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MAIN TECHNICAL SPECIFICATION
FOR
LT SWITCHGEAR PACKAGE

PROJECT : 3X16.65MW STG Project

CUSTOMER : M/s RSPL, Gujarat

CONSULTANT : M/s JACOBS, Mumbai

Ref. Doc

Revisions:

Refer to record of
Revisions

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24.05.2016



LIST OF ANNEXURES

<u>ANNEXURE. NO.</u>	<u>DESCRIPTION</u>
ANNEXURE-1	TECHNICAL SPECIFICATION FOR IMCC
ANNEXURE-2	SWITCHBOARD SLDs
ANNEXURE-3	SUB-VENDOR LIST
ANNEXURE-4	DCS IO LIST FOR SIGNALs
ANNEXURE-5	DRIVE CONTROL PHILOSOPHY
ANNEXURE-6	DEVIATION FORMAT
ANNEXURE-7	TOOLS & TACKLEs AND COMMISSIONING SPARES
ANNEXURE-8	PRICE FORMAT
ANNEXURE-9	PACKAGE EXECUTION SCHEDULE
ANNEXURE-10	DOCUMENTs TO BE SUBMITTED AFTER AWARD OF CONTRACT
ANNEXURE-11	CHECK LIST
ANNEXURE-12	QAP WITH GUIDELINES

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HYDERABAD**

C O N T E N T S

<u>SEC. NO.</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
1.0.0	INTENT OF SPECIFICATION.....	4
2.0.0	SCOPE OF WORK	4
3.0.0	LIST OF MATERIAL CODES.....	5
4.0.0	CODES AND STANDARDS.....	5
5.0.0	GENERAL REQUIREMENTS	7
6.0.0	TECHNICAL REQUIREMENTS	9
7.0.0	INSPECTION, TESTING AND ACCEPTANCE.....	21
8.0.0	INFORMATION REQUIRED BY PURCHASER FROM THE BIDDER.....	22
9.0.0	PACKING AND DISPATCH.....	23
10.0.0	DOCUMENTATION.....	24
11.0.0	GUARANTEE.....	24
12.0.0	QUALITY PLAN.....	25

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PRODUCT STANDARD
PROJECT ENGINEERING
HYDERABAD

PY-55199

Rev No.00

PAGE 4 of 26

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1.0.0 INTENT OF SPECIFICATION

This specification covers the design, manufacture, assembly & testing at manufacturer's works; packing & transportation to site including transit insurance; supervision of erection, testing & commissioning of LT Switchgear complete with all accessories for efficient and trouble-free operation of the power plant.

It is not the intent to specify completely herein all details of the equipment; nevertheless, the equipment shall be complete and operative in all respects and shall conform to the highest standard of engineering, design and workmanship.

Should the bidder wish to deviate from this specification in any way, bidder shall draw specific attention to such deviation by listing the deviations in the deviation schedule without which bidder's offer will be considered in conformity with the specification in all respects.

SITE CONDITION:

Project	:	3X16.65MW STG Project
Site Location	:	Dwaraka, Gujarat
Elevation above MSL	:	Upto 1000m above MSL
Design ambient temp	:	50°C
Humidity	:	99%
Atmosphere	:	Dusty, Tropical & Corrosive.

2.0.0 SCOPE OF WORK

2.1.1 Scope of Supply

- i. ALL IMCCs shall be DOUBLE FRONT, DRAWOUT DESIGN & all DBs SHALL BE SINGLE FRONT, FIXED DESIGN.

Sl.No	Switchboard	Main Qty (No.s)	Fault rating switchboard (for 1sec) (KA)
1	415V STG IMCC-1, 2 & 3	3	65
2	110V DCDB	1	15
3	240V AC UPSDB	1	20

- ii. All cable termination accessories such as lugs, glands (Double compression type nickel-plated brass cable glands), bimetallic connectors at switchgear end for power, control, and signal cables etc. as per the cable sizes indicated against feeder list.
- iii. Commissioning Spares & Tools and Tackles as per Annexure-7
- iv. All IMCCs and DBs shall be provided with Integral Base frame of ISMC-75.

2.1.2 Scope of Service

- i. Supervision of Installation, testing and commissioning of Intelligent Controllers, Numerical Relays and LT Switchgear by respective OEMs and establishment of communication with DCS/ECS.



PRODUCT STANDARD
PROJECT ENGINEERING
HYDERABAD

PY-55199

Rev No.00

PAGE 5 of 26

- ii. Supervision of Installation, testing and commissioning for modification/additional job at site, if required.
- iii. Supervision of Installation, testing and commissioning of LT Switchgear Package
- iv. Special Testing Equipment for commissioning of Intelligent Controller and communication with DCS if any at site shall be provided by Bidder.

3.0.0 LIST OF MATERIAL CODES

Variant no.	Description	Material code
01	415V STG-IMCC-1,2 & 3	PY9755199012
02	110V DCDB	PY9755199020
03	240V AC UPSDB	PY9755199039
04	Commissioning Spares	PY9755199047
05	Tools & Tackles	PY9755199055
06	SUPERVISION OF INSTALLATION, TESTING & COMMISSIONING OF INTELLIGENT CONTROLLERS, NUMERICAL RELAY & LT SWITCHGEAR BY THE RESPECTIVE OEMs AT SITE <u>Inclusive of the following:-</u> Lump-sum price for supervision of installation, testing & commissioning of Intelligent Controller, Numerical Relays and LT Switchgear by respective OEMs and establishment of communication with DCS/ECS including travel, Lodging, Boarding etc. for respective OEMs.	PY9755199063
07	MODIFICATION / ADDITIONAL JOB ON LT SWITCHGEAR PACKAGE AT SITE BY THE OEM <u>Inclusive of the following:-</u> Lump-sum price for Modification / Additional Job on LT Switchgear package at site by the OEM including travel, Lodging, Boarding etc.	PY9755199071

4.0.0 CODES AND STANDARDS


- 4.1.1** The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the following BIS standards unless otherwise specified.


IS: 1248	Electrical Indicating instruments
IS: 2147	Degree of protection provided by enclosures for low voltage Switchgear and Control gear.
IS/IEC:60529	Degree of protection provided by enclosures IP Code.
IS: 13947	Specification for low voltage switchgear and control gear
IS/IEC:60947	Low voltage switchgear and control gear
IS: 2705	Current Transformers
IS: 3156	Voltage Transformers
IS: 4237	General Requirements for Switchgear and Control gear for voltages not exceeding 1000 V.
IS: 5082	Wrought Aluminium and Aluminium alloys for electrical purposes.
IS: 6875	Switches and push buttons.


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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<table border="0" style="width: 100%;"> <tr> <td style="width: 20%;">IS: 8544</td> <td>A.C. motor starters of voltage not exceeding 1000 volts.</td> </tr> <tr> <td>IS: 8623</td> <td>Factory built assemblies of Switchgear & Control gear for voltages up to and including 1000 V AC & 1200 V DC. Part-II particular requirements for busbar trunking systems (bus ways)</td> </tr> <tr> <td>IS: 10118</td> <td>Code of practice for selection, installation and maintenance of switchgear and controlgear.</td> </tr> <tr> <td>IS: 12021</td> <td>Specification of control transformers.</td> </tr> <tr> <td>IS: 11171</td> <td>Dry type power Transformers</td> </tr> <tr> <td>IS: 13703</td> <td>LV fuses</td> </tr> <tr> <td>IS: 5</td> <td>Colors for ready mixed paints and enamels</td> </tr> <tr> <td>IS: 3231</td> <td>Electrical relays for power systems</td> </tr> <tr> <td>IS: 2824</td> <td>Method of determining the comparative tracking index of solid insulating materials under moist conditions</td> </tr> <tr> <td>IS: 11353</td> <td>Guide for uniform system marking and identification of conductors and apparatus terminals.</td> </tr> <tr> <td>IS: 6005</td> <td>Code of practice of phosphating of iron and steel</td> </tr> <tr> <td>IS: 3618</td> <td>Phosphate treatment of Iron and Steel for Protection against corrosion.</td> </tr> <tr> <td>IS: 5578</td> <td>Guide for marking of insulating conductor</td> </tr> <tr> <td>IS:694-2010</td> <td>Polyvinyl Chloride insulated unsheathed and sheathed cables/cords with rigid and flexible conductor for rated voltages up to and including 450/750V.</td> </tr> <tr> <td>IS: 13779-1999</td> <td>AC Static Watt-hour Meters, Class 1 & 2.</td> </tr> <tr> <td>IS: 14697</td> <td>AC Static Transformer Operated Watt-hour and VAR-Hour Meters, Class 0.2S and 0.5 S.</td> </tr> </table> <p>4.1.2 In case of imported equipments, standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian standards.</p> <p>4.1.3 The equipment shall also confirm to the provisions of Indian electricity rules and other statutory regulations currently in force in the country.</p> <p>4.1.4 In case Indian standards are not available for any equipment, standards issued by the IEC/BS/VDE/IEEE/NEMA or equivalent agency shall be applicable.</p> <p>4.1.5 In case of any contradictions between various referred standards / specifications/ data sheets and statutory regulations the following order of priority shall govern:</p> <ol style="list-style-type: none"> i. Statutory regulations ii. This Specification & Technical Specification for IMCC (Annexure-1) iii. Switch boards SLDs 			IS: 8544	A.C. motor starters of voltage not exceeding 1000 volts.	IS: 8623	Factory built assemblies of Switchgear & Control gear for voltages up to and including 1000 V AC & 1200 V DC. Part-II particular requirements for busbar trunking systems (bus ways)	IS: 10118	Code of practice for selection, installation and maintenance of switchgear and controlgear.	IS: 12021	Specification of control transformers.	IS: 11171	Dry type power Transformers	IS: 13703	LV fuses	IS: 5	Colors for ready mixed paints and enamels	IS: 3231	Electrical relays for power systems	IS: 2824	Method of determining the comparative tracking index of solid insulating materials under moist conditions	IS: 11353	Guide for uniform system marking and identification of conductors and apparatus terminals.	IS: 6005	Code of practice of phosphating of iron and steel	IS: 3618	Phosphate treatment of Iron and Steel for Protection against corrosion.	IS: 5578	Guide for marking of insulating conductor	IS:694-2010	Polyvinyl Chloride insulated unsheathed and sheathed cables/cords with rigid and flexible conductor for rated voltages up to and including 450/750V.	IS: 13779-1999	AC Static Watt-hour Meters, Class 1 & 2.	IS: 14697	AC Static Transformer Operated Watt-hour and VAR-Hour Meters, Class 0.2S and 0.5 S.
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Ref. Doc																																				


TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 7 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>5.0.0 GENERAL REQUIREMENTS</p> <p>5.1.1 The offered equipment shall be brand new with state of art technology and proven field record of accomplishment. No prototype equipment shall be offered.</p> <p>5.1.2 Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply.</p> <p>5.1.3 Vendor shall give a notice of at least one year to BHEL, end user of equipment and Consultant before phasing out the product/spares to enable the end user for placement of order for spares and services.</p> <p>5.1.4 Only major meters and controls are indicated in the SLDs. Any Intelligent Controllers, auxiliary relays, timers, switches, etc, as required while developing the control schematic and felt necessary for safe operation, even if these are not specifically included, shall be supplied by the Bidder. All relays, metering and control components shall be mounted on the panel front only.</p> <p>5.1.5 All dummy panels and rear extensions required for bus trunking, cable terminations, mounting of Intelligent Controllers, relays, metering and control components etc., shall be supplied by the bidder. The details of each type of such panels shall be furnished.</p> <p>5.1.6 All incomers shall have ON/OFF/TRIP indication lamps and trip switch for sending end breaker.</p> <p>5.1.7 Auto-Manual Changeover scheme for switchboard with two incomers and one Bus-Coupler:</p> <p>The AUTO/ MANUAL CHANGEOVER scheme is described in brief as follows:</p> <p style="text-align: center;"><u>Facility to be provided</u></p> <p>The below mentioned scheme is applicable for switchboard with two incomers & bus coupler.</p> <ol style="list-style-type: none"> a. Normally both the incomers & bus coupler circuit breakers shall be so interlocked that at any given point of time, any two out of three circuit breakers can be closed at a time. This is to avoid paralleling of two incomers.(see (d) below) b. The auto transfer scheme (ATS) shall have provisions as mentioned below: <ol style="list-style-type: none"> i. Numerical relay with IEC 61850 GOOSE option. ii. In case of sustained under voltage on any of the incomers, the affected incomer shall be tripped automatically. After checking that the voltage on the bus-section connected with other incomer is healthy & after ensuring that the voltage on the bus-section connected with the affected (tripped) incomer is less than 20% of normal rated voltage, the bus coupler shall be closed automatically. iii. When the voltage on the affected incomer returns to normal, it shall be possible to close the tripped incomer manually. This shall automatically trip the bus coupler breaker, after momentary paralleling, thus reverting the system to normal operating mode with closed incomers & open bus coupler. 		
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TD- 201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 8 of 26
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Ref. Doc				


TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 9 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>5.1.11 Manual transfer</p> <ol style="list-style-type: none"> a. It is possible to trip incomer no. 1 or 2 after closing the bus-coupler to facilitate maintenance as required. Manual transfer would permit momentary paralleling and as such check-synchronizing relay shall be provided to ensure system safety. b. When supply is again available at incomer breaker after auto changeover has already taken place, it shall be possible to restore the system to normal operating condition by operating selector switch (meant for tripping incomer no. 1 or 2 or bus-coupler) and by setting auto/ manual switch in 'Manual' mode. c. In manual transfer the closing circuit shall be checked through contacts of check synchronizing relay. <p>5.1.12 As a minimum, contractor shall provide the signals as per the I/O List attached as Annexure-04 and Drive control Philosophy Annexure-05 (potential free contacts) for remote annunciation and metering. During detail engineering the I/O list may be revised as per requirement, the same is to be provided by vendor without any commercial implication.</p> <p>The following miscellaneous signals are also to be provided.</p> <ol style="list-style-type: none"> i. Auto/Manual switch in manual position ii. Auto transfer completed iii. Auto transfer blocked iv. Supplies paralleled beyond preset time delay. <p>5.1.13 All potential free contacts (including spare contacts) and analogue input signals shall be duly wired to the terminal block in the respective panel for onward wiring.</p> <p>5.1.14 The switchboards shall be suitable for installation and satisfactory operation in a pressurized substation or in substation with restricted natural air ventilation in a tropical, humid and corrosive atmosphere.</p> <p>5.1.15 The switchboards shall be designed to operate under specified site conditions. If not specifically mentioned a design ambient temperature of 50 deg C and altitude not exceeding 1000 metres above mean sea level shall be considered.</p> <p>5.1.16 All the equipment described in this specification is intended for continuous duty at the specified ratings under the specified ambient conditions.</p> <p>5.1.17 Energy meters if provided separately shall be digital type with TTB.</p> <p>6.0.0 TECHNICAL REQUIREMENTS</p> <p>6.1.0 DESIGN AND FABRICATION REQUIREMENT</p> <p>6.1.1 Intelligent IMCCs shall be metal enclosed, Double Front, Draw-out design and DBs shall be metal enclosed, Single Front, Fixed type design. All IMCCs and DBs shall be freestanding, floor mounting, compartmentalized, modular type suitable for indoor installation. Panels shall be free standing with ISMC-75.</p>		
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TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 10 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>6.1.2 For Draw out IMCCs all feeders, circuit breakers as well as switch fuse feeders shall be draw out type.</p> <p>6.1.3 The switchboard's enclosure shall be dust, damp and vermin proof and shall provide a minimum IP-5X degree of protection. Non-deteriorating gaskets shall be used between all adjacent units and beneath all covers and doors for dust proofing.</p> <p>6.1.4 The switchboard shall be assembled out of vertical panels of uniform height in single line up.</p> <p>6.1.5 It shall be possible to extend the switchboards, in either direction at a later date. Ends of bus bars shall be suitably drilled for this purpose. Panels at extreme ends shall have openings, which shall be covered with plates screwed to the panel. Details of drilled holes in bus bar and openings in the panels, provided for future extension shall be clearly shown in the vendor drawings.</p> <p>6.1.6 The switchboard shall be designed to ensure maximum safety during operation, inspection, connection of cables, relocation of outgoing circuits and maintenance, with the bus bar system energized and without taking any special precautions.</p> <p>6.1.7 Adequate means shall be provided to prevent shorting of power and / or control terminals due to accidental dropping of maintenance tools etc. inside the switchboard. Checking and removal of components shall be possible without disturbing adjacent equipment.</p> <p>6.1.8 All identical equipment and corresponding parts shall be fully interchangeable.</p> <p>6.1.9 Instruments / relays, indicating lamps, etc. of IMCCs incomer shall be mounted in a separate compartment adjacent to the incomer compartment.</p> <p>6.1.10 Switchboards shall be self-ventilated. Ventilation louvers (without cooling fans) in bus bar chamber may be accepted in specific cases and if provided shall be backed up with fine wire mesh of brass for vermin proofing.</p> <p>6.1.11 All panels shall be of same height. Panels shall be bolted together to form a continuous flush front switchboard suitable for front of board operation. All switch operating handles, meters shall be between 300mm to 1800mm from the bottom of base frame of panel.</p> <p>6.1.12 Sheet steel used for fabrication shall be cold rolled, cold annealed. Minimum thickness of various members shall be as follows:- Base frame / Channel / Gland plate : 3 mm Load Bearing Members/ Doors : 2 mm Internal Partitions : 1.6 mm Construction shall be rigid and robust. All steel work shall be flawless and have a smooth finish. Stiffener shall be provided where required for sufficient rigidity.</p> <p>6.1.13 The switchboard shall be provided with integral base frame of ISMC-75 for each vertical panel. The switchboard integral base frame shall be suitable for tack welding.</p>		
Ref. Doc		<p>6.1.14 Module door interlocked with main power isolating devices. Power circuit isolation device to have pad locking in the OFF position with door closed.</p>		


TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 11 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>6.1.15 Clearance between phases and between phase and earth as well as the insulation levels shall be in accordance with relevant standard. Sufficient Clearance shall be maintained between the door mounted devices and the top of components mounted inside the compartment.</p> <p>6.1.16 Paint shade shall be 631 of IS 5.</p> <p>6.1.17 Earthing: Two separate earthing terminals shall be provided. Bolted joints with tooth spring washers for good earth continuity. Earth bus to run in all cable alley of the panel and shall be extendable at both ends.</p> <p>6.1.18 All openings, covers, removable covers, adjacent covers and doors shall be provided with neoprene Gaskets. Removable blanking plates shall be provided to cover the openings in the event of withdrawing the feeder modules. Number of blanking plates shall be 10% of each module size with a minimum of one number.</p> <p>6.1.19 All hardware shall be corrosion resistant. All joints and connections of the panel members shall be made by zinc-passivated cadmium plated high quality steel bolts, nuts and washers.</p> <p>6.1.20 A removable, full length lifting angle shall be provided for each shipping split of each IMCCs & DBs. The lifting angle shall be bolted to each side sheet or divider sheet of the shipping split to evenly distribute the weight of the IMCCs & DBs during lifting. Alternatively, lifting hooks shall be provided for lifting the Boards. Hooks shall not leave any openings in the IMCCs & DBs, when the same are removed.</p> <p>6.1.21 Switchboard shall be assembled in such a manner that it is not necessary to have rear accessibility to remove any internal devices or components.</p> <p>6.1.22 Hinges provided for doors shall not be visible from front.</p> <p>6.1.23 Switchboard's construction, mounting of various equipment viz. circuit breakers, instruments, relays, bus bars & secondary wiring and number of feeders per vertical panel shall be done with due consideration to the following :-</p> <ol style="list-style-type: none"> i. Facility for ease of operation, inspection, maintenance and repairs. ii. Minimum vibration and noise. iii. Risk of accidental short circuits and open circuits. iv. Interchangeability of components. v. Risk of accidental contact and danger to personnel due to live parts. vi. Secure and vibration-proof connections for power and control circuits. vii. When rear door is opened, only cable connections shall be accessible. viii. Rating of vertical bus bars. ix. Conformity to latest Indian Electricity Rules and other statutory regulation (in the state in which the installation is located) as regards safety, earthing and other essential provisions specified therein for insulation and operation of electrical plants. <p>6.1.24 The switchboard shall be formed using distinct vertical panels each comprising of following compartments.</p> <ol style="list-style-type: none"> i. A metal enclosed horizontal bus bar compartment running at top unless otherwise specified. ii. Individual feeder modules in multi-tier mode. 		
Ref. Doc		<ol style="list-style-type: none"> i. A metal enclosed horizontal bus bar compartment running at top unless otherwise specified. ii. Individual feeder modules in multi-tier mode. 		


TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 12 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<ul style="list-style-type: none"> iii. Vertical bus bars serving all feeder modules in the vertical panel. iv. Cable termination compartment. v. Perforated sheet steel / insulating material enclosed horizontal auxiliary bus bars for control, interlock, indication and metering wiring running horizontally. vi. Metal sheets shall be provided between two adjacent vertical panels running up to full useful height of the switchboard. <p>6.1.25 <u>Compartmentalized Design</u> :-</p> <ul style="list-style-type: none"> i. All feeders shall be housed in separate compartments. All compartments to be fully segregated from one another, as well as from bus bar chambers, with sheet steel barriers. Terminal chambers for incoming feeders shall be segregated from those for outgoing feeders. This type of construction may be Single Front or Double Front as specified in elsewhere. Each feeder compartment shall have a separate door. ii. Separate compartments shall be provided specifically for circuit breakers, horizontal and vertical bus bar / cable chambers, which will be fully and effectively segregated from one another. This is to confine internal faults to faulted compartment and to prevent damage to equipment in any other compartments. It shall be possible to maintain equipment in individual compartments / terminals whilst the remainder of Switchboard is energized. <p>6.1.26 <u>Draw-out Design</u> :</p> <ul style="list-style-type: none"> i. The circuit breaker including its operating mechanism, starter / switch fuse feeders or MCCB with equipment shall be mounted on wheeled trolley / carriage moving on guides designed to align correctly and allow smooth movement. ii. Incoming and outgoing power connections for each draw out cubicle between fixed portion of the panel and trolley shall be by means of self-aligning plug-in contacts. Both male and female contacts shall be of silver plated copper. Contact design shall ensure adequate pressure normally and increase in contact pressure during short circuits. iii. Control wiring connections between trolley and fixed part of panel shall be made by sliding type terminals, which will make and / or break in test and service positions, depending on control scheme. iv. The draw out design shall have three positions - 'SERVICE' 'TEST' and 'ISOLATE' for circuit breaker and motor starter feeders. For switch fuse feeders, only 'SERVICE' and 'ISOLATE' positions shall be provided. The movement of position from Service to Test or vice-versa shall be possible with the door of the circuit breaker / starter feeder closed for safety purpose. Movement of draw out carriage from 'TEST' to 'SERVICE' or vice versa shall be only possible when switchgear is in OFF condition. v. Position indicator shall be provided on the panel to indicate the position of the feeder trolley viz. 'ISOLATE', 'TEST' and 'SERVICE'. vi. In the 'TEST' position it shall be possible to check the feeder operation including control logic without energizing the power circuit. vii. Automatic safety shutter shall be provided in all Panels for all openings which will provide access to the live parts of the switchgear upon withdrawal of any portion of the switchgear components parts. The vertical bus assembly shall be isolated from the unit mounting space by means of a full height steel barrier. Automatic shutter mechanisms shall be provided to close off all unused stab openings when a plug-in unit is moved to the "TEST" position or removed from the structure. Unused stab openings shall be covered with snap-in covers. 		
Ref. Doc				


TD-201 Rev No.00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 13 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<ul style="list-style-type: none"> viii. There shall be provision for pad locking the trolley in all the positions for complete safety. ix. Feeder compartments shall be totally closed from all sides, with a door on the front side. x. The draw out portion of the cubicles shall be effectively connected to the earth bus through scraping contacts. It must be ensured that the draw out portion gets earthed both in service and test positions. <p>6.1.27 Fixed Type or Non-Draw-out Design :</p> <ul style="list-style-type: none"> i. All power as well as control connections of the feeder are fixed type i.e. by bolts or screws. ii. All feeder equipment to be mounted on a plate which in turn is fixed within the compartment by screws. iii. Bakelite shall not be used for construction and / or insulation purpose. iv. One no horizontal ground bus of size mentioned elsewhere shall be provided through out the Switchboard assembly. v. The construction of horizontal and vertical bus bars, neutral bus bar and ground bus bar shall be such that it shall be maintainable from the front side of the cubicle. <p>6.1.28 Disconnecting Link type TB shall be provided for CTs.</p> <p>6.2.0 CONSTRUCTION & TECHNICAL PARAMETERS OF MAIN COMPONENTS:-</p> <p>6.2.1 Busbar & Insulating Materials:</p> <ul style="list-style-type: none"> i. The Switchboards shall have main horizontal and riser bus bars sleeved, housed in a separate compartment, segregated from all other compartments, with sheet steel barriers. Bus bars shall be of high conductivity electrolytic Aluminum , suitable for carrying the rated and short time current without overheating. Bus bars shall be adequately supported on insulators to withstand dynamic stresses due to short circuits. Bus bar support design should ensure free thermal expansion. Maximum bus bar temperature shall not exceed 85° C under normal operating condition and 200° C under short-circuit condition. ii. For double front IMCC separate set of vertical bus bars shall be provided for front and rear section of IMCC. iii. All bus bar connections and bus taps to individual feeders shall be either by means of 1100 / 650 V grade multi-strand annealed copper conductor PVC insulated wires or links insulated with shrunk PVC sleeves. Bus bars shall be color coded for easy identification of three phases. Feeders rated above or equal to 63A shall have link connection with bus bar/ bus bar dropper. iv. All insulating materials used in manufacture shall be non-hygroscopic and shall be treated for preventing fungus growth. Insulating and support materials shall be SMC/DMC. Surface of insulators shall be highly glazed and treated with silicone compound to minimize accumulation of dust, condensation of moisture and tracking. The insulating materials shall preferably be non-carbonizing type. v. Bus bars for risers shall be rated to carry 125% of the rated current of all feeders connected to the risers. vi. Bus bars for main horizontal and risers shall be of uniform section throughout. vii. The minimum cross section of neutral bus bars shall be more than half the size of bus bars for phase. viii. Bus bars of different voltage level shall be fully segregated from each other. ix. Neutral bus bar shall be extended to all outgoing feeders. 		
Ref. Doc				


TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 14 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>6.2.2 General :</p> <ol style="list-style-type: none"> i. All feeders to be provided with appropriate components and protective devices as called for in Single Line Diagram, Control Schematic and Data Sheet enclosed with specifications. ii. Indicating meters and instruments and protective relays of the incoming feeder shall be mounted in a separate compartment adjacent to the incoming feeder compartment. For outgoing feeders these may be mounted in the same compartment. <p>6.2.3 Air Circuit Breaker & Safety Interlocks :</p> <ol style="list-style-type: none"> i. The circuit breakers shall be of air break and of horizontal draw out construction, with 3 poles and isolable bolted neutral link for Motor Feeders or 4 poles for Incomers and Non-Motor Feeders. ii. Circuit breakers shall be power operated. iii. The closing mechanism of the circuit breakers shall be Motor wound, spring charged with a provision of manual charging. iv. The operating mechanism shall be mechanically and electrically trip-free and non-pumping. Anti-pumping feature may be built in or a separate anti-pumping relay may be provided. A mechanical closing device may be provided, if feasible. v. A mechanical trip device suitable for front of board operation and a mechanical 'ON-OFF' indicator shall be provided. Trip device should be shrouded to prevent inadvertent mal operation. vi. A series or shunt trip coil, as called for in the Technical Specification of IMCC shall be provided for tripping the circuit breakers. Wattage of shunt trip coils will be sufficiently high to prevent it from picking up or holding on with specified number of indicating lights wired in series with the same. vii. Provision shall be made for remote closing and tripping of the circuit breakers, with electrically operated mechanism. A 'local/remote' selector switch shall also be provided wherever called for technical Specification of IMCC. viii. In case of spring charged mechanism, 'Spring Charged' and 'Spring Discharged' indication (mechanical) shall be provided. ix. Interlock shall be provided to prevent plugging in or withdrawal of circuit breaker trolley unless it is open. Any attempt to do so shall trip the circuit breaker. x. Interlock to prevent closing of circuit breaker, unless it is in 'SERVICE' or 'TEST' position and correctly locked in that position shall be provided. xi. The circuit breaker compartment door shall be interlocked to prevent access to a breaker which is in SERVICE position. It shall not be possible to open the door unless the breaker is in 'TEST' position. xii. Main contacts shall have ample area and adequate contact pressure to carry the rated and short time current without excessive temperature rise. The contacts shall be adjustable for wear and easily replaceable. Main contacts shall open before and close after the arcing contacts, when these are provided. Arcing contacts shall be easily accessible for inspection and replacement. xiii. The tips of main and arcing contacts shall be silver plated or shall be of suitable material, to minimize erosion of contacts due to arcing. xiv. Auxiliary switches directly operated by the breaker mechanism shall be provided for control and interlocks. A minimum of six normally open and six normally closed contacts shall be provided. The contacts shall be rated for 10Amp. At 240V A. C. / 110V D.C. all spare contacts shall be wired upto terminal block. Auxiliary contacts in the "trip" circuit shall close before the breaker main contacts close and shall open after 		
Ref. Doc				


TD-201 Rev No.00	Form No.		<p style="text-align: center;">PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD</p>	<p>PY-55199</p> <p>Rev No.00</p> <p>PAGE 15 of 26</p>
<p>COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>the main contacts have opened. All other contacts shall operate simultaneously with the main contacts.</p> <p>6.2.4 <u>Switch-Disconnecter :</u></p> <ol style="list-style-type: none"> i. Switch disconnectors shall be two position (ON / OFF) type, heavy duty load break, quick make and break type complying with the requirements of IS/IEC 60947 Part-3 and suitable for front of board operation. Switch disconnector for switch disconnector fuse shall be of minimum AC 22 category and switch disconnector for motor starter feeder shall be of AC 23 category. ii. Switch disconnectors shall be interlocked with compartment door to prevent opening or closing of the door in the closed (ON) position of the switch disconnector, in case of compartmentalized switchboard. Provision for padlocking the switch disconnector in open or closed position also shall be made. iii. All live terminals on the Switch disconnector shall be adequately shrouded to prevent accidental contact and danger to the personnel. iv. Switch disconnectors shall be rated for 125% of circuit full load current with minimum rating of 25Amps. v. Height of operating handle of switch disconnectors in Switchboard shall be between 300mm and 1800mm from the bottom of base frame of Switchboard. vi. Switch disconnector shall be provided with 1NO+1NC auxiliary contacts. <p>6.2.5 <u>Moulded Case Circuit Breaker (MCCB) :</u></p> <ol style="list-style-type: none"> i. MCCB's shall be 3 pole conforming to as IS 60947 and Single Line Diagram MCCB's less than 250A shall have adjustable thermal over current and magnetic short-circuit releases. MCCBs more than 250A shall be provided with microprocessor based release for overload, short circuit and ground fault protection. ii. All MCCB outgoing feeders shall be provided with ground fault protection as per IE rule. iii. In case of motor loads, the overload and short circuit characteristic shall be selected to avoid minimum tripping during starting. iv. MCCBs shall be provided with spreader links, phase separators, very depth rotary handle, UV/shunt trip unit, auxiliary contacts for ON/OFF/Trip Status. v. MCCB Ics (Service Breaking capacity) rating at rated bus voltage shall be more than the bus fault level. vi. All MCCB outgoing feeder shall be coordinated with incomer feeder for selectivity up to the prospective fault level. <p>6.2.6 <u>Motor Protection Circuit Breaker (MPCB) :</u></p> <ol style="list-style-type: none"> i. MPCB's shall conform to IS- 60947(Part 1, 2 & 4) and shall have the short circuit breaking capacity as called for. ii. MPCB's shall provide overload, short circuit, & single phasing protection. iii. MPCB's shall have 1NO + 1NC integral auxiliary contacts and 1NO + 1NC short circuit signaling contacts. iv. MPCB's shall be provided with spreader links, phase separators, very depth rotary handle, UV/shunt trip unit, auxiliary contacts for ON/OFF/Trip Status. v. MPCB Ics (Service Breaking capacity) rating at rated bus voltage shall be more than the bus fault level. vi. All MPCB outgoing feeder shall be coordinated with incomer feeder for selectivity up to the prospective fault level. 		
Ref. Doc				


TD-201 Rev No.00	Form No.		<p style="text-align: center;">PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD</p>	<p>PY-55199</p> <p>Rev No.00</p> <p>PAGE 16 of 26</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">COPYRIGHT AND CONFIDENTIAL</p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>6.2.7 Miniature Circuit Breaker (MCB) :</p> <ol style="list-style-type: none"> i. MCB shall be Heat resistant plastic moulded type as per IS-8828. ii. MCB shall be provided with quick break trip free mechanism, direct acting thermal overload, short circuit trip elements. iii. Short circuit capacity shall not be less than 9kA at 0.8pf. iv. DIN Channel mounting. v. Single phase MCBs mounted adjacent to each other and connected to different phases will be provided with adequate insulated phase barriers. vi. The MCBs shall be selected from standard current ratings as per the SLD KW ratings or current ratings. vii. Motor duty MCBs shall be provided if asked for. <p>6.2.8 Fuses :</p> <ol style="list-style-type: none"> i. All fuses shall be non-deteriorating high rupturing capacity, link type mounted in suitable fuse carriers or fuse bases, conforming to IS 13703. ii. Fuses for motor feeders (if applicable) shall be properly coordinated with overload relay so that they do not operate-during starting of the respective motors and shall provide adequate protection for all feeder components. iii. For switch fuse feeders, the rating of the fuse, if not specified, shall be same as that of the switch rating. iv. Fuses shall be provided with operation indicators and it shall be possible to change fuses with the circuit live. v. All fuses in control, indication and metering circuit shall be HRC, link type. vi. Insulated fuse pulling handles shall be supplied for each size of fuse with the Switchboard. <p>6.2.9 Contactors :</p> <ol style="list-style-type: none"> i. Contactors shall be magnetic, air break type generally as per IS 60947 Part-4 suitable for Type 2 co-ordination with the combination Switch Fuse Unit/ MPCB/MCCB. ii. All power contactors shall be rated for 125% of feeder full load current. Minimum rating shall be not less than 9 Amps. iii. Coil voltage shall be as specified. Contactor coils shall operate satisfactorily and drop OFF at voltages as given in IS 60947 Part-4. iv. Power contactor's making and breaking capacities shall be suitable for AC3 / AC4 categories of duty as per IS 60947 (Part- 4), unless the contactors are required for special duty, in which case, they will be suitably derated. For AC3 duty making capacity shall be minimum 10 times rated current and breaking capacity shall be minimum 8 times rated current. For AC4 duty making capacity shall be minimum 12 times rated current and breaking capacity shall be minimum 10 times rated current. v. All power contactors shall be provided with 2 Normally Open (NO) and 2 Normally Closed (NC) auxiliary contacts; preferably, convertible from NO to NC and vice versa. vi. All contactor coils to be suitable for tropical climatic conditions as specified elsewhere. Insulation Class for Coils shall be Class 'H'. vii. Reversible contactors shall be electrically and mechanically interlocked. viii. All the terminal shall be shrouded such that they offer protection against finger contact as under IP 20 degree of protection. 		
		Ref. Doc		


TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 17 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>6.2.10 Bimetal Relays :</p> <ol style="list-style-type: none"> i. All bimetal overload relays shall be of hand reset type with at least one NO and one NC contact with reset type push buttons, mounted on door such that it shall be possible to reset the O/L relay with door closed. Overload relay for application involving heavy duty starting with long acceleration time shall be adjustable type of CT operated relay. ii. All bimetal relays shall have built-in single phasing prevention feature and ambient temperature compensation. iii. Range of bimetal relays shall be generally 70% to 110% of circuit full load current. <p>6.2.11 Motor Protection Relays :</p> <p>Whenever specifically called for, micro-processor based motor protection relay in addition to overload relay shall also provided. Motor protection relay shall have following bare minimum features:-</p> <ul style="list-style-type: none"> • Thermal over load with pre-alarm (49) • Over current (51) • Earth fault (64) • Locked rotor protection (51 LR) • Current unbalance (negative sequence) (46) <p>6.2.12 Indicating Lamps :</p> <ol style="list-style-type: none"> i. Indicating lamps shall be low burden type 22mm dia LED with series resistor. Lamps shall be LED type except where neon lamps are specifically called for Lamp covers shall be provided with interchangeable colored lenses of Perspex or equivalent unbreakable material. It should be noted that lenses should not get discolored in course of time, due to the heat generated by the lamps. Lamp holder provided shall be suitable for easy removal / insertion of lamps. ii. When neon lamps are used on D.C. circuits, they shall be tested for operation at specified D.C. voltage without any ripple content. Generally following color code shall be followed for indicating lamps. iii. The color of indicating lamps shall normally be the following unless otherwise specified:- <ul style="list-style-type: none"> • Red - Feeder 'ON' • Green - Feeder 'OFF' • White - 'Trip Circuit Supervision' • Amber - Auto Trip • White - 'Spring Charged' • RYB - Potential Indication for 3Ph A.C. supply • BLUE - TEST position • BLUE - SERVICE position <p>6.2.13 Current Transformers :</p> <ol style="list-style-type: none"> i. Current Transformers with magnetic core shall conform to latest edition / amendment of IS 2705. ii. The design and construction shall be sufficiently robust to withstand thermal and dynamic stresses due to maximum short circuit current, available at the point of installation of current transformer. iii. Secondary terminals of the C.T. shall be brought out suitably to a disconnecting / shorting link type terminal block which shall be easily accessible for testing and external connections. iv. Terminals shall be marked in accordance with IS 2705. A name / rating plate as per IS 2705 shall be provided on each current transformer which shall be easily readable after opening the door. 		
Ref. Doc				


TD-201 Rev No.00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 18 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>6.2.14 Control Transformers :</p> <ol style="list-style-type: none"> i. Control transformer shall be double wound, air cooled type with one leg of secondary earthed unless otherwise specified. ii. VA rating of the Control transformer to be adequate to supply about 150% of the control loads of the Switchboard. Voltage regulation of the Control transformer shall be limited to 4%. iii. The control transformer shall be provided with easy changeover arrangement for feeding the complete bus from either transformer or independently. iv. The control transformers shall have $\pm 2.5\%$ and $\pm 5\%$ tapping on primary side. v. Mounting of control transformer shall be such that the heat generated by it does not affect any other component inside the enclosure. <p>6.2.15 Control and Selector Switches :</p> <ol style="list-style-type: none"> i. Control and selector switches shall be of rotary type, provided with suitable nameplate engraved with switch operating positions. ii. Breaker control switch shall be of pistol grip type spring return, with position indicator, sequence interlock and normal after closing (NAC) contact. iii. Selector switches shall have stay put positions with oval handle. The number of contacts and their operation in each switch shall be as per the requirement. <p>6.2.16 Instrument Relays :</p> <ol style="list-style-type: none"> i. All relays and instruments shall be flush mounting type. The instruments shall preferably be of the rectangular shape and shall have adequate scale length. Protective relays shall be in accordance with the protective scheme specified. All relays and instruments shall be mounted in dust-tight, damp-proof, tropicalized cases. Instruments and relays shall be able to withstand a high voltage test of 2000 volts(rms) for one minute. Wherever possible, metering instruments and relays shall be draw out type. Minimum size of indicating instruments will be 96 mm sq. for incoming feeders. Indicating instruments for outgoing feeders, may be 72 mm sq. ii. Relays/ releases shall be micro-processor based numerical type or electromechanical type as specified. Electro-Mechanical type relays shall be provided with hand reset type mechanical operation indicator of direct acting type or fitted with an auxiliary unit, where required. The auxiliary unit shall be shunt reinforcing, shunt seal-in or series seal-in type, as specified. It shall also be provided with minimum two pairs of self, hand or combined self and hand reset type contacts, as specified. iii. C.T. secondary rating and current setting range of relays shall be as specified in the drawing. <p>6.2.17 Indicating / Recording Instruments :</p> <p>All indicating instruments shall be of industrial grade 'A' accuracy, suitable for flush mounting and in accordance with IS 1248. Selector switches to be provided for ammeters and voltmeters as called for elsewhere. Kilo-watt hour meters shall be in accordance with IS 722, suitable for flush mounting. Ammeters for motor feeders shall have an extended suppressed scale up to six times the rated current (e.g. 0-5/30). Where specified, these can be a part of combined metering and protection module.</p>		
Ref. Doc				


TD-201 Rev No.00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 19 of 26
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Ref. Doc				


TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 20 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<ul style="list-style-type: none"> iii. Screened control cable shall be used for wiring of potential-free contacts from the modules to the marshalling cabinet. iv. Unless otherwise specified, 8 nos. terminals shall be considered for each module to be pre-wired in marshalling cabinet (from each module of each shipping section of each IMCC) <p>6.2.22 Space Heater :</p> <ul style="list-style-type: none"> i. Adequately rated anti-condensation space heaters shall be provided in each breaker panel and in cable alleys of the Switchboard to maintain inside Switchboard temperature, 5°C above outside ambient temperature. ii. Panel & motor space heaters shall be fed from a separate 240 V AC bus derived from the upstream side of Incomer. Which in-turn shall be fed from separate space heating transformer. These space heating transformer shall be located in each bus with auto changeover facility among the transformers. iii. The space heaters shall be located at the bottom of the switchboards, and shall be controlled through a thermostat with an adjustable setting and a manually operated switch. The thermostat shall preferably be located in the metering or relay chamber. iv. Space heater shall be strip type, rated for operation on 240V, single phase, 50Hz. A.C. supply unless otherwise specified. v. Each space heater shall be complete with a rotary type ON/OFF switch, HRC fuse in the phase, neutral link in neutral and a control thermostat. vi. A separate DP isolator and link type HRC fuses/ MCB shall be provided in motor feeders for control of space heaters of motors. These shall be wired through a 'NC' contact of the contactor / circuit breaker for motor control. vii. Power supply for space heaters of motors shall be fed from same space heater bus through MCB and interlocked with Main Power contactor of respective motor feeder. <p>6.2.23 Auxiliary Supply :</p> <p>Auxiliary bus bars each of minimum size 25X3 mm copper, shall be provided for following applications. Exact number of bus bars shall depend on various controls, metering and auxiliary power distribution requirement.</p> <ul style="list-style-type: none"> i. Panel space heater supply and motor space heater supply. ii. Control supply for breaker tripping, closing and indication circuits, breaker spring charging motors. iii. Control supply for motor starter control and indication circuit. iv. 240V AC UPS Bus for Motor Intelligent Controller. <p>Tee-off connectors shall be used for distributing auxiliary supply to each vertical panel. Rubber grommets shall be used for all wire entries to make the entries dust and vermin proof.</p> <p>6.2.24 Cable Termination :</p> <ul style="list-style-type: none"> i. Cable entry to Switchboards shall be from bottom of the Switchboard. ii. Ample space shall be provided in the cable compartment to accommodate XLPE insulated Aluminum conductor cables, details will be furnished during detail engineering. iii. Removable undrilled gland plate shall be provided for termination of cables. 		
Ref. Doc				


TD-201 Rev No.00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 21 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>iv. Power / control termination shall be properly shrouded so that there is no accidental touch to other line terminals while working on any terminal block. For this, Power terminations shall be properly shrouded and segregated from terminal blocks of other feeders.</p> <p>v. All power and control terminals from fixed portion of the panel shall be wired up to power and control terminals in respective cable alley for external cable termination.</p> <p>6.2.25 <u>Painting & Finishing :</u></p> <p>i. All metal works and metal pans of the Switchboard shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphatising, passivating and then sprayed with a high corrosion resistant primer. The primer shall be baked in an oven. The finishing treatment shall be by application of synthetic enamel or epoxy or chlorinated rubber of color shade, as specified.</p> <p>ii. All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The under surface shall be prepared by applying a coat of phosphate paint and coat of yellow zinc chromate primer. The under surface shall be made free from all imperfections before undertaking the finishing coat.</p> <p>iii. After preparation of the under surface, the switchboard shall be spray painted with two coats of epoxy based final paint or shall be powder coated.</p> <p>iv. Painting shall be of synthetic Enamel/Epoxy/Chlorinated rubber .For painting seven tanks method shall be followed.</p> <p>v. Color shade of final paint shall be 631 of IS 5.</p> <p>vi. The finished panels shall be dried in stoving ovens in dust free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff paint etc. Vendor shall supply final paint (1 litre per switchboard) in non-returnable container for final touch up at site.</p> <p>vii. All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust formation. If these parts are moving elements then they shall be greased.</p> <p>6.2.26 <u>Nameplate and Labels :</u></p> <p>i. One nameplate giving designation of the Switchboard shall be affixed prominently on top of the Board. Details of designation will be specified.</p> <p>ii. Labels giving following details shall be affixed on each feeder compartment.</p> <ul style="list-style-type: none"> • Feeder No. • Equipment Reference Number and Description • Rating (KW / KVA / AMP) <p>iii. All components whether mounted inside the MCC or on the door shall be permanently and clearly labeled with reference number and/or letter of their function. (Rating of fuse shall form a part of the fuse designation.)</p> <p>iv. All labels shall be non-corrodible, preferably laminated plastic, with white letters on black background.</p> <p>v. Labels for feeder designation shall be fixed on the front side of respective feeder with chrome plated, self tapping, and countersunk head screws. These labels shall be identical size to permit interchange. Spare feeders shall have blank labels to enable engraving in later stage, if necessary.</p> <p>7.0.0 INSPECTION AND TESTS</p> <p>7.1.1 During fabrication, the switchboard shall be subjected to inspection by BHEL to assess the progress of work, as well as to ascertain that</p>		
Ref. Doc				


TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 22 of 26
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>only quality raw material is used. The manufacturer shall furnish all necessary information concerning the supply to inspectors.</p> <p>7.1.2 Tests shall be carried out at the manufacturer's works before _dispatch. All routine tests as specified by the applicable codes and standards shall be conducted. Type test certificates for the switchgear panel, circuit breakers and Intelligent Controller from a recognized testing authority, shall be furnished with the bids.</p> <p>7.1.3 All routine & acceptance tests shall be carried out at manufacturer's work under his care & expense.</p> <p>7.1.4 Type tests if asked shall be performed. Short circuit test shall be performed at CPRI and heat run test may be performed at manufacturer's works. Heat run test shall be performed on at least one incomer & two outgoing vertical panels of the ordered switchboard.</p> <p>7.1.5 Type, Routine & Acceptance test shall be witnessed by Purchaser's representative and an inspector of BHEL or an agency authorized by the BHEL . Prior notice of minimum 4 weeks shall be given to the inspector for witnessing the tests.</p> <p>7.1.6 In addition, acceptance tests shall be conducted as follows to check mechanical and electrical operation of various equipment and control circuits:</p> <ol style="list-style-type: none"> a) A general visual check shall be carried out. This shall cover measurement of overall dimensions, location, number and type of devices, terminal boxes, location and connection of terminals etc. b) Manual and electrical operation of Circuit breakers / Intelligent Controller/ Releases shall be checked under worst conditions of auxiliary supply voltage. c) All routine tests specified in relevant Indian Standards shall be carried out on all circuit breakers. d) Mili-volt drop test on all bus bar joints. e) Test for protective relay operation by primary or secondary injection method. f) Operation of all meters. g) Secondary wiring continuity test with a low voltage (6 volts) tester. h) Insulation test with 500 volts megger, before and after H.V. test i) H.V. test on power and control circuits / components (2 KV for one minute). j) Simulating external circuits for remote operation of breaker, remote indicating lights and other remote operations, if any, for operational test. k) Pick-up and drop-out voltages for shunt-trip and closing coils. l) C.T. Polarity Test m) Earth continuity test with a low voltage (6 volts) tester. <p>Vendor shall provide all facilities such as power supply, testing instruments and apparatus required for carrying out the tests. Required copies of test certificates for all the tests carried out along with copies of type test certificates and certificates from sub-vendor for the components procured from them are to be submitted once again before dispatch of the Switchboards.</p>		
Ref. Doc		<p>8.0.0 INFORMATION REQUIRED BY PURCHASER FROM THE BIDDER</p> <p>The vendor shall submit with his offer the following information:</p>		


TD-201 Rev No.00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 23 of 26
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Ref. Doc				


TD-201 Rev No.00	Form No.		<p align="center">PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD</p>	PY-55199 Rev No.00 PAGE 24 of 26
<p align="center">COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>packet shall have its respective label on the outside for clear identification.</p> <p>9.1.4 The equipment may be stored outdoors for long periods before installation. The packing should be suitable for outdoor storage in areas with heavy rains and high ambient temperature unless otherwise agreed.</p> <p>10.0.0 DOCUMENTATION:</p> <p>10.1.1 Documents to be submitted along with the technical bid / offer:</p> <ol style="list-style-type: none"> Deviation schedule (Refer Annexure-6) Switchboard wise GA, dimensions and weights Un-priced price format (Refer Annexure-8) Type test certificates (Short circuit, Temperature rise and IP class) for switchboards which are similar in configuration to the switchboards present in this Project. Duly filled Check List (Annexure-11) <p>Technical offer of the bidder will be evaluated only on the basis of deviation schedule and Price Format. Nature of Deviations shall only be of Design / Manufacturing constraints and non-availability of items / components / makes in market. Switchboard dimensions are for fixing Purchaser's tentative room layout.</p> <p>Un-priced price format consists of Items of Main offer and Unit rates for additions / deletions of supplies / services / spares during execution. All fields shall be quoted in this format only.</p> <p>Note: No price implications shall be entertained for deviations withdrawn during the technical scrutiny. If any deviations are accepted by BHEL during technical scrutiny then also there will be no price implication. Hence, in no case there will be consideration of Price implications.</p> <p>10.1.2 Offer is liable for rejection when</p> <ol style="list-style-type: none"> The offer is incomplete with respect to above clauses. The above documents are not submitted in BHEL's formats. Any field is left blank in the Price format. Discrepancy is observed between Un-priced and Priced bid. <p>10.1.3 Documents to be submitted after award of contract: Refer Annexure-10.</p> <p>11.0.0 GUARANTEE:</p> <p>11.1.1 The supplier shall be fully responsible in respect of design, selection of components, manufacture, quality of workmanship and operation of all the equipments, accessories etc. supplied under this scope of contract up to the Guarantee period.</p> <p>11.1.2 Guarantee period shall be as per the commercial terms and conditions of the NIT.</p>		
		Ref. Doc		

TD-201 Rev No.00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	PY-55199 Rev No.00 PAGE 25 of 26
<div style="display: flex; justify-content: space-between;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);"> <p>COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.</p> </div> <div style="flex-grow: 1;"> <p>12.0.0 QUALITY PLAN</p> <p>12.1.1 Quality Assurance Program</p> <p>The successful Bidder shall provide and implement a documented Quality Assurance programme. The programme shall be capable of providing assurance that design, purchasing, manufacturing, loading, shipping, storage, erection, construction, testing, and examination of Scope of Supply to ensure that it will comply with the requirements of the Specifications and documents.</p> <p>The quality control organization shall follow-up the inspection and testing to ensure adherence to quality of the Scope of Supply and compliance with the programme and with the test procedures. In particular, it shall:</p> <ul style="list-style-type: none"> • Provide all design and engineering Divisions and its Sub vendor with detailed instructions regarding inspection and testing; • Organise the tests required in the programme, witness them and issue test certificates; • Inspect the Equipment before packing, check the quality of packing and if Equipment and packing are found to comply with the requirements, authorise shipment. • Inspect for possible transport damages if any, and prepare and submit repair procedures for approval; • Organise and witness all inspection and testing on Site and issue test certificates. <p>No Equipment shall be packed, prepared for shipment, or dismantled for the purpose of packing for shipment, unless it has been satisfactorily inspected and approved for shipment.</p> <p>12.1.2 Quality Assurance Manual</p> <p>The successful Bidder's Quality Assurance Programme shall be documented in a Quality Assurance Manual. A copy of the Quality Assurance Manual shall be submitted for review and comment.</p> <p>12.1.3 Quality Management System</p> <p>Successful Bidder Quality Management System shall meet the requirements of ISO 9001, "Quality Systems - Model for quality assurance in design/development, production, installation and servicing". The successful Bidder shall demonstrate compliance with this requirement.</p> </div> </div>				
Ref. Doc				

TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	ANNEXURE-1 TO PY-55199 REV NO. 00 Page 1 of 9
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>PROJECT: 3X16.65MW STG Project</p> <p>CUSTOMER: M/s RSPL, Gujarat</p> <p>CONSULTANT: M/s JACOBS, Mumbai</p> <p style="text-align: center;"><u>TECHNICAL SPECIFICATION FOR INTELLIGENT MCC (IMCC)</u></p> <p>This document is to be followed with concurrence to Main Technical Specification for LT Switchgear Package PY-55199 Rev-00</p> <p>1.0 INTELLIGENT MOTOR CONTROL CENTRE (IMCC):</p> <p>1.1 Constructional features:</p> <ol style="list-style-type: none"> i. Intelligent fully draw-out type with modules having service, test and isolated positions. Floor mounting, free standing with ISMC 75 high for fixing on the inserts on the floor. IMCC shall be double front, totally enclosed dust, damp and vermin proof. ii. IMCC shall be Modular type, fully compartmentalized with metal/insulating material partition. All the module of the IMCCs shall be spacious to facilitate maintenance of equipment inside modules. The design of modules shall be such as to provide interchangeability of similar unit. iii. Pollution degree applicable shall be pollution degree 3 as per IS 13947 (Part 1) : 1993. Enclosure shall have min. IP-5X degree of protection. iv. Paint shade shall be 631 of IS 5. <p>1.2 Incomer and bus coupler panels:</p> <ol style="list-style-type: none"> i. Auto changeover facility shall be provided between the two incomers & bus coupler. ii. Numerical relay with IEC 61850 GOOSE option. iii. Incomers shall be provided with MFM (Multi-Function Meter) with communication facility with DCS preferably through Intelligent Controller Communication Network. iv. For detailed operation scheme, refer to Main Technical Specification for LT Switchgear Package Cl. No. 5.0.0 of PY55199 Rev-00. <p>1.3 Feeder modules:</p> <ol style="list-style-type: none"> i. Feeders shall be double front, fully draw-out type. IMCC shall consist of MPCB/MCCB, contactor and intelligent controllers (for DOL Motor feeders only) with communication features as main power components to ensure type 2 coordination. The short circuit release of MPCB/MCCBs shall be selected such as to avoid tripping during starting of devices. ii. MCCB's shall be 3 pole conforming to as IS 60947 and Single Line Diagram MCCB's less than 250A shall have adjustable thermal over current and magnetic short-circuit releases. MCCBs more than 250A shall be provided with microprocessor based release for overload, short circuit and ground fault protection. iii. MPCB's shall conform to IS- 60947(Part 1, 2 & 4) and shall have the short circuit breaking capacity as called for. 		
Ref. Doc				

TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	ANNEXURE-1 TO PY-55199 REV NO. 00 Page 2 of 9
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>iv. MPCB with built in release (for protection and metering) and contactor in Type-2 co-ordination for Motors upto 75KW. Comprehensive Motor Protection Relay with IES Protocol and ACB for Motors 90KW and Above.</p> <p>v. The characteristic of MPCB shall match the motor duty application. Rated ultimate short circuit breaking capacity (Icu) shall be 65 KA. Ratings shall be at least 125% of the full load current of the motor. For small rating drives such as valves. Utilization category shall be A.</p> <p>vi. Control Supply for Motor Feeders with contactor. 110V AC SPN to be derived from separate control transformer for each bus section with changeover switch shall be provided.</p> <p>vii. For 30KW and Above motor feeders Earth Leakage protection with CBCT shall be provided.</p> <p>viii. 20% Spare Feeders with Minimum 1 no. for each rating and Type shall be provided.</p> <p>ix. All the MOVs /Actuators are Integral Type. Intelligent Module for MOVs/Actuators feeders is not applicable. (refer SLDs)</p> <p>1.4 Busbars and terminations:</p> <p>i. The IMCC shall have main horizontal and riser bus bars sleeved, housed in a separate compartment, segregated from all other compartments, with sheet steel barriers. Bus bars shall be of high conductivity electrolytic Aluminum , suitable for carrying the rated and short time current without overheating. Bus bars shall be adequately supported on insulators to withstand dynamic stresses due to short circuits. Bus bar support design should ensure free thermal expansion. Maximum bus bar temperature shall not exceed 85° C under normal operating condition and 200° C under short-circuit condition.</p> <p>ii. For double front IMCC separate set of vertical bus bars shall be provided for front and rear section of IMCC.</p> <p>iii. All bus bar connections and bus taps to individual feeders shall be either by means of 1100 / 650 V grade multi-strand annealed copper conductor PVC insulated wires or links insulated with shrunk PVC sleeves. Bus bars shall be color coded for easy identification of three phases. Feeders rated above or equal to 63A shall have link connection with bus bar/ bus bar dropper.</p> <p>iv. All insulating materials used in manufacture shall be non-hygroscopic and shall be treated for preventing fungus growth. Insulating and support materials shall be SMC/DMC. Surface of insulators shall be highly glazed and treated with silicone compound to minimize accumulation of dust, condensation of moisture and tracking. The insulating materials shall preferably be non-carbonizing type.</p> <p>v. Bus bars for risers shall be rated to carry 125% of the rated current of all feeders connected to the risers.</p> <p>vi. Bus bars for main horizontal and risers shall be of uniform section throughout.</p> <p>vii. The minimum cross section of neutral bus bars shall be more than half the size of bus bars for phase.</p>		
Ref. Doc	<p>viii. Bus bars of different voltage level shall be fully segregated from each other.</p> <p>ix. Neutral bus bar shall be extended to all outgoing feeders.</p>			

TD- 201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	ANNEXURE-1 TO PY-55199 REV NO. 00 Page 3 of 9
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>1.5 Short circuit strength:</p> <p>Rated short time withstand current shall not be less than 65 KA for 1 second. Rated peak withstand current not less than 2.1 times the specified short circuit level.</p> <p>1.6 Intelligent Controllers:</p> <ol style="list-style-type: none"> i. All Motor Protection Relays (Intelligent Controllers) shall have single port for Modbus TCP/IP Communication. ii. Intelligent MCCs (IMCCs) shall be provided with ACB/MCCB/MPCB with inbuilt communication capable Modular Motor Management System (MMS) for motor feeder and Feeder Management System (FMS) for incomers. MMS shall cover all functional requirements between the motor feeder and automation system. The dedicated MMS shall incorporate all protection features (Motor thermal overload, current unbalance, Locked Rotor, Short circuit, earth fault) monitoring of winding and bearing temperature if applicable for motor, measurement of energy parameters as per data sheet, development of interlock logic through inbuilt software function blocks and timers and necessary interlocks from DCS and LCS, remote display of motor parameters on DCS, device internal error memory/error history, communication with DCS for energy metering module, required number of IO interface and interlocking status on MODBUS TCP/IP protocol on Screened twisted pair copper cable. Running status of the connected load shall be determined by monitoring motor current to give a true indication of running status. The device shall provide monitoring of operating hours, downtime hours, number of starts, overload trips and have permissible starting capabilities, unless otherwise specified in Datasheet. iii. The FMS shall perform similar functionalities as MMS, however protection and measurement function as required for these feeders shall be provided in the FMS. iv. It shall be possible to remotely monitor and program all programmable parameters, diagnostic data and operating data. v. Remote reset of protection function. vi. In the event of a communication network failure, the device shall operate as a stand-alone device. Upon of the network restoration, the device shall automatically resume communication with the network. vii. A network gateway to provide onward communication to plant DCS shall be housed inside the IMCC panel on a screened compartment. The compartment shall be screened with Aluminum screening with no more than 10mm opening. viii. All cabling up to network gateway shall be in IMCC vendor scope and shall be factory wired and tested for all communication parameters. <p>Separate power source (240 V AC) from UPSDB for controllers is provided. The same shall be provided to each controller through MCB (for controller only). To achieve the same, a separate bus for UPS supply shall be provided in IMCC.</p> <p>Two redundant 240V AC UPS power supplies will be provided at each IMCC by Purchaser. Automatic changeover and manual changeover of UPS buses in IMCC shall be provided along with selector switches by bidder.</p>		
Ref. Doc	<p>Control shall be done:-</p> <ul style="list-style-type: none"> o From 16 character keypad and backlit LCD alphanumeric display provided on the controller. The keypad shall have facility to start and stop the motor through a 			

TD-201 Rev No. 00	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	ANNEXURE-1 TO PY-55199 REV NO. 00 Page 4 of 9
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>separate key (touch screen type) or separate PBs are to be provided for the same on the front of the module.</p> <ul style="list-style-type: none"> ○ From HMI (located in control room)/DCS/ECS. <p><u>Communication to DCS:</u></p> <ol style="list-style-type: none"> i. Intelligent Controller module shall have single port for MODBUS TCP/IP Protocol for communication with DCS. ii. IED's and Numerical Relays shall be connected in STAR topology to Ethernet switches. iii. There shall be two separate rings of Ethernet switches. One ring of Ethernet switches for Incomer/Bus coupler (IEC61850 protocol) which shall be connected to ECS. Other ring (Modbus TCP/IP protocol) of Ethernet switches of Motor Protection Relays(Intelligent Controller) shall be connected to DCS. iv. Bidder to consider number of Ethernet switches accordingly with min. 20% spare. Refer ECS Block Diagram in Annexure-4 (ECS I/O List for Signals) and Annexure-5 (Drive Control Philosophy). v. Bidder shall provide necessary arrangement for interconnection of IED/Relays/Controllers to Ethernet Switches and Ethernet switches interconnection inside IMCC. Multimode FO ports in these switches shall be provided for interconnecting Ethernet switches to ECS/DCS and other IMCC Ethernet switches in ring communication. (Refer attached ECS Block diagram in Annexure-4 (DCS I/O List for Signals) and Annexure-5 (Drive Control Philosophy). All relay and Ethernet switches shall be provided with conformal coating. vi. For Communication interface test with DCS, DCS vendor will visit at IMCC vendor's works. It's switchgear vendors responsibility to provide technical support with DCS vendor's for proper data transmission/ communication protocol compatibility between IMCC and ECS/DCS. The communication cables from IMCCs to DCS/ECS shall be in Customer's scope. vii. Communication cabling upto Ethernet switches and between all IMCCs shall be in bidder scope. Accordingly FO, Cat 5/ other communication cables shall be considered by bidder. viii. Maximum distance among IMCCs will be 30 mts. ix. Bidder shall submit the system architecture for review. <p>1.7 Working Philosophy:</p> <p>Provision of Parameterization of the intelligent controllers from DCS shall be provided. Necessary software and hardware shall be provided. DCS/ECS shall be able to monitor, control, metering and annunciations for I/Cs, B/C & O/G Motor feeders.</p> <p>Necessary software and hardware shall be provided. Commands to O/G feeders/Incomers from DCS/ECS shall be through soft.</p> <p>DCS/ECS located in control room shall be able to monitor, control, metering and annunciations for I/Cs, B/C & O/G feeders. Please refer ECS Signal I/O list & Drive control philosophy for Signal Interface (Annexure-4 & 5).</p>		
Ref. Doc	<p>1.10 Motor controller</p> <p>The motor controller should offer minimum the following protections:</p> <ul style="list-style-type: none"> • Thermal overload 			

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- Adjustable overload pre-alarm
 - Earth fault
 - Stalling
 - Unbalance
 - Short circuit
 - Single phase prevention
 - Under current
 - Too many starts
 - Under voltage
 - Under voltage lockout
 - Breaker or contactor failure alarm
 - Trip failure alarm
 - Over temperature
 - Winding and bearing temperature (if applicable for motor)
- The motor controller should offer the following minimum display and indications:
- Voltage
 - Frequency
 - Power factors
 - Power consumption, KW
 - Thermal capacity
 - Temperature
 - Phase and average Amp.
 - Earth fault current
 - % motor load
 - % unbalance
 - Peak current during starting
 - Starting time
 - Pre trip values
- The motor controller should offer the following minimum Fault /alarm history descriptions:
- No. of trips
 - No. of operations (Forward/Reverse)
 - Hours run
 - Hours run last start
 - Kilowatt hours
 - Kilowatt peak demand
 - Alarm / trip history (with date and time)
 - Alarm /trip description
 - Reference start curve (in graphics)
 - Start curve (in graphics)
 - Time to trip /reset

2.0 DATASHEET FOR IMCC :-

A. Climatic Condition		
1.0	Design Ambient Temperature	50 deg C.
2.0	Altitude above MSL	<1000M.
3.0	Relative Humidity	89%



**PRODUCT STANDARD
PROJECT ENGINEERING
HYDERABAD**

**ANNEXURE-1
TO PY-55199**

REV NO. 00

Page 6 of 9

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4.0	Environment	Dusty/Tropical/Corrosive
B. System Particulars :-		
1.0	Voltage	415 ± 6%
2.0	Frequency	50Hz ± 3%
3.0	No. of Phases	3 Phase / 4 Wire
4.0	System Grounding	Effective
5.0	Fault Level	65kA , 3 Ph, Symm.
C. Control/Auxiliary Supply :-		
1.0	Breaker	<ul style="list-style-type: none"> • Spring Charging Motor – 110V DC. • Closing Coil – 110 V DC. • Tripping Coil – 110 V DC. • Control Circuits – 110 V DC.
2.0	Motor Feeders	<ul style="list-style-type: none"> • Contactor Coil – 110 V AC.
3.0	Potential Indicating Lights	110 V AC.
4.0	Other Indicating Lights	110V AC.
5.0	Space Heater	240V AC.
D. Construction :-		
1.0	Type	Compartmentalized, Intelligent Type MCC
2.0	Type of Feeders	Both Circuit Breakers and other feeders shall be Fully Draw-out, Form 3b.
3.0	No. of Fronts	Double Front.
4.0	Base Frame	ISMC 75 required.
5.0	Max. No. of feeders per vertical section.	6 nos.
6.0	Enclosure Material	CRCA sheet steel (Thickness as mentioned in Main Specification)
7.0	Protection Class	Minimum IP 5X.
E. Rating of Circuit Breakers :-		
1.0	Type of Circuit Breaker	ACB, Electrical closing & tripping.
2.0	Poles	TPN for Incomer Breakers & 3 Pole for Motor feeders.
3.0	Voltage	500V
4.0	Nominal Current	As per SLD.
5.0	Rated Short Circuit making capacity (Icm).	136 kA (Peak)
6.0	Rated ultimate short circuit breaking capacity(Icu).	65 kA (RMS)
7.0	Rated Service short	65 kA (RMS)

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	circuit breaking capacity (Ics).	
8.0	Rated Short time current withstand current (Icw)	65 kA for 1 Sec.
9.0	Temperature Rise	Vendor to furnish
10.0	Dielectric withstand test voltage	2.5 KV, for 1 minute.
11.0	Circuit Breaker Operating Mechanism	(a) <u>Closing</u> - Motorized spring charged electrical closing. (b) <u>Tripping</u> -Mechanical closing - padlock facility. Direct(release) and shunt trip -Electrical. Manual - Mechanical shrouded.
12.0	Type of Protection release	Microprocessor based electronic release with metering, protection and communication facility with Single communication port suitable for IEC61850.
13.0	Intelligent Feeder Management Device	To be provided.
14.0	CT on neutral circuit	To be provided.
F. Contactors :-		
1.0	Type	Air Break.
2.0	Duty Class	Minimum AC3.
3.0	Rating	1.2 times motor full load current.
G. Components :-		
1.0	Main Bus bar (Phase & neutral) and risers	<ul style="list-style-type: none"> • Material - Aluminum. • Heat Shrinkable PVC Sleeves - required. • Main Bus bar position - TOP • Material of Bus bar support - DMC/SMC/Cast Epoxy
2.0	Auxiliary Bus	<ul style="list-style-type: none"> • Material - Copper. • Min Size - 25 X 3 mm.
3.0	Earth Bus	<ul style="list-style-type: none"> • Material - Aluminum • Size - 75X10 mm
4.0	Isolators	Provision of Pad Locking required in Open & Closed position of the Isolators.
5.0	MCCB/MPCB Feeders	<ul style="list-style-type: none"> • Poles - 3 Poles • <u>Type of Protection Release</u> - Microprocessor based Electronic release with metering, protection and communication facility. • Rated Service short circuit breaking capacity (Ics) - 65 kA (RMS). • Rated Short Circuit making capacity (Icm) - 136 kA (Peak).

TD-201 Rev No. 00	Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	ANNEXURE-1 TO PY-55199 REV NO. 00 Page 8 of 9																																																
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Ref. Doc	<table border="1"> <tr> <td data-bbox="252 302 363 510">6.0</td> <td data-bbox="363 302 678 510">Protection Provided</td> <td data-bbox="678 302 1433 510"> <ul style="list-style-type: none"> • Earth Leakage Protection with CBCT – Yes. • Intelligent Motor Management Device – Yes. • Complete co-ordination with Incomer ACB – Required. • CT on neutral circuit – to be provided. </td> </tr> <tr> <td data-bbox="252 510 363 683">7.0</td> <td data-bbox="363 510 678 683">Accuracy Class of Instruments</td> <td data-bbox="678 510 1433 683"> <ul style="list-style-type: none"> • Ammeter – 2.5 • KWh Meters / PF Meters – 1. • Multifunction meter – Class 1.0 with communication. </td> </tr> <tr> <td data-bbox="252 683 363 761">8.0</td> <td data-bbox="363 683 678 761">Indicating Instrument Sizes</td> <td data-bbox="678 683 1433 761">96 mm X 96 mm</td> </tr> <tr> <td data-bbox="252 761 363 801">9.0</td> <td data-bbox="363 761 678 801">Cable Entry</td> <td data-bbox="678 761 1433 801">Bottom</td> </tr> <tr> <td data-bbox="252 801 363 884">10.0</td> <td data-bbox="363 801 678 884">Cable Glands & Lugs</td> <td data-bbox="678 801 1433 884">To be supplied</td> </tr> <tr> <td data-bbox="252 884 363 967">11.0</td> <td data-bbox="363 884 678 967">CT Secondary for meters & relays</td> <td data-bbox="678 884 1433 967">1 Amp.</td> </tr> <tr> <td data-bbox="252 967 363 1008">12.0</td> <td data-bbox="363 967 678 1008">Space Heater</td> <td data-bbox="678 967 1433 1008">240 V AC , 50 Hz.</td> </tr> <tr> <td data-bbox="252 1008 363 1048">13.0</td> <td data-bbox="363 1008 678 1048">Painting</td> <td data-bbox="678 1008 1433 1048">631 of IS 5</td> </tr> <tr> <td data-bbox="252 1048 363 1131">14.0</td> <td data-bbox="363 1048 678 1131">Relays</td> <td data-bbox="678 1048 1433 1131">Multifunctional relays, draw out type with communication port.</td> </tr> <tr> <td data-bbox="252 1131 363 1214">15.0</td> <td data-bbox="363 1131 678 1214">Nameplate Details</td> <td data-bbox="678 1131 1433 1214">Main Nameplate & Nameplate for each feeder required.</td> </tr> <tr> <td colspan="3" data-bbox="252 1214 1433 1254">H. NOTES & ADDITIONAL REQUIREMENT :-</td> </tr> <tr> <td data-bbox="252 1254 363 1422">1.0</td> <td data-bbox="363 1254 678 1422">Incomer Feeders</td> <td data-bbox="678 1254 1433 1422">MCC shall have two Incomers with Auto-Manual Transfer facility. MCCB upto 630A / ACB for 800A and above upto 1000A.</td> </tr> <tr> <td data-bbox="252 1422 363 1505">2.0</td> <td data-bbox="363 1422 678 1505">Spare Feeders</td> <td data-bbox="678 1422 1433 1505">20% Spare Feeders with minimum one number for each rating and type.</td> </tr> <tr> <td data-bbox="252 1505 363 1588">3.0</td> <td data-bbox="363 1505 678 1588">Type of Motor Starter</td> <td data-bbox="678 1505 1433 1588">DOL.</td> </tr> <tr> <td data-bbox="252 1588 363 1671">4.0</td> <td data-bbox="363 1588 678 1671">Protection of Incomer Feeders</td> <td data-bbox="678 1588 1433 1671">As per SLD.</td> </tr> <tr> <td data-bbox="252 1671 363 2123">5.0</td> <td data-bbox="363 1671 678 2123">Motor Feeders</td> <td data-bbox="678 1671 1433 2123"> <ul style="list-style-type: none"> • MPCB with build in release (for protection & metering) and contactor in Type-2 co-ordination for Motors upto 75KW. • Comprehensive Motor protection relay with IEC protocol and ACB for Motors 90KW & above. • For 30KW and above motor feeders, Earth Leakage protection with CBCT to be provided. • Control supply for Motor Feeders with contactor, 110V AC SPN to be derived from separate control transformer for each bus section with changeover switch. </td> </tr> </table>				6.0	Protection Provided	<ul style="list-style-type: none"> • Earth Leakage Protection with CBCT – Yes. • Intelligent Motor Management Device – Yes. • Complete co-ordination with Incomer ACB – Required. • CT on neutral circuit – to be provided. 	7.0	Accuracy Class of Instruments	<ul style="list-style-type: none"> • Ammeter – 2.5 • KWh Meters / PF Meters – 1. • Multifunction meter – Class 1.0 with communication. 	8.0	Indicating Instrument Sizes	96 mm X 96 mm	9.0	Cable Entry	Bottom	10.0	Cable Glands & Lugs	To be supplied	11.0	CT Secondary for meters & relays	1 Amp.	12.0	Space Heater	240 V AC , 50 Hz.	13.0	Painting	631 of IS 5	14.0	Relays	Multifunctional relays, draw out type with communication port.	15.0	Nameplate Details	Main Nameplate & Nameplate for each feeder required.	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		<ul style="list-style-type: none"> 240V AC UPS redundant supply will be provided at MCC by Purchaser for Intelligent Controller, further it shall be distributed throughout the length of the board by separate bus, with changeover facility.
6.0	Control device on compartment door	Stop Push button, Reset P.B etc.
7.0	Indication on Compartment door	ON, OFF, TRIP.
8.0	Meters	Communication capable energy meter shall provide current feedback to DCS, wherever required on communication link.

Form No.



**PRODUCT STANDARD
PROJECT ENGINEERING
HYDERABAD**

**ANNEXURE-2
TO PY-55199**

REV NO. 00

Page 1 of 1

PROJECT: 3X16.65MW STG Project

CUSTOMER: M/s RSPL, Gujarat

CONSULTANT: M/s JACOBS, Mumbai

LIST OF SWITCHBOARD SLDs

Sl. No.	Description
1.	SLD of 415V STG IMCC-1,2,3 (No. of Pages-2)
3.	SLD of 110V DCDB (No. of Pages-1)
5.	SLD of 240V UPSDB (No. of Pages-1)

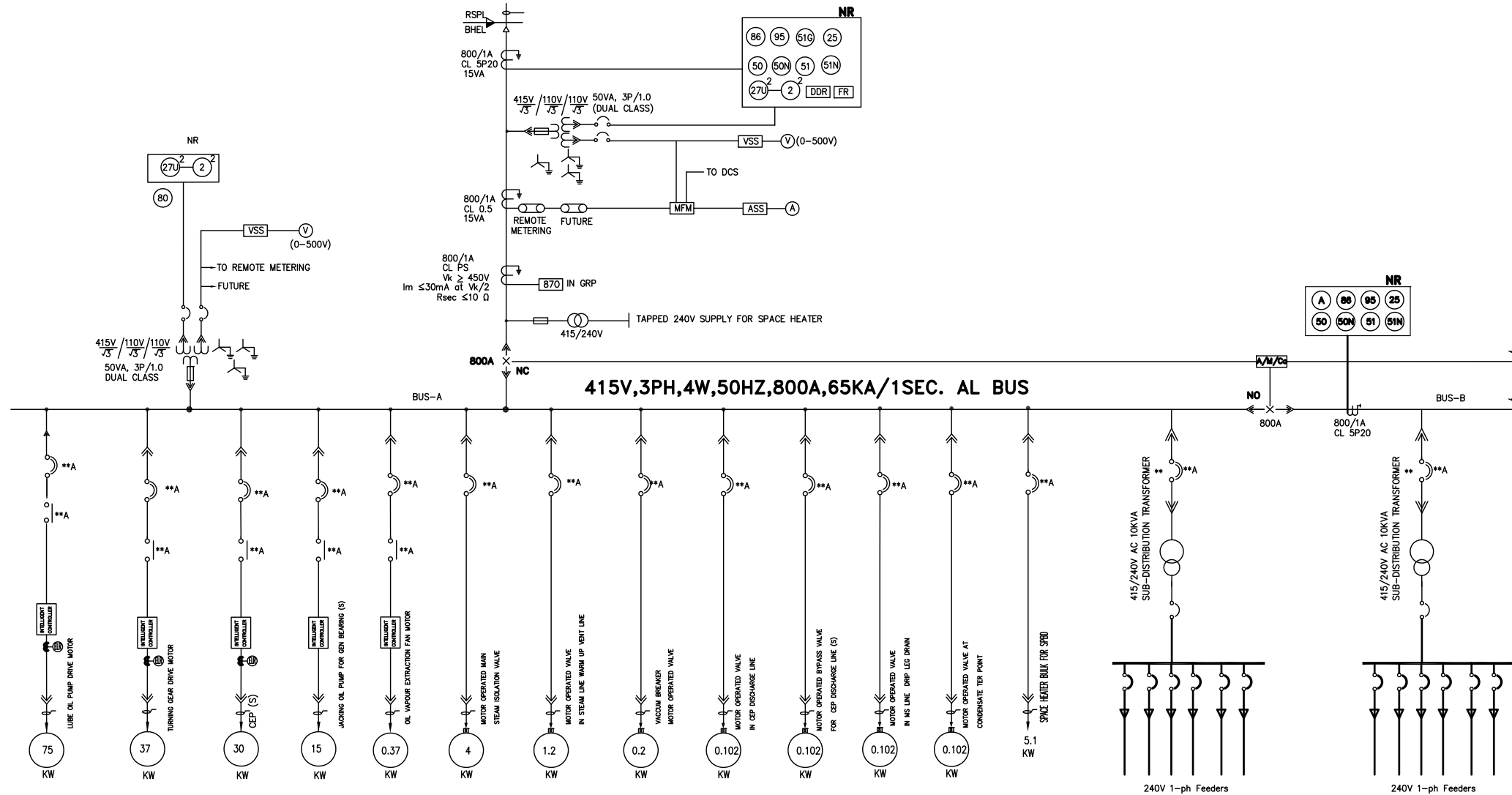
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DRG. NO. 3-381-21-02489

INCOMER-1(FROM UNIT AUX. TRANSFORMER)



240V, 1-PH AC LOADS (SUB-DIS. TRAF0-1)

Sl.No.	Description	Rating (kW)	Quantity
1	Generator Control Panel	0.5	1
2	Generator Relay Panel	0.5	1
3	Generator Space Heaters	0.95	2
4	Exciter Space Heater	0.95	1
5	Water Leakage Detector for Generator Cooler	0.024	1
6	Turbine Control Panel-Illumination	0.3	1
7	NG Cubicle Load	1.32	1
8	AVR	0.5	1

240V, 1-PH AC LOADS (SUB-DIS. TRAF0-2)

Sl.No.	Description	Rating (kW)	Quantity
1	Generator Control Panel	0.5	1
2	Generator Relay Panel	0.5	1
3	Generator Space Heaters	0.95	2
4	Water Leakage Detector for Generator Cooler	0.024	1
5	Dial Type Thermometers	0.024	1
6	LGB Speed Indicator	0.04	1
7	LAV Cubicle Load	1.32	1

- LEGEND:**
- LT. AIR CIRCUIT BREAKER
 - CURRENT TRANSFORMER
 - DRAWOUT CONTACT
 - CONTACTOR
 - AUX. CONTACTOR
 - A/M/Co AUTO & MOMENTARY CHANGEOVER
 - MCCB/MPCB
 - FR FAULT RECORDER
 - AMMETER
 - VOLTMETER
 - UNDER VOLTAGE RELAY
 - TIMER
 - TRIP CKT SUPERVISION RELAY
 - HIGH SPEED TRIPPING RELAY
 - THERMAL OVERLOAD RELAY WITH SINGLE PHASE PROTECTION
 - MCB
 - CHECK SYNCH RELAY
 - DDR DYNAMIC DISTURBANCE RECORDER

- NOTES:**
- BUS BAR MATERIAL -AL/AL ALLOY E-91E CONFORMING TO IS-5082-1981. BUS BAR SHALL BE INSULATED BY PVC SLEEVES.
 - MCC IS INTELLIGENT TYPE, DOUBLE FRONT & DRAWOUT TYPE(FORM 3b) PANEL.
 - PAINT SHADE SHALL BE 631 OF IS 5.
 - ALL INDICATING LAMPS ARE CLUSTER LED TYPE WITH SERIES RESISTOR.
 - HEATER SUPPLY FOR SPACE HEATER SHALL BE TAPPED FROM INCOMER BEFORE BREAKER.
 - ON,OFF & TRIP INDICATIONS SHALL BE PROVIDED FOR INCOMERS,BUS-COUPLER, BUS PTS AND OUTGOING FEEDERS.
 - CABLE ENTRY FROM BOTTOM.
 - ALL CONTROL VALVES, MOVs, ACTUATORS ARE INTEGRAL TYPE.
 - ENCLOSURE SHALL HAVE MIN. IP-5X DEGREE OF PROTECTION
 - PANEL SHALL BE MADE FROM CRCA SHEET STEEL WITH 2.0MM THICKNESS FOR LOAD & NON LOAD BEARING MEMBERS. 1.6MM FOR INTERNAL PARTITIONS. UNDRILLED REMOVABLE BOTTOM GLAND PLATE THICKNESS SHALL BE 3MM.
 - ALL THE SIGNAL & CONTROL TERMINATIONS SHALL BE DONE IN MARSHALING BOX FOR EASE OF CABLING BETWEEN MCC & DCS.
 - MPCBs CONFIRMING TO IS 60947 WITH IN BUILT RELEASE FOR SHORT CIRCUIT, OVERLOAD, LR, UNBALANCE AND GROUND FAULT PROTECTION FOR MOTORS UPTO 75KW. COMPREHENSIVE MPR WITH COMMUNICATION & ACB FOR MOTORS ≥90KW.
 - AMMETER WITH SELECTOR SWITCH SHALL BE PROVIDED FOR ALL O/G MOTOR FEEDER RATED ≥ 30KW.
 - 110V A.C SPN TO BE DERIVED FROM SEPARATE CONTROL TRANSFORMER FOR EACH BUS SECTION WITH MANUAL CHANGEOVER SWITCH FOR CONTROL SUPPLY. SEPARATE AUXILIARY BUS SHALL RUN EACH FOR CONTROL SUPPLY, SPACE HEATER AND 240V UPS SUPPLY FOR MOTOR CONTROLLER.
 - AUTO CHANGE OVER FOR INCOMER & BUS COUPLER SHALL BE DONE THROUGH UNDER VOLTAGE RELAYS.
 - CT METERING FOR REMOTE INDICATION IN LCS AND PROVISION FOR SPACE HEATER SHALL BE PROVIDED FOR MOTORS ≥ 30KW. SPACE HEATER SHALL BE PROVIDED THROUGH SEPARATE MCB & INTERLOCK WITH MAIN POWER CONTACTOR.
 - FOR MOTOR RATINGS UPTO 75KW EITHER MCCB/MPCB CAN BE PROVIDED.
 - MCCB/MPCB CONTACTOR RATINGS & THERMAL O/L RELAY RANGE SHALL BE SELECTED TO MEET TYPE-2 CO-ORDINATION CHART.
 - FOR 30KW AND ABOVE MOTOR FEEDERS ELR WITH CBCT SHALL BE PROVIDED. CBCT SHALL BE DESIGNED FOR PRIMARY EARTH FAULT CURRENT OF 100mA. ELR Aux. SUPPLY SHALL BE 110V DC.
 - MCC SHALL HAVE BASE CHANNEL OF SIZE ISMC-75.
 - MCC SHALL BE EXTENDABLE AT BOTH ENDS.
 - FEEDERS SHALL BE INTERCHANGEABLE BETWEEN SIMILAR TYPE OF FEEDER MODULES.
 - MOTOR CONTROLLER SHALL BE FLUSH MOUNTED ON THE RESPECTIVE DOORS.
 - EARTH BUS OF MIN. 75X10MM SHALL RUN IN ALL CABLE ALLEY OF THE PANEL AND THE PANEL SHALL BE PROVIDED WITH TWO EARTHING TERMINALS.
 - TEMP RISE OF BUS SHALL BE 40 DEGREE OVER AN AMBIENT OF 50 DEGREE.
 - 240V REDUNDANT AC UPS SUPPLY WILL BE PROVIDED AT THE MCC FOR INTELLIGENT MOTOR CONTROLLERS.
 - MANUAL CHANGEOVER BETWEEN TWO FEEDERS SHALL BE POSSIBLE THROUGH SELECTOR SWITCH & CONTACTOR.

SUBMITTED FOR:	APPROVAL:	INFORMATION:	REFERENCE:	RECORD:	CONSTRUCTION:
CLIENT					
M/s. RSPL Limited RSPL CHEMICAL COMPLEX Jamnagar, Gujarat STEAM TURBINE GENERATOR PACKAGE ISCR001A/B					
CONSULTANT					
JACOBS JACOBS LIMITED					
CONTRACTOR					
BHARAT HEAVY ELECTRICALS LTD. HYDERABAD					
DESIGNED	SRS				
DRAWN	SRS				
CHECKED	AVS				
APPROVED	J.K.P				
415V STG IMCC SLD					
SCALE N.T.S SHEET 01 of 02 REV. 01					
VENDOR'S DRAWING NO. 3-38121-02489					

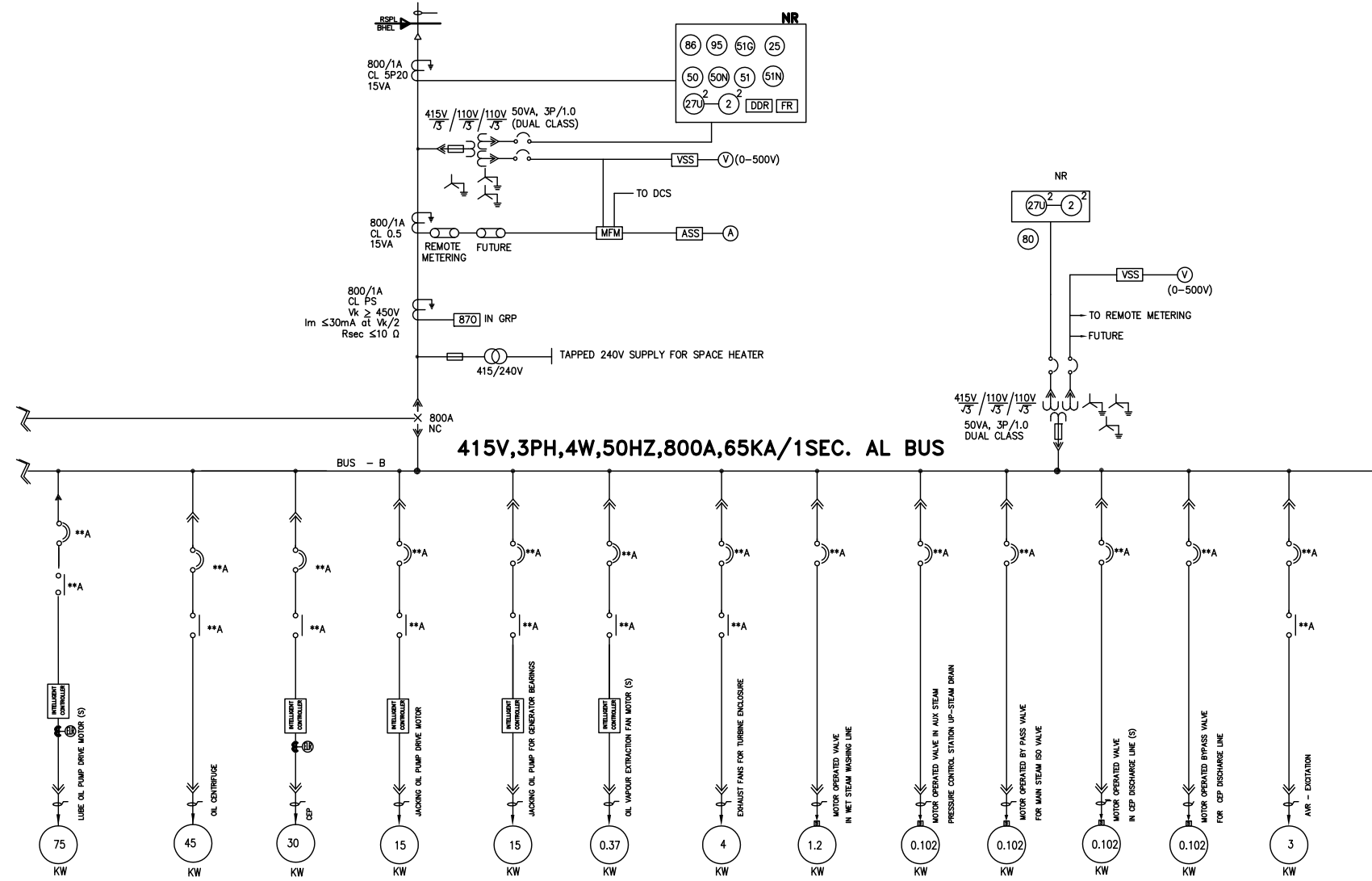
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INVENTORY NO. SIGN. AND DATE REF. DRG. NO.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	S.M	
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DRG. NO. 3-381-21-02489

415V TPN INCOMER FROM CUSTOMER



LEGEND:

	LT. AIR CIRCUIT BREAKER		AMMETER
	CURRENT TRANSFORMER		VOLTMETER
	DRAWOUT CONTACT		UNDER VOLTAGE RELAY
	CONTACTOR		TIMER
	AUX. CONTACTOR		TRIP CKT SUPERVISION RELAY
	AUTO & MOMENTARY CHANGEOVER		HIGH SPEED TRIPPING RELAY
	MCCB		THERMAL OVERLOAD RELAY WITH SINGLE PHASE PROTECTION
	FAULT RECORDER		MCB
			CHECK SYNCH RELAY
			DYNAMIC DISTURBANCE RECORDER

NOTES:

27. I/Cs & B/C ACBs WITH NUMERICAL RELAYS (NR). NRs SHALL HAVE SINGLE COMMUNICATION PORT SUITABLE FOR IEC 61850.

28. MFM SHALL BE OF MICROPROCESSOR BASED AND WITH COMMUNICATION PORT TO BE CONNECTED TO DCS. MFM : 1.0 ACCURACY CLASS.

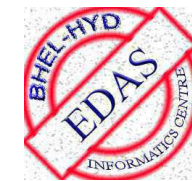
29. ALL RATING OF MCCB, BUS-BAR SHALL BE IN PANEL RATING.

30. 20% SPARE FEEDERS TO BE CONSIDERED WITH MINIMUM ONE NUMBER OF EACH RATING AND TYPE IN EACH SWITCHBOARD (FOR 415 & 240V FEEDERS.)

31. MCCB LESS THAN 250A SHALL BE ADJUSTABLE THERMAL O/C AND MAGNETIC SHORT-CIRCUIT RELEASES. MCCBs MORE THAN 250A SHALL BE PROVIDED WITH MICROPROCESSOR BASED RELEASE FOR O/L, S/C AND GROUND FAULT PROTECTION.

32. 110V REDUNDANT DC SUPPLY WILL BE PROVIDED AT THE MCC FOR ACB/NR CONTROLS. MANUAL CHANGEOVER SWITCH TO BE PROVIDED FOR THE SAME.

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SUBMITTED FOR:	APPROVAL	INFORMATION	REFERENCE	RECORD	CONSTRUCTION
CLIENT	M/s. RSPL Limited RSPL CHEMICAL COMPLEX Jamnagar, Gujarat STEAM TURBINE GENERATOR PACKAGE 12CRD01A/B				
CONSULTANT	JACOBS LIMITED				
CONTRACTOR	BHARAT HEAVY ELECTRICALS LTD. HYDERABAD				
DESIGNED	SRS				
DRAWN	SRS				
CHECKED	SRS				
APPROVED	J.K.P				
DATE:	07.03.16				
SCALE	N.T.S	SHEET	02 OF 02	REV.	01
VENDOR'S DRAWING NO. 3-38121-02489					

3-38121-02490

DRG. NO.

SH.01 OF 01

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COMPUTER FILE NAME

REF. DRG. NO.

SIGN. AND DATE

INVENTORY NO

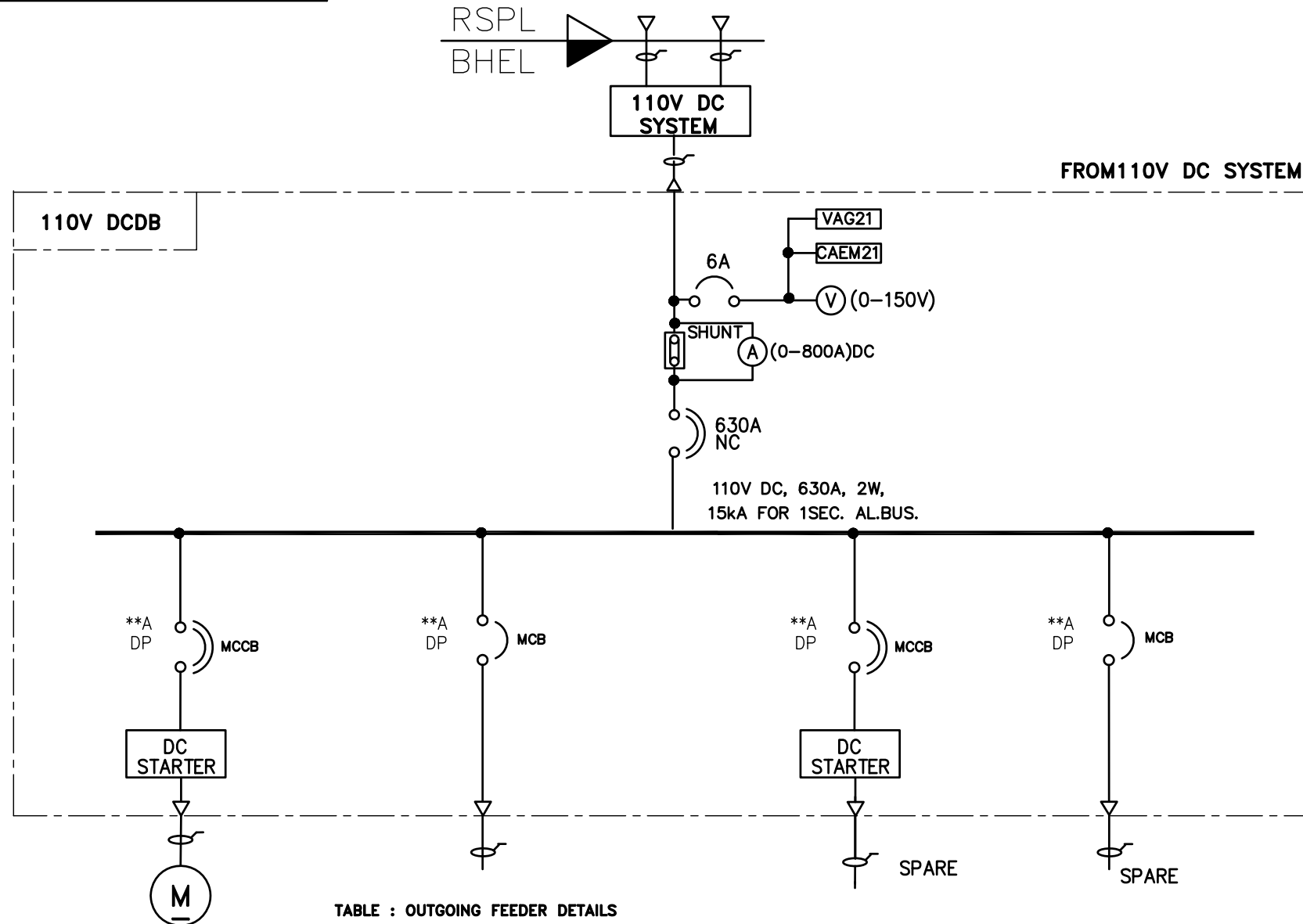


TABLE : OUTGOING FEEDER DETAILS

SL.	LOAD/FEEDER	FEEDER DETAILS			REMARKS
		TYPE	RATING	FEEDERS	
01	EMG. OIL PUMP	MCCB	15KW	3	WITH DC STARTER CUBICLE
02	TURBINE ENCLOSURE	MCB	0.3KW	3	
03	GENERATOR CONTROL PANEL	MCB	0.6KW	6	
04	GENERATOR RELAY PANEL	MCB	0.6KW	6	
05	AVR-DC LOAD	MCB	0.6KW	3	
06	STG MCC CONTROL	MCB	1KW	6	
07	SPARE	MCCB	15KW	1	WITH DC STARTER CUBICLE
08	SPARE	MCB	0.3KW	1	
09	SPARE	MCB	0.6KW	3	
10	SPARE	MCB	1 KW	2	

LEGEND:

- (A) AMMETER
- (V) VOLTMETER
- (MCCB) MCCB
- (MCB) MCB
- (SFU) SFU
- (C) CABLE
- (X) INDICATION LAMP

NOTES:-

- DCDB SHALL BE SINGLE FRONT, FIXED TYPE, COMPARTMENTALIZED WITH IP 5X DEGREE OF PROTECTION.
- PAINT SHADE SHALL BE 631 OF IS 5.
- CABLE ENTRY FROM BOTTOM. BASE CHANNEL SHALL BE OF ISMC75.
- 75*10 MM EARTH BUS BAR SHALL RUN THROUGHOUT THE LENGTH ON THE BOTTOM PANEL
- RATING OF ALL COMPONENTS OF DC STARTER PANELS SHALL BE SELECTED AS PER DC DUTY.
- REFER TABLE FOR RATING AND QTY OF FEEDER DETAILS.
- MCCB/MCBs SHALL BE SUITABLE FOR DC DUTY.
- BOTH INCOMERS AND ALL OUT GOING FEEDERS SHALL HAVE ON, OFF, TRIP INDICATIONS LAMP (LED CLUSTER TYPE)
- PANEL SHALL BE MADE FROM CRCA SHEET STEEL WITH 2.0MM THICKNESS FOR LOAD & NON LOAD BEARING MEMBERS. 1.6MM FOR INTERNAL PARTITIONS.
- UNDRILLED REMOVABLE BOTTOM GLAND PLATE THICKNESS = 3MM.
- MCCB LESS THAN 250A SHALL BE ADJUSTABLE THERMAL O/C AND MAGNETIC SHORT-CIRCUIT RELEASES.
- MCCBs > 250A SHALL BE PROVIDED WITH MICROPROCESSOR BASED RELEASE FOR O/L, S/C AND GROUND FAULT PROTECTION.
- MCCBs FOR NON-MOTOR FEEDERS SHALL BE OF SUITABLE DC DUTY.

SUBMITTED FOR:	APPROVAL	INFORMATION	REFERENCE	RECORD	CONSTRUCTION
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CLIENT	M/s. RSPL Limited RSPL CHEMICAL COMPLEX Jamnagar, Gujarat STEAM TURBINE GENERATOR PACKAGE: 13CK001A/B
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CONSULTANT	JACOBS LIMITED
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CONTRACTOR	BHARAT HEAVY ELECTRICALS LTD. HYDERABAD
------------	--

DESIGNED	SRS	110V DCDB SLD				
DRAWN	SRS					
CHECKED	AVS					
APPROVED	J.K.P					
DATE: 07.03.16	SCALE	N.T.S	SHEET	01 OF 01	REV.	01
VENDOR'S DRAWING NO. 3-38121-02490						

3-38121-02491

DRG. NO.

SH. 01 OF 01

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INVENTORY NO

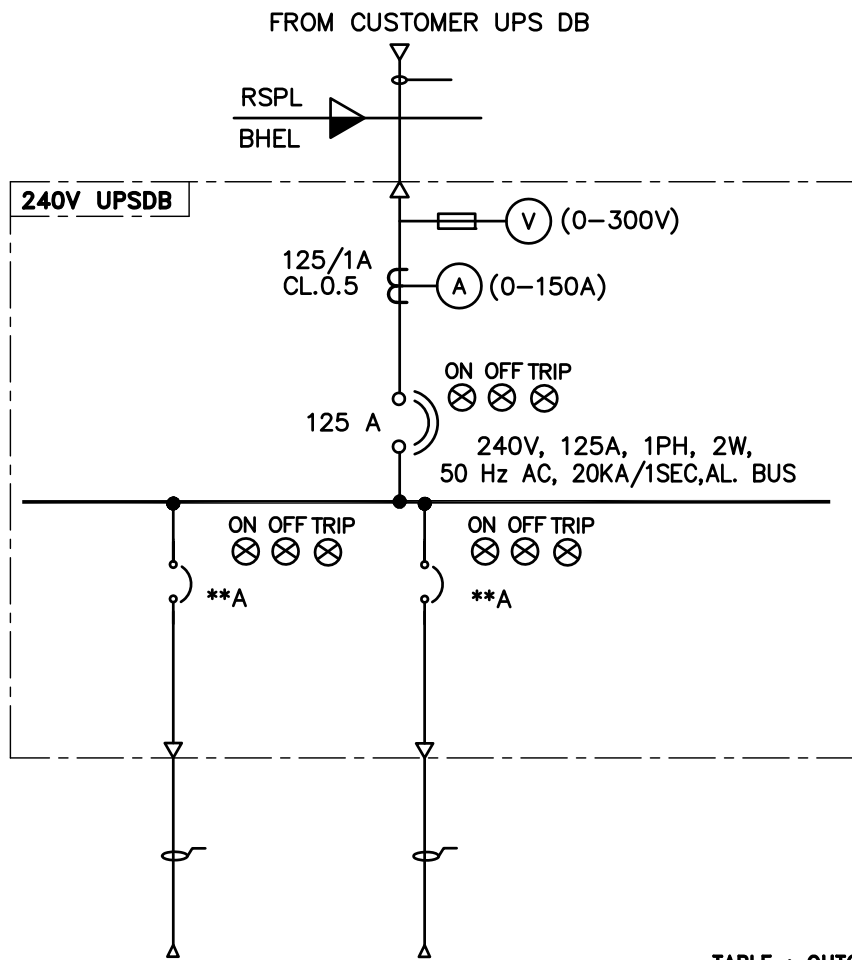
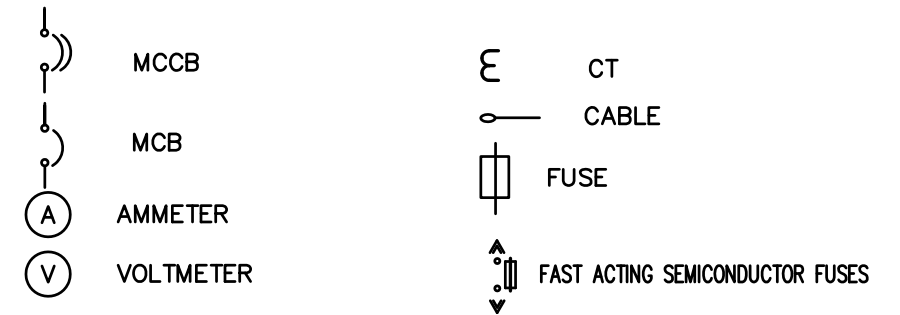


TABLE : OUTGOING FEEDER DETAILS FOR UPSDB

SL.	FEEDER DESCRIPTION	MCB RATING	QTY.
01	TURBINE CONTROL PANEL	10A	3
02	AVR LOAD	6A	3
03	STR CTRL TURN. DRV. MOTOR	6A	3
04	GEN CONTROL PANEL	6A	3
05	STG MCC INTL. CONTROLLER	10A	6
06	SPARE	6A	3
07	SPARE	10A	4

LEGEND: -



NOTES:-

- UPS DB SHALL BE SINGLE FRONT, FIXED TYPE, COMPARTMENTALIZED.
- CABLE ENTRY FROM BOTTOM. BASE CHANNEL SHALL BE OF ISMC75.
- PAINT SHADE SHALL BE 631 OF IS 5.
- ENCLOSURE PROTECTION SHALL BE IP-5X.
- ON,OFF,TRIP INDICATING LAMPS SHALL BE OF LED (CLUSTER TYPE)
- REFER TABLE FOR RATING AND QTY OF FEEDER DETAILS
- 50*6MM EARTH BUS BAR SHALL RUN THROUGHOUT THE LENGTH OF THE PANEL AT THE BOTTOM.
- MCCB LESS THAN 250A SHALL BE ADJUSTABLE THERMAL OVER LOAD AND MAGNETIC SHORT CIRCUIT RELEASES.
- PANEL SHALL BE MADE FROM CRCA SHEET STEEL WITH 2.0MM THICKNESS FOR LOAD & NON LOAD BEARING MEMBERS. 1.6MM FOR INTERNAL PARTITIONS.
- UNDRILLED REMOVABLE BOTTOM GLAND PLATE THICKNESS = 3MM.

SUBMITTED FOR:	APPROVAL	INFORMATION	REFERENCE	RECORD	CONSTRUCTION
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CLIENT	M/s. RSPL Limited RSPL CHEMICAL COMPLEX Jamnagar, Gujarat STEAM TURBINE GENERATOR PACKAGE: 13CK001A/B
--------	--

CONSULTANT	JACOBS LIMITED
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CONTRACTOR	BHARAT HEAVY ELECTRICALS LTD. HYDERABAD
------------	--

DESIGNED	SRS	240V UPSDB SLD
DRAWN	SRS	
CHECKED	AVS	
APPROVED	J.K.P	
DATE: 07.03.16	SCALE	N.T.S
SHEET		01 OF 01
REV.		01
VENDOR'S DRAWING NO. 3-38121-02491		





**PRODUCT STANDARD
PROJECT ENGINEERING
HYDERABAD**

**ANNEXURE-3 TO
PY-55127**

REV NO. 00

Page 1 of 2

PROJECT: 3X16.65MW STG Project

CUSTOMER: M/s RSPL, Gujarat

CONSULTANT: M/s JACOBS, Mumbai

SUB-VENDOR LIST FOR ELECTRICAL COMPONENTS

Sub vendors for the LT switchgear components shall be as per the following list:

Sl.No.	ITEM	RECOMMENDED ELECTRICAL VENDOR
1.	Air Circuit Breaker	Siemens, L&T, Schneider, C&S, GE , LT Switchgear OEM Recommended.
2.	Intelligent Motor Controllers	Siemens, Schneider, L&T, Rockwell Automation, LT Switchgear OEM recommended.
3.	NUMERICAL RELAYS	ABB, Alstom, Easun Reyrole, L&T, Schneider, Siemens, LT Switchgear OEM recommended.
4.	Heavy Duty Switch	Siemens, L&T, Schneider, ABB, C&S, Indo Asian, EE.
5.	Switch Fuse Unit	ABB, C&S, Havell's, Siemens, L&T, Indo Asian, Schneider, GE, Standard Electricals Ltd.
6.	Fuses	Siemens, L&T, Cooper Bussman, Indo Asian Switchgear, GE
7.	Power Contactors/ Auxiliary Contactors	Siemens, L&T, Schneider, ABB, Bhartia Industries Ltd., C&S , GE
8.	Overload Relays	Siemens, L&T, Schneider, ABB, Bhartia Industries Ltd., C&S, GE
9.	Earth Leakage Circuit Breaker	Datar Switchgear Pvt. Ltd., indo Asian Switchgear, Legrand, Havell's, Schneider
10	MCB	Datar Switchgear Pvt. Ltd., Indo Asian Switchgear, Legrand, Havell's, Schneider, Siemens, Standard Electricals Ltd, Indiana Current Control Limited
11	MCCB	AEG, GE, Siemens, L&T, Indo Asian, Schneider
12	CT and PT	Pragati, Kappa, Jyoti, Silkans, Precise, AE, Gilbert Maxwell, Kalpa Electricals, Narayan Powertech
13	Control Transformer	Kappa, Silcon, Pragati, Powerpack
14	Push buttons and Indicating Lamps	Siemens, Teknic Controls, L&T, Bhartia Industries Ltd., C&S, Cands, Essen, Hotline, Precifine, Schneider, Shri Tulsi Switchgears Limited, Technic.
15	Meters	AE, IMP, Rishabh, Areva, Meco, Nippen
16	Terminals	Elmex, Connect Well
17	Auxiliary Relays	ABB, Areva, Jyoti, Siemens, L&T, Schneider, GEC
18	Control/ Selector Switch	Kaycee, Areva, Jyoti, L&T, Switron, Siemens, Hotline Switchgear & Controls, Recon, Reliable Electronic Components
19	Breaker Control Switch	Areva, Switron, Reliable Electronic Components
20	Timer	Siemens, L&T, Schneider, ABB, Bhartia Industries Ltd, Electronic Automation, GEC.
21	Transducers	ABB, Elster, Pyrotech Electronics, Meco, Vitronics India
22	Cable Glands (Hazardous Area/ Weatherproof)	Baliga, Comet Industries, Flexpro, FEPL, FCG Power, FCG Flame Proof Control Gears, Prompt Engineers, Sudhir Switchgears, Standard Metal, Comet Brass Products, Electromag India, United Agro
23	LT Isolator	Siemens, L&T, GE Power

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Ref. Doc

Form No.



**PRODUCT STANDARD
PROJECT ENGINEERING
HYDERABAD**

**ANNEXURE-3 TO
PY-55127**

REV NO. 00

Page 2 of 2

24	Cable Lugs	Dowell, Crown, Niko, Forward Engineering, Automic Electric, Electromac Industries
25	PVC Wires	Phinolex, Q-Flex, Kundan, Anchor, Orbit, Mardia

NOTES:

- 1) Vendor shall strictly follow the list of makes for equipments as specified above.
- 2) For components other than the above, vendor shall submit past track record for the proposed sub-vendors and obtain written approval from BHEL.
- 3) BHEL reserves the right to choose any particular make from the above list for Protection relays during order execution for overall system integration.

Following Documents shall be submitted during the time of bid submission without which the offer will be incomplete and viable for rejection.

Bidder shall have successfully executed atleast One no. Intelligent MCC, comprising of ACB Incomers with Numerical Relays and Intelligent Motor Controllers during last 3 years, ending on last date on techno-commercial bid opening.

Following supporting documents to be submitted by bidder:-

- a) Past Track Record (PTR) for successfully supplied LT Switchgear Package comprising atleast one no. 415V Intelligent MCC with ACB Incomers, Numerical Relays and Intelligent Motor Controllers.
- b) Customer's approved GA, SLD, BOM and Schematic drawings including architecture drawing of Intelligent Motor Controller/Numerical Relay showing details of communication protocol/switches with upstream processor complete in all respect, of which the bidder intends to submit the PTR.

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Ref. Doc



Project: 3X16.65 MW STG Project

Bharat Heavy Electricals Limited

Customer : M/s RSPL, Gujarat

PE&SD-Hyderabad

Consultant: M/s JACOBS, Mumbai

Annexure-4 to PY55199 Rev 00

SIGNAL INPUT LIST TO ECS

S. No	TAG NO.	DESCRIPTION	ECS	REMARKS	REV
A	415V STG IMCC				
1		415V STG -IMCC 1- I/C 1 CURRENT	√	Soft	00
2		415V STG -IMCC 1- I/C 1 VOLTAGE	√	Soft	00
3		415V STG -IMCC 1- I/C 1 KW READING	√	Soft	00
4		415V STG -IMCC 1- I/C 2 CURRENT	√	Soft	00
5		415V STG -IMCC 1- I/C 2 VOLTAGE	√	Soft	00
6		415V STG -IMCC 1- I/C 2 KW READING	√	Soft	00
7		415V STG -IMCC 1-BUS-1 PT VOLTAGE	√	Soft	00
8		415V STG -IMCC 1-BUS-2 PT VOLTAGE	√	Soft	00
9		415V STG -IMCC 2- I/C 1 CURRENT	√	Soft	00
10		415V STG -IMCC 2- I/C 1 VOLTAGE	√	Soft	00
11		415V STG -IMCC 2- I/C 1 KW READING	√	Soft	00
12		415V STG -IMCC 2- I/C 2 CURRENT	√	Soft	00
13		415V STG -IMCC 2- I/C 2 VOLTAGE	√	Soft	00
14		415V STG -IMCC 2- I/C 2 KW READING	√	Soft	00
15		415V STG -IMCC 2-BUS-1 PT VOLTAGE	√	Soft	00
16		415V STG -IMCC 2-BUS-2 PT VOLTAGE	√	Soft	00
17		415V STG -IMCC 3- I/C 1 CURRENT	√	Soft	00
18		415V STG -IMCC 3- I/C 1 VOLTAGE	√	Soft	00
19		415V STG -IMCC 3- I/C 1 KW READING	√	Soft	00
20		415V STG -IMCC 3- I/C 2 CURRENT	√	Soft	00
21		415V STG -IMCC 3- I/C 2 VOLTAGE	√	Soft	00
22		415V STG -IMCC 3- I/C 2 KW READING	√	Soft	00
23		415V STG -IMCC 3-BUS-1 PT VOLTAGE	√	Soft	00
24		415V STG -IMCC 3-BUS-2 PT VOLTAGE	√	Soft	00

NOTE:

- 1)AI for Motor Feeders shall be as per Drive Control Philosophy.
- 2) In addition to above AI Signals, Consider 20% Spare AI Signals for PE&SD use other than contract requirement.



Project: 3X16.65 MW STG Project
Customer : M/s RSPL, Gujarat
Consultant: M/s JACOBS, Mumbai

Bharat Heavy Electricals Limited
PE&SD-Hyderabad
Annexure-4 to PY55199 Rev 00

SIGNAL INPUT LIST TO ECS

S. NO.	TAG NO.	DESCRIPTION	PURPOSE	REMARKS	Type	REV
			ECS			
A	415V STG IMCC					
1		415V STG IMCC- 1 SWBD -I/C -1 CB TRIPPED ON FAULT	√	ALARM	Soft	00
2		415V STG IMCC- 1 SWBD -I/C -1 CB CLOSE	√	INDICATION	Soft	00
3		415V STG IMCC- 1 SWBD -I/C -1 CB OPEN	√	INDICATION	Soft	00
4		415V STG IMCC- 1 SWBD - I/C-1 READY TO CLOSE	√	INDICATION	Soft	00
5		415V STG IMCC- 1 SWBD - TRIP CIRCUIT TROUBLE	√	ALARM	Soft	00
6		415V STG IMCC- 1 SWBD - DC FAIL	√	ALARM	Soft	00
7		415V STG IMCC- 1 SWBD -I/C -2 CB TRIPPED ON FAULT	√	ALARM	Soft	00
8		415V STG IMCC- 1 SWBD -I/C -2 CB CLOSE	√	INDICATION	Soft	00
9		415V STG IMCC- 1 SWBD -I/C -2 CB OPEN	√	INDICATION	Soft	00
10		415V STG IMCC- 1 SWBD - I/C-2 READY TO CLOSE	√	INDICATION	Soft	00
11		415V STG IMCC- 1 SWBD - BUS COUPLER CB TRIPPED ON FAULT	√	ALARM	Soft	00
12		415V STG IMCC- 1 SWBD - BUS COUPLER CB CLOSE	√	INDICATION	Soft	00
13		415V STG IMCC- 1 SWBD - BUS COUPLER CB OPEN	√	INDICATION	Soft	00
14		415V STG IMCC- 1 SWBD - BUS COUPLER READY TO CLOSE	√	INDICATION	Soft	00
15		415V STG IMCC- 2 SWBD -I/C -1 CB TRIPPED ON FAULT	√	ALARM	Soft	00
16		415V STG IMCC- 2 SWBD -I/C -1 CB CLOSE	√	INDICATION	Soft	00
17		415V STG IMCC- 2 SWBD -I/C -1 CB OPEN	√	INDICATION	Soft	00
18		415V STG IMCC- 2 SWBD - I/C-1 READY TO CLOSE	√	INDICATION	Soft	00
19		415V STG IMCC- 2 SWBD - TRIP CIRCUIT TROUBLE	√	ALARM	Soft	00
20		415V STG IMCC- 2 SWBD - DC FAIL	√	ALARM	Soft	00
21		415V STG IMCC- 2 SWBD -I/C -2 CB TRIPPED ON FAULT	√	ALARM	Soft	00
22		415V STG IMCC- 2 SWBD -I/C -2 CB CLOSE	√	INDICATION	Soft	00
23		415V STG IMCC- 2 SWBD -I/C -2 CB OPEN	√	INDICATION	Soft	00
24		415V STG IMCC- 2 SWBD - I/C-2 READY TO CLOSE	√	INDICATION	Soft	00
25		415V STG IMCC- 2 SWBD - BUS COUPLER CB TRIPPED ON FAULT	√	ALARM	Soft	00
26		415V STG IMCC- 2 SWBD - BUS COUPLER CB CLOSE	√	INDICATION	Soft	00
27		415V STG IMCC- 2 SWBD - BUS COUPLER CB OPEN	√	INDICATION	Soft	00
28		415V STG IMCC- 2 SWBD - BUS COUPLER READY TO CLOSE	√	INDICATION	Soft	00
29		415V STG IMCC- 3 SWBD -I/C -1 CB TRIPPED ON FAULT	√	ALARM	Soft	00
30		415V STG IMCC- 3 SWBD -I/C -1 CB CLOSE	√	INDICATION	Soft	00
31		415V STG IMCC- 3 SWBD -I/C -1 CB OPEN	√	INDICATION	Soft	00
32		415V STG IMCC- 3 SWBD - I/C-1 READY TO CLOSE	√	INDICATION	Soft	00
33		415V STG IMCC- 3 SWBD - TRIP CIRCUIT TROUBLE	√	ALARM	Soft	00
34		415V STG IMCC- 3 SWBD - DC FAIL	√	ALARM	Soft	00
35		415V STG IMCC- 3 SWBD -I/C -2 CB TRIPPED ON FAULT	√	ALARM	Soft	00
36		415V STG IMCC- 3 SWBD -I/C -2 CB CLOSE	√	INDICATION	Soft	00
37		415V STG IMCC- 3 SWBD -I/C -2 CB OPEN	√	INDICATION	Soft	00
38		415V STG IMCC- 3 SWBD - I/C-2 READY TO CLOSE	√	INDICATION	Soft	00
39		415V STG IMCC- 3 SWBD - BUS COUPLER CB TRIPPED ON FAULT	√	ALARM	Soft	00
40		415V STG IMCC- 3 SWBD - BUS COUPLER CB CLOSE	√	INDICATION	Soft	00
41		415V STG IMCC- 3 SWBD - BUS COUPLER CB OPEN	√	INDICATION	Soft	00
42		415V STG IMCC- 3 SWBD - BUS COUPLER READY TO CLOSE	√	INDICATION	Soft	00

NOTE:

- 1) ON/OFF/Trip status for Motor Feeders shall be as per Drive Control Philosophy.
- 2) In addition to above DI Signals, Consider 20% Spare DI Signals for PE&SD use other than contract requirement.



Project: 3X16.65 MW STG Project
Customer : M/s RSPL, Gujarat
Consultant: M/s JACOBS, Mumbai

Bharat Heavy Electricals Limited
PE&SD-Hyderabad
Annexure-4 to PY55199 Rev 00

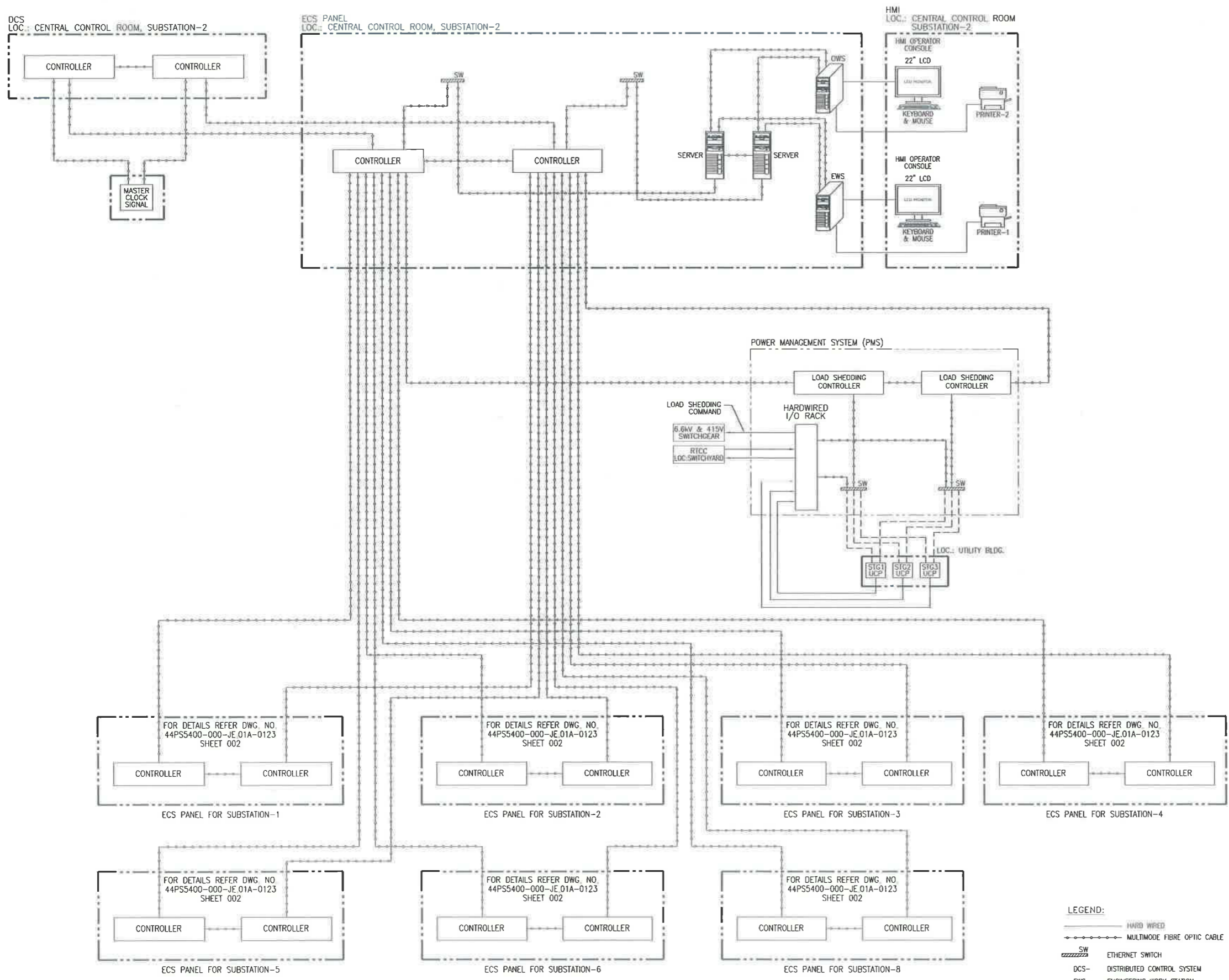
SIGNAL INPUT LIST TO ECS

S. NO.	TAG NO.	DESCRIPTION	TYPE OF I/O	PURPOSE	Normal Field Contact	REMARKS	REV
				ECS			
A	415V STG IMCC						
1		415V STG IMCC- 1 SWBD -I/C -1 CB CLOSE	DO	√	-	COMMANDS	00
2		415V STG IMCC- 1 SWBD -I/C -1 CB OPEN	DO	√	-	COMMANDS	00
3		415V STG IMCC- 1 SWBD -I/C -2 CB CLOSE	DO	√	-	COMMANDS	00
4		415V STG IMCC- 1 SWBD -I/C -2 CB OPEN	DO	√	-	COMMANDS	00
5		415V STG IMCC- 1 SWBD - BUS COUPLER CLOSE ON DEAD BUS	DO	√	-	COMMANDS	00
6		415V STG IMCC- 1 SWBD - BUS COUPLER TRIP	DO	√	-	COMMANDS	00
7		415V STG IMCC- 2 SWBD -I/C -1 CB CLOSE	DO	√	-	COMMANDS	00
8		415V STG IMCC- 2 SWBD -I/C -1 CB OPEN	DO	√	-	COMMANDS	00
9		415V STG IMCC- 2 SWBD -I/C -2 CB CLOSE	DO	√	-	COMMANDS	00
10		415V STG IMCC- 2 SWBD -I/C -2 CB OPEN	DO	√	-	COMMANDS	00
11		415V STG IMCC- 2 SWBD - BUS COUPLER CLOSE ON DEAD BUS	DO	√	-	COMMANDS	00
12		415V STG IMCC- 2 SWBD - BUS COUPLER TRIP	DO	√	-	COMMANDS	00
13		415V STG IMCC- 3 SWBD - I/C -1 CB CLOSE	DO	√	-	COMMANDS	00
14		415V STG IMCC- 3 SWBD -I/C -1 CB OPEN	DO	√	-	COMMANDS	00
15		415V STG IMCC- 3 SWBD -I/C -2 CB CLOSE	DO	√	-	COMMANDS	00
16		415V STG IMCC- 3 SWBD -I/C -2 CB OPEN	DO	√	-	COMMANDS	00
17		415V STG IMCC- 3 SWBD - BUS COUPLER CLOSE ON DEAD BUS	DO	√	-	COMMANDS	00
18		415V STG IMCC- 3 SWBD - BUS COUPLER TRIP	DO	√	-	COMMANDS	00

NOTE:

- 1) In addition to above DO Signals, Consider 20% Spare DO Signals for PE&SD use other than contract requirement.
- 2) ALL THE ABOVE SIGNALS ARE IN SOFT.

OVERALL ECS NETWORK SYSTEM



- NOTES:**
- ECS SYSTEM SHALL BE DESIGNED BASED ON THE REQUIREMENT SPECIFIED IN TECHNICAL SPECIFICATION NO.-44PS5400-000-JE.02A-0038
 - POWER MANAGEMENT SYSTEM (PMS) TO PROVIDE ALL NECESSARY SUPERVISORY POWER CONTROL, POWER MANAGEMENT, LOAD MANAGEMENT AND LOAD SHARING SHALL BE INTEGRAL PART OF ECS.
 - THERE WILL BE AN ETHERNET BASED INTERFACE BETWEEN THE DCS AND ELECTRICAL CONTROL SYSTEM VIA ETHERNET TCP/IP. THIS INTERFACE WILL ENABLE THE OPERATOR AND MAINTENANCE TECHNICIANS TO VIEW DIAGNOSTIC DATA FROM THE INTELLIGENT PROTECTION AND MOTOR RELAYS IN THE SUBSTATIONS. REFER TO ECS SPECIFICATION NO.- 44PS5400-000-JE.02A-0038.
 - CCR IS EQUIPPED WITH MASTER TIME CLOCK PROVIDING SNTP TIME MESSAGING TO ALL DEVICES (ECS, PMS, RELAYS ETC.)
 - COMMUNICATION CABLE (FIBRE OPTIC, RJ45) BETWEEN ECS AND OTHER EQUIPMENT WITHIN RESPECTIVE SUBSTATION SHALL BE INCLUDED IN THE SCOPE OF ECS SUPPLIER.

REFERENCE DOCUMENTS:-

DOCUMENT NUMBER	DESCRIPTION
44PS5400-000-JE.01A-0003	KEY SINGLE LINE DIAGRAM
44PS5400-022-JE.01A-0004	PROTECTION & METERING DIAGRAM FOR 33kV
44PS5400-022-JE.01A-0005	6.6 kV TYPICAL FEEDER SLD
44PS5400-022-JE.01A-0006	TYPICAL SINGLE LINE DIAGRAM FOR 415V PMCC (TYPE-1)
44PS5400-022-JE.01A-0007	TYPICAL SINGLE LINE DIAGRAM FOR 415V EPMCC (TYPE-2)
44PS5400-022-JE.01A-0008	TYPICAL SINGLE LINE DIAGRAM FOR 415V PMCC (TYPE-3)
44PS5400-022-JE.01A-0009	TYPICAL SINGLE LINE DIAGRAM FOR 415V MCC
44PS5400-000-JL-01A-0001	OVERALL PLOT PLAN
44PS5400-022-JE.01C-0038	SUBSTATION-1 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0039	SUBSTATION-2 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0040	SUBSTATION-3 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0041	SUBSTATION-4 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0042	SUBSTATION-5 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0124	SUBSTATION-6 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0126	SUBSTATION-8 EQUIPMENT LAYOUT

REV NO	DESCRIPTION	DRN	CHKD	APPD	DATE	
A	ISSUED FOR ENQUIRY	NVJ	JDY	MRS	JT	11.05.16

REVISIONS

PROJECT NAME: **RSPL CHEMICAL COMPLEX**
 DEVBHUMI DWARKA, GUJARAT

CLIENT: **RSPL**
 W/s. RSPL LIMITED
 C-1/C-2, 3RD FLOOR,
 SAFAL PROFITAIRE, CORPORATE ROAD,
 NR. PRAHALAD NAGAR GARDEN,
 AHMEDABAD-380 015
 GUJARAT, INDIA
 Tel: +91 79 29701607-08
 FAX: +91 79 29701606

ENGINEERING CONSULTANT: **JACOBS**
 JACOBS HOUSE, RANKKRISHNA MANDIR ROAD,
 KONDIVITA, ANDHERI (EAST),
 MUMBAI - 400 059, INDIA
 Tel: +91 22 28812000
 FAX: +91 22 28208295

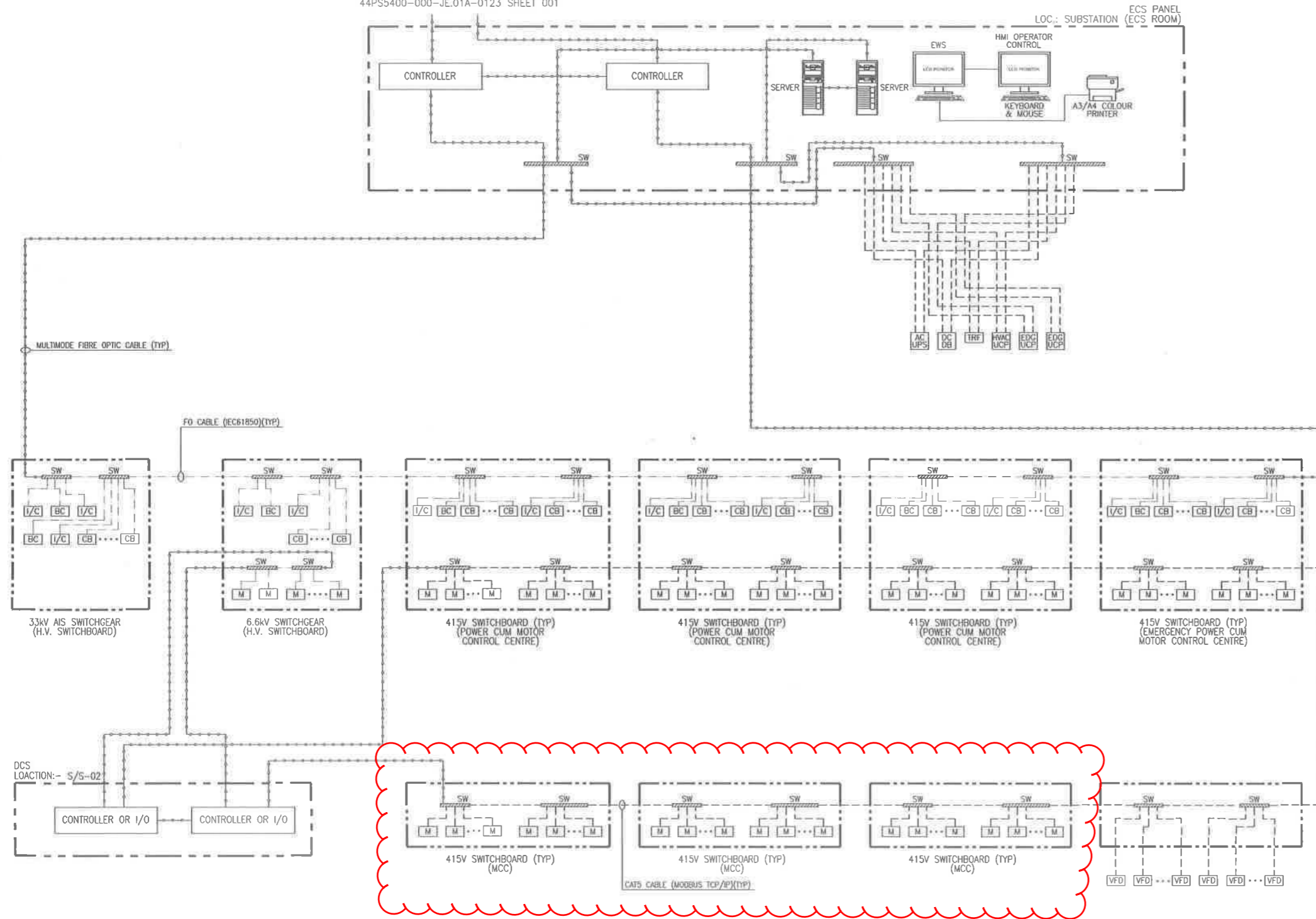
A MEMBER OF THE JACOBS ENGINEERING GROUP, INC.

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OVERALL ELECTRICAL CONTROL SYSTEM (ECS)

PROJ. NO.	DRAWING NO.	SHEET	REV.
44PS5400	44PS5400-000-JE.01A-0123	1 OF 2	A

FOR CONTINUATION REFER DRG. NO.
44PS5400-000-JE.01A-0123 SHEET 001



- LEGEND:**
- HARD WIRED
 - - - - CAT5 CABLE (MODBUS TCP/IP)
 - FIBRE OPTIC CABLE (IEC61850)
 - MULTIMODE FIBRE OPTIC CABLE
 - SW SWITCH
 - I/C RELAY FOR INCOMER
 - BC RELAY FOR BUS COUPLER
 - P FEEDER PROTECTION RELAY
 - M MOTOR PROTECTION RELAY
 - CB RELAY FOR OUTGOING BREAKER FEEDER
 - FW FIRE WALL
 - VFD VARIABLE FREQUENCY DRIVE
 - AC UPS AC UPS
 - DC DB DDCB & BATTERY CHARGER
 - HVAC UCP HVAC UNIT CONTROL PANEL
 - STG UCP UNIT CONTROL PANEL (STEAM TURBINE GENERATOR)
 - EDG UCP GENERATOR CONTROL PANEL (EMERGENCY DIESEL GENERATOR)
 - TRF TRANSFORMER AUXILIARY ALARM CONTACTS
 - THCP THERMISTOR HEATER CONTROL PANEL
 - PMS- POWER MANAGEMENT SYSTEM
 - DCS- DISTRIBUTED CONTROL SYSTEM
 - EWS- ENGINEERING WORK STATION
 - HMI- HUMAN MACHINE INTERFACE
 - CCR- CENTRAL CONTROL ROOM
 - SNTP- SIMPLE NETWORK TIME PROTOCOL
 - RTCC- REMOTE CONTROL TAP CHANGER CONTROL PANEL
 - OPC- OPEN PLATFORM COMMUNICATION

- NOTES:**
- POWER MANAGEMENT SYSTEM (PMS) TO PROVIDE ALL NECESSARY SUPERVISORY POWER CONTROL, POWER MANAGEMENT, LOAD MANAGEMENT AND LOAD SHARING SHALL BE INTEGRAL PART OF ECS.
 - THERE WILL BE AN ETHERNET BASED INTERFACE BETWEEN THE DCS AND ELECTRICAL CONTROL SYSTEM VIA ETHERNET TCP/IP OR OPC. THIS INTERFACE WILL ENABLE THE OPERATOR AND MAINTENANCE TECHNICIANS TO VIEW DIAGNOSTIC DATA FROM THE INTELLIGENT PROTECTION AND MOTOR RELAYS IN THE SUBSTATIONS. REFER TO ECS SPECIFICATION NO - 44PS5400-000-JE.02A-003B.
 - NUMBER OF RELAYS IN IEC61850 & MODBUS TCP/IP SHALL BE CONNECTED IN STAR TOPOLOGY.
 - VFD, AC UPS, DC UPS, HVAC UCP, EDG CP SHALL BE WITH ETHERNET TCP/IP PROTOCOL. PROTOCOL.
 - INTELLIGENT RELAYS OF INCOMER, BUS COUPLER AND BREAKER POWER FEEDER OF 33kV SWITCHBOARD, 6.6kV SWITCHBOARD AND 415V SWITCHBOARD SHALL BE WITH IEC 61850 PROTOCOL WITH REDUNDANT FIBRE OPTIC PORTS.
 - CCR IS EQUIPPED WITH MASTER TIME CLOCK (PART OF ICSS) PROVIDING SNTP TIME MESSAGING TO ALL DEVICES (ECS, PMS, RELAYS ETC.)
 - COMMUNICATION CABLE (FIBRE OPTIC, RJ45) BETWEEN ECS AND OTHER EQUIPMENT WITHIN RESPECTIVE SUBSTATION SHALL BE INCLUDED IN THE SCOPE OF ECS SUPPLIER.
 - FOR SUBSTATIONWISE EQUIPMENT LIST, REFER RESPECTIVE SUBSTATION EQUIPMENT LAYOUT ENCLOSED WITH THE REQUISITION.

REFERENCE DOCUMENTS:-

DOCUMENT NUMBER	DESCRIPTION
44PS5400-000-JE.01A-0003	KEY SINGLE LINE DIAGRAM
44PS5400-022-JE.01A-0004	PROTECTION & METERING DIAGRAM FOR 33kV
44PS5400-022-JE.01A-0005	6.6 kV TYPICAL FEEDER SLD
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44PS5400-022-JE.01C-0038	SUBSTATION-1 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0039	SUBSTATION-2 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0040	SUBSTATION-3 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0041	SUBSTATION-4 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0042	SUBSTATION-5 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0124	SUBSTATION-6 EQUIPMENT LAYOUT
44PS5400-022-JE.01C-0126	SUBSTATION-8 EQUIPMENT LAYOUT
44PS5400-022-JE.03A-00010	ECS I/O LIST

REV NO	DESCRIPTION	DRN	CHKD	APPD	DATE
A	ISSUED FOR ENQUIRY	NVJ	JOY	MRS	JT 11.05.16

PROJECT NAME : RSPL CHEMICAL COMPLEX
DEVBHUMI DWARKA, GUJARAT

CLIENT : M/s. RSPL LIMITED
C-1/C-2, 3RD FLOOR,
SAFAL PROFITAIRE, CORPORATE ROAD,
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ENGINEERING CONSULTANT : JACOBS HOUSE, RANKKRISHNA MANDIR ROAD,
KONDIVITA, ANDHERI (EAST),
MUMBAI - 400 059, INDIA
Tel:- +91 22 26812000
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JACOBS
EVOLUTION IS CONSTANT

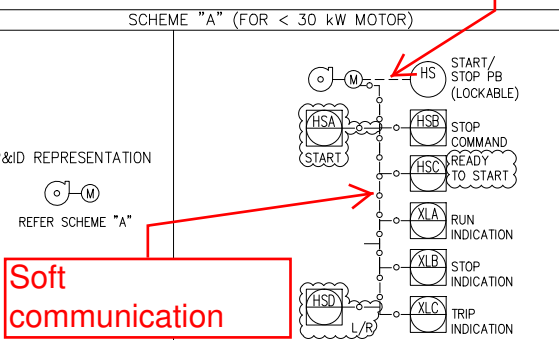
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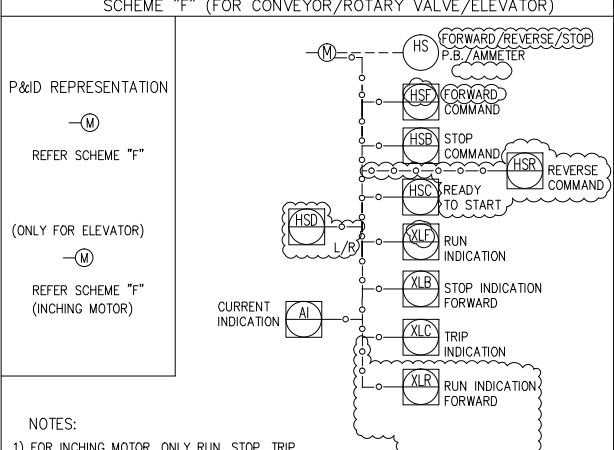
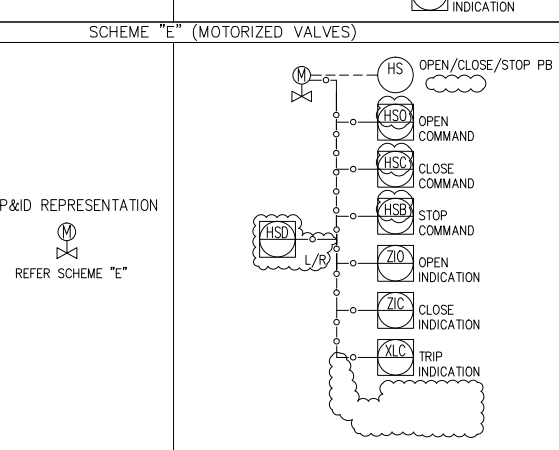
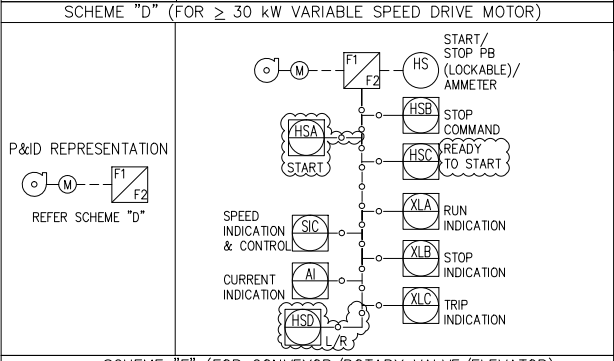
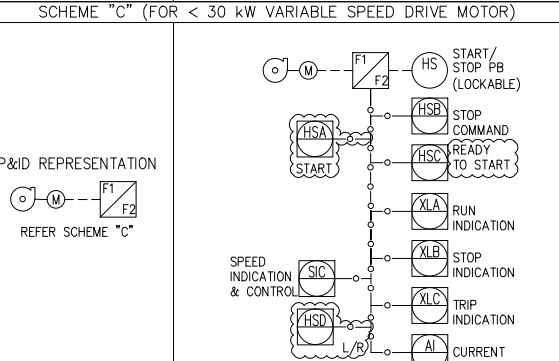
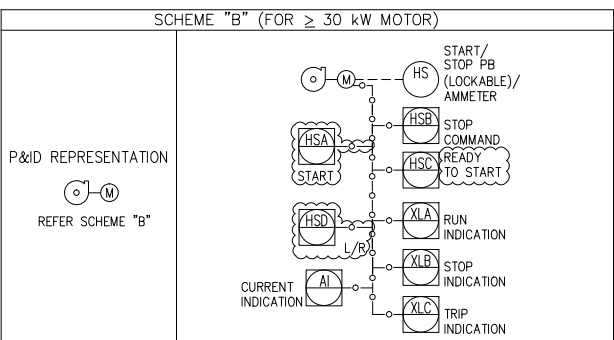
**ELECTRICAL CONTROL SYSTEM FOR SUBSTATION
(TYPICAL)**

PROJ. NO.	DRAWING NO.	SHEET	REV.
44PS5400	44PS5400-000-JE.01A-0123	2 OF 2	A

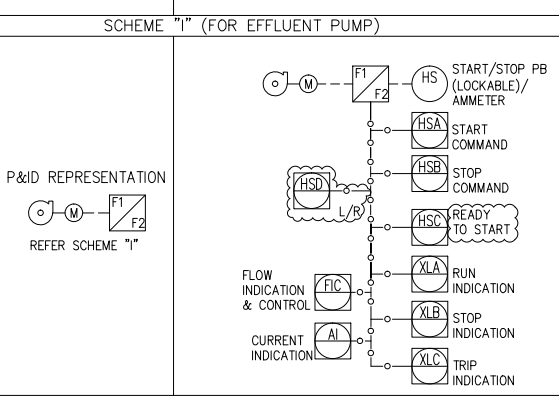
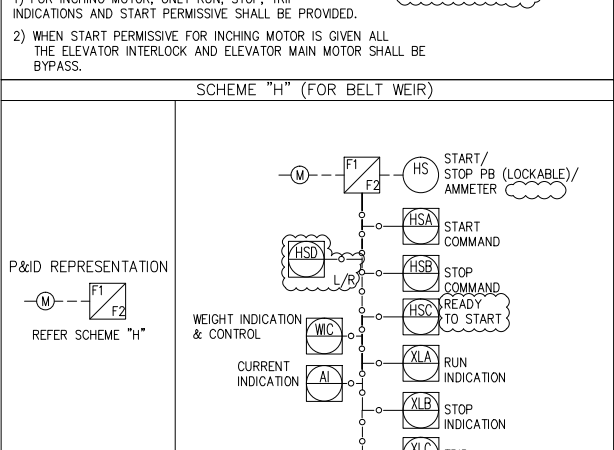
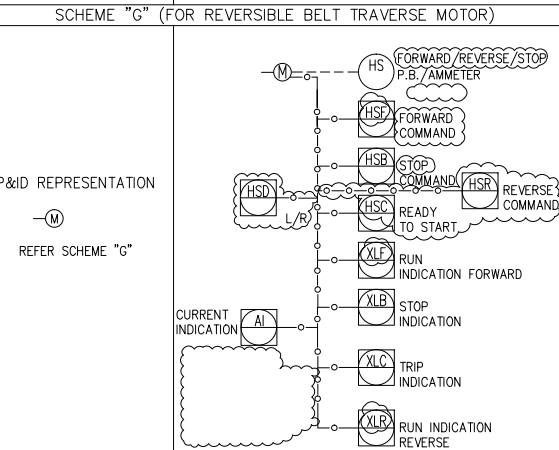
Hard wired communication



Soft communication



NOTES:
1) FOR INCHING MOTOR, ONLY RUN, STOP, TRIP INDICATIONS AND START PERMISSIVE SHALL BE PROVIDED.
2) WHEN START PERMISSIVE FOR INCHING MOTOR IS GIVEN ALL THE ELEVATOR INTERLOCK AND ELEVATOR MAIN MOTOR SHALL BE BYPASS.



Legend:
HS= Command
XL= Feedback

NOTES
1) ALL CONVEYING EQUIPMENT SHALL BE PROVIDED WITH ZSS (ZERO SPEED SWITCH), PULL CORD SWITCH AND SWAY SWITCH.
2) ALL ELEVATORS SHALL BE WITH BOOT LEVEL INDICATION OF INCHING FACILITY.
3) SCHEME A TO D IS APPLICABLE FOR PUMPS, FANS, BLOWERS, COMPRESSORS AND AGITATORS.

REV NO	DESCRIPTION	DRN	CHKD	APPD	DATE
B	RE-ISSUED FOR ENGINEERING	SDJ	RHM	DRD	12.02.16
A	FOR ENGINEERING	SGM	RHM	DRD	27.08.13

REVISIONS

PROJECT NAME : **RSPL CHEMICAL COMPLEX**
JAMNAGAR, GUJARAT

CLIENT : **RSPL LIMITED**
C-1/C-2, 3RD FLOOR,
SAFAL PROFITAIR, CORPORATE ROAD,
NR. PRAHALAD NAGAR GARDEN,
AHMEDABAD-380 015
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ENGINEERING CONSULTANT : **JACOBS**
JACOBS HOUSE, RAMKRISHNA MANDIR ROAD,
KONDIVITA, ANDHERI (EAST),
MUMBAI - 400 059, INDIA
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PIPING AND INSTRUMENTATION DIAGRAM
SYMBOL SHEET - 3

PROJ.NO.	DRAWING NO.	SHEET	REV.
44PS5400	44PS5400-000-JP-01D-0003	SSH3	B
DATE	FILE NAME	SCALE	PLOT SCALE
27.08.2013	-	-	-
			DRAWN BY
			SGM

Form No.



**PRODUCT STANDARD
PROJECT ENGINEERING
HYDERABAD**

**ANNEXURE-6 TO
PY-55199**

REV NO. 00

Page 1 of 1

PROJECT: 3X16.65MW STG Project

CUSTOMER: M/s RSPL, Gujarat

CONSULTANT: M/s JACOBS, Mumbai

Enquiry No.:

Item:

Name of Bidder:

Offer Ref. No.:

DEVIATION FORMAT

Sl. No.	Clause no. & Spec. no.	Description as per Specification	Deviation taken	Nature of Deviation	Remarks

NOTES:

- Technical offer of the bidder will be evaluated only on the basis of Deviation Schedule. Deviation Schedule constitutes this sheet (with these Notes) duly signed and stamped.**
- Deviations, if any, shall be clearly brought out only in this format. Deviations mentioned / taken elsewhere or in any other format will be ignored.
- Additional sheets in the same format can be attached by the vendor, if necessary.
- Nature of Deviations shall only be of Design / Manufacturing constraints and non-availability of items / components / makes in market.
- No price implications shall be entertained for deviations withdrawn during the technical scrutiny. If any deviations are accepted by BHEL during technical scrutiny then also there will be no price implication. Hence, in no case there will be consideration of Price implications.
- Reasons for the deviations shall be specified in the Remarks column.
- If there are no deviations from the specifications, bidder still has to submit the Deviation Schedule by writing "NO Deviations" in this format.
- If the "Deviation Schedule" is not submitted along with the offer, the bidder's offer is likely to be rejected without any further interaction with the bidder.
- Only the accepted deviations in conjunction with the original tender shall constitute the contract document for the award of job to the bidder.

**SIGNATURE
OF BIDDER** _____

NAME _____

DESIGNATION _____

COMPANY SEAL

DATE _____

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Ref. Doc



**PRODUCT STANDARD
PROJECT ENGINEERING
HYDERABAD**

**ANNEXURE-7 TO
PY-55199**

REV NO. 00

Page 1 of 1

PROJECT: 3X16.65MW STG Project

CUSTOMER: M/s RSPL, Gujarat

CONSULTANT: M/s JACOBS, Mumbai

LIST OF SPARES AND TOOLS & TACKLES

1. Commissioning Spares List:

Sl. No.	Description	Quantity
1	Closing Coil	4 nos.
2	Tripping Coil	4 nos.
3	Control Fuses	20 nos.
4	MCBs	20 nos.
5	Auxiliary Contactors	30 nos.
6	Timers	2 nos.
7	Glass for front facia meters	20 nos.
8	Control TBs	100 nos.
9	Power TBs	40 nos.
10	Slide In Contact Assembly	20 nos.
11	Shrouds	20 nos.
12	Gaskets	5 sets
13	Push Buttons	10 nos.
14	Limit Position Switches	10 nos.
15	L/R Switches	3 nos.
16	Breaker Control Switches	4 nos.
17	Lamps (LED)	40 nos.

Note: Type and rating shall be decided during execution without any price implications.

2. Tools and Tackles List:

Sl. No.	Description	Quantity
1	Breaker handling Truck	3 nos.
2	Breaker Operating Handle	2 nos.
3	Fuse Pullers	5 nos.
4	Breaker Racking Handle	2 nos.

A suitable universal type circuit breaker handling truck shall be provided . The truck shall have platform of adequate mechanical strength for bearing the weight of the largest circuit breaker and shall be provided with necessary guide rails and stops. The height of the platform shall be adjustable to suit the levels at which the different circuit breakers are mounted in the switchboard.

SECTION-2

UNIT RATES FOR THE SWITCHGEAR ITEMS / SERVICES FOR COMPONENTS' ADDITION / DELETION

BIDDER:		PRICE OFFER NO. & DATE:		
SL. NO.	DESCRIPTION	RATING	PRICE Ex Works (Rs)	
II. FOR FEEDER MODULES:				
BOM: ALL FITMENTS EXCEPT NUMERICAL RELAY				
		RATING	DRAWOUT	FIXED
1	AC BOARD INCOMERS & BUS COUPLERS (SFU)	Upto 250A		
		400A		
		630A	NA	
2	AC BOARDS INCOMERS & BUS COUPLERS (MCCB)	Upto 250A		
		400A		
		630A	NA	
3	DC BOARDS INCOMERS & BUS COUPLERS (MCCB)	Upto 250A		
		400A		
		630A		
4	AC BOARDS INCOMERS & BUS COUPLERS (ACB) WITH COMMUNICABLE MFM	upto 630A	NA	NA
		800A		
		1000/1250A		
		1600/2500A		
		3200A		
5	ACB CONTROLLED STARTER FEEDER	90kW to 160kW		
6	AC BOARDS OUTGOING ACB FEEDER	800A		
		1000A		
		1250A		
		1600A		
7	DOL/RDOL OUTGOING FEEDER	Upto 5.5kW		
		5.6-12kW		
		12.1-22kW		
		22.1-35kW		
		35.1-54.9kW		
		55-74.9kW		
		75-99.9kW		
		100-150kW		
		RDOL Upto 5.5kW		
		RDOL 5.6 to 12kW		
		RDOL 22.1-35kW	NA	NA
RDOL 35.1-55kW	NA	NA		
8	AC BOARDS OUTGOING MCCB FEEDERS	Upto 32A		
		63A		
		100A		
		125A		
		160A		
		200A		
		400A		
9	AC BOARDS OUTGOING MPCB FEEDERS	Upto 32A		
		63A		
		100A		
		125A		
		160A		
		200A		
		400A		
10	AC BOARDS OUTGOING MCB FEEDERS	Upto 6A		
		6A-32A		
		63A		
		100A		
		125A		
		160A	NA	NA
		250A	NA	NA
400A	NA	NA		
11	AC BOARDS OUTGOING SFC FEEDERS	Upto 32A		
		63A		
		100A		
		125A		
		160A		
		250A		
		400A	NA	NA
630A	NA	NA		

SECTION-2

UNIT RATES FOR THE SWITCHGEAR ITEMS / SERVICES FOR COMPONENTS' ADDITION / DELETION

BIDDER:		PRICE OFFER NO. & DATE:				
SL. NO.	DESCRIPTION	RATING	PRICE Ex Works (Rs)			
12	DC BOARDS OUTGOING MCB FEEDERS	Upto 6A				
		16A				
		32A				
		63A				
		100A				
		125A				
		150A				
		200A				
		250A	NA	NA		
		300A	NA	NA		
13	DC BOARDS OUTGOING MCCB FEEDERS	Upto 6A				
		16A				
		32A				
		63A				
		100A				
		125A				
		150A				
		200A				
		250A				
		300A				
14	UPSDB BOARDS OUTGOING MCB FEEDERS	Upto 6A				
		16A				
		32A				
		63A				
		100A				
		125A				
		150A	NA	NA		
		200A	NA	NA		
		15	UPSDB BOARDS OUTGOING MCCB FEEDERS	Upto 6A		
				16A		
32A						
63A						
100A						
125A						
150A	NA			NA		
200A	NA			NA		
16	CONTROL / SUB DIST TRANSFORMER MCB FEEDERS (MCB IN DRAWOUT AND TRAF0 IN FIXED)			Upto 2.5kVA 415/110V 1ph		
				2.5-5kVA 415/110V 1ph	NA	
		10kVA 415/110V 1ph	NA			
		15kVA 415/110V 1ph	NA			
		Upto 2.5 KVA 415/240V 1ph				
		2.5-5 KVA 415/240V 1ph	NA			
		10kVA 415/240V 1ph	NA			
		15kVA 415/240V 1ph	NA			
17	MCB MODULE (9kA MCBs)	30 Nos.	NA			
		20 Nos.	NA			
		10 Nos.	NA			
18	LINE / BUS VT MODULES		DRAWOUT	FIXED		
a)	PT MODULE IN D/O EXE. COMPRISING OF 3 Nos. of PTs (415V/√3)/(110V/√3)/(110V/√3), 200VA CL1/3P	200VA				
b)	PT MODULE IN D/O EXE. COMPRISING OF 3 Nos. of PTs (415V/√3)/(110V/√3)/(110V/√3), 100VA CL1/3P	100VA				
c)	PT MODULE IN D/O EXE. COMPRISING OF 3 Nos. of PTs (415V/√3)/(110V/√3)/(110V/√3), 50VA CL1/3P	50VA				
19	VACANT MODULE / COMPT.	Upto 200 mm	NA			
		201 TO 500 mm	NA			
		501 TO 800 mm	NA			
20	MARSHALLING COMPT. WITH WIRING (MTB)	Upto 300 mm	NA			
		Above 300 mm	NA			
21	FEEDER MANAGEMENT SYSTEM	Upto 32A				
		63A				
		100A				
		125A				
		160A				
		250A				
		400A				
		630A				
800A						

Signature & Seal of bidder

Date:

SECTION-2

UNIT RATES FOR THE SWITCHGEAR ITEMS / SERVICES FOR COMPONENTS' ADDITION / DELETION

BIDDER:		PRICE OFFER NO. & DATE:	
SL. NO.	DESCRIPTION	RATING	PRICE Ex Works (Rs)
22	INTELLIGENT / MOTOR CONTROLLERS FOR OUTGOING FEEDER	Upto 5.5kW	
		5.6-12kW	
		12.1-22kW	
		22.1-35kW	
		35.1-54.9kW	
		55-74.9kW	
		75-99.9kW	
		100-150kW	
III. COMMON ITEMS:			
1	RELAYS		
a)	80 (DC supply supervision relay)		
b)	86 (VAJH 23 or equivalent)		
c)	95 (Trip circuit supervision relay)		
d)	27 (Undervoltage relay - Numerical type)		
e)	27-N (No-volt relay)		
f)	2 (Timer)		
g)	DC Earth fault relay (CAEM 21 or equivalent)		
h)	CBCT + CAG12 Relay + VTT 11		
i)	25 (Check synch relay)		
j)	94 (Antipumping relay)		
k)	97 (PT FUSE MONITORING RELAY)		
l)	VAJC or equivalent		
m)	VAA63 or equivalent		
n)	Comprehensive electronic motor protection relay without communication facility		
o)	Comprehensive electronic motor protection relay with communication facility		
p)	Interposing relay		
2	NUMERICAL RELAYS		
a)	Numerical relay for I/C & B/C feeder of MCC		
b)	Numerical relay for ACB O/G feeder		
c)	Numerical relay for ACB controlled motor feeder		
3	STAYPUT SELECTOR SWITCH 5-WAY, 4-POLE IN EACH WAY		
4	SELECTOR SWITCH, 2-POLE, 4-WAY		
5	TNC SWITCH		
6	PB (2 NO + 2 NC)		
7	MCB, DP	6A	
		16A	
		32A	
		63A	
8	MCB, 4-POLE	16A	
		32A	
9	MPCB	16A	
		32A	
		63A	
		100A	
		250A	
10	MCCB	16A	
		32A	
		63A	
		100A	
		250A	
11	NIL		
12	INDICATING LAMP ASSEMBLY (LED)		
13	SLIDE IN CONTACT (SIC) FOR D/O MODULES (Male & Female)		
14	DUAL VOLTMETER		
15	DUAL FREQUENCY METER		
16	SYNCHROSCOPE		
17	ELCB		
18	CTs		
a)	METERING CTs	Upto 25A/1A	
		50A/1A	
		100A/1A	
		150A/1A	
		200A/1A	
		250A/1A	
		400A/1A	
		600A/1A	
		800A/1A	
		1250A/1A	

Signature & Seal of bidder

Date:

SECTION-2

UNIT RATES FOR THE SWITCHGEAR ITEMS / SERVICES FOR COMPONENTS' ADDITION / DELETION

BIDDER:		PRICE OFFER NO. & DATE:	
SL. NO.	DESCRIPTION	RATING	PRICE Ex Works (Rs)
		2500A/1A	
		3200A/1A	
		4000A/1A	
b)	CLASS PS CTs	630/1A	
		800/1 A	
		Upto 25A/1A	
		50A/1A	
		100A/1A	
		150A/1A	
		200A/1A	
		250A/1A	
c)	PROTECTION CTs	400A/1A	
		600A/1A	
		800A/1A	
		1250A/1A	
		2500A/1A	
		3200A/1A	
		4000A/1A	
d)	CBCT	100 mA	
19	Meters & their Selector Switches		
a)	AC ammeter		
b)	AC voltmeter		
c)	Voltmeter selector switch		
d)	Ammeter selector switch		
e)	kWh meter with Maximum Demand Indicator (MDI)		
f)	DC Voltmeter		
g)	DC Ammeter		
h)	Double voltmeter		
i)	Double frequency meter		
j)	Synchroscope		
k)	DC Shunt (75 mV)		
l)	kW meter		
m)	PF meter		
n)	kVA meter		
o)	Multifunction Meter (Communicable Type)		
20	Transducers		
a)	Current		
b)	Voltage		
c)	kW		
d)	kVAR		
21	Unit rate for 1 no. auxiliary contactor with 2 NO + 2 NC contacts	AC	
		DC	
		15A	
		30A	
		63A	
		100A	
22	Power contactors (AC with 2 NO + 2 NC)	150A	
		300A	
		400A	
		500A	
		630A	
		63A	
		100A	
		150A	
23	Power contactors (DC with 2 NO + 2 NC)	200A / 250A	
		400A	
		630A	
24	Auxiliary relay for contact multiplication	--	
25	Local starters (MK1 or equivalent)	< 5.5kW	
		22kW-D3	
26	DC starter modules	15kW-D3	
		11kW-D3	

SECTION-2

UNIT RATES FOR THE SWITCHGEAR ITEMS / SERVICES FOR COMPONENTS' ADDITION / DELETION

BIDDER:		PRICE OFFER NO. & DATE:	
SL. NO.	DESCRIPTION	RATING	PRICE Ex Works (Rs)
28(a)	ACB Closing Coil	1000A	
28(b)	ACB Closing Coil	800A	
28(c)	ACB Closing Coil	630A	
29(a)	ACB Shunt Trip Coil	1000A	
29(b)	ACB Shunt Trip Coil	800A	
29(c)	ACB Shunt Trip Coil	630A	
30(a)	Air Circuit Breaker	1000A	
30(b)	Air Circuit Breaker	800A	
30(c)	Air Circuit Breaker	630A	
31(a)	Limit Switch of ACB	1000A	
31(b)	Limit Switch of ACB	800A	
31(c)	Limit Switch of ACB	630A	
32(a)	Spring Charging Motor of ACB	1000A	
32(b)	Spring Charging Motor of ACB	800A	
32(c)	Spring Charging Motor of ACB	630A	
33	Type Test charges	For 65kA Switchboard	
a	Short Time withstand test		
b	Temperature rise test		
c	Type II Coordination test		
d	Duty cycle test for breaker		
e	Degree of protection test		
f	Mechanical endurance test for breakers		
g	Electrical endurance test for breakers		
34	Communication		
a	Ethernet Switch		
35	Miscellaneous		
a	Breaker Handling Truck		
b	Breaker Operating Handle		
c	Fuse Pullers		
d	Breaker Racking Handle		
e	Glass for front facia meters		
f	Shrouds		
g	Gaskets		
36	Lumpsum price including Service, Lodging, Boarding etc.for Supervision of Erection & Commissioning at site	One Man day	
37	Wall Mounted DB (with 1 No.MCCB Incomers of 150A and 6 no. outgoing feeders of 32A MCCB) - 3Ph.	--	



**PRODUCT STANDARD
PROJECT ENGINEERING
HYDERABAD**

**ANNEXURE-9
TO PY-55199**

REV NO. 00

Page 1 of 2

Form No.

PROJECT: 3X16.65MW STG Project

CUSTOMER: M/s RSPL, Gujarat

CONSULTANT: M/s JACOBS, Mumbai

PACKAGE EXECUTION MILESTONES/SCHEDULE


Sl. No.	Event	Schedule	
		For GA, SLD Drawings, and BOM	For Scheme Drawings and Architecture Drawing for IMCC
1	Kick Off Meeting / Furnishing revised inputs (if any)	Within 2 weeks of P.O. / L.O.I. date (Note-1)	
2	Drawings submission	Within 4 weeks from P.O. date	Within 5 weeks from P.O. date
3	BHEL Comments (along with Final/Firm inputs and revisions)	Within 2 weeks from receipt of the "Drawings in line with Inputs" (Note-2)	Within 3 weeks from receipt of the "Drawings in line with Inputs" (Note-2)
4	Revised Drawings submission	Within 2 weeks from BHEL's comments date	Within 2 weeks from BHEL's comments date
5	BHEL Comments / Approval for Manufacture Clearance	Within 2 weeks from receipt of the revised Drawings	Within 2 weeks from receipt of the revised Drawings
6	Revised Drawings submission	Within 2 weeks from BHEL's comments / Manufacture Clearance date	Within 2 weeks from BHEL's comments / Manufacture Clearance date
7	BHEL Approval on Revised Drawings	Within 2 weeks from receipt of the revised Drawings	Within 2 weeks from receipt of the revised Drawings
8	Manufacturing cycle time, Inspection call & Delivery	Within 14 weeks from Manufacture clearance date of GA & SLD Drawings (progressively)	
9	As-Manufactured Drawings + Commissioning Manuals	Note-3	

Notes:

1. Kick off Meeting will be held after order placement at BHEL-Hyderabad. It is Vendor's responsibility to call and fix up date for the meeting. It is intended to provide revised inputs (if any) and clarifications on the inputs during the Kick off meeting. It is vendor's responsibility to collect the above within 2 weeks from P.O. / L.O.I. beyond which delays will be to the vendor's account.
2. It is Vendor's responsibility to submit the Drawings in line with the latest inputs else the drawings will be rejected. Delays on account of this will be attributed to the Vendor.
3. Two sets of As-Manufactured drawings and Commissioning Manuals shall be dispatched along with the first consignment. For further submission, refer the annexure for "Documents to be submitted after award of contract".

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	Form No.		PRODUCT STANDARD PROJECT ENGINEERING HYDERABAD	ANNEXURE-9 TO PY-55199 REV NO. 00 Page 2 of 2
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Ref. Doc				

PROJECT: 3X16.65MW STG Project**CUSTOMER: M/s RSPL, Gujarat****CONSULTANT: M/s JACOBS, Mumbai****DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT****1. Documents to be submitted during detailed engineering:**

Sl. No.	Description	Category	Initial Submission	Revised Drawings Submission	Final Submission
1	Data Sheets	Approval	10 sets	10 sets	10 sets
2	General Arrangement, Foundation Plan & Loading Details Drawing	Approval	10 sets	10 sets	10 sets
3	Single Line Diagrams	Approval	10 sets	10 sets	10 sets
4	Heat Load Details	Review	10 sets	3 sets	10 sets
5	Sizing Calculations of horizontal and vertical bus bars for continuous duty and bus bracing duty requirement	Review	10 sets	3 sets	10 sets
6	Schematic & Wiring Diagrams	Approval	10 sets	10 sets	10 sets
7	Block Logic Diagrams	Approval	10 sets	10 sets	10 sets
8	Quality Plan	Approval	10 sets	10 sets	10 sets
9	Commissioning Spares List	Review	1 set	3 sets	Nil
10	Mandatory Spares List	Review	NA	NA	NA
11	List of Tools & Tackles	Review	1 set	3 sets	Nil
12	List of Cable Accessories (Glands & Lugs)	Review	1 set	3 sets	Nil
13	Packing List / Shipped Loose Component List (Switchboard-wise) – Refer Note-a	Review	Nil	Nil	3 sets
14	DC Starter Resistance Sizing Calculation	Review	1 set	Nil	10 sets
15	Catalogues / Drawings for Breakers, Contactor, SFU, FSU, O/L relay, Fuse, Instrument Transformers, Relays, Meters etc.	Info	1 set	Nil	10 sets
16	Type Test Certificates	Review	10 sets	Nil	10 sets
17	Inspection Test Reports	Review	Nil	Nil	10 sets
18	Switchboards Erection & Commissioning Manual	Info	Nil	Nil	10 sets
19	Intelligent Controller Erection & Commissioning Manual	Info	3 sets	Nil	10 sets
20	Switchboards Operation & Maintenance Manuals – Refer Note-b	Info	Nil	Nil	12 sets
21	Intelligent Controller Operation & Maintenance Manuals – Refer Note-b	Info	Nil	Nil	12 sets
22	As-Manufactured drawings	Review	Nil	Nil	10 sets
23	Architecture Drawing for IMCC	Approval	10 sets	10 sets	10 sets
24	CPRI Test Certificates for Short time rating and Temp Rise Test for the duty as specified in the datasheet	Review	10 sets	Nil	10 sets

Form No.



PRODUCT STANDARD
PROJECT ENGINEERING & SYSTEMS DIVISION
HYDERABAD

ANNEXURE-10
to PY55199

Rev No. 00

Page 2 of 2

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Notes:

- a. For all equipment, seller shall provide spreadsheet Packing List showing in complete detail split shipment packaging content and their shipping dates. As a minimum, the spreadsheet shall indicate,

Supplier's name,	Actual ship date for each carton or container,
Part numbers,	Erection / IFC drawing number,
Item name & tag number,	Quantity,
Seller's reference drawing number,	Unit of measure,
Carton or container number,	Minimum following dimensions for each shipping sections –
Forecast ship date,	Weight, Length, Width, Height.

NOTE: Vendor shall dispatch the panels generally with all components mounted. If, for reason of preventing transit damage or for any other means, the components/items have to be packed separately and dispatched then such loose items have to be listed in the packing list. The list shall have references duly tracing them to the respective packing box/crate. The packing list shall be furnished for BHEL's review and acceptance before seeking dispatch clearance. If such loose items are not declared then it shall be deemed that there are no such loose items.

- b. O&M manuals must include the following as minimum:

Written Description of Equipment Operation,	Factory Test Results,
Equipment List and Data Sheets,	Operation Instruction Books,
Long- and Short-Term Storage Instructions.	Maintenance Instruction Book,
Instruction Manuals for Breakers, Contactor,	Installation Instructions,
SFU, FSU, O/L relay, Fuse, Instrument	
Transformers, Relays, Meters etc,	

2. Final Handing Over Documentation:

(i) In addition to above, final handing over documentation in neatly bound volumes shall be made in 12 sets of hard copies and 3 sets of CDs for the End User. It shall include the following:

- (a) "As-Built" Drawings (incorporating site modifications, if any)
- (b) Data Sheets
- (c) Test Certificates
- (d) Guarantee Certificates
- (e) Component Catalogues with Makes and Contact Details.
- (f) Architecture Drawing for IMCC.

3. Documentation along with the Consignment:

Two sets of As-Manufactured Drawings, Inspection Test Reports and O&M and E&C Manuals shall be dispatched along with the consignment. The same shall also be listed in the packing list.

Ref. Doc



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CHECKLIST FOR BID SUBMISSION

(TO BE FILLED BY THE BIDDER AND SUBMITTED ALONG WITH THE OFFER)

PROJECT	3X16.65MW STG Project
CUSTOMER	M/s RSPL, Gujarat
CONSULTANT	M/s JACOBS, Mumbai

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(Tick the checkboxes to confirm in affirmative.)

S/N	Description	Bidder Confirmation
1	Bidder has read each Clause of the Main Specification (PY55199) and all its annexures.	<input type="checkbox"/>
2	Bidder has explicitly specified the nature and extent of Deviation against any Clause (referred above in Point 1) in the Deviation Schedule (i.e. Annexure - 8 to PY55199).	<input type="checkbox"/>
3	Any conflict between provisions of the Specification has been included by the Bidder in the Deviation Schedule itself.	<input type="checkbox"/>
4	Bidder confirms that they have read the provisions of the Deviation Schedule and have included the Schedule in the Offer after agreeing to the said provisions.	<input type="checkbox"/>
5	Bidder confirms that Prices for all items mentioned in the Price Format have been quoted; Unpriced and Priced Schedules included in the Techno-commercial Offer and Priced Offer respectively.	<input type="checkbox"/>
6	Bidder confirms that Type Test Certificates have been included in the Offer.	<input type="checkbox"/>
7	Bidder confirms that Switchboard wise GA Drawings with dimensions and weights have been included in the Offer.	<input type="checkbox"/>

Notes:

- Offer received without affirmative confirmation against any of the above points may not be considered for evaluation.

SIGNATURE OF BIDDER _____
NAME _____
DESIGNATION _____
DATE _____

COMPANY SEAL



QAP GUIDELINES & FORMAT

(ANNEXURE - 12 to PY55199 Rev-00)

The QAP format and guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement.

Note :

1. Typical /Indicative /Standard QAP(s) for equipment /package attached is reference document and to use by successful bidder in future for preparation and submission of QAP for BHEL /CUSTOMER approval.
2. No deviation to reference document is acceptable.

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**GUIDELINES TO VENDORS FOR
PREPARATION OF QUALITY ASSURANCE PLAN**

1. QAP shall be made in landscape mode on A4 size paper as per the format enclosed. Font size shall be minimum 10.
2. Each page of QAP shall contain the following information.
 - a) Vendor's name & address.
 - b) Customer: BHEL, Hyderabad.
 - c) Project.
 - d) BHEL Product Standard Number/revision number as referred in P.O.
 - e) BHEL Purchase Order Number & Date.
 - f) Product as per P.O. description.
 - g) QAP Number (unique and shall not repeat)/revision number/date.
 - h) Page number and number of pages
3. QAP shall contain four parts / stages as follows.
 - a) Raw materials and bought out items.
 - b) In process Control / Inspection.
 - c) Final assembly, Inspection & Testing.
 - d) Painting, preservation & packing.
4. Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc).
5. Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.)
6. Under 'Class', indicate minor, major or critical depending on the importance of characteristic.
7. Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.)
8. Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.)
9. Under 'Reference document' and 'Acceptance norms', appropriate National & International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review & approval by our Engineering dept.
10. Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc.
11. Please refer 'Agency' in QAP format.
Under P: Perform, W: Witness, V: Verify
Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR

2: (Vendor / Sub vendor)

Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, under Witness (W) column use 1. Under 'Verify' column, use code 1.

12. Under 'D' please put (Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification.
13. Vendor's signature & stamp should be available on each page of QAP.
14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification & Approved Drawings.
15. The following operations/characteristics/check points may be included (AS APPROPRIATE)
- a) Visual check
 - b) Dimensional check
 - c) Mechanical and Chemical properties.
 - d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.)
 - e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc.
 - f) Check for correctness for all components mounted as per General arrangement Drawing, Bill Of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc.
 - g) Verification of test certificate for protection class for the enclosures.
 - h) Mechanical functioning of switches.
 - i) Continuity of earthing and provision of earth points.
 - j) Colour coding of wiring, size, tightness & dressing of wiring.
 - k) Review of test certificates of assembled items, raw materials, internal test reports etc.
 - l) Witness of functional checks, which may include mechanical run & electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc.
 - m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc.
 - n) Material identification (for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.)
 - o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non Destructive Tests.
 - p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating)
 - q) All tests as per BHEL Product Standard & approved drawings including Type tests and Routine tests on individual items and on System as a whole.
 - r) Packing and Preservation.

16. **QAP Format enclosed.**

17. **Typical Manufacturing QAP is attached.**

VENDOR'S NAME & ADDRESS:		TYPICAL MANUFACTURING QUALITY PLAN							QP. NO.:				
		CUSTOMER: BHEL, HYDERABAD – 32.			BHEL P.O.NO.:				REV NO: 00		DATE:		
		PROJECT:			P.O.DATE:				PAGE 1 OF 6				
		PRODUCT: LT SWITCHGEAR			BHEL SPEC:				REV:				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
1.1	Steel for fabrication	Mechanical & chemical properties	Major	Chemical & Mechanical.	Sample	IS-513 & 1079	IS-513 & 1079	Log book/test certificate	√	2		1	
		Dimensions	Major	Measurement	Sample	Approved drawing	Approved drawing	-do-		2		1	
		Surface quality	Major	Visual	Random	Material spec.	Material spec.	-do-		2		1	Shall be free from rust, pitting, dents etc.
1.2	Air circuit breaker	Routine tests	Major	Electrical	100%	IS-13947, Part -2	IS-13947, Part -2	-do-	√	2		1	
		Type test	-do-	Electrical	Sample	-do-	-do-	-do-	√	2		1	
1.3	Air break Switches	Routine tests	Major	Electrical	100%	IS-13947, Part -3	IS-13947, Part -3	-do-	√	2		1	
		Type test	-do-	Electrical	Sample	-do-	-do-	-do-	√	2		1	
1.4	HRC fuses / MCCB / MCB	Routine tests	Major	Electrical	100%	IS-13703	IS-13703	-do-	√	2		1	
		Type test	-do-	Electrical	Sample	-do-	-do-	-do-	√	2		1	
1.5	Relays	Routine tests	Major	Electrical	100%	IS-3231/ Approved drgs/ Bhel tech spec	IS-3231/ Approved drgs/ Bhel tech spec	-do-	√	2		1	
		Type test	-do-	Electrical	Sample	-do-	-do-	-do-	√	2		1	

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR 3. End client (if applicable) AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

VENDOR'S NAME & ADDRESS:		TYPICAL MANUFACTURING QUALITY PLAN							QP. NO.:				
		CUSTOMER: BHEL, HYDERABAD – 32.			BHEL P.O.NO.:				REV NO: 00		DATE:		
		PROJECT:			P.O.DATE:				PAGE 2 OF 6				
		PRODUCT: LT SWITCHGEAR			BHEL SPEC:				REV:				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.6	Instrument transformers (CTs/PTs)	Routine tests	Major	Electric al	100%	IS-2026	IS-2026	-do-	√	2		1	
		Type test	-do-	Electric al	Sample	-do-	-do-	-do-	√	2		1	
1.7	Air break contactors	Routine tests	Major	Electric al	100%	IS-2959	IS-2959	-do-	√	2		1	
		Type test	-do-	Electric al	Sample	-do-	-do-	-do-	√	2		1	
1.8	Indicating instruments	Routine tests	Major	Electric al	100%	IS-1248	IS-1248	-do-	√	2		1	
		Type test	-do-	Electric al	Sample	-do-	-do-	-do-	√	2		1	
1.9	Bus Bars	Chemical composition	Major	chemica l	Sample	IS-5082 for Al IS-1897 for Cu	As per Spec.	-do-	√	2		1	
		Tensile strength	-do-	Mechan ical	-do-	IS-5082 for Al IS-1897 for Cu	As per Spec.	-do-		2		1	
		Conductivity	-do-	Electric al	-do-	IS-5082 for Al IS-1897 for Cu	As per Spec.	-do-		2		1	
1.10	Gaskets	Dimensions	-do-	Measur ement.	-do-	IS-3400	IS-3400	-do-		2		1	
		Routine tests	-do-	Mechan ical.	-do-	IS-3400	IS-3400	-do-	√	2		1	
		Type tests	-do-	Electric al	Sample	Bhel spec	Bhel spec	TC from independent agency	√	2		1	
2.0	INPROCESS INSPECTION												

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VENDOR'S NAME & ADDRESS:		TYPICAL MANUFACTURING QUALITY PLAN							QP. NO.:				
		CUSTOMER: BHEL, HYDERABAD – 32.			BHEL P.O.NO.:				REV NO: 00		DATE:		
		PROJECT:			P.O.DATE:		BHEL SPEC:		REV:		PAGE 3 OF 6		
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
2.1	Panel fabrication	Visual check for pitting, rusting of plates	Major	Visual	100%	Visual	Visual	Log Book / QC REPORT		2		1	
		Pretreatment of sheet steel	Major	Process	100%	Spec	Spec	Log Book / QC REPORT		2		1	
		Dimensions after cubicle fabrication	Major	Measrt.	100%	Approved drawing	Approved drawing	-do-	√	2		1	
		Gasket between doors & Equipment	Major	visual	100%	Approved drawing	Approved drawing	-do-		2		1	
2.2	Wiring checks	Wire size	Major	visual	Sample	Wiring diagram	Wiring diagram	-do-		2		1	
		Proper wire clamping	Major	visual	-do-	Approved drawing	Approved drawing	-do-		2		1	
		Continuity check	Major	Electric al	100%	Schematic drawing	Schematic drawing	-do-		2		1	
		Tightness of termination	Major	visual	Random	As per shop practice	As per shop practice	-do-	√	2		1	
		Ferruling	Major	Visual	Radom	As per shop practice	As per shop practice	-do-		2		1	
3.0	FINAL INSPECTION & TESTING												
3.1	Switchgear Assembly	Visual check including layout, Tag plates, Bus marking and sleeving, Joint shrouding, Identification and location & mounting of components, Wiring arrangement & ferruling etc..	Major	Visual	100%	GA drawing	GA drawing	Log Book / QC REPORT	√	2		1, 3	

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VENDOR'S NAME & ADDRESS:		TYPICAL MANUFACTURING QUALITY PLAN							QP. NO.:				
		CUSTOMER: BHEL, HYDERABAD – 32.			BHEL P.O.NO.:				REV NO: 00		DATE:		
		PROJECT:			P.O.DATE:				PAGE 4 OF 6				
		PRODUCT: LT SWITCHGEAR			BHEL SPEC: REV:								
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
		Dimensional Check including operational height, Bus size, clearances, creepage distances, gland size etc..	-do-	Measurement	100%	GA drawing	GA drawing	Log book /QC report	√	2	1, 3		
		Paint shade, DFT & Adhesion test	-do-	Visual & Measurement.	Random	BHEL spec/ approved drg	BHEL spec/ approved drg	Inspection report	√	2	1, 3		
		Circuitry checks: Continuity, connections etc for power & control circuits.	Major	Electrical	100%	Wiring diagram	Wiring diagram	Inspection report	√	2	1, 3		
		Verification of Bus bar support arrangement with respect to the type tested panel drgs, provision for external cable termination and bus duct flange dimensions (if applicable)	Major	Visual & Measurement	100%	Approved drgs /schematics & BHEL spec	Approved drgs /schematics & BHEL spec	Inspection report	√	2	1, 3		
		Bill of Material / Make of components checks	Major	Visual	100%	Approved data sheets /drgs & BHEL spec	Approved data sheets /drgs & BHEL spec	Inspection report	√	2	1, 3		

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VENDOR'S NAME & ADDRESS:		TYPICAL MANUFACTURING QUALITY PLAN							QP. NO.:				
		CUSTOMER: BHEL, HYDERABAD – 32.			BHEL P.O.NO.:				REV NO: 00		DATE:		
		PROJECT:			P.O.DATE:				PAGE 5 OF 6				
		PRODUCT: LT SWITCHGEAR			BHEL SPEC:				REV:				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
		Manual and electrical operation check of Breakers, Relays etc.. & Operation check for all control functions and interlocks as per schematic drgs in test and service position including mechanical interlock as applicable	Major	Visual & Electrical	100%	Approved drgs /schematics & BHEL spec	Approved drgs /schematics & BHEL spec	Inspection report	√	2	1, 3		
		Relay operation check through primary /secondary injection	Major	Electrical	100%	Approved drgs /schematics & BHEL spec	Approved drgs /schematics & BHEL spec	Inspection report	√	2	1, 3		
		Communication check between relays and Data concentrator /HMI (if applicable)	Major	Electrical	100%	Approved drgs /schematics & BHEL spec	Approved drgs /schematics & BHEL spec	Inspection report	√	2	1, 3		
		HV test on power & control circuits	Major	Electrical	100%	IS-8623	IS-8623	Inspection report	√	2	1, 3		
		IR test	Major	Electrical	100%	IS/BHEL spec	IS/BHEL spec	Inspection report	√	2	1, 3		
		Measurement of tightness of bus bar joints by torque wrench	Major	check	Random	As per manufacturer's std	As per manufacturer's std	Inspection report	√	2	1, 3		
		Inter changeability of identical modules /feeders (if applicable)	Major	Visual	Random	As per manufacturer's std	As per manufacturer's std	Inspection report	√	2	1, 3		

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VENDOR'S NAME & ADDRESS:		TYPICAL MANUFACTURING QUALITY PLAN							QP. NO.:				
		CUSTOMER: BHEL, HYDERABAD – 32.			BHEL P.O.NO.:				REV NO: 00		DATE:		
		PROJECT:			P.O.DATE:				PAGE 6 OF 6				
		PRODUCT: LT SWITCHGEAR			BHEL SPEC: REV:								
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
										D	P	W	
3.2	TYPE TEST	Short circuit making and breaking test	CRITICAL	Electric al	Sample	IS-13947 Part 1, clause 8.1.2 / BHEL spec	IS-13947 Part 1, clause 8.1.2 / BHEL spec	TEST CERTIFICAT E	√	2		1, 3	
		Short time current with stand test	CRITICAL	Electric al	Sample	IS-13947 Part 1, clause 8.1.2 / BHEL spec	IS-13947 Part 1, clause 8.1.2 / BHEL spec	TEST CERTIFICAT E	√	2		1, 3	
		Temperature rise test	CRITICAL	Electric al	Sample	IS-13947 Part 1, clause 8.1.2 / BHEL spec	IS-13947 Part 1, clause 8.1.2 / BHEL spec	TEST CERTIFICAT E	√	2		1, 3	
		Degree of protection for panels	CRITICAL	Electric al	Sample	IS-13947 Part 1, clause 8.1.2 / BHEL spec	IS-13947 Part 1, clause 8.1.2 / BHEL spec	TEST CERTIFICAT E	√	2		1, 3	
3.3	FAT	HMI operation and functional checks as per separate approved FAT procedure (if applicable)	CRITICAL	Electric al	100%	Approved FAT procedure	Approved FAT procedure	TEST CERTIFICAT E	√	2	1, 3		
4.0	PRESERVATION & PACKING												
		Preservation, Packing & Marking of cases	MAJOR	VISUAL	100%	AS PER BHEL SPEC	AS PER BHEL SPEC			2		1	

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR 3. End client (if applicable) AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.