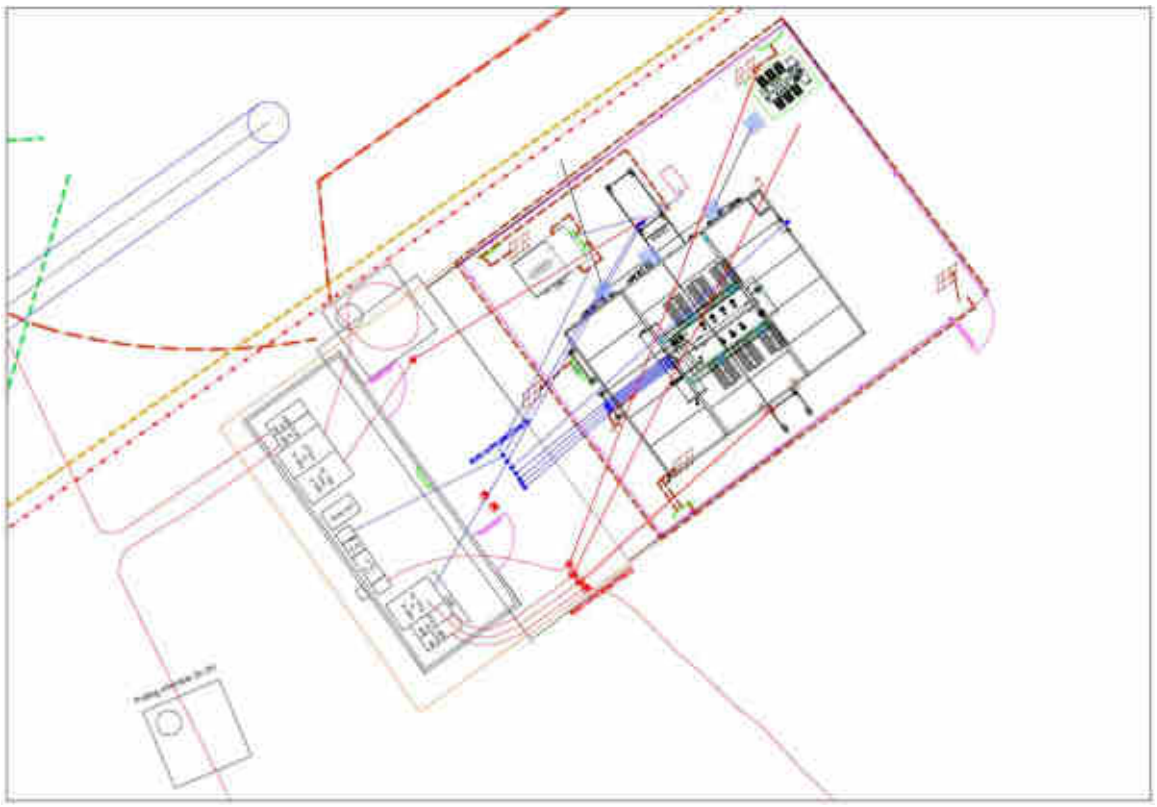
A: Approval, Acceptance

R: Responsibility

7.1 Location of the installation

The works will be located at the North-West of the platform.

The complete general arrangement is provided in the annex an extract is given below.



7.2 Site works

7.2.1 Preparatory Civil works, ducts, finishing

The Company will have to supply and install a concrete prefabricated Load Center compliant with NFC 13200. This includes the preparatory civil works, the delivery on ITER site, the lifting operation, cables laying and connections (described in another chapter)

A/ The Load Center must be installed astride on the existing platform. The company will have to excavate the soil at the vicinity of the existing blinding concrete slab which shall be extended. A sand bed might be necessary in accordance with the manufacturer's recommendation.

A grounding network must be installed by the contractor (120mm² copper cable, buried at 1m depth) around the substation, it must be connected to the existing earthing ring already buried around the T9 transformer. Buried connection will be done by exothermic welding.

The existing ducts visible on the photo below must be extended up to the basement of the substation/new pulling chamber (see hereafter).

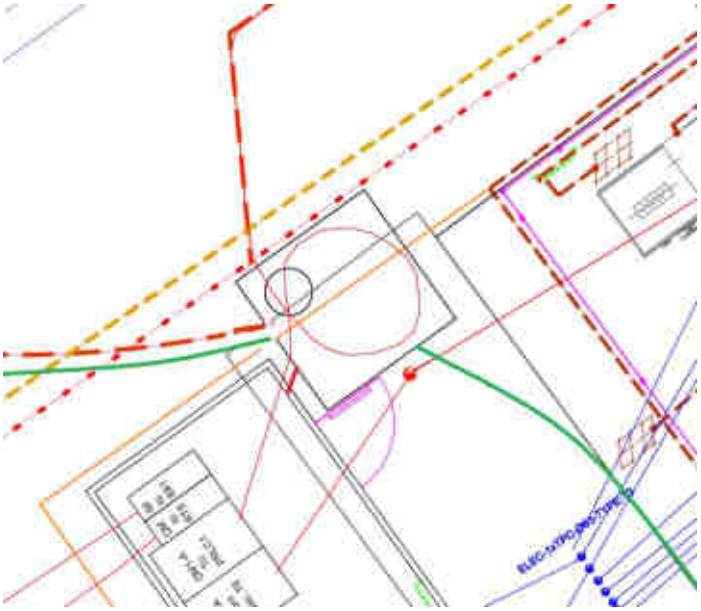
Indicative number of duct to be extended:

-9 Ducts 63mm

-6 Ducts 160-200mm

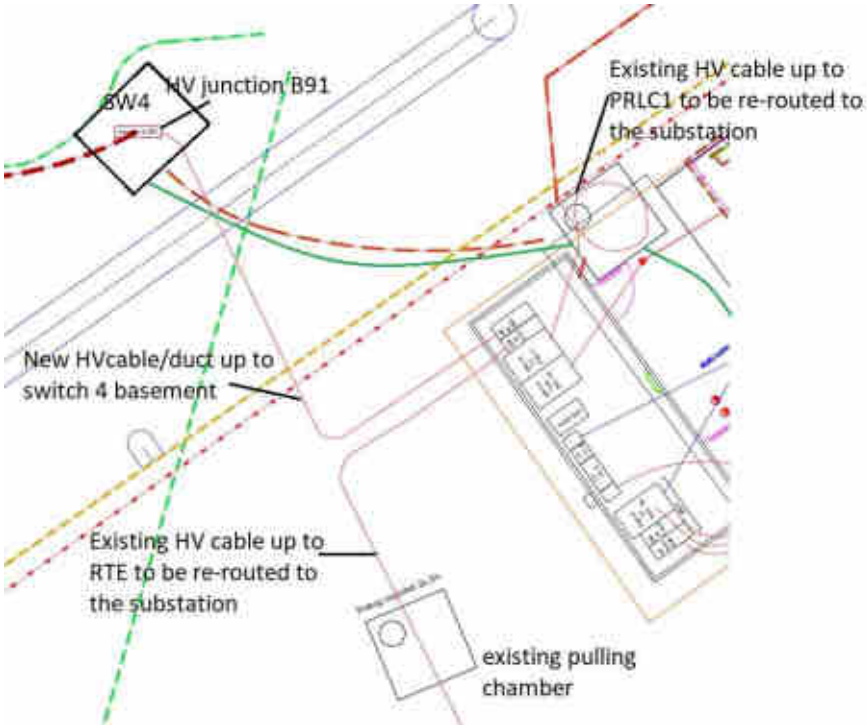
B/the pulling chamber visible of picture above must be replaced. To do so, the contractor will have to supply and install a concrete pulling chamber 2x2x2m (bottomless, bed gravel instead). The chamber must be fitted with an Iron cast frame + cover 400kN diam open. 610mm and a ladder. The concrete cover of the pulling must include four ''ARTEON'' hooks or equivalent system allowing a safe lifting.

In addition the contractor will have to prepare 4 ducts penetration in the pulling chamber (HV link to PRLC1 200mm, fiber optic up to SW4 63mm, spare duct up to SW04 160mm).



C/The company will have to re-route the RTE HV cable, and to pull a new portion of HV cable between the substation and the SW4. HV Cables are described in the next chapter.

It is possible to use the existing ducts however the company will have to make the necessary excavations to pull back the cable and to extend the ducts up to the substation



D/ when all the electrical works will be completed, the company will have to back fill and to finish the area. In front of the load center the cable will be shallow, the company must supply and install a fence and a pedestrian gate in order to forbid the access to any vehicle.

The fence must be made by rigid panels 2.50m large x 1.93m height composed by welded rectangular meshes 200 x 55mm, 5mm diameter wires.

- **Galvanized according standard 10244-2 class D**
- **Coated with 2 layers Epoxy and Polyester (grey RAL 7016)**
- **10 years warranty against corrosion**
- **Wire breaking strength 500 – 700 N/mm^2**

Fence posts shall anchored in concrete foundations. An equipotential bonding in bare copper cable must be installed along the fence with grip connections on each fence panel and connected on each post.

A pedestrian gate (1000mm large) must be also installed to access the transformer with High Voltage restricted area access sign.

Each fence side must have an Electrical Danger sign.

7.2.2 Prefabricated Substation

The layout of the substation shall be approved by IO. One is proposed below but can be modified.

Example of substation

The expected dimensions of the envelope are as following,
External Length =7.52m, external width=2.86m, RAL 1015. A basement is mandatory.

The Substation shall include:

- 2 access doors.
- False floor with necessary cable trays, with independent paths for MV, LV and IC cables
- Manual switch and indoor lighting devices (LED)
- Auxiliary lights with manual switch,
- At least 2 Sockets.
- Main Earthing Busbar, and equipotential network
- HVAC units for Heating and cooling
- Emergency lighting with remote control
- 2 Outdoor lighting devices (20w led) with detector above the doors
- The Contractor shall provide the regulatory signs and safety equipements (SF6, electrified care, glove, stool, 2 fire extinguishers…)
- RONIS Locks for Interlocking (the details are provided in the dedicated section)
- 6 Spares HV fuses (3 per QM)
- Low voltage Electrical Boards, 15kV switchgear, UPS, Emergency distribution panel (see below)

7.2.2.1 22kV switchgear-protection relays and auxiliaries

The primary side of the transformers (T9, and auxiliary) from B36 will be equipped with SM6 swichgears by Schneider Electric.

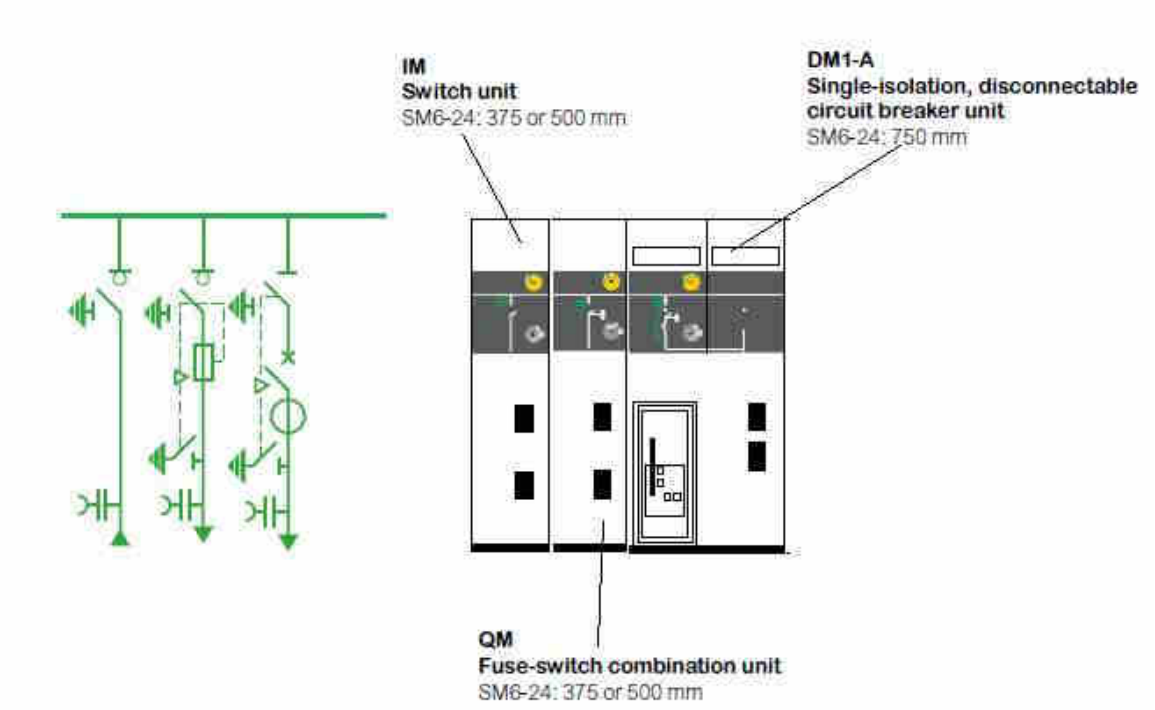
It is expected to Install:

- 1 IM incoming cabinet
- 1 QM for the Auxiliary transformer 160kVA
- 1 DM1-A Single-isolation, disconnectable circuit breaker for T9

Circuit breaker units will be equipped with protection relay (see below)

Minimum requirement for the switchgear

- Un (kV) : 22
- Ur (kV) : 24
- Busbar rated current Ir (A): 630
- Short duration short circuit withstand Ik (kA/1s) : 20
- Internal arc classification : A-FL or A-FLR according installation condition
- Internal Arc Withstand current (kA/1s) : 20
- Internal Arc duct exhaust outlet: LEFT SIDE
- IM incoming panel rated current (A) : 630
- QM Fuse switch combination unit 200A+3 fuses SOLEFUSE 16A+Mx tripping coil
- DM1-A Disconnector / Circuit breaker panel rated current (A) : 630*
- SF1 Circuit breaker rated current (A) : 630
- SF1 Circuit breaker breaking capacity Isc (kA) : 20 @ 24 kV
- SF1 Circuit Breaker Making Capacity Ima (kA) : 50 @ 24 kV
- 1 Core Balance CT CSH200 (DM1A)
- Shunt coil 230VAC
- 3 Electronic Current transformers LPCT TLP 130 (DM1A Primary T9)



Protection relays to be installed in the DM1-A (switchgear 1)

- SEPAM S81 or S82 (supply 48Vdc)
- LPCT interface CCA671
- 1 Power converter 230Vac/48Vdc

- Communication module ACE850TP (supply 230Vac from UPS)
- Related circuit breakers, terminal blocks, RJ45 cables…
- 1 Internet switch MOXA EDS-405-MM-SC (48Vdc)
- 1 DIN rail mounted patch rack
- All related circuit breakers

Overview of the sepam architecture (22kV+15kV)

7.2.2.2 15kV switchgear-protection relays and auxiliaries

The Substation will be equipped with SM6 swichgears by Schneider Electric.

It is expected to Install:

- 1 DM1-A Single-isolation, disconnectable circuit breaker (incoming cabinet from T9 transformer)
- 1 DM1-A Single-isolation, disconnectable circuit breaker (to PRLC1)
- 1 QM Switch-Fuse unit (RTE transformer)
- 1 IM Switch Unit (link to the B91)

Circuit breaker units will be equipped with protection relay (see below)

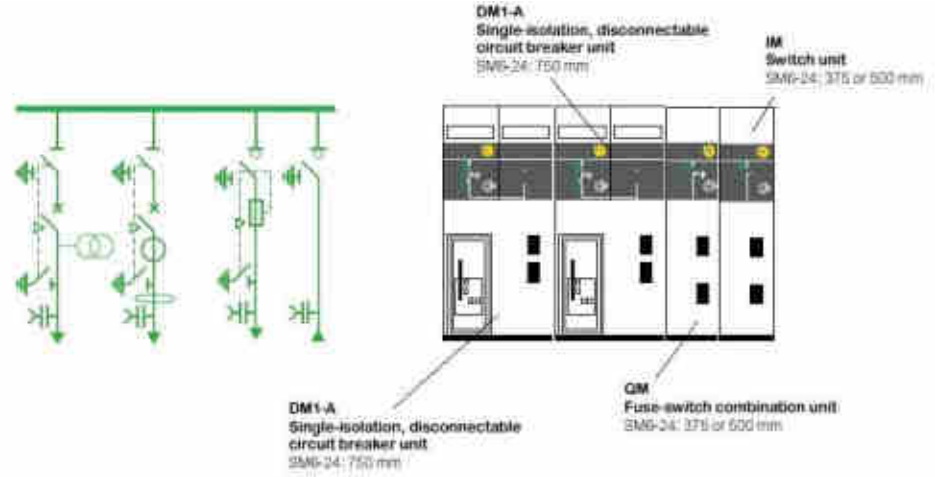
Minimum requirement for the switchgear

- ✓ Un (kV) : 15
- ✓ Ur (kV) : 24
- ✓ Busbar rated current Ir (A): 630
- ✓ Short duration short circuit withstand Ik (kA/1s) : 12,5
- ✓ Internal arc classification : A-FL or A-FLR according installation condition
- ✓ Internal Arc Withstand current (kA/1s) : 12.5
- ✓ IM Switch Unit rated current (A) : 630
- ✓ QM Fuse switch combination unit 200A+3 fuses SOLEFUSE 16A+Mx tripping coil
- ✓ 2 DM1-A Disconnector / Circuit breaker panel rated current (A) : 630
- ✓ (x2) SF1 Circuit breakers rated current (A) : 630
- ✓ SF1 Circuit breaker breaking capacity Isc (kA) : 20 @ 24 kV
- ✓ SF1 Circuit Breaker Making Capacity Ima (kA) : 50 @ 24 kV
- ✓ 3 Electronic Current transformers LPCT TLP 130 (DM1-A PRLC1)

- ✓ 3 Voltage transformer unit 24kV, type VRQ2n/S1, prim Voltage (kV) : 15/√3, sec voltage (V) : 100/√3, accuracy class 0.5, thermal power 30VA (DM1A secondary side)
- ✓ 1 Core Balance CT CSH200 (DM1-A link PRLC1)
- ✓ All the Shunt trip coil are in 230VAC (from the UPS)

***Note 1:** CTs (T9 secondary protection) are already installed at secondary side of the transformer

Note 2: interlocks see **7.2.5**



Protection relays to be installed in the DM1-A (switchgear 2 and 3)

- SEPAM S81 or S82 (supply 48Vdc)
- LPCT interface CCA671 (only Switchgear 3)
- 1 Power converter 230Vac/48Vdc
- Communication module ACE850TP (supply 230Vac)
- Related circuit breakers, terminal blocks, RJ45 cables…

Overview of the sepam architecture (22kV+15kV)

Open/Close state of the IM and QM must be sent to the sepam (DM1-A sec T9).

7.2.2.3 Low voltage UPS

The substation must be equipped with an UPS 5kVA dedicated to switchgear low voltage supply.

The minimum requirements for the UPS are:

- ✓ Power 5Kva, input 400VAC
- ✓ Autonomy 2 hours at full load
- ✓ Output 230VAC
- ✓ Earthing system TNS

7.2.2.4 Low voltage distribution board

The contractor shall supply and install a Main Distribution Board as follows:

- Schneider prisma plus including 2 mains columns (class4 and class 2) and 2 column for cables (the following arrangement is proposed for reference but may be optimized by the contractor).The incoming/outgoing cables will arrive by the bottom of the MDB, Terminal blocks must be foreseen.

  - Main characteristics:

    - Nominal current 160A, expected IK3 max 20kA
    - Form 2b
    - Busbars LINERGY 250A (at least),
    - 1 column 800mm width,
    - 1 column 400mm width,
    - 2 columns for cables 300mm width
    - Steel panels 10/10mm at least with epoxy paint
    - IP55, IK10
    - Large Earthing Busbar.

Column A (800mm), Glazed door

Class 4

Manual transfer Device based on 2 NSX250F 4P4D+micrologic 2.2 (sources from auxiliary transformer 160kVA and from Emergency panel defined in 7.2.2.5), Circuit breakers must be fitted with a mechanical interlocking system, MX shunt trip coil, OF/SD contact.

- 1 voltage light indicator 230Vac and its circuit breaker

- counting unit type diris A40 and its circuit breaker
- 1 NSX100N 4P4D + micrologic 2.2 with sub distribution breakers as follows:
    - 1 Circuit breaker 10A-4P for the UPS (5kVA)
    - 1 Circuit breaker 20A-4P for Spare
    - 1 Circuit breaker 2P 16A+RCD 30mA for the 230V sockets (T9 substation)
    - 1 Circuit breaker 2P 16A+RCD 30mA for the 230V sockets (T9 transformer zone)
    - 1 Circuit breaker 2P 10A for lighting and emergency lighting
    - 1 Circuit breaker 2P 4A for emergency lighting
    - 1 Circuit breaker 2P 10A for outdoor lighting (substation)
    - 1 Circuit breaker 2P 10A for outdoor lighting (transformer zone)
    - 2 Circuit breakers 2P 16A for the HVAC
    - 1 multiclip 160A 4P
    - A set of terminal block
- 2 NSX100N 4P4D + micrologic 2.2 as spare

The board shall be equipped with a surge protection device

- Surge arrester (main busbar):
- Type 1+2
- TNS electric system nominal voltage 230/400VAC
- Imp=25kA (10/350) by pole mini
- Current In ≥ 5 kA per pole. Wave 8/20
- Up≤1.5kV
- With remote signaling contact wired on cage clamps
- Protected by fuse according to the manufacturer (if integrated fuse, attention must be paid to short circuit current value)
- Short-circuit current (50Hz): to be adapted to the installation point (depending of the electrical calculation note).

The Respect L1+L2+L3 <=50cm is mandatory

Column B (400mm), Glazed door
Class 2

- 1 main circuit breaker 2P 20A
- 1 modular distribution block
- A set of modular circuit breakers 2P for transformer protection panel, protection relay, tripping coil.
- A set of terminal block.

All the open or moulted case breakers shall be equipped with MX 230V tripping coil and OF/SD contact. The modular breaker shall be equipped with OF/SD contact.

Modular circuit breaker will be IC60N from SE, curve and type will be determined by the caneco calculation note (included in the scope of the company)

CB, UPS Faults will have to be monitored (trough the SEPAM)

Cable Columns (300mm)

Cable columns will be placed as following: 1 on the left of the column A, 1 on the right of the column B. Each cable columns must include, Power and control terminal blocks, Vertical cable tray.

7.2.2.5 Emergency power supply panel

The company must supply and install a small electrical panel allowing the connexion of a diesel generator 40kVA. Panel characteristics and equipment:

- IP66, Ik10
- Size 500x400x300mm approximately
- Main protection IC60N 4P4D curve B +RCD 30mA+Mx shunt trip coil+of/sd contact
- Terminal blocks (diesel connection and link to T9 class 4 auxiliary board)
- Large grounding busbars

7.2.3 Auxiliary transformer 43AGT9-TR-2000

The company will have to supply and install a 160kVA ONAN transformer, the transformer will be supplied in 22kV from T9 substation. The network downstream will be 410V (no load), TNS system. This transformer will be dedicated to the class 4.

The transformer will be installed on the existing retention tank.

The installation works include HV, LV, IC cables, grounding and all the related accessories (HV termination etc….): see detail in the related section

The Transformer must have the following characteristics

- ITERTag Number : 43AGT9-TR-2000
- Rated Power : 160kVA
- Location : Outdoor
- Rated Frequency : 50 Hz
- Cooling : ONAN
- Coupling diagram : Dyn11
- Type : Oil Immersed, Hermetically sealed
- Rated voltages
  - HV side : Ur = 22 kV
  - LV side : Ur = 0.41 kV (no load)
- Tapping: +/- 2x2.5%
- Highest voltage for the equipment
  - HV side : Um = 24 kV
  - LV side : Um = 1.1 kV
- Rated short duration induced withstand voltage
  - HV side : 50 kV
  - LV side : 3 kV
- Rated Lightning impulse withstand voltage
  - HV side : 125 kV
- Maximum load and no-load losses classification as per (EU) 548/2014 regulation : Ao-Ck
- Short circuit impedance @ 75 ºC : 4 %
- Thermal Insulation : Class A
- Winding temperature rise : ≥ 65 ºC
- Oil temperature rise : ≥ 60 ºC
- Connections

- Primary side :Plug-in Bushings for Separable Connector Interface A (250 A) 24 kV with locking device for RONIS ELP1 key lock (delivered without key lock)
- Secondary side including Neutral : Porcelain Bushings for cable in cable box outdoor designed

- Corrosivity (According ISO 12944-2) : C3 (Medium)
- Durability (According ISO 12944-1) : H (High 15-25 years)
- Final Colour : RAL 7030

7.2.3.1 Accessories

- 4 wheels direct with blocking system
- Lifting lugs
- Hauling holes
- Protective device DMCR or DGPT2
- Rating plate

The DGPT2 relay must trip the QM switchgear, a trip or open command on the primary side shall trip the secondary side (main circuit breaker)

7.2.3.2 Insulating Oil

Insulating oil shall be “uninhibited” mineral type insulating oil according IEC 60296, in conformance with the specifications given in the table below:

Property	Unit	Test Method	Typical Data
Appearance		IEC 60296	Clear, no sediment
Density [20°C]	kg/dm3	ISO 12185	< 0.895
Viscosity [40°C]	mm^2/s	ISO 3104	< 12
Viscosity [-30°C]	mm^2/s	ISO 3104	< 1800
Pour point	°C	ISO 3104	< -40
Acidity	mg KOH/g	IEC 62021	< 0.01
Corrosive sulphur		IEC 62535	Non Corrosive
Water content	mg/kg	IEC 60814	< 30
Furfural content	mg/kg	IEC 61198	< 0.05
Dielectric Dissipation Factor @ 90°C		IEC 60247	< 0.5 after oxidation stability tests
Breakdown voltage	kV	IEC 60156	> 70
Sludge after 164 hours	Wt %	IEC 61125 C	< 0.8
Flash point	°C	ISO 2719	> 135
PCB content		IEC 61619	Not detectable

7.2.3.3 Tests to be performed

The transformer shall be tested in accordance with IEC 60076-1.The test report must be provided to IO before delivery.

7.2.4 Site integration

T9 (TR1000) transformer is currently in operation (temporary configuration), the company must perform the integration of the new distribution scheme including the T9 substation, cable pulling and connection.

7.2.4.1 Transformer's protection panel.

The company must reintegrate the existing transformer's protection board in the new scheme of distribution. The company must supply and install the necessary cables.

The transformer protection panel shall be supplied from the UPS. The company must send the CT information to the SEPAM 80 secondary side. The existing SEPAM 10 (F01 on the drawing) will be removed, new cables must be pulled between the substation and the transformer's protection board. The 2 others SEPAM10 (ground tank fault, cable screen fault) will be kept. The trip signals will be sent to the SEPAM 80 (CB transformer primary side). Open/Trip command on the SEPAM 80 located at the transformer's primary side, must trip the SEPAM 80 at the transformer's secondary side. The tripping cables up to B36, SW04, the power supply from SSEN container must be supressed (KM6 relay etc…).

The drawing of the transformer protection board is annexed to the present document

7.2.4.2 MV cables installation and connection

All the MV cables/accessories must have the following characteristics:

- Cable compliant with NFC33226
- U0/U :12/20kV (24kV)
- Aluminium
- Trefoil formation
- Core class 2 stranded, compacted
- Core max continuous temperature 90C, 250C in case of short circuit
- Screen of Extruded semi-conductor compound around the core
- Insulation XLPE
- Semiconductor: strippable ribbed extruded compound with hygroscopic powder.
- Aluminium screen glued to the outer sheath
- Outer sheath PE flame retardant C2, Eca (CPR)

A/ 22kV cable from B36

The company will have to cut the terminations on T9 primary side and to pull back the existing HV cable up the 22kV switchgear (IM) located in T9 substation. The company must supply and install 1 set of HV termination **Indoor Cold shrink 3M termination E3UIC RF-24-50-240 (24kV).** The company will have to connect the existing grounding cable in the T9 substation (main grounding bar)

- The company must install the interlock Keys type RONIS profile 201 RONIS (ELP1 or HFS SP1). If the existing locks are re-installed, it will be necessary to supply the necessary accessories. Refer to the related section.

B/ Link T9 Substation (DM1-A 22kV) to Primary T9TR1000.

The company must supply and install:

- 1 new Cables 3x1x240mm² Aluminium+PE 70mm² bare copper, approximate length 20m (TPC duct) between the Transformer's primary circuit breaker (DM1-A 22kV) and the transformers primary side.
- 1 set of Indoor Cold shrink 3M termination E3UIC RF-24-50-240 (24kV) on T9 substation Circuit Breakers (22 kV)
- 1 set of Separable connector 630A interface type C (24kV) on T9 primary and secondary side
- The company must install the interlock Keys type RONIS profile 201 RONIS (ELP1 or HFS SP1). If the existing locks are re-installed, it will be necessary to supply the necessary accessories. Refer to the related section.

The company will have to use the existing ducts and cable trays on transformers side.

C/ Link T9 Secondary side (15kV)-T9 substation (DM1-A 15kV)

The company must cut the cable terminations currently connected to the SW04 (switch 4), to pull back the cable up to the T9 substation (DM1-A 15kV) and to re-connect it. The company must supply and install 1 set of HV termination **Indoor Cold shrink 3M termination E3UIC RF-24-50-240 (24kV).** In addition, The Company will have to connect the existing grounding cable in the T9 substation (main grounding bar). If possible, the contractor will have to create a loop in the basement of the substation with the spare length of cable.

- The company must install the interlock Keys type RONIS profile 201 RONIS (ELP1 or HFS SP1). If Existing locks are re-installed, it will be necessary to supply the necessary accessories. Refer to the related section.

D/ T9 substation (QM 22kV) to T9TR2000 auxiliary transformer.

The contractor will have to supply and install:

- 1 new Cables 3x1x50mm² Aluminium+PE 50mm² bare copper, approximate length 25m (TPC duct) between the Transformer's primary switchgear (QM) and the transformers primary side.
- 1 set of Indoor Cold shrink 3M termination E3UIC RF-24-50-240 (24kV) on T9 substation 22kV QM switchgear.
- 1 set of Separable connector 250A interface type A (24kV) on T9TR2000 primary side
- The company must install the interlock Keys type RONIS profile 201 RONIS (ELP1 or HFS SP1). Refer to the related section

E/ Link T9 substation (15kV DM1-A PRLC1) to PRLC1

The company must cut the terminations currently connected to the SW04 (switch 4), to pull back the cable up to the T9 substation (DM1-A link PRLC1) and to re-connect it. The company must supply and install 1 set of HV termination **Indoor Cold shrink 3M termination E3UIC RF-24-50-240 (24kV).** In addition, The company will have to connect the existing grounding cable in the T9 substation (main grounding bar). If possible, the contractor will have to create a loop in the basement of the substation with the spare length of cable.

- The company must install the interlock Keys type RONIS profile 201 RONIS (ELP1 or HFS SP1). If Existing locks are re-installed, it will be necessary to supply the necessary accessories. Refer to the related section.

F/ Link T9 substation (15kV QM) to RTE transformer.

The company must cut the terminations currently connected to the SW04 (switch 4), to pull back and re-route the cable up to the T9 substation (QM for RTE TSA protection) and to re-connect it. The company must supply and install 1 set of HV termination **Indoor Cold shrink 3M termination E3UIC RF-24-50-240 (24kV).** In addition, The supplier will have to connect the existing grounding cable in the T9 substation (main grounding bar)

- The company must install the interlock Keys type RONIS profile 201 RONIS (ELP1 or HFS SP1). If Existing locks are re-installed, it will be necessary to supply the necessary accessories. Refer to the related section.

G/ Link T9 substation (15kV IM) to B91

The contractor must supply and install:

- 1 new Cables 3x1x240mm² Aluminium+PE 70mm² bare copper, approximate length 20m (TPC duct) between the IM 15kV switchgear and the basement of the switch4.
- 1 MV cables junctions box type J3UP-RF-RSM-24-50/240 Al/Cu for the connection between the new cable and the existing cable from B91. The junction shall be installed in the basement of SW4
- 1 set of Indoor Cold shrink 3M termination E3UIC RF-24-50-240 (24kV) on T9 substation IM 15kV switchgear

7.2.4.3 LV, signal, IC cables and various equipment

The company will have to supply and install cables between T9 substation and T9TR2000 transformer, T9TR1000 protection board, T9TR1000 area

The cables must be fire retardant according to IEC60332-3, low smoke according to IEC60034 and Halogen free following IEC 60754-2 standard. Several portions of cable tray or cable ladder must be installed in order to arrange the cable laying.

When possible cables will be pulled in the existing cable ducts.

A/ T9TR2000 secondary side-T9 substation class 4 electrical board.

The company must supply and install a 5G95 cable U1000R2V type in the a TPC duct the expected length is 25m.

The supplier will have to ground the neutral on T9TR2000 secondary side using a 50mm² copper insulated conductor. The conductor must be bonded to the closest Earthing busbar. The cable shall be identified as SP0.

B/ T9TR1000 protection board-T9 substation 22kV or 15kV DM1-A Transformer's protection.

As described in 7.2.4.1, the contractor will have to supply and install:

- **4 Cables 2x6mm² copper for CT 300/1 (phases), and cable screen fault.**
- **1 Cables 3G10mm² copper (power supply from UPS)**

The power supply from the SSEN UPS (CAP0099) shall be disconnected and wired as spare on terminal blocks

The existing inter-trip cable from B36 (CAS001 from 43AE00-CU-1006) must be re-routed up to the substation DM1-A 22kV circuit breaker. If it is not possible to pull back this cable, the company will have to install a new one (5G6 approximate length 25m).

The inter-trip cable currently connected to SW04 (CAS002) must be re-routed up to 15kV DM1-A in T9 substation. An inter-trip function primary/secondary CB will be implemented at T9 substation level. In the transformer's protection panel, KM6 relay will be disconnected.

The optical fiber currently pending (CAO002, 12FO monomode) must be terminated using LC connectors on T9 substation and B36 side.

The existing inter-trip cable between the SW04 and RTE TSA must be re-routed up to the 15kV QM switchgear (RTE TSA).

C/ Internal distribution in T9 substation

The company must supply and install all the other necessary cable for internal distribution (HVAC, Lightings, cables between SEPAM, sockets, link between emergency power supply panel and T9 distribution board, IC cables…..)

In addition, the company must supply and install:

- **4 IP55 Led spotlights on the transformer's area (including the cables)**
- **2 sockets 16A 230V 1P+N+G (including the cables)**

7.2.5 Key Interlocks

All the locks must be RONIS profile. The cylinder must have the Code engraved, keys must have Code and Number engraved, each lock must be delivered with **two keys**. All keys must be Profile RC EM.

7.2.5.1 Switchgear 22kV 43AET9-JB-1000

A-IM panel 43AET9-CU-1000 (Incoming from B36)

Disconnector switch is locked open when the key is absent (or free)

- **Code : CKB**
- **Number : EM50255**

Earthing switch is locked in open position when the key is absent (or free)

- **Code : CKC**
- **Number : EM50431**

B-QM panel 43AET9-CU-1001 (Auxiliary transformer protection)

Earthing switch is locked in open position when the key is absent (or free)

- Code : CJZ
- Number : EM50211

Key is free when earthing switch is closed and cable compartment door is locked removed (transformer access)

- Code : CKA
- Number : EM50233

C-DM1-A panel 43AET9-CU-1002

The circuit breaker can be closed if the key is present

The circuit breaker is locked open when the key is absent

- **Code : CJT**
- **Number : EM32431**

Disconnector locked closed key CJT is absent, key CJW is trapped

Disconnector locked open key CJT is trapped, key CJW is absent

- **Code : CJT**
- **Number : EM32431**
- **Code : CJW**
- **Number : EM32651**

Earthing switch is locked in open position when the key is absent (or free)

- Code : CJU
- Number : EM32453

Key is free when earthing switch is closed and cable compartment door is locked removed

- **Code : CJS**
- Number : EM32255

RONIS ELC12 or HFS AST3GT5000 key transfer box must be added on the low voltage compartment front face

- **1 Key absent : CJT EM32431**
- **1 Key absent : CJN EM14651**
- **1 Key trapped : CJW EM32651**

7.2.5.2 Switchgear 15kV 43AGT9-JB-1000

A-DM1-A panel 43AGT9-CU-1000

The circuit breaker can be closed if the key is present

The circuit breaker is locked open when the key is absent

- **Code : CJO**
- **Number : EM32013**

Disconnector locked closed key CJO is absent, key CJX is trapped

Disconnector locked open key CJO is trapped, key CJX is absent

- **Code : CJO**
- **Number : EM32013**
- **Code : CJX**
- **Number : EM50013**

Earthing switch is locked in open position when the key is absent (or free)

- Code : CJV
- Number : EM32615

Key is free when earthing switch is closed and cable compartment door is locked removed

- **Code : CJR**
- Number : EM32233

RONIS ELC12 or HFS AST3GT5000 key transfer box must be added on the low voltage compartment door

- **1 Key absent : CJO EM32013**
- **1 Key absent : CJP EM32035**
- **1 Key trapped : CJX EM50013**

B-DM1-A panel 43AGT9-CU-1001

The circuit breaker can be closed if the key is present

The circuit breaker is locked open when the key is absent

- **Code : CJY**
- **Number : EM50035**

Disconnector locked closed key CJY is absent, key CDW is trapped

Disconnector locked open key CJY is trapped, key CDW is absent

- **Code : CJY**
- **Number : EM50035**
- **Code : CDW**
- **Number : EM52635**

Earthing switch is locked in open position when the key is absent (or free)

- Code : BZG
- Number : EM50433

RONIS ELC12 or HFS AST3GT5000 key transfer box must be added on the low voltage compartment door

- **1 Key absent : CJY EM50035**
- **1 Key absent : BZH EM50455**
- **1 Key trapped : CDW EM52635**

C-QM panel 43AGT9-CU-1002 (RTE transformer TSA1)

Earthing switch is locked in open position when the key is absent (or free)

- Code : BZE
- Number : EM50235

Key is free when earthing switch is closed and cable compartment door is locked removed (transformer access)

- Code : BZF
- Number : EM50411

D-IM panel 43AGT9-CU-1003

Disconnector switch is locked open when the key is absent (or free)

- Code : BWW
- Number : EM10415

Earthing switch is locked in open position when the key is absent (or free)

- **Code : BWX**
- **Number : EM10451**

7.2.5.3 22kV/15kV Transformer 43AGT9-TR-1000

- Key interlocking for separable connector :

A-22kV Separable connectors

- Code : CJS
- Number : EM32255

B-15kV Separable connectors

- Code : CJR
- Number : EM32233

7.2.5.4 22kV/0.4kV Auxiliary Transformer 43AGT9-TR-2000

- Key interlocking for separable connector :

A-22kV Separable connectors

- Code : CKA
- Number : EM50233

B-0.4kV Incoming Circuit breaker MDB

- Code : CJZ
- Number : EM50211

7.2.5.5 15kV network interlocking

- **Key interlocking for :**
  - **Transformer 43AGT9-TR-1000 LOTO**
  - **Between IO 15kV network and CEA 15kV network**

RONIS ELC23 or HFS AST5GT5000 key transfer box must be installed on substation wall

- **1 Key trapped : CJN EM14651**
- **1 Key trapped : CJP EM32035**
- **1 Key free : CJU EM32453**
- **1 Key free : CJV EM32615**
- **1 Key free : CJQ EM32211**

7.2.5.6 General Interlocking Diagram

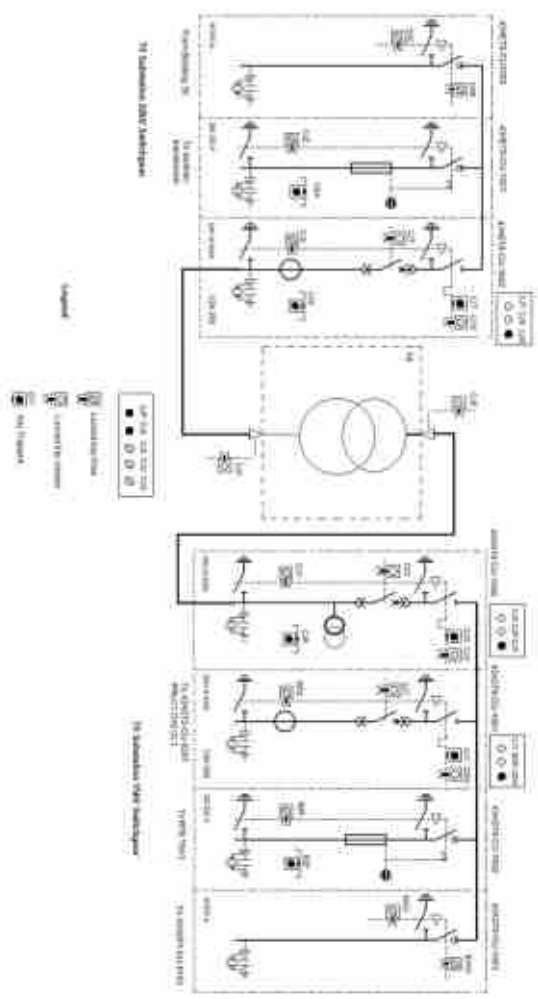


Diagram detailed in Annex 2

7.2.6 Grounding and equipotential network

As written in 7.2.1, the contractor will have to supply and install a peripheral grounding ring around T9 substation. This grounding ring must be connected to the existing one already in place around T9 slab. The 120mm² copper conductor will be buried at 1m depth, the installer shall make a connection (loop shape) to the main grounding bar installed in the T9 substation. The equipotential network shall be complete (fence, inside the LC, lights, cable tray, transformer) using copper cables of 25mm².

8 List of Deliverables

Deliverables and preliminary planning are listed below, reflecting the IO needs. The contractor may propose different organisation for optimizing its scope between supply and installation.

- **Contract Placed: T0**
- **PPSPS, Access request of personnel, Works authorization: T0 + 2 week**
- **Calculation note and drawings: T0 + 5 week**
- **Delivery of the T9 substation: T0 + 25 weeks**
- **Installation works and As built documentation: T0 + 30 weeks**

8.1 As-Built documentation

The contractor shall provide a complete As-built documentation which should be updated and completed version of aforementioned documentation, completed with mainly:

- **All the drawings in both native and pdf formats. Electrical/control drawings must be created using SEE Electrical Expert V3R4.**
- **Caneco calculation note**
- **Equipment datasheets**
- **Test report**
- **Certificate of conformity**

9 General conditions and requirements

9.1 Applicable codes and standards

The Contractor shall comply in performing the contract, with applicable laws, decrees, circulars and standards.

The Contractor shall comply with French construction standards or to European construction standards if such European standards exist and are equivalent to those French standards.

Unified Technical Documents (DTUs) and DTU Specifications and Calculation Rules shall be considered as industry practices and are applicable to the contract.

The Contractor shall be responsible for all requests for administrative authorisations and declarations that are required by virtue of applicable regulations.

For all products and materials subject to quality standards, the Contractor must only use products and materials that comply with said standards.

For all the works related to lightning Protection, the QUALIFOUDRE certification is mandatory.

9.2 Language

Since the official language of the ITER Organization is English, all written communication and deliverables shall be in English.

9.3 Delivery

The following generic requirements apply both for the shipment of equipment, etc. from the manufacture/assembly site to the ITER Site or to any intermediate site.

Suitable precautions shall be taken to avoid damage to the equipment. The equipment in the scope of the contractor will be subject to control and inspection, before unloading (on the truck). The delivery can be refused by IO if the equipment is damaged or not complete. The equipment remains under the responsibility of the contractor until the final acceptance of the installation works. The contractor is responsible of the delivery on site and has to deal with possible site constraints.

9.4 Site Data

9.4.1 Necessary information

The Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Works. To the same extent, the Contractor shall be deemed to have inspected and examined the site, its surroundings, the above data and other available information, and to have been satisfied as to all relevant matters.

9.5 Roads and Traffic management

It is the responsibility of the Contractor to put in place all the necessary safety and traffic management measures, in accordance with applicable rules and regulations, to ensure that staff and vehicles retain safe passage across the ITER Site. All the required equipment etc. to create a safe environment for the Works and ITER staff shall be provided by the Contractor.

During the Works, any road shall not be blocked for more than half it's width. For total closure of any roads, Works shall be performed on Saturdays only.

Roads accessing the worksite must be kept clean at all times. For this purpose, the Contractor shall organize road washing as often as earth is observed.

Vehicles or machinery, particularly those used for earthworks and civil engineering works, must be manoeuvred safely. Any damage to surrounding structures (buildings, roads, sidewalks, walkways) must be immediately repaired by the Contractor.

9.6 Safety

The supplier will have to comply with the relevant IO OSH site instructions. The list is available in the PGC Annex 0 (42FYPZ). If the supplier does not have access to Iter Document Management system, the document can be sent on demand.

A safety plan (PPSPS) shall be established by the Contractor (at a minimum in French) prior to the start of the Works. Contractor will have to use the ITER template. The supplier and the potential subcontractor will have to attend to the common inspection with the relevant stakeholder.

9.7 Environmental protection

The Contractor shall comply with environmental protection requirements and procedures applicable at the ITER Site:

- **ITER Organization Environmental Management System doc 1: PMAE v1 (ITER_D_97W4PN);**
- **Environmental requirements, (ITER_D_97WRFP [).**

An environmental respect plan shall be provided by the Contractor 2 weeks prior to the start of the Works, using the ITER template.

Debris and waste of all type shall be removed as work progresses.

The Contractor shall be responsible for cleaning, repairing and restoring facilities which it dirtied or damaged to their original condition, and shall remove their debris and rubbish to public rubbish tips.

Should said cleaning fail to be performed, it will be done by a third party at the loss and expense of the Contractor.

9.8 Access to the site / Worksite installation

Access to the ITER Site is subject to the ITER Site Access Procedures

The Contractor shall be responsible for supplying and installing fencing protecting the worksite which shall be maintained for the duration of the works and removed after completion of the Works. The Contractor shall also display signs prohibiting entry onto the worksite.

9.9 Work authorisation

Prior to the start of any Works on the ITER Site, a Work Authorisation must be obtained in accordance with the Work Authorisation Procedure. Permit to work will be managed by the IO. The contractor will appears in the PTW system as Acceptor.

10 Quality Assurance (QA) requirements

Works performed through this contract will be QC3

The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.

The general requirements are detailed in ITER Procurement Quality Requirements.

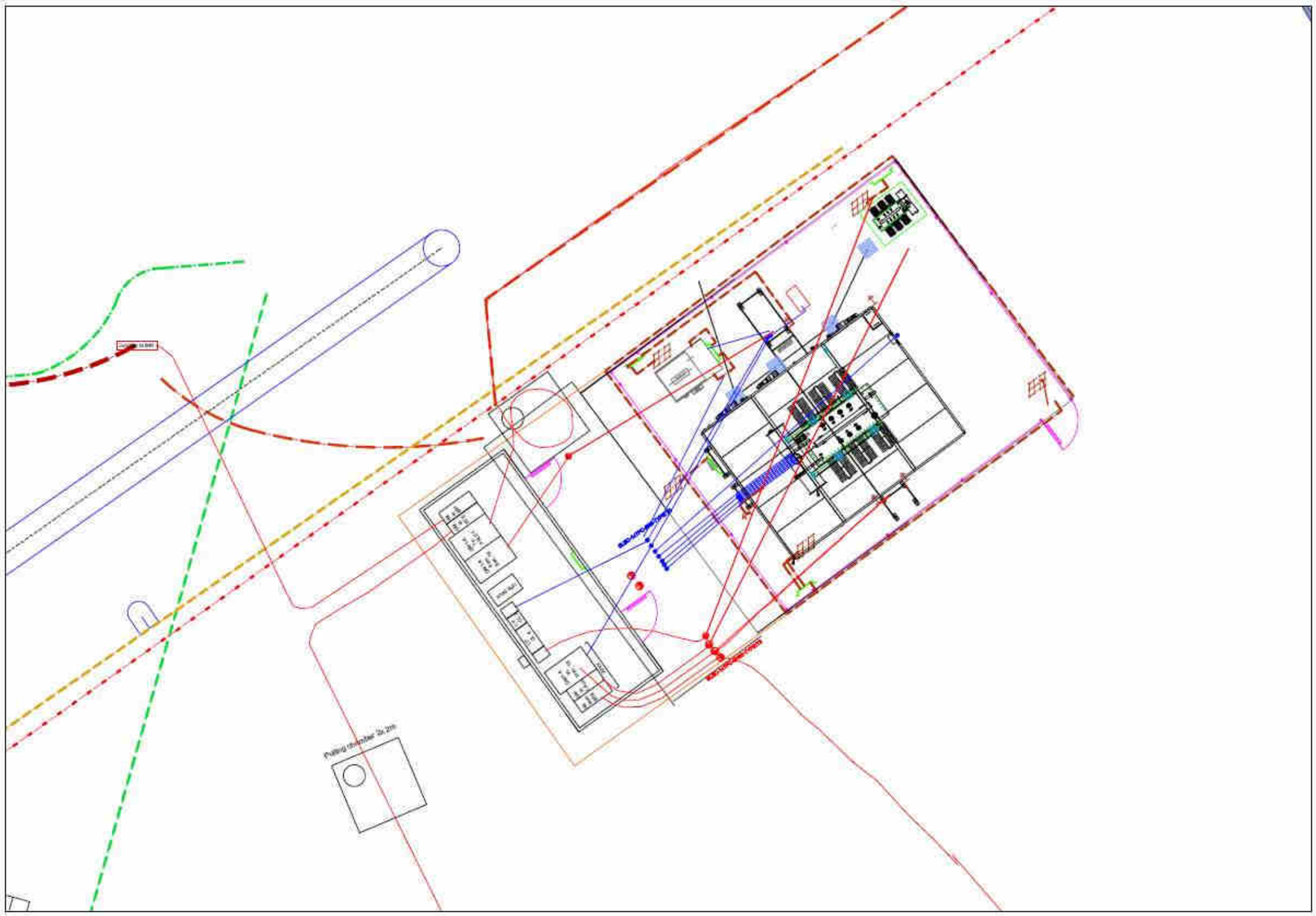
Prior to commencement of the Works, a Quality Plan must be submitted for ITER Organization approval giving evidence of the above and describing the organisation for this task; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities (see Procurement Requirements for Producing a Quality Plan).

Documentation developed as the result of this task shall be retained by the Contractor for a minimum of five (5) years and then may be discarded at the direction of the ITER Organization.

Prior to acceptance, delivery or payment, the Contractor shall perform a review of items and services status with respect to contract requirements shall be made and documented. This review shall be done in accordance with and documented in the Contractor's Release Note –refer to.

The Contractor shall obtain written agreement from the ITER Organization to any modifications to the design or this specification. Deviations and non-conformances shall be processed in accordance with the procedure. The Contractor shall commit to process non-conformance reports and associated remedial and corrective actions expeditiously.

Annex 1 Global Layout



Annex 2 Interlock diagram