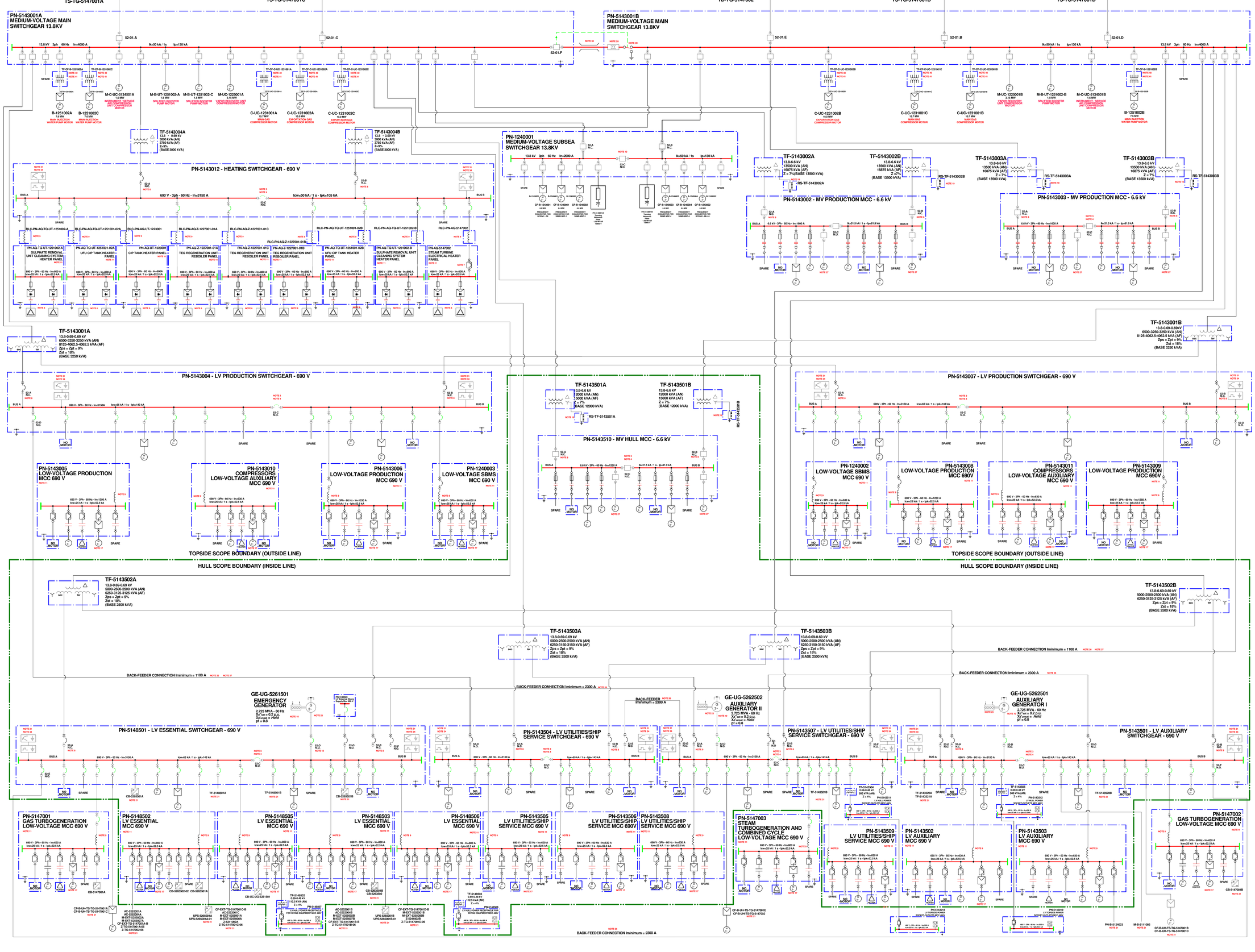

REFERENCE DOCUMENTS

I-ET-3000.00-0000-940-P4X-002 - SYMBOLS FOR PRODUCTION UNITS DESIGN
I-ET-3010.00-5140-700-P4X-001 - SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS
I-ET-3010.00-5140-741-P4X-002 - MEDIUM VOLTAGE MOTOR CONTROL CENTER AND SWITCHGEAR FOR OFFSHORE UNITS
I-MD-3010.2Q-5140-705-P4X-002 - ELECTRICAL SYSTEM DESCRIPTIVE MEMORANDUM
I-MC-3010.2Q-5147-700-P4X-002 - ELECTRICAL SYSTEM LOAD BALANCE
I-LI-3010.2Q-1200-940-P4X-002 - EQUIPMENT LIST

GENERAL NOTES AND REQUIREMENTS

1 - PANELS RATED CURRENTS ARE PRELIMINARY AND SHALL BE CONFIRMED DURING DETAILED DESIGN.

2 - TRANSFORMERS WINDINGS RATED POWERS ARE PRELIMINARY AND SHALL BE CONFIRMED DURING DETAILED DESIGN.

3 - PARALLEL OPERATION BETWEEN ANY SECONDARY AND/OR ANY TERTIARY WINDINGS OF TRANSFORMERS SHALL BE PERMITTED ONLY FOR MOMENTARY LOAD TRANSFERENCE FOR WINDINGS WITH THE SAME CONNECTION GROUP WHEN THE SYNCHRONIZATION BETWEEN BUSBARS IS GUARANTEED. THERE SHALL BE INTERLOCKS TO AVOID CONTINUOUS OPERATION IN CONDITIONS WHEN SHORT-CIRCUIT WITHSTAND CURRENTS OF SECONDARY / TERTIARY AND TERTIARY / TERTIARY WINDINGS OF TRANSFORMERS. THERE SHALL BE INTERLOCKS TO AVOID CONTINUOUS OPERATION IN CONDITIONS WHEN SHORT-CIRCUIT WITHSTAND CURRENTS OF PANELS ARE SURPASSED.

4 - IN NORMAL OPERATION, THE INTERLOCK SHALL PERMIT THAT ONLY 2 (TWO) OF 3 (THREE) INCOMING AND TIE CIRCUIT-BREAKERS (52-A, 52-B AND 52-E) BE SIMULTANEOUSLY CLOSED, EXCEPT IN MOMENTARY PARALLEL OPERATION OF TRANSFORMERS OR FEEDERS, DURING LOAD TRANSFERENCE. FOR BUSBARS WITH BACK-FEEDERS, THE INTERLOCK SHALL PERMIT THAT ONLY 2 (TWO) OF 4 (FOUR) INCOMING AND BACK-FEEDERS CIRCUIT-BREAKERS). REFER TO I-MD-3010.2Q-5140-700-P4X-002 - ELECTRICAL SYSTEM DESCRIPTIVE MEMORANDUM FOR DETAILS.

5 - BELOW ARE LISTED THE MAIN CONDITIONS FOR CONNECTION AMONG HULL SWITCHGEARS, EMERGENCY GENERATOR, AUXILIARY GENERATORS AND MAIN GENERATORS (REFER TO I-MD-3010.2Q-5140-700-P4X-002 - ELECTRICAL SYSTEM DESCRIPTIVE MEMORANDUM):
- IT IS NOT PERMITTED TO CLOSE PARALLEL OPERATION OUT OF SYNCHRONISM (BLOCK BY RELAY 78);
- IT IS NOT PERMITTED CONTINUOUS PARALLEL OPERATION IN CONDITIONS WITH SHORT-CIRCUIT CURRENTS HIGHER THAN THE WITHSTAND CURRENTS OF THE PANELS. TEMPORARY PARALLEL OPERATION (CONTINUOUS OR TEMPORARY) BETWEEN MAIN GENERATORS IS PERMITTED IN THIS CONDITION IF NONE LOW VOLTAGE GENERATOR IS IN PARALLEL;
- CONTINUOUS PARALLEL OPERATION BETWEEN EMERGENCY GENERATOR AND OTHER GENERATORS IS PERMITTED ONLY IF APPROVED BY CLASSIFICATION SOCIETY. OTHERWISE, ONLY TEMPORARY PARALLEL OPERATION BETWEEN EMERGENCY GENERATOR AND OTHER GENERATORS IS PERMITTED TO LOAD TRANSFERENCE;
- IT IS NOT PERMITTED CONTINUOUS OR TEMPORARY PARALLEL OPERATION BETWEEN MORE THAN 2 (TWO) LOW-VOLTAGE GENERATORS. WHEN 2 (TWO) LOW-VOLTAGE GENERATORS ARE IN PARALLEL OPERATION, IT IS NOT PERMITTED PARALLEL OPERATION (CONTINUOUS OR TEMPORARY) AMONG THEM AND MAIN GENERATORS;
- IT IS PERMITTED PARALLEL OPERATION (CONTINUOUS OR TEMPORARY) BETWEEN 1 (ONE) LOW-VOLTAGE GENERATOR AND MAIN GENERATORS THROUGH 1 (ONE) WINDING OF TF-5143002A/B OR TF-5143003A/B. IN THIS CONDITION PARALLEL OPERATION (CONTINUOUS OR TEMPORARY) THROUGH MORE THAN 1 (ONE) WINDING IS NOT PERMITTED;
- IT IS PERMITTED PARALLEL OPERATION (CONTINUOUS OR TEMPORARY) BETWEEN MORE THAN 1 (ONE) LOW-VOLTAGE GENERATOR AND MAIN GENERATORS IF THE LOW-VOLTAGE GENERATORS ARE NOT CONNECTED TO THE SAME LOW VOLTAGE SUB-SYSTEM (E.G.: AUXILIARY GENERATOR I CONNECTED TO PN-5143001 IN PARALLEL WITH MAIN GENERATION THROUGH TERTIARY OF TF-5143002A AND AUXILIARY GENERATOR II CONNECTED TO PN-5143002 IN PARALLEL WITH MAIN GENERATION THROUGH TERTIARY OF TF-5143002B, AND BACK-FEEDER BETWEEN PN-5143001 AND PN-5143001 OPEN);

6 - QUANTITY OF OUTGOING FEEDERS IN EACH PANEL IS NOT PRESENTED; THE FINAL QUANTITY OF OUTGOING FEEDERS FOR IN EACH PANEL SHALL BE DEFINED IN DETAILED DESIGN.

7 - MOULDED-CASE CIRCUIT BREAKERS MAY BE EXCLUDED, IF THE THYRISTORIZED POWER PANEL IS FED FROM PANEL INSTALLED IN THE SAME ROOM.

8 - THE SECONDARY AND TERTIARY CIRCUIT-BREAKERS OF THE MAIN TRANSFORMERS SHALL OPEN WHEN PRIMARY CIRCUIT-BREAKERS OPEN. THE SECONDARY AND TERTIARY CIRCUIT-BREAKERS CAN BE CLOSED ONLY AFTER THE PRIMARY CIRCUIT-BREAKER HAS BEEN CLOSED.

9 - PARAMETERS OF INCOMING REACTORS SHALL BE DEFINED DURING DETAILED DESIGN. IN ORDER TO LIMIT THERMAL EQUIVALENT SHORT-CIRCUIT CURRENT DURING ONE SECOND IN DOWNSTREAM PANELS IN 18 kA.

10 - NO NEGATIVE TOLERANCE FOR SATURATED SUB-TRANSIENT REACTANCE SHALL BE CONSIDERED FOR MAIN, AUXILIARY AND EMERGENCY GENERATORS. NO POSITIVE TOLERANCE FOR UNSATURATED TRANSIENT REACTANCE SHALL BE CONSIDERED FOR MAIN, AUXILIARY AND EMERGENCY GENERATORS.

11 - IF A MCC OR A THYRISTORIZED PANEL AND ITS UPSTREAM SWITCHGEAR ARE LOCATED IN DIFFERENT ROOMS, THE MCC OR PANEL SHALL HAVE AN INCOMING CIRCUIT-BREAKER. DETAILED DESIGN SHALL DEFINE PANELS FINAL LOCATION.

12 - THE INTERLOCK SHALL PERMIT THAT ONLY 2 (TWO) OF 3 (THREE) INCOMING AND TIE CIRCUIT-BREAKERS (52-A, 52-B AND 52-C) BE SIMULTANEOUSLY CLOSED. IT IS NOT PERMITTED TO CLOSE PARALLEL OPERATION (CONTINUOUS OR TEMPORARY). REFER TO I-MD-3010.2Q-5140-700-P4X-002 - ELECTRICAL SYSTEM DESCRIPTIVE MEMORANDUM FOR DETAILS.

13 - EMERGENCY GENERATOR SHALL START AUTOMATICALLY IN CASE OF UNDERVOLTAGE (RELAY FUNCTION 27) IN BUSBAR B OF PN-5148501 IF NO INHIBITION SIGNAL (COMPRISED FIRE INSIDE EMERGENCY GENERATOR ROOM, OR CONFIRMED SMOKE INSIDE EMERGENCY GENERATOR ROOM, OR CONFIRMED GAS INSIDE EMERGENCY GENERATOR ROOM) IS PRESENT. THE INHIBITION SIGNAL FOR EMERGENCY CIRCUIT-BREAKER DEPENDS ON VOLTAGE CONDITIONS IN BUSBAR A. THE OPERATION OF THE AUTOMATIC STARTING OF THE EMERGENCY GENERATOR, ACCORDING TO THE CONFIGURATION OF THE CIRCUIT-BREAKERS CONNECTED TO THE PANEL PN-5148501, IS DETAILED IN I-MD-3010.2Q-5140-700-P4X-002 - ELECTRICAL DESCRIPTIVE MEMORANDUM.

14 - AUXILIARY GENERATORS SHALL START AUTOMATICALLY IN CASE OF UNDERVOLTAGE (RELAY FUNCTION 27) IN BUSBAR B OF PN-5143501 IF NO SAFETY SIGNAL BLOCKING IT. AUXILIARY GENERATOR I SHALL NOT START AUTOMATICALLY IN CASE OF ESD-3T. INCOMING CIRCUIT-BREAKER 52-D OF AUXILIARY GENERATOR I SHALL ALWAYS BE CLOSED MANUALLY BY OPERATOR. AUXILIARY GENERATOR II SHALL BE STARTED AND CLOSED MANUALLY. REFER TO DETAILS IN I-MD-3010.2Q-5140-700-P4X-002 - ELECTRICAL SYSTEM DESCRIPTIVE MEMORANDUM.

15 - N.C. MEANS "NORMALLY CLOSED". AND N.O. MEANS "NORMALLY OPENED". THE INDICATION OF N.C. AND N.O. IS ONLY FOR INITIAL OPERATIONAL CONDITIONS. THE OPERATIONAL CONDITIONS DEPEND ON THE AVAILABILITY OF ELECTRICAL SYSTEM. OPERATORS MAY CHOOSE OTHER DISTRIBUTION CONFIGURATION ACCORDING TO SPECIFIC OR CONTINGENCY CONDITIONS.

16 - MV SWITCHGEARS, MV MCCs AND LV SWITCHGEARS SHALL HAVE ARC MONITORING DEVICES INSTALLED IN BUSBARS COMPARTMENTS. IN OUTGOING CABLES COMPARTMENTS AND IN COMPARTMENTS WITH COUPLING PARTS OF SWITCHING DEVICES. THE ACTUATION OF ARC MONITORING DEVICES SHALL BE CONFIRMED BY CURRENT SENSORS.

17 - FOR LOW-VOLTAGE MCCs, SOFT-STARTERS OR VSDS MAY BE INSTALLED INSIDE OR OUTSIDE THE LOW-VOLTAGE PANELS.

18 - THE LOW-VOLTAGE CIRCUIT-BREAKER SHALL NOT HAVE INSTANTANEOUS OVERCURRENT TRIP DEVICE. WHEN THE GENERATOR'S DEMAND REACHES 85% OF ITS RATED CAPACITY, AN ALARM SIGNAL SHALL BE SENT TO AAC THROUGH ELECTRICAL SYSTEM AUTOMATION. WHEN THE GENERATOR DEMAND REACHES 90% OF ITS RATED CAPACITY, A TRIP SIGNAL SHALL BE SENT TO PN-5143001 BACK-FEEDERS CIRCUIT-BREAKERS.

19 - 13.8 kV GROUNDING SYSTEM SHALL BE THROUGH HIGH RESISTANCE AT MAIN GENERATORS' NEUTRALS. 6.6 kV GROUNDING SYSTEM SHALL BE THROUGH HIGH RESISTANCE AT SECONDARY TRANSFORMERS WINDINGS. 690 V GROUNDING SYSTEM SHALL BE SOLIDLY GROUNDED. 690 V NEUTRAL OF MAIN GENERATOR(S) FOR GENERATOR(S) THE GROUNDING RESISTOR SHALL BE CONNECTED AT THE SECONDARY OF A GROUNDING TRANSFORMER.

20 - TO LIMIT THE SHORT-CIRCUIT AT THE MAIN SWITCHGEAR, A SHORT-CIRCUIT PEAK CURRENT LIMITING DEVICE SHALL BE INSTALLED BETWEEN SWITCHGEAR BUSBARS.

21 - ONE FEEDER FOR EACH LOAD. THE TYPE OF FUNCTIONAL UNIT DEPENDS ON THE LOAD TYPE.

22 - INCOMING CIRCUIT-BREAKERS FROM GENERATORS AND FROM TRANSFORMERS, TIE CIRCUIT-BREAKERS AND BACK-FEEDER CIRCUIT-BREAKERS, SHALL HAVE SYNCHRONIZATION CHECK RELAYS (FUNCTION 25) IN ORDER TO AVOID CLOSING OUT OF SYNCHRONISM.

23 - DETAILED DESIGN SHALL CONTROL THE SIZING OF ESSENTIAL LOADS TO KEEP THE EMERGENCY GENERATOR RATED POWER IN 2.18MW. EMERGENCY AND AUXILIARY GENERATORS RATED POWER SHALL BE 2.18MW.

24 - THE CLASSIFICATION OF ELECTRICAL LOADS ACCORDING TO THE KIND OF POWER SUPPLY (NORMAL OR ESSENTIAL) IS DEFINED IN I-MC-3010.2Q-5147-700-P4X-002 - ELECTRICAL SYSTEM LOAD BALANCE.

25 - THE DISTRIBUTION OF 220 VAC AND DC SYSTEMS ARE NOT INCLUDED IN THIS DOCUMENT.

26 - DETAILED DESIGN SHALL DEFINE THE FINAL CURRENT CAPACITY OF BACK-FEEDER CONNECTIONS, ACCORDING TO CABLES SIZING CALCULATION AND COMPLYING WITH MINIMUM VALUES REQUIRED BY BASIC DESIGN.

27 - OUTGOING TO SEA WATER LIFT PUMP MOTORS SHALL BE OUTFITTED WITH CIRCUIT-BREAKERS THE USE OF CONTACTORS IS ALLOWED ONLY IF THE MOTOR PROTECTION IS GUARANTEED BY FUSES. THE FUSES SHALL BE IN ACCORDANCE TO IEC 60282-2 AND IEC 60269-4. FOR LOW-VOLTAGE MOTOR CONTROL CENTER AND SWITCHGEAR FOR OFFSHORE UNITS.

28 - WHEN THE AUXILIARY GENERATORS DEMAND REACHES 85% OF THEIR RATED CAPACITIES, AN ALARM SIGNAL SHALL BE SENT TO AAC THROUGH ELECTRICAL SYSTEM AUTOMATION.

29 - AUXILIARY GENERATORS CAN BE USED TO OPERATE WITH LOW POWER DEMAND AND DURING COMMISSIONING. REFER TO NOTE 5 AND I-MD-3010.2Q-5140-700-P4X-002 - ELECTRICAL SYSTEM DESCRIPTIVE MEMORANDUM FOR DETAILS.

30 - FOR TRANSFORMERS THE IMPEDANCES TOLERANCES SHALL BE IN ACCORDANCE WITH IEC 60076-1.

31 - ALL LOADS FED FROM LV SWITCHGEARS SHALL HAVE EARTH FAULT INDICATOR (EFI) CONNECTED TO AN INSULATION MONITORING DEVICE. INSULATION MONITORING DEVICES SHALL BE SUITABLY INSTALLED CONSIDERING DIFFERENT TOPOLOGIES OF THE ELECTRICAL SYSTEM.

32 - FOR REDUNDANT ESSENTIAL LOADS INSTALLED IN HAZARDOUS AREA ZONE 1 OR WHICH CABLES CROSS HAZARDOUS AREA ZONE 1, OUTGOING CIRCUIT-BREAKERS SHALL HAVE INDIVIDUAL GROUND FAULT DETECTOR DEVICES (EFI). IN CASE OF GROUND FAULT DETECTION, EFI SHALL ALARM AND INSTANTANEOUSLY TRIP THE CIRCUIT-BREAKERS.

33 - ELECTRICAL HEATERS LOCATED AT HAZARDOUS AREA, LOADS INSTALLED IN HAZARDOUS AREA ZONE 1 OR WHICH CABLES CROSS HAZARDOUS AREA ZONE 1 SHALL HAVE INDIVIDUAL GROUND FAULT DETECTOR DEVICES (EFI). IN CASE OF GROUND FAULT DETECTION, EFI SHALL ALARM AND INSTANTANEOUSLY TRIP THE CIRCUIT-BREAKERS.

34 - FOR PANELS WITH THE POSSIBILITY TO OPERATE IN "L" CONFIGURATION WITH THE INTERCONNECTION CIRCUIT-BREAKERS CLOSED, AND FOR SWITCHGEARS WITH POSSIBILITY TO OPERATE CONNECTED THROUGH BACK-FEEDERS, IT SHALL BE PROVIDED A LOGIC TO DISABLE ONE OF THE INSULATION MONITORING DEVICES. THE LOGIC SHALL ALLOW THE INSULATION MONITORING DEVICE TO ENABLE BOTH INSULATION MONITORING DEVICES DURING THE RETURN OF "T" CONFIGURATION.

35 - NOT ALL LOADS ARE INDICATED IN THIS DOCUMENT. THE ESTIMATED LOADS OF EACH PANEL ARE DEFINED IN I-MC-3010.2Q-5147-700-P4X-002 - ELECTRICAL SYSTEM LOAD BALANCE. ALL RATED POWER LOADS INDICATED ARE PRELIMINARY DETAILED DESIGN SHALL SHIFT LOADS AMONG MCCs AND CDCs AND VICE-VERSA, ACCORDING TO FINAL RATED POWER, FOLLOWING REQUIREMENTS OF I-ET-3010.00-5140-700-P4X-001 - SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS.

36 - EARTH FAULT INDICATORS (EFI) IN ALL LOW VOLTAGE MCCs SHALL BE COMPATIBLE WITH INSULATION MONITORING DEVICES (IMD) OF RESPECTIVE UPSTREAM SWITCHGEARS. IT INCLUDES MCCs SUPPLIED IN BASIC DESIGN AND MCCs SUPPLIED IN SEPARATE CONTRACTS, IF ANY (E.G.: TOPSIDES MCCs CONNECTED TO HULL SWITCHGEARS).

37 - BACK-FEEDERS ARE EXCLUSIVE TO SUPPLY POWER FROM HULL TO TOPSIDE PANELS WHEN MAIN GENERATION IS OFF. POWER FLOW FROM TOPSIDE TO HULL USING THESE BACK-FEEDERS ARE NOT ALLOWED.

38 - DETAILED DESIGN SHALL DEFINE THE TECHNOLOGY TO INTERCONNECTION BETWEEN PANELS SECTIONS, EVALUATING ALL POSSIBLE SOLUTIONS.

39 - WHEN THE SWITCH IS AT BUSBAR POSITION AND STARTS TO MOVE TO THE GROUNDED POSITION, THE TIE CIRCUIT-BREAKER (52-D1 F) SHALL OPEN BEFORE THE OPENING OF THE CONTACTS OF THE SWITCH. IT SHALL NOT BE POSSIBLE TO CLOSE THE TIE CIRCUIT-BREAKER WITH THE SWITCH AT GROUNDED POSITION.

40 - ILLUSTRATIVE SYMBOLOGY THAT DOES NOT REPRESENT TRANSFORMERS CONSTRUCTIONAL ASPECTS, SUCH AS SECONDARY WINDINGS QUANTITY.

41 - THE QUANTITY OF VSD-FC TRANSFORMERS SHALL BE DEFINED ACCORDING TO REQUIREMENTS OF I-MD-3010.2Q-5140-700-P4X-002 - ELECTRICAL DESCRIPTIVE MEMORANDUM.

42 - VSD-FC TRANSFORMERS RATES POWER SHALL BE DEFINED DURING DETAILED DESIGN.

HOLD POINTS

1 - PRE-MAGNETIZATION SYSTEM APPLICATION UNDER EVALUATION.
2 - REPRESENTATION OF GE-TG-5262001 - SEA WATER DUMP LINE TURBOGENERATOR.

ABBREVIATIONS

LV - LOW-VOLTAGE
MV - MEDIUM VOLTAGE
MCC - MOTOR CONTROL CENTER
EFI - EARTH FAULT INDICATOR
IMD - INSULATION MONITORING DEVICE
VSD-FC - VARIABLE SPEED DRIVER - FREQUENCY CONVERTER

LEGEND

BOUNDARY LINE BETWEEN TOPSIDE AND HULL
EQUIPMENT BOUNDARY

REV.	DESCRIPTION	DATE	EXEC.	CHECK	APPROV.
0	ORIGINAL ISSUE	Dec/29/23	U4QR	UR6X	UQBE

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Smart Electrical 2019 / I-DE-3010.2Q-5140-946-P4X-002

PETROBRAS | SRGE

CLIENT: MARLIM LESTE E SUL
JOB: BASIC DESIGN - REVIT I
AREA: MARLIM LESTE E SUL
TITLE: KEY ONE-LINE DIAGRAM

DESIGN	ESUP	EXEC.	U4QR	CHECK	UR6X	APPROV.	UQBE
SCALE	NOT TO SCALE	DRAWING				SHEET	1 OF 1
INTERNAL							
DATE	Dec/29/23	No.	I-DE-3010.2Q-5140-946-P4X-002				

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