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## TECHNICAL SPECIFICATION FOR 110V UPS SYSTEM

**PROJECT : STANDBY SRU (525 TPD)**

**CUSTOMER : INDIAN OIL CORPORATION LIMITED (IOCL)**

**CONSULTANT : TECHNIP INDIA LIMITED, CHENNAI**

| Revisions:                   | Prepared by :       | Checked by :    | Approved by :   | Date :     |
|------------------------------|---------------------|-----------------|-----------------|------------|
| Refer to record of revisions | <br>SRINIVASA RAO K | <br>K RANGAMANI | <br>SAROJ KUMAR | 21.01.2022 |



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## 1.0 INTENT OF SPECIFICATION:

- 1.1 This specifications covers the design, manufacture, assembly, testing at manufacturer's works, packing and transportation to site, supervision of erection, testing and commissioning for 110V AC UPS System, complete with all accessories for making the equipment complete and for efficient and trouble free safe operation.
- 1.2 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 confirm to the highest standard of engineering, design and workmanship.

## 2.0 SITE CONDITIONS:

| Sl. No. | Description                 | Data  |
|---------|-----------------------------|---|
| 1       | Project                     | 525 TPD Standby Sulphur Recovery Unit (SRU)   |
| 2       | Site Location               | Paradip, Jagatsinghpur District, Odisha   |
| 3       | Elevation Above MSL         | Less than 1000m above Mean Sea Level  |
| 4       | Maximum Ambient Temperature | 42.4°C  |
| 5       | Minimum Ambient Temperature | 11.3°C  |
| 6       | Design Ambient Temperature  | 45°C  |
| 7       | Environment                 | Dusty, Tropical, Corrosive, Marine as found in Refinery/ Hydrocarbon Industry in a coastal environment. |
| 8       | Relative Humidity           | Average Monthly: Maximum 95%, Minimum 55%   |
| 9       | Seismic Zone                | Zone-III as per IS-1893 Part-1  |

## 3.0 SCOPE OF WORK:

- 3.1 Supply of 110V Parallel Redundant UPS System including 1X 100% Ni-Cd Battery for 24 hours 5 minutes back up time to be located in SRR-811.
- 3.2 Supply of cable termination accessories such as lugs, glands etc. for UPS System, Batery Isolation Box & UPS Battery end for all Power and Control cables.
- 3.3 Supply of Mandatory Spares: For list, refer Annexure-I to this specification.
- 3.4 Supply of Commissioning Spares: For list, refer Annexure-I to this specification.
- 3.5 Supervision Services for Erection & Commissioning of 110V UPS System Package including Battery by Supplier at site.
- 3.6 Training to owner's personnel at site:

Providing training to ten numbers OWNER's engineers at site for one week for the operation and maintenance of the following equipment.

1. AC UPS system (UPS System & Battery)



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- 3.7 Comprehensive Annual Maintenance Contract (AMC) for five years for 110V UPS System & Battery.

#### 4.0 CODES AND STANDARDS:

- 4.1 The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of IS/ IEC standards specified in Technical Requirements attached as Annexure-I (Doc. No. B366-999-XI-MR-0440).
- 4.2 In case of imported equipment, Standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian Standards.
- 4.3 The equipment shall also confirm to the provisions of Indian Electricity Rules and other statutory regulations currently in force in the country.
- 4.4 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.

#### 5.0 ORDER OF PRIORITY:

- 5.1 In case of any contradictions between various referred Standards/ Specifications/ Data Sheets/ Statutory regulations/ enclosed annexures, the following sequence shall be followed as order of priority:

1. Statutory regulations
2. This specification (PY55465)
3. Technical Requirements (Annexure-I to PY55465) – Refer Note (a) below.
4. Codes and Standards

Notes:

(a) In case of any contradiction between Doc. No. 080557C-000-JSS-1671-001 (Technip's Technical Specification) and Doc. No. PDRP-8531-SP-0006 (IOCL Standard Specification), which are both part of Technical Requirements (Annexure-I to PY55465), Doc. No. 080557C-000-JSS-1671-001 (Technip's Technical Specification) shall have higher priority.

- 5.2 In case of further contradiction among above documents, it is bidder's responsibility to highlight the same during bid stage itself. Else, BHEL's decision shall be final during execution. The same shall be complied without any time/ cost implication to BHEL.

#### 6.0 GENERAL REQUIREMENTS:

- 6.1 The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.
- 6.2 Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment at least for 10 years from the date of supply.
- 6.3 Vendor shall give a notice of at least one year to the end user of equipment and BHEL before phasing out the product/ spares to enable the end user for placement of order for spares and services.



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## 7.0 TECHNICAL REQUIREMENTS:

- 7.1 All the requirements of UPS System shall be as per Technical Requirements attached as Annexure-I (Doc. No. B366-999-XI-MR-0440).
- 7.2 UPS System shall be grounded i.e. Grounded supply shall be available at the output of UPS System.
- 7.3 UPS System Battery (Ni-Cd type) shall be designed as per IEEE-1115 standard for NI-Cd Battery and Design Margin (10%), Aging Factors (1.25) shall be considered accordingly.
- 7.4 **Rating of UPS shall of 2 kVA (minimum). However, UPS System Battery shall be sized as per actual load of 0.5 kVA with 24 Hours and 5 min. back-up time.** Proper labeling and documentation shall be available in UPS for operator's ready reference.
- 7.5 Accessories as applicable for UPS System Battery shall be supplied for completeness of UPS System.
- 7.6 All potential free contacts and analogue input signals including unused contacts/ports shall be duly wired to the terminal block in the respective panel.
- 7.7 Cable glands for 3-core cables shall be weatherproof single compression nickel plated brass type (ET) with check nuts and PVC shrouds. Cable lugs shall be of tinned copper heavy duty crimped type. Cable details shall be finalized during detailed engineering.
- 7.8 **Cable scope Matrix:**

| SL No. | Cable From                       | Cable to                | Cable Type<br>[Type/OD/No of Runs] | Scope of Cable | Cables Accessories Supply<br>(Glands & lugs) |
|--------|----------------------------------|-------------------------|------------------------------------|----------------|--|
| 1.     | BHEL MCC/PMCC Panels             | UPS Incomer-1 & 2       | 1Rx3.5Cx4 Sq.mm Cu, XLPE           | BHEL           | Vendor                                       |
| 2.     | BHEL MCC/PMCC Panels             | UPS Incomer-3 (By-pass) | 1Rx3.5Cx35 Sq.mm Al, XLPE          | BHEL           | Vendor                                       |
| 3.     | UPS Panels (Rectifiers/Chargers) | Battery Isolation box   | 1Rx3Cx2.5 Sq.mm, Cu, XLPE          | BHEL           | Vendor                                       |
| 4.     | Battery isolation box            | Battery                 | 1Rx3Cx2.5 Sq.mm, Cu, XLPE          | BHEL           | Vendor                                       |
| 5.     | UPS Panels (Rectifiers/Chargers) | UPS DB                  | 1Rx3Cx2.5 Sq.mm, Cu, XLPE          | BHEL           | Vendor                                       |

- (a) The Cable details indicated above are indicative. Same may vary during detailed engineering. Exact cable sizes shall be informed to vendor during detailed engineering. Vendor to supply the cable accessories for these cables without any implication to BHEL.



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- (b) The Supply of Cables & accessories (glands & lugs) for internal cable connections within the UPS Panels are by UPS bidder. The supply of Cable accessories for BHEL supplied cables terminating at UPS, Battery & isolation box end as listed above are also by the UPS bidder.

7.9 Bidder shall consider suitable terminals at the respective equipment end for terminating these cables.

7.10 The following are the approved makes (sub-vendor list) of 110V UPS System Equipment.

| Sl.No.      | Item Description                                  |       |
|-------------|---|-------|
| <b>I.</b>   | <b>BATTERIES – NICKLE CADMIUM</b>                 |       |
| 1.          | AMCO SAFT INDIA LTD                               | INDIA |
| 2.          | HBL POWER SYSTEMS LTD                             | INDIA |
| <b>II.</b>  | <b>AUX. RELAYS</b>                                |       |
| 1.          | ABB INDIA LIMITED                                 | INDIA |
| 2.          | C&S ELECTRIC LTD                                  | INDIA |
| 3.          | EASUN REYROLLE LTD                                | INDIA |
| 4.          | GE T&D INDIA LIMITED                              | INDIA |
| 5.          | JYOTI LTD   | INDIA |
| 6.          | OMRON   | INDIA |
| 7.          | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED          | INDIA |
| 8.          | SIEMENS LTD                                       | INDIA |
| <b>III.</b> | <b>BIMETAL RELAYS</b>                             |       |
| 1.          | ABB INDIA LIMITED                                 | INDIA |
| 2.          | C&S Electric Ltd                                  | INDIA |
| 3.          | GE T&D India Limited                              | INDIA |
| 4.          | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED          | INDIA |
| 5.          | Siemens Ltd                                       | INDIA |
| <b>IV.</b>  | <b>INSTRUMENT TRANSFORMERS – CT &amp; PT (MV)</b> |       |
| 1.          | C&S ELECTRIC LIMITED                              | INDIA |
| 2.          | GILBERT & MAXWELL ELECTRICALS PVT. LTD            | INDIA |
| 3.          | KALPA ELEKTRIKAL PVT LTD                          | INDIA |
| 4.          | KAPPA ELECTRICALS                                 | INDIA |
| 5.          | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED          | INDIA |
| 6.          | NARAYAN POWERTECH PVT. LTD.                       | INDIA |
| 7.          | PRAGATI ELECTRICALS PVT. LTD.                     | INDIA |
| 8.          | PRECISE ELECTRICALS                               | INDIA |
| 9.          | SILKAANS ELECTRICALS PVT. LTD.                    | INDIA |
| <b>V.</b>   | <b>CONTACTOR</b>                                  |       |
| 1.          | ABB INDIA LIMITED                                 | INDIA |
| 2.          | BCH ELECTRIC LTD                                  | INDIA |
| 3.          | C&S ELECTRIC LTD                                  | INDIA |
| 4.          | GE T&D INDIA LIMITED                              | INDIA |
| 5.          | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED          | INDIA |
| 6.          | SIEMENS LTD                                       | INDIA |
| <b>VI.</b>  | <b>MCCB</b>                                       |       |
| 1.          | ABB INDIA LIMITED                                 | INDIA |



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|--------------|--|-------|
| 2.           | GE T&D INDIA LIMITED                               | INDIA |
| 3.           | HAVELLS INDIA LTD                                  | INDIA |
| 4.           | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED           | INDIA |
| 5.           | SIEMENS LTD  | INDIA |
|              |  |       |
| <b>VII.</b>  | <b>TIMERS</b>                                      |       |
| 1.           | ELECTRONIC AUTOMATION PVT LTD                      | INDIA |
| 2.           | HONEYWELL AUTOMATION INDIA LIMITED                 | INDIA |
| 3.           | ICA PVT. LIMITED (OMRON)                           | INDIA |
| 4.           | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED           | INDIA |
| 5.           | OEN  | INDIA |
| 6.           | SIEMENS LIMITED                                    | INDIA |
| 7.           | GE T&D INDIA LIMITED                               | INDIA |
|              |  |       |
| <b>VIII.</b> | <b>PUSH BUTTON &amp; INDICATING LAMPS</b>          |       |
| 1.           | C & S ELECTRIC LTD                                 | INDIA |
| 2.           | ESSEN DEINKI                                       | INDIA |
| 3.           | HOTLINE SWITCHGEAR & CONTROLS                      | INDIA |
| 4.           | PRECIFINE PRODUCTS PVT. LTD.                       | INDIA |
| 5.           | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED           | INDIA |
| 6.           | SHRI TULSI SWITCHGEARS PVT LTD                     | INDIA |
| 7.           | SIEMENS LIMITED                                    | INDIA |
| 8.           | TEKNIC ELECTRIC (I) PVT. LTD.                      | INDIA |
|              |  |       |
| <b>IX.</b>   | <b>MCB</b>   |       |
| 1.           | ABB INDIA LIMITED                                  | INDIA |
| 2.           | C & S ELECTRIC LTD                                 | INDIA |
| 3.           | HAVELLS INDIA LTD                                  | INDIA |
| 4.           | NOVATEUR ELECTRICAL & DIGITAL SYSTEMS P            | INDIA |
| 5.           | INDIANA CURRENT CONTROL LTD                        | INDIA |
| 6.           | LEGRAND (INDIA) PVT. LTD                           | INDIA |
| 7.           | SIEMENS LIMITED                                    | INDIA |
| 8.           | STANDARD ELECTRICALS LTD                           | INDIA |
| 9.           | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED           | INDIA |
| 10.          | POLYCAB INDIA LIMITED (MCB UPTO CURRENT RANGE 63A) | INDIA |
|              |  |       |
| <b>X.</b>    | <b>CONTROL SWITCHES / SELECTOR SWITCHES</b>        |       |
| 1.           | GE T&D INDIA LIMITED                               | INDIA |
| 2.           | HOTLINE SWITCHGEAR & CONTROLS                      | INDIA |
| 3.           | KAYCEE INDUSTRIES LTD.                             | INDIA |
| 4.           | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED           | INDIA |
| 5.           | RELIABLE ELECTRONIC COMPONENTS PVT LTD             | INDIA |
| 6.           | SIEMENS LIMITED                                    | INDIA |
| 7.           | SWITRON DEVICES                                    | INDIA |
|              |  |       |
| <b>XI.</b>   | <b>EARTH LEAKAGE CIRCUIT BREAKER</b>               |       |
| 1.           | ABB INDIA LIMITED                                  | INDIA |
| 2.           | GE T&D INDIA LIMITED                               | INDIA |
| 3.           | HAVELLS INDIA LTD                                  | INDIA |





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| 4.           | LEGRAND (INDIA) PVT. LTD                           | INDIA |
| 5.           | NOVATEUR ELECTRICAL & DIGITAL SYSTEMS P            | INDIA |
| 6.           | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED           | INDIA |
| 7.           | SIEMENS LTD  | INDIA |
|              |  |       |
| <b>XII.</b>  | <b>MCB</b>   | INDIA |
| 1.           | ABB INDIA LIMITED                                  | INDIA |
| 2.           | C&S ELECTRIC LTD.                                  | INDIA |
| 3.           | HAVELLS INDIA LTD.                                 | INDIA |
| 4.           | NOVATEUR ELECTRICAL & DIGITAL SYSTEMS              | INDIA |
| 5.           | INDIANA CURRENT CONTROL LTD.                       | INDIA |
| 6.           | LEGRAND (INDIA) PVT LTD                            | INDIA |
| 7.           | SIEMENS LIMITED                                    | INDIA |
| 8.           | STANDARD ELECTRICAL LIMITED                        | INDIA |
| 9.           | SCHNEIDER ELECTRIC INDIA PVT LTD                   | INDIA |
| 10.          | POLYCAB INDIA LIMITED (MCB upto current range 63A) | INDIA |
|              |  |       |
| <b>XIII.</b> | <b>FUSES</b>                                       |       |
| 1.           | COOPER BUSSMAN INDIA PVT LTD                       | INDIA |
| 2.           | GE T&D INDIA LIMITED                               | INDIA |
| 3.           | HAVELLS INDIA LTD                                  | INDIA |
| 4.           | SCHNEIDER ELECTRIC INDIA PRIVATE LIMITED           | INDIA |
| 5.           | NOVATEUR ELECTRICAL & DIGITAL SYSTEMS              | INDIA |
| 6.           | SIEMENS LIMITED                                    | INDIA |
|              |  |       |
| <b>XIV.</b>  | <b>CABLES-MEDIUM VOLTAGE-POWER-XLPE &amp; PVC</b>  | INDIA |
| 1.           | AJANTA ELECTRIC INDUSTRIES                         | INDIA |
| 2.           | APAR INDUSTRIES LTD                                | INDIA |
| 3.           | ASSOCIATED FLEXIBLES & WIRES [P] LTD               | INDIA |
| 4.           | CABLE CORPORATION OF INDIA LIMITED                 | INDIA |
| 5.           | CORDS CABLE INDUSTRIES LTD                         | INDIA |
| 6.           | FINOLEX CABLES LTD.                                | INDIA |
| 7.           | GEMSCAB INDUSTRIES LTD                             | INDIA |
| 8.           | GUPTA POWER INFRASTRUCTURE LIMITED                 | INDIA |
| 9.           | HAVELLS INDIA LTD                                  | INDIA |
| 10.          | INSUCON CABLE AND COND PVT LTD                     | INDIA |
| 11.          | KEC INTERNATIONAL LTD                              | INDIA |
| 12.          | KEI INDUSTRIES LIMITED                             | INDIA |
| 13.          | POLYCAB INDIA LIMITED                              | INDIA |
| 14.          | RALLISON ELECTRICALS PVT. LTD.                     | INDIA |
| 15.          | RAVIN CABLES LIMITED                               | INDIA |
| 16.          | SPECIAL CABLES PVT. LTD.                           | INDIA |
| 17.          | SRIRAM CABLES PVT LTD                              | INDIA |
| 18.          | SURAJ CABLES                                       | INDIA |
| 19.          | TCL CABLES PRIVATE LIMITED                         | INDIA |
| 20.          | APAR INDUSTRIES LIMITED                            | INDIA |
| 21.          | UNIVERSAL CABLES LTD                               | INDIA |
| 22.          | SUYOG ELECTRICALS LIMITED                          | INDIA |
|              |  |       |
| <b>XV.</b>   | <b>CABLES: CONTROL-XLPE &amp; PVC</b>              |       |



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| 1.  | AJANTA ELECTRIC INDUSTRIES               | INDIA |
| 2.  | ASSOCIATED CABLES PVT LTD                | INDIA |
| 3.  | ASSOCIATED FLEXIBLES & WIRES [P] LTD     | INDIA |
| 4.  | CABLES CORPORATION OF INDIA LIMITED      | INDIA |
| 5.  | CMI LIMITED                              | INDIA |
| 6.  | CORDS CABLE INDUSTRIES LTD               | INDIA |
| 7.  | DELTON CABLES LIMITED                    | INDIA |
| 8.  | ECKO CABLES PVT. LTD.                    | INDIA |
| 9.  | ELKAY TELELINKS LTD.                     | INDIA |
| 10. | FINOLEX CABLES LTD.                      | INDIA |
| 11. | GEMSCAB INDUSTRIES LTD                   | INDIA |
| 12. | HAVELLS INDIA LTD                        | INDIA |
| 13. | ICON CABLE LTD.                          | INDIA |
| 14. | INSUCON CABLES AND COND PVT LTD          | INDIA |
| 15. | KEC INTERNATIONAL LTD                    | INDIA |
| 16. | KEI INDUSTRIES LIMITED                   | INDIA |
| 17. | NORTH EASTERN CABLES PVT. LTD.           | INDIA |
| 18. | POLYCAB INDIA LIMITED.                   | INDIA |
| 19. | RALLISON ELECTRICALS PVT. LTD.           | INDIA |
| 20. | RAVIN CABLES LIMITED                     | INDIA |
| 21. | RELIANCE ENGINEERS LTD.                  | INDIA |
| 22. | SCOT INNOVATION WIRES & CABLES PVT. LTD. | INDIA |
| 23. | SPECIAL CABLES PVT. LTD.                 | INDIA |
| 24. | SRIRAM CABLES PVT LTD                    | INDIA |
| 25. | SURAJ CABLES                             | INDIA |
| 26. | SUYOG ELECTRICALS LIMITED                | INDIA |
| 27. | THERMO CABLES LTD.                       | INDIA |
| 28. | TCL CABLES PRIVATE LIMITED               | INDIA |
| 29. | UNIVERSAL CABLES LTD                     | INDIA |
|     |  |       |

- 7.11 The minimum list of Fittings & Accessories to be included for each of the UPS Package. Bidder shall include all accessories over & above that indicated here to make the UPS system functionally complete with reliable operation & maintenance.

### 8.0 INSPECTION, TESTING AND ACCEPTANCE:

- 8.1 The Manufacturer has to supply the **110V UPS System** of best quality. The Manufacturer has to maintain quality control during manufacturing of equipment as per the approved Quality Assurance Plans.
- 8.2 Before raising inspection call, manufacturer shall submit all the internal test reports/ certificates for the equipment.
- 8.3 Type test report of equipment and all components / accessories carried out shall be submitted for review. Type tests should have been carried out within a period of last 5 years (as on date of enquiry) checked at the time of inspection. In case valid type test certificates are not available same shall be conducted by vendor without any time and price implication to BHEL and reports shall be submitted for BHEL review. Type test shall be carried out as per latest IS/IEC. Type tests shall be performed on one unit.

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8.4 All cubicle assemblies, and their associated equipment shall be fully assembled, wired and tested in the manufacturer's factory. The factory test equipment and the test methods used shall conform to the relevant IS/IEC Publications and shall be subject to approval.

8.5 All routine and acceptance tests as per relevant IS/IEC standards and as per approved Quality Assurance Plan shall be carried out at manufacturer's works under his care and expense.

## 9.0 DOCUMENTATION:

### 9.1 Documents to be submitted along with the technical bid/ offer:

1. Un-priced price schedule (Refer Annexure-II) with details of makes in Unpriced format
2. UPS System & Battery GA, dimensions and weights
3. Battery Sizing Calculations
4. Type test certificates as per Technical Requirements attached as Annexure-I (Doc. No. B366-999-XI-MR-0440).
5. Deviation schedule (Refer Annexure-III)
6. Check List for Bid submission (Refer Annexure-IV).

#### Notes:

1. 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.
2. The Bidder may note that the drawings, data and manuals listed as above are minimum requirements only. The Bidder shall ensure that all other necessary write-ups, calculations etc., and information required to fully describe the equipment offered are submitted with his bid.
3. 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.

### 9.2 Offer is liable for rejection when

- 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.

### 9.3 Documents to be submitted after award of contract:

Vendor shall submit the following documents in 4 sets for information, review and approval.

| Sl.No | Document Description  | Submission Schedule   | Category |
|-------|---|-----------------------|----------|
| 1.    | Index of drawings and documents to be issued (Vendors Documents Index)  | Within 1 week from PO | <b>A</b> |
| 2.    | General arrangement drawings of the UPS and Batteries giving overall dimensions, weights, dynamic loading and identification key of major items | Within 1 week from PO | <b>A</b> |
| 3.    | Schematic diagrams  | Within 1 week from PO | <b>A</b> |
| 4.    | Connection or terminal diagrams   | Within 1 week from PO | <b>A</b> |



|                       |  |   |                   |    |
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|-----|--|-----------------------|----------|
| 5.  | Panel layout drawings, including details of positions and dimensions of all cable entries and terminations         | Within 1 week from PO | <b>A</b> |
| 6.  | Battery sizing calculations  | Within 1 week from PO | <b>A</b> |
| 7.  | Sizing Calculations of UPS System components such as Battery Charger, Inverter, Transformers etc.                  | Within 1 week from PO | <b>A</b> |
| 8.  | Heat losses  | Within 1 week from PO | <b>A</b> |
| 9.  | Details of, and time/current curves for all protective devices   | Within 1 week from PO | <b>R</b> |
| 10. | Material list giving manufacturers and specifications of individual major bought in components                     | Within 1 week from PO | <b>A</b> |
| 11. | Floor fixing details and space requirements for withdrawal and access  |                       | <b>A</b> |
| 12. | Any other relevant drawings, documents and data necessary for satisfactory installation, operation and maintenance | Within 1 week from PO | <b>R</b> |
| 13. | Write up on system operation   | Within 1 week from PO | <b>R</b> |
| 14. | Quality Approval Plan (QAP)  | Within 1 week from PO | <b>A</b> |
| 15. | Other relevant documentation as per Annexure-1   | Within 1 week from PO | <b>R</b> |

A: Approval I: Information R: Review

**Notes:**

1. BHEL shall furnish comments/approval within 1 week from the receipt of vendor documents.
2. Vendor shall re-submit the revised documents incorporating changes for comments/approval within 1 week from the BHEL comment's date.

**9.4 Documentation immediately after dispatch**

Following documents shall be submitted in neatly bound volumes immediately after dispatch, in required no. of hard copies and CDs for the End User as mentioned below:

**3 sets of hard copies and 3 sets of CDs:**

- a. "As-Manufactured" Drawings
- b. Test Certificates
- c. Guarantee Certificates

**10 sets of hard copies and 3 sets of CDs:**

- a. O&M Manuals
- b. Component Catalogues with Makes and Contact Details.

**9.5 Documentation along with the consignment**

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

**9.6 As-built documentation after commissioning of UPS System**

|                       |   |  |                   |    |
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In case the UPS System undergo any modifications at site during E&C, "As-Built" Drawings incorporating site modifications, shall be submitted in 10 sets of hard copies and 3 sets of CDs. The changes/ modifications will be provided to the vendor by BHEL after commissioning of the UPS System at site. In case, BHEL informs that there are no modifications at site during E&C, the As-Manufactured Drawings will be submitted as "As-Built Drawings" in 10 sets of hard copies.

## 10.0 GUARANTEE:

- 10.1 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.
- 10.2 Guarantee period shall be as per the commercial terms and conditions of the NIT.

## 11.0 QUALITY PLAN:

### 11.1 Quality Assurance Programme:

- 11.1.1 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 comply with the requirements of the specifications and documents.
- 11.1.2 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:
1. Provide all design and engineering Divisions and its Sub vendor with detailed instructions regarding inspection and testing;
  2. Organise the tests required in the programme, witness them and issue test certificates;
  3. Inspect the Equipment before packing, check the quality of packing and if Equipment and packing are found to comply with the requirements, authorise shipment;
  4. Inspect for possible transport damages if any, and prepare and submit repair procedures for approval;
  5. Organise and witness all inspection and testing on Site and issue test certificates.
- 11.1.3 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.

### 11.2 Quality Assurance Manual:

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.

### 11.3 Quality Management System:

- 11.3.1 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.
- 11.3.2 Quality Assurance:
1. All routine tests shall be conducted on the equipment at supplier's works.

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2. All tests will be witnessed by BHEL and/ or BHEL's customer as per the approved QAP. Hence test procedures, list of tests to be conducted shall be submitted as per the documentation schedule.

## 12.0 PACKING AND DISPATCH:

- 12.1 All the equipments shall be divided into several shipping sections for protection and ease of handling during transportation. The equipment shall be properly packed for selected mode of transportation i.e. by ship/ rail or trailer. The equipment shall be wrapped in polyethylene sheets before being placed in wooden cases to prevent damage to the finish. Crates/ cases shall have skid bottoms for handling. Cases shall be suitable for lifting by cranes. Special precaution notations such as fragile, this side up, center of gravity, weight, owner's particulars, purchase order number etc. shall be clearly marked on the package together with other details as per purchase order.
- 12.2 The commissioning spare items, mandatory spare items, tools & tackles and cable glands & lugs shall be separately packed. Each packet shall have its respective label on the outside for clear identification.
- 12.3 The detailed packing list shall be furnished for BHEL's review and acceptance before seeking dispatch clearance. Vendor shall dispatch the panels generally with all components mounted. If, for reason of preventing transit damage or for any other reasons, the components/ items have to be packed separately and dispatched then such loose items have also to be listed in the packing list. The list shall have references duly tracing them to the respective packing box/ crate. If such loose items are not declared then it shall be deemed that there are no such loose items.
- 12.4 The equipment may be stored outdoors before installation. The packing should be suitable for outdoor storage in areas with heavy rains and high ambient temperature unless otherwise agreed.

## 13.0 SPECIAL CONDITIONS:

- 13.1 Bidder should confirm that "after-sales service" facilities will be made available free of cost for proper commissioning/ maintenance of equipments offered. The vendor should depute their Technician/ Engineer at their cost for rectification of any defects during guarantee/ warranty period.
- 13.2 Bidder should furnish particulars of their factory or workshop including location and machinery installed with the capacities for manufacturing of the switchgear. Parties who do not have established manufacturing facilities need not quote for the tender.
- 13.3 Vendor to confirm that all equipments supplied by vendor are of proven design and are type tested. Type test certificates shall be as per Technical Requirements attached as Annexure-I (Doc. No. B366-999-XC-MR-0040).

## 14.0 COMPREHENSIVE POST WARRANTY ANNUAL MAINTENANCE CONTRACT(CPWAMC):

- 14.1 Bidder shall include Comprehensive AMC for 5 years after the Completion of the warranty period for 110V UPS System.
- 14.2 Bidder shall propose 5 years maintenance Contract and shall exclusively mention the services to be provided, methodology, scope of work and suppliers responsibility with year-wise breakup.



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- 14.3 In the event of any malfunction of the system hardware / software, experience service engineer shall be made available at site within 24 hours on the receipt of such information from OWNER.
- 14.4 The Contract shall include supply of maintenance spares, tools and tackles as required, travel, boarding and lodging of the service engineer. The quote shall be made year-wise up to 5 years. Contract shall include for on-site stock and shall give Cost of each item after expiry of 5 years AMC with escalation formula.
- 14.5 Supplier shall stock 1 one number of each type of Card / module and any other additional spares recommended, at owner site, and these shall not be part of the mandatory spares. Supplier Can use these spares during the AMC. The spares used shall be replaced by supplier within 7 days with no Cost to Owner. Supplier shall maintain a record of all faults during the AMC.
- 14.6 The service order under the AMC including supply of spare parts and services shall broadly encompass;
- 14.7 Preventive Maintenance:  
Once a year, involving Complete overhaul of the system, inspection of hardware and software, fault prediction, inspection of power supply quality, environmental and operating Condition Checks, major repairs / replacements and detailed reporting. This visit is in addition to visit required for periodic maintenance.
- 14.8 Periodic Maintenance:  
Site visits, minimum four times in a year, inspection of general healthiness of the system, study and advice on daily maintenance, inspection of hardware.
- If any problem is reported, running of test programs, on-line servicing and solving reported problems. Checks shall be Conducted on running system ie a) on-line sub-systems and b) others (Supplier to state).
- 14.9 Emergency Service:  
Any failure shall be on system supplier's account. The engineer must report at site within 24 hours of first intimation through telephone/email/fax of report of failure, with necessary spares. The system must be brought back within 24 hours after reporting at site.
- 14.10 Shutdown Visit:  
During annual shutdown of the plant, suppliers engineer shall visit and Carry out all the Checks required. Each visit shall not be part of periodic / preventative maintenance visit.
- 14.11 Software Maintenance / Support:  
Supplier is to maintain existing operating and application software to improve upon performance of system. Software modification and up-gradation as and when required shall also be Covered under this scope at no extra Cost.
- 14.12 Notes:-  
1. Bidder to note that while Carrying out the AMC activities IOCL engineers may associate with system engineers. On-job training of these associated engineers shall be Covered under this scope. All financial aspects of the AMC must be listed Clearly.

## 15.0 PRICE FORMAT:

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Refer Annexure-II of this specification.

#### 16.0 PACKAGE EXECUTION MILESTONES CUM SCHEDULE:

Refer Annexure-III of this specification.

#### 17.0 CHECK LIST FOR BID SUBMISSION:

Check List for Bid Submission is provided as Annexure-IV to this specification.

This Check List shall be followed for submitting the Bid documents. The Check List itself shall be filled by the Bidder in entirety and mandatorily submitted along with the Offer.

#### 18.0 LIST OF MATERIAL CODES AS PER ENQUIRY

| Variant No.  | Description  | Quantity | Material Code |
|--|--|----------|---------------|
| 1. Main Supply & Mandatory Spares (Variant Nos. from 00 to 01 below)   |  |          |               |
| 00   | 110V AC Parallel Redundant UPS System & 1X100% UPS Battery(Ni-Cd)          | 1 Set    | PY9755465006  |
| 01   | Mandatory Spares for UPS System  | 1 Set    | PY9755465014  |
| 2. Supervision of E&C & Training of 110V UPS System Package (Variant Nos. from 02 to 04 below)                                     |  |          |               |
| 02   | Erection Supervision, Commissioning of 110V UPS System Package (Travel)    | 1 Set    | PY9755465022  |
| 03   | Erection Supervision, Commissioning of 110V UPS System Package (Services)  | 1 Set    | PY9755465030  |
| 04   | Training to owner's personnel at site (Services)                           | 1 Set    | PY9755465049  |
| 05   | Training to owner's personnel at site (Incidental Chares including Travel) | 1 Set    | PY9755465057  |
| 3. Annual Maintenance Contract(AMC) of 110V UPS System including UPS System Battery for 5 years (Variant Nos. from 05 to 09 below) |  |          |               |
| 06   | AMC for 1 <sup>st</sup> year   | 1 Set    | PY9755465065  |
| 07   | AMC for 2 <sup>nd</sup> year   | 1 Set    | PY9755465073  |
| 08   | AMC for 3 <sup>rd</sup> year   | 1 Set    | PY9755465081  |
| 09   | AMC for 4 <sup>th</sup> year   | 1 Set    | PY9755465090  |
| 10   | AMC for 5 <sup>th</sup> year   | 1 Set    | PY9755465103  |

#### 19.0 BILL OF MATERIALS (BOM):

| Sl.No. | Item Description   | Quantity | Quantity (Unit) | Scope (Vendor/ Purchaser) | Remarks   |
|--------|--|----------|-----------------|---------------------------|---|
| I.     | <b>110V AC UPS System Package Equipment:</b>   |          |                 |                           |   |
| 1.     | 110V AC Parallel Redundant UPS System of 2 kVA Rating with By-Pass supply & 1X100% UPS Battery(Ni-Cd) with back-up time of 24 hours 5 minutes as per TYPICAL UPS SYSTEM SLD attached in Annexure-I to this Specification | 1        | Set             | Vendor                    | UPS System Package also consists of items specified at I(2), I(3), I(4) below |

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| Sl.No. | Item Description   | Quantity | Quantity (Unit) | Scope (Vendor/ Purchaser) | Remarks   |
|--------|--|----------|-----------------|---------------------------|---|
| 2.     | Battery isolating Box including breaker or switch  | 1        | Nos.            | Vendor                    |   |
| 3.     | Commissioning spares as per Annexure-I of this specification.  | 1        | Set             | Vendor                    |   |
| 4.     | Special Tools and Accessories for UPS System & UPS System Battery as per Annexure-I of this specification.   | 1        | Set             | Vendor                    |   |
| 5.     | 110V UPS DB  | 1        | Set             | <b>Purchaser</b>          |   |
| II.    | <b>Mandatory Spares</b><br>(Refer Annexure-I to this Specification for list)   | 1        | Set             | Vendor                    | All the technical requirements of these mandatory spares shall be as per main equipment to be supplied by vendor. |
| III.   | <b>Supervision Services for Erection &amp; Commissioning of 110V UPS System Package by Supplier at site.</b>   |          |                 |                           |   |
| 1.     | Lump sum price for travel by UPS System Package OEM to and from Site per visit. (1 Set = 2 Visits)   | 1        | Set             | Vendor                    |   |
| 2.     | Lump sum price including Services, Lodging, Boarding etc. for UPS System Package OEM at site. (1 Set = 15 Days)  | 1        | Set             | Vendor                    |   |
| IV.    | <b>Training to owner's personnel at site</b>   |          |                 |                           |   |
| 1.     | Lump sum price for training services of UPS System Package OEM for TEN OWNER' s Engineers for a period of at least seven days at Site (1 Set = 7 Days in 1 visit)  | 1        | Set             | Vendor                    |   |
| 2.     | Lump sum price for Travel, Lodging, Boarding etc. of UPS System Package OEM at site for training services of UPS System Package for TEN OWNER' s Engineers for a period of at least seven days at Site (1 Set = 7 Days in 1 visit)                       | 1        | Set             | Vendor                    |   |
| V.     | <b>Comprehensive Post Warranty Annual Maintenance Contract(CPWAMC) for 5 years of 110V UPS System Package including UPS System Battery:</b> [Annual charges for Post Warranty maintenance for UPS System as per Specification for the following periods] |          |                 |                           |   |
| 1.     | First year after expiry of defect liability  | 1        | Set             | Vendor                    |   |
| 2.     | Second year after expiry of defect liability   | 1        | Set             | Vendor                    |   |
| 3.     | Third year after expiry of defect liability  | 1        | Set             | Vendor                    |   |
| 4.     | Fourth year after expiry of defect liability   | 1        | Set             | Vendor                    |   |
| 5.     | Fifth year after expiry of defect liability  | 1        | Set             | Vendor                    |   |



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| DOCUMENT CATEGORY   |   | DOCUMENT REVIEW STATUS (BY CLIENT)  |                    |              |              |
|---|---|---|--------------------|--------------|--------------|
| (USE "X" MARK)\<br><input type="checkbox"/> APPROVAL<br><input type="checkbox"/> REVIEW<br><input checked="" type="checkbox"/> INFORMATION  |   |   |                    |              |              |
| <h2><u>ANNEXURE-I TO PY55465</u></h2>   |   |   |                    |              |              |
|   |   |   |                    |              |              |
|   |   |   |                    |              |              |
|   |   |   | <i>GCS</i>         | <i>PK</i>    | <i>SA</i>    |
| A   | 20.01.22  | ISSUED FOR INFORMATION  | GCS                | PK           | SA           |
| REV   | DATE  | DETAILS OF REVISION   | PREPARED           | CHECKED      | APPROVED     |
| CLIENT  | <br>IndianOil  | INDIAN OIL CORPORATION LIMITED<br>PARADIP REFINERY PROJECT<br>PARADIP ODISHA      |                    |              |              |
| CONSULTANT  |    |   | TECHNIP INDIA LTD. |              |              |
| PROJECT   | 525 TPD STANDBY SRU PROJECT<br>IOCL PARADIP REFINERY, ODISHA, INDIA   |   |                    |              |              |
| ESC   | <br>ENGINEERS INDIA LIMITED<br><small>(A Govt. of India Undertaking)</small> |   |                    |              |              |
| <br>DEPT. PE&SD.   | BHEL<br>Hyderabad   | NAME<br>DRN<br>CHD<br>APPD  | SIGN<br>DATE       | DATE<br>DATE | DATE<br>DATE |
|   | CODE 450  |   |                    |              |              |
| The information on this document is the property of<br>BHARAT HEAVY ELECTRICALS LIMITED, It must<br>not be used directly or indirectly in any way<br>detrimental to the interest of the company |   | TITLE : UPS-MR Inputs   |                    |              |              |
|   |   | BHEL DRG NO. B366-999-XI-MR-0440 <span style="float: right;">REV</span>           |                    |              |              |
|   |   | CUST. DRG NO. 080557C-26899053-ELE-A4307-005 <span style="float: right;">A</span> |                    |              |              |
|   |   | SHT NO.1  |                    | NO. OF SHT.5 |              |

## JOB SPECIFICATION FOR UPS SYSTEM

PROJECT : STANDBY SRU PROJECT  
CLIENT : IOCL, PARADIP  
LOCATION : PARADIP  
JOB NO. : B366

|            |            |                        |                |               |                |
|------------|------------|------------------------|----------------|---------------|----------------|
| A          | 20.01.2022 | ISSUED FOR INFORMATION | GCS            | PK            | SA             |
| Rev.<br>No | Date       | Purpose                | Prepared<br>by | Checked<br>by | Approved<br>by |



**SPECIFIC REQUIREMENTS:**

- 1.0 UPS vendor shall guarantee the performance of complete engineering and UPS system equipment consisting of inverter, battery charger, battery and fault diagnostic system.
- 2.0 Vendor shall confirm that the scope of work shall be compliance in all respects as specified in the requisition document and all other equipment, materials and work not explicitly mentioned but nevertheless required to fulfil the functional requirements shall be deemed to be included in the scope of vendor with no additional cost and time implication to the owner.
- 3.0 All test equipment & tools required for testing and commissioning at site shall be brought by vendor at his own expense.
- 4.0 Considering the total load of 0.4kVA redundant load requirement and 20% Spare on overall capacity the rating of AC UPS has been selected of 2 KVA based on the nearest higher standard UPS ratings.
- 5.0 The final selected UPS rating for the supply shall be having proven track record.
- 6.0 Battery and Charger/ inverter sizing calculations shall be subject to owner's review and batteries and chargers/ inverters of approved rating/ capacity shall be supplied without any cost/ time implications.
- 7.0 All commissioning spare parts shall be supplied by the bidder.
- 8.0 List of recommended spare parts for two years operation and maintenance shall be furnished by the bidder along with bid.
- 9.0 UPS system configurations for Process Unit duty shall be of parallel redundant type. This system shall provide redundancy in all components except battery which is sized for 1x100% of the continuous load as per data sheet (No. 080557C-000-SP-1671-001).
- 10.0 Output voltage of AC UPS shall be 110V AC.
- 11.0 Cable glands & lugs shall be supplied by the bidder. Cable sizes shall be finalized during detail engineering.
- 12.0 Mandatory Spares :

|   | Equipment                              | Quantity   |
|---|--|--|
|   | <b>UPS</b>                             | <b>One set of spares for each UPS System</b>                   |
| 1 | Thyristors/ Transistors / IGBT / Diode | 1 no. of each type and rating                                  |
| 2 | Control cards                          | 1 no. of each type   |
| 3 | Power supply cards                     | 1 no. of each type and rating                                  |
| 4 | Control fuses / MCB                    | 20% or 1 no. (min) of each type and rating - whichever is more |
| 5 | Power fuses / MCB                      | 20% or 1 no. (min) of each type and rating -whichever is more  |
| 6 | Indication lamp covers                 | 3 nos. of each colour  |
| 7 | Indication lamps                       | 10% or 3 nos. (min) - whichever is more                        |
| 8 | Panel cooling fans                     | 1 no. each rating  |
|   | <b>BATTERY</b>                         |  |
| 9 | Complete cell assembly                 | 3 nos. of each type and rating                                 |

**REMARKS:**

1. Type-means the make, model no., type, size/length, rating, material as applicable.
2. Wherever % is identified, vendor shall supply next rounded figure.
3. Mandatory spares as indicated above do not cover commissioning spares.
4. Mandatory spares as indicated above do not cover two year O&M spares.



5. If any of the items of above Mandatory Spares list are "Not Applicable or Not used" in the offered UPS System, vendor to inform/specify in the offer with valid reason.

13.0

- a. UPS system shall comprise of 2 nos. chargers & 2 nos. inverters (each rated for 100% capacity) and 1 set of Batteries (rated for 100% AH capacity).
- b. Battery for the FDAS UPS System shall be of Ni-Cad type.

14.0 Special tools and tackles required for the maintenance of the equipment, if any, shall be supplied along with each UPS system.

15.0 Galvanic isolation in the UPS output shall be as per the instrumentation requirements.

16.0 Cables shall be as per standard specification 080557C-000-JSS-1621-001, (All cables to be used for UPS and its distribution shall be of copper conductor). All interconnecting wiring/ cabling in the UPS shall be supplied by the vendor and shall be done internally through the panel/UPS. Cable sizing calculation (as applicable) shall be furnished by vendor post order for approval prior to cable ordering.

17.0 AC incomer cable sizes to the UPS shall be furnished post order. The panel/UPS input terminal shall be suitable for terminating these cable sizes.

18.0 The UPS Room sizes and available space for new UPS is as per the building drawing 080557C-088-DW-1625-001 attached with the MR. The UPS dimensions shall be such to accommodate in the given room size maintaining adequate clearances.

**19.0 List of attachments:**

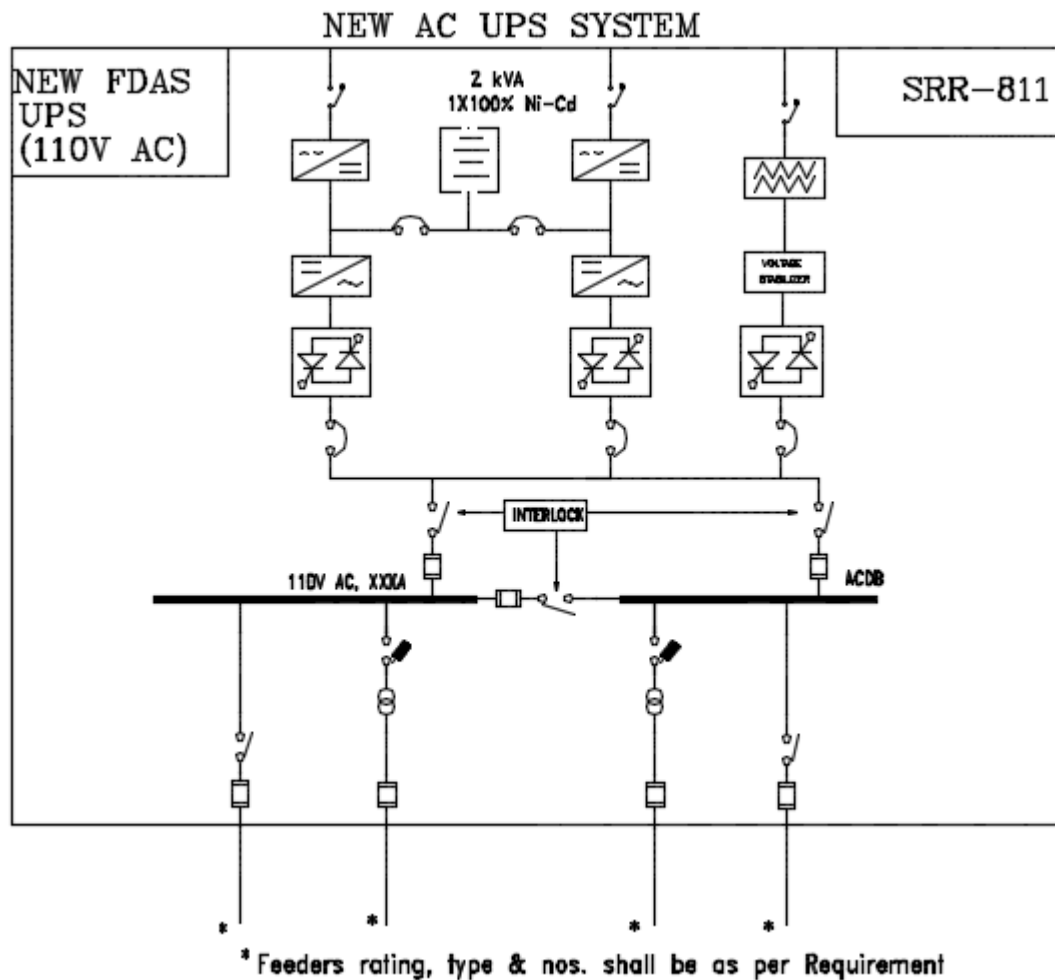
Attachment-1 : Job specification for AC UPS for FDAS system. (Doc. No. 080557C-000-JSS-1671-001)



Attachment-2 : Job specification for electrical power and control cables(Doc. No. 080557C-000-JSS-1621-001)

Attachment-3 : Conceptual equipment & cable routing layout existing substation ss-331s & UPS / Battery room at SRR-811(Doc. No. 080557C-088-DW-1625-001)

Attachment-4 : Data sheet for AC UPS (080557C-000-SP-1671-001)

## 20.0 TYPICAL UPS SYSTEM SLD:





|   |                                  |   |  |             |
|---|----------------------------------|---|--|-------------|
|   | <b>PROJECT</b>                   |   | <b>Standby SRU &amp; Additional Tanks<br/>IOCL- Paradip Refinery</b> |             |
|   | <b>CLIENT</b>                    |   | <b>INDIAN OIL CORPORATION LIMITED</b>                                |             |
| <b>JOB SPECIFICATION FOR<br/>AC UPS FOR FDAS SYSTEM</b>   | <b>Project No.</b><br>080557C001 | <b>Document No.</b><br>080557C-000-JSS-1671-001 | <b>Rev. No.</b><br>B   | Page 1 of 8 |

## JOB SPECIFICATION FOR AC UPS FOR FDAS SYSTEM



| REV. | DATE       | DESCRIPTION       | PREPARED | CHECKED | APPROVED | AUTHORIZED |
|------|------------|-------------------|----------|---------|----------|------------|
| B    | 08.06.2020 | ISSUED FOR DESIGN | SRT      | CG      | SV       | JMC        |
| A    | 10.12.2019 | ISSUED FOR DESIGN | NM       | CG      | SV       | JMC        |

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|  |                           |  |               |             |
|--|---------------------------|--|---------------|-------------|
|   | PROJECT                   | Standby SRU & Additional Tanks<br>IOCL- Paradip Refinery |               |             |
|  | CLIENT                    | INDIAN OIL CORPORATION LIMITED                           |               |             |
| JOB SPECIFICATION FOR<br>AC UPS FOR FDAS SYSTEM  | Project No.<br>080557C001 | Document No.<br>080557C-000-JSS-1671-001                 | Rev. No.<br>B | Page 2 of 8 |

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|  |                                  |   |  |             |
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|   | <b>PROJECT</b>                   |   | <b>Standby SRU &amp; Additional Tanks<br/>IOCL- Paradip Refinery</b> |             |
|  | <b>CLIENT</b>                    |   | <b>INDIAN OIL CORPORATION LIMITED</b>                                |             |
| <b>JOB SPECIFICATION FOR<br/>AC UPS FOR FDAS SYSTEM</b>  | <b>Project No.</b><br>080557C001 | <b>Document No.</b><br>080557C-000-JSS-1671-001 | <b>Rev. No.</b><br>B   | Page 3 of 8 |

## 1. INTRODUCTION

**INDIAN OIL CORPORATION LIMITED (IOCL)** has awarded Fax of Acceptance (FOA) dated 29<sup>th</sup> August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

## 2. DEFINITIONS

Wherever used in this procedure, the following words shall have the meaning as given hereunder;



| Abbreviation          | Definition  |
|-----------------------|---|
| IOCL / CLIENT / OWNER | Indian Oil Corporation Limited  |
| PMC / CONSULTANT      | Technip India Limited   |
| CONTRACTOR            | Party whose services are obtained for performing the works specified as part of LSTK / packages.                          |
| VENDOR                | Any third party supplying the equipment / materials for setting up the Plant  |
| PROJECT               | Indicates Standby SRU and Additional tanks Project, Paradip Refinery  |
| SITE                  | Sulphur Recovery Unit   |
| UNIT                  | Indicates any particular portion of the project to be built which can be<br>Process related or Utilities/Offsites related |

## 3. GENERAL

### 3.1 **Scope**

AC UPS System shall be designed in accordance with Specification No. PDRP-8531-SP-0006, Rev.F3 which is attached as Annexure-1 with this document and addendum requirement covered in this document.

This addendum shall be read in conjunction with Specification No. PDRP-8531-SP-0006, Rev.F3 and data sheet.

|   |  |  |  |               |             |
|---|--|--|--|---------------|-------------|
|  |  | PROJECT                                  | Standby SRU & Additional Tanks<br>IOCL- Paradip Refinery |               |             |
|   |  | CLIENT                                   | INDIAN OIL CORPORATION LIMITED                           |               |             |
| JOB SPECIFICATION FOR<br>AC UPS FOR FDAS SYSTEM                                   | Project No.<br>080557C001  | Document No.<br>080557C-000-JSS-1671-001 |  | Rev. No.<br>B | Page 4 of 8 |

The equipment offered by vendor shall be complete in all respect. Any material or accessories which may not have been specifically mentioned, but which are usual or necessary for satisfactory and trouble free operation and maintenance of the equipment, shall be furnished without any extra charge.

### 3.2 Specifications

3.2.1 If any conflict arises among the documents, the order of precedence of documents shall be as follows

- Statutory regulations
- Single Line diagram
- Data Sheet
- Scope of Supply
- Job specification for supply

3.2.2 Manufacturer must declare in the offer any exception and / or deviation from the job specification for supply. The lack of any declaration and / or deviation shall be considered as full compliance with the job specification for supply.

### 3.3 Manufacturer's responsibility

3.5.1 Manufacturer shall not make assumptions to replace information not furnished by contractor. manufacturer is required to obtain necessary information from contractor or other reliable sources. All claims arising from lack of knowledge of required information shall be rejected by contractor.

3.5.2 It shall be the manufacturer's responsibility to furnish all items essential for the safe and satisfactory operation of the high voltage Switchboard, notwithstanding the inclusion or omission of same from this specification or the associated requisition and its data sheets or the purchase order.

3.5.3 Manufacturer shall submit a list of all appliances, special tools and accessories that are necessary or incidental to the proper installation, even though these items are not included on the drawings, specifications or Project data sheets.

## 4. ADDENDUM TO DOC. NO PDRP-8531-SP-0006, REV F3

The following amendments and additions shall apply to Project Specification for AC UPS System Doc no. PDRP-8531-SP-0006, Rev F3. The clauses of PDRP-8531-SP-0006, Rev. F3 that are not amended in this Addendum remain applicable without change.



### 4.1 Amendment to CL.1.0 & CL.4.2 in page 4 of 26 & 6 of 26 respectively:-

The configuration for the proposed FDAS UPS system shall be of "Parallel Redundant" type.

### 4.2 Amendment to CL.3.1 in page 4 of 26:-

The document number referred as "PDRP-8820-SP-0001" shall be read as "080557C-088-CN-0007-003.



|  |                                  |   |  |             |
|--|----------------------------------|---|--|-------------|
|   | <b>PROJECT</b>                   |   | <b>Standby SRU &amp; Additional Tanks<br/>IOCL- Paradip Refinery</b> |             |
|  | <b>CLIENT</b>                    |   | <b>INDIAN OIL CORPORATION LIMITED</b>                                |             |
| <b>JOB SPECIFICATION FOR<br/>AC UPS FOR FDAS SYSTEM</b>  | <b>Project No.</b><br>080557C001 | <b>Document No.</b><br>080557C-000-JSS-1671-001 | <b>Rev. No.</b><br>B   | Page 5 of 8 |

#### 4.3 Amendment to CL.3.5 in page 4 of 26:-

The maximum noise level measured at 1 m distance in any position, at any load between 0 - 100% shall not exceed 70 dB (A).

#### 4.4 Amendment to CL.3.7 in page 5 of 26:-

The document number referred as "PDRP-8440-SP-0006" shall be read as "080557C-000-JSD-2300-001.

#### 4.5 Amendment to CL.4.3.1 in page 7 of 26:-

The voltage level for the proposed UPS for FDAS System shall be of 110V, 1 Phase. The bypass power supply shall be suitable for 3 Phase and neutral.

#### 4.6 Amendment to CL.4.4.1 in page 8 of 26:-



The voltage level for the proposed UPS for FDAS System shall be of 110V, 1 Phase. The stand up time shall be of 24 hours and 5 mins.

#### 4.7 Amendment to CL.5.5 in page 13 of 26:-

The type of Battery for the proposed FDAS UPS System shall be of Ni-Cad.

#### 4.8 Amendment to CL.5.15 in page 19 of 26:-

- Terminals shall be suitable for the type and the material of the cables foreseen.
- Clamp type terminals shall be used for connection of all wires up to 10 sqmm. Bolted type terminals suitable for cable lugs shall be provided for wire size above this. Tinned copper lugs for all external connection shall be provided with panels.
- Each wire shall generally be terminated individually on its terminal.
- Minimum 20% spare terminals shall be provided for future use.
- All terminal blocks and wires shall be tagged for identification in accordance with drawings / relevant standards.
- Incoming and outgoing circuits will be connected to terminal strips; the direct connection of external cables to the components is not acceptable.
- Terminals shall be installed inside the switchboard in an easily accessible position to allow the inspection, the pulling and connection of cables.
- Adequate supporting facilities shall be provided for cables in order to avoid the tensile stress transmission to the terminals.

|  |                                  |   |  |             |
|--|----------------------------------|---|--|-------------|
|   | <b>PROJECT</b>                   |   | <b>Standby SRU &amp; Additional Tanks<br/>IOCL- Paradip Refinery</b> |             |
|  | <b>CLIENT</b>                    |   | <b>INDIAN OIL CORPORATION LIMITED</b>                                |             |
| <b>JOB SPECIFICATION FOR<br/>AC UPS FOR FDAS SYSTEM</b>  | <b>Project No.</b><br>080557C001 | <b>Document No.</b><br>080557C-000-JSS-1671-001 | <b>Rev. No.</b><br>B   | Page 6 of 8 |

#### 4.9 Amendment to CL.5.16.1 in page 19 of 26:-



All conductors of power, protection and current carrying metering circuits shall have a minimum cross section of 2.5 mm<sup>2</sup>. All other conductors except those of control electronic logics shall have a minimum cross section of 1.5 mm<sup>2</sup>

#### 4.10 Amendment to CL.5.18 in page 20 of 26:-

- Each vertical section shall be provided with a space heater to prevent condensation, capable of maintaining an internal temperature at about 5°C above the external temperature.
- Space heaters shall not influence the operation of temperature sensitive components.
- All space heaters shall be fed at 240V AC (Unless specified otherwise) by a disconnect switch and a contactor controlled by a temperature switch.
- Fuses shall protect each space heater circuit.

#### 4.11 Additional Requirements:-

- 4.11.1 Electronic Cards of UPS system shall be ISA-G3 compliant as per std.S.71.04.
  - 4.11.2 Unless specified otherwise, all interconnecting cables, as required between UPS system and ACDB, UPS system and battery disconnecting switch/batteries shall be in the scope of vendor. The cables interfacing with battery shall be of standard flexible cables. Cables from UPS to ACDB and UPS to Battery and from ACDB to downstream distribution systems shall be only copper irrespective of the cable size.
  - 4.11.3 UPS system shall be provided with ACDB with two I/C & one B/C scheme with 100% redundancy of feeders on each section. Each section of ACDB shall be provided with 2 Nos of outgoing feeders to feed the PDB for FDAS System.. Each ACDB shall be provided with 20% spare feeders for future use.
  - 4.11.4 UPS system shall be sized to have at least 20% capacity for future load growth.
  - 4.11.5 All information detailed in IEC 60146-1-1 as appropriate for the equipment, shall be given on a nameplate.
  - 4.11.6 One nameplate giving designation of the equipment shall be affixed prominently on top. Details of designation are as follows, unless specified otherwise.
    - Equipment Description as per data sheet / SLD
    - Equipment Tag No. as per data sheet / SLD
- (a) The switchboard of the unit shall be provided with the following labels.
- nameplate with the identification mark

|  |                                  |   |  |             |
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|  | <b>CLIENT</b>                    |   | <b>INDIAN OIL CORPORATION LIMITED</b>                                |             |
| <b>JOB SPECIFICATION FOR<br/>AC UPS FOR FDAS SYSTEM</b>  | <b>Project No.</b><br>080557C001 | <b>Document No.</b><br>080557C-000-JSS-1671-001 | <b>Rev. No.</b><br>B   | Page 7 of 8 |

- nameplate with Manufacturer's name
- markers for each terminal and terminal block designation
- tags bearing the schematic reference for all measurement instruments, control and signaling devices

(b) Nameplates shall be non-corrodible, preferably laminated plastic, characters shall preferably be white letters on black background. All name plates shall be secured with screws.

(c) Battery racks shall be provided with nameplates bearing the identification mark and all data required by relevant standards. Warning label shall also be provided.

Nameplates shall be made of corrosion resistant material and shall be fastened to the rack in a well visible position.

#### 4.11.7 Accessibility and maintenance safety

Power supply terminals and terminals powered from outside sources shall be shrouded with cover.

Equipment and components located within the enclosure shall not be mounted directly on the walls of the enclosure. The location and grouping of components and auxiliary equipment shall permit easy identification and access for operational, maintenance and repair purposes, without unnecessary interruption of supply to the load. Suitable partitioning between individual items shall be provided where necessary to allow adjustment and inspection to be carried out safely.

Items requiring access for maintenance such as cooling fans and AC capacitors shall be located so as to facilitate and required maintenance from the front of the unit. If rear access is required to carry out any form of maintenance, this shall clearly be identified in the documentation.



4.11.8 Each vertical section of AC UPS shall be provided with an 11W CFL light (suitable for 240V AC single phase supply, unless specified otherwise) with a door operated switch.

4.11.9 The power supply to auxiliary equipment e.g. panel lighting, fans, space heater etc shall not be a UPS supply and shall be supplied from the normal plant supply.

4.11.10 The maximum height of the operating handles / switches / measuring instruments shall not exceed 1800mm from finished floor level (FFL) and the minimum height shall not be less than 300mm from FFL.

#### 4.11.11 Fault Diagnostic Unit

If specified in the data sheet, each UPS set shall have provision for adding microprocessor based 'ON line fault diagnostic unit'. This shall supervise the UPS operation continuously. It shall identify and locate faults immediately so that corrective action can be taken. Fault Diagnostic unit shall be compatible to hook up with owner's PC through RS232/RS485/IEC 61850 interface. The software for

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|  | <b>CLIENT</b>                    |   | <b>INDIAN OIL CORPORATION LIMITED</b>                                |             |
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working with fault diagnostic of UPS shall be provided on a CD ROM.

The fault diagnostic unit shall have provision for automatic print out facilities for time, Input/output voltages, currents, frequency as a minimum under the following conditions.


- UPS power source changeover from mains to battery.
- UPS power source changeover from battery to mains.
- Changeover from inverter to stabilized bypass supply and vice versa.
- Changeover from one inverter to other inverter.
- Changeover time in case of inverter to stabilized bypass supply and from one inverter to other inverter.
- UPS failure.
- Type of failure incident along with diagnostic report.

In addition to the above, any other feature which vendor feels may be useful shall be provided and highlighted separately.

If any additional equipment (e.g. bin connector, adaptor cards etc.) are required for connecting this unit with UPS system as well as with owner's PC the same are also to be included in the vendor's scope.

## 5. **ANNEXURES**


ANNEXURE – 1 : PROJECT SPECIFICATION FOR AC UPS SYSTEM (DOC. No. PDRP-8531-SP-006, REV F3)

|   |   |  |
|---|---|--|
| <br><b>IndianOil</b> | <b>PARADIP REFINERY PROJECT<br/>PROJECT SPECIFICATION</b> | <b>A</b><br><br><b>PDRP-8531-SP-0006</b><br><b>PAGE : 1 of 26</b><br><b>REV : F3</b> |
|   | <b>AC UNINTERRUPTABLE POWER SYSTEM<br/>(UPS)</b>          |  |

|                          |                                       |
|--------------------------|---------------------------------------|
| <b>Client's Name:</b>    | Indian Oil Corporation Limited (IOCL) |
| <b>Project Title:</b>    | Paradip Refinery Project (PDRP)       |
| <b>Project Location:</b> | Paradip, Orissa State, India          |
| <b>Document Category</b> | Class 1                               |

| REVISION | F3             | SIGNATURE |
|----------|----------------|-----------|
| DATE     | 30 Nov 10      |           |
| ORIG BY  | Paul Perry     |           |
| CHKD BY  | Soumya De      |           |
| APP. BY  | Paul Perry     |           |
| APP. BY  | Satendra Singh |           |


| REVISION HISTORY |          |                                  |            |
|------------------|----------|----------------------------------|------------|
| Revision         | Date     | Reason for Issue                 | Originator |
| 01               | 11.04.07 | First Issue for Comment          | A K Bhan   |
| A1               | 24.08.07 | Approved for Design              | P.Teager   |
| A2               | 18.01.08 | Approved for Design              | M Alam     |
| F1               | 12.08.09 | For Project Implementation Phase | P. Rush    |
| F2               | 16.09.09 | For Project Implementation Phase | J. Carver  |
| F3               | 30.11.10 | Final with ATIs Incorporated     | P. Perry   |

|   |   |  |
|---|---|--|
| <br><b>IndianOil</b> | <b>PARADIP REFINERY PROJECT<br/>PROJECT SPECIFICATION</b> | <b>A</b><br><br><b>PDRP-8531-SP-0006</b><br><b>PAGE : 2 of 26</b><br><b>REV : F3</b> |
|   | <b>AC UNINTERRUPTABLE POWER SYSTEM<br/>(UPS)</b>          |  |

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## ATTACHMENTS

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## 1.0 SCOPE

This standard covers the design and fabrication of factory built assemblies (FBA) of dual redundant static AC Uninterruptible Power Systems (UPS) for essential power supplies such as instrument systems. This standard also includes all items of equipment and materials necessary to complete the UPS and the information, documents and data required to be submitted by the Vendor.

Each UPS shall comprise a dual redundant system of the following equipment: constant voltage rectifier/chargers, rechargeable storage batteries, static inverters, a static transfer switch, a maintenance bypass switch and transformer, complete with all necessary control protection, indication, wiring and distribution equipment.

Individual requirements shall be as defined in the requisition. All equipment shall be suitable for continuous operation.

## 2.0 STANDARDS

The assemblies and equipment therein shall conform to the requirements of the latest revisions and amendments of the applicable IS / IEC standards, local laws, codes and regulations applicable to India, including the standards as per Attachment 1.

## 3.0 GENERAL REQUIREMENTS

### 3.1 Service Conditions

The equipment shall be suitable for continuous operation under the service conditions as defined in IEC 60146. Any other environment or special service conditions to be met are described in the requisition.


The Vendor shall provide all necessary heating and ventilating to provide proper functioning of all equipment which forms part of the assembly taking into consideration the external service conditions specified in the Basic Engineering Design Data document, PDRP-8820-SP-0001.

The UPS shall be installed within air conditioned buildings and shall be considered clean and dry with a maximum ambient temperature of 42.4°C which shall be considered as the design temperature for the equipment. The ambient design temperature for batteries shall also be 42.4°C.

### 3.2 Quality and Workmanship

The equipment shall comprise fully type tested assemblies in current, regular production at the Vendor's works. Type test reports shall be made available for review.

Vendor shall provide spare parts and components availability.

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The Vendor shall provide a statement defining the availability, reliability and maintainability of his equipment in relation to defined product lifetime expectancy.

### **3.3 General and Safety Requirements**

The assembly shall be designed and manufactured to ensure safety during operation, repair and maintenance and to minimise the risk of short circuits. General and Safety Requirements shall be as specified in IEC 62040-1-2.

### **3.4 Electromagnetic Compatibility**

#### **3.4.1 Emissions**

The equipment emissions should not interfere with the intended function of other equipment.

Emissions shall comply with IEC 62040-2 and IEC 61000-3-2.

#### **3.4.2 Immunity**

The equipment should have intrinsic immunity to external electromagnetic disturbances. Immunity shall comply with IEC 62040-2 and IEC 61000-3-2.

The performance of the UPS shall not be adversely affected by portable radio transmitters.

### **3.5 Acoustic Noise**

The maximum sound power level at 1m from the equipment surface should be according to what indicated in document No PDRP-8440-SP-0013.

### **3.6 Miscellaneous Parts**

The Vendor shall supply one complete set of fuses, internal wiring, nuts, bolts, covers, armour clamps, lugs, heat shrinkable terminations, earth bar, labels and all items necessary to complete the UPS.

Cable glands shall be supplied by Contractor.

### **3.7 Finish**

The finish may be Vendor's standard, but must be able to withstand the described climatic conditions and specific requirements.


The specific requirements for Vendor standard equipment are detailed in the Protective Paint and Coatings specification, PDRP-8440-SP-0006.

Details of the Vendor's preparation and finishing specifications shall be provided with the tender.

Paint shall be RAL 7035.

### **3.8 Special Tools and Accessories**

The Vendor shall supply a complete set of special tools, and any devices necessary for the erection, operation, testing and maintenance of the UPS. A suitable lockable box to accommodate these tools and devices shall be provided by the Vendor.

|  |   |   |
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Battery tools and accessories shall be included within a separate but similar cabinet to that above for all other items. The extent of supply shall depend upon the battery system, and shall include cell connectors, safety clothing, electrolyte, test equipment, grease, paint, insulated wrenches and slings as appropriate.

### 3.9 **Commissioning Spares**

These shall include fuse links, lamps, etc., and those items considered consumable or from experience, likely to require replacement during installation and commissioning of the equipment.

### 3.10 **Information Required with MR**

The Vendor shall provide the information and data listed in the Attachment 2.

## 4.0 **CHARACTERISTICS**

### 4.1 **General**

System configurations shall be as defined in the requisition. The total equipment shall comprise an electronically regulated, fully integrated system which shall be in accordance with IEC 60146 and IEC 62040 and suitable for continuous operation.

All solid state components shall be rated for at least full load requirements at continuous operation for the life of the UPS.

The FBA shall be complete with all protection devices to prevent damage to components against short circuits, overloads and voltage surges.

The ratings specified in the requisition are the actual ratings required from the assembly when installed and working in the specified location and under any specified special service conditions.


Cubicle mounted electronic components shall be rated to either a surrounding air temperature of 50°C or the predicted temperature within the cubicle, whichever is the greater assuming a maximum ambient temperature.

In the design of the system the voltage drop in all components and connections shall be taken into consideration.

### 4.2 **System Configuration**

System configurations for Process Unit duty shall be dual redundant UPS system. This system provides redundancy in all components. Each battery is sized for 100% of the continuous load. Refer to AC UPS Single Line Diagram 3210-8532-70-600-0003 for a typical arrangement.

For non-process unit related duties, the configuration shall be a single UPS with bypass facility.

|  |   |   |
|--|---|---|
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|  | <b>AC UNINTERRUPTABLE POWER SYSTEM<br/>(UPS)</b>          |   |

### 4.3 AC Input Power Supply

#### 4.3.1 System

415V, 3 phase.

240V, 1 phase.

Unless otherwise specified the system shall be:

- Primary Power Supply 3 phase and neutral
- Bypass Power Supply (up to 30kVA) 1 phase and neutral
- Bypass Power Supply (above 30kVA) 3 phase and neutral
- 50Hz  $\pm$  2%
- Voltage  $\pm$  10% continuous
- Solidly Earthed type TN-S

Incoming power supply sources to the UPS System (UPS-1 /UPS- 2/Bypass-1/Bypass-2) shall not fall on the same primary Generation/distribution source. It is preferable to provide the bypass incoming supply from a different substation/PCC.

All the input supplies to the UPS shall be provided from SFUs and not from the contactor controlled modules.

#### 4.3.2 Dynamic Variations

Short-time input voltage dips may occur; to a value of rated voltage minus 20%.

Transient high frequency voltage spikes of 2kV superimposed on the rated voltage may be expected owing to, for instance, a high-rupturing capacity (HRC) fuse blowing.

The UPS shall withstand input surges and randomly phased over voltages on the AC Input Power Supply.

#### 4.3.3 Inrush


The UPS inrush current shall be within the agreed fuse characteristics provided by Contractor and recommended by the Vendor in the Tender.

#### 4.3.4 Harmonic Currents

The Vendor shall state the maximum harmonic currents supplied to the UPS and whether a harmonic filter is supplied.

When reduced values of harmonic currents are required in the requisition either a filter or 12 pulse operation may be offered.

For equipment rated 60kVA or more, 12 pulse operation shall be offered as an alternative to 6 pulse. Choice of equipment to be provided shall be agreed with IOCL.

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#### 4.4 **UPS AC Output Power Supply**

##### 4.4.1 System

Unless otherwise specified the system shall be:

- 110 VAC, 1 phase and neutral, two wire for Instrumentation.
- 240 VAC for Telecommunications, IT, Information Technology, Security systems, CCTV systems equipment.
- 50Hz
- Solidly Earthed type TN-S
- Unless otherwise stated, stand up time is 60 min.

##### 4.4.2 Static Variations

The maximum allowable voltage variations are plus 2% and minus 2% of rated voltage as set, on rated balanced load, all power factors and □ 4% on maximum unbalanced load (no load one phase).

The frequency shall not vary more than plus 2% and minus 2% of its rated value.

Output voltage shall be manually variable by plus 3% and minus 3%.

##### 4.4.3 Dynamic Variations

The dynamic output variations are not critical for a duration not exceeding 100 ms, but any voltage variation shall be limited to plus 10% and minus 5% during 0-100%-0 load changes. After the 100 ms period the permissible voltage fluctuations shall be within the rated static limits. The frequency variations shall not exceed the rated static limits.

##### 4.4.4 Voltage Transients

The following peak voltage transients shall not be exceeded following a change in steady state conditions.

1st cycle      30% of steady state peak

2nd cycle      15% of steady state peak

Recovery to steady state shall be complete within 4 cycles


The required output voltage transient specification shall be maintained for transfers of 100% of the design load.

##### 4.4.5 Frequency

The output load shall not experience a rate of change of frequency greater than 0.3 Hz per second unless specified.

The inverter shall continue to operate at the limit of its own internal frequency standard should the standby supply exceed the specified output frequency tolerance. It shall operate like this until the bypass supply returns to within limits.



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#### 4.4.6 Harmonic Distortion

The equipment shall be capable of running continuously delivering maximum continuous RMS rated current under the following load characteristics.

|              |                    |
|--------------|--------------------|
| 3rd harmonic | 44% of fundamental |
| 5th harmonic | 33% of fundamental |
| 7th harmonic | 18% of fundamental |
| 9th harmonic | 7% of fundamental  |

The total harmonic distortion of the voltage waveform of the a.c. output shall not exceed:

- a) 5% at the fundamental frequency when supplying a linear load within the maximum short time rating.
- b) 10% at the fundamental frequency when supplying any load within the maximum short time rating.

The Vendor shall advise the maximum allowable crest factor of output current which shall not be less than 2.1.

#### 4.4.7 Load Power Factor

The AC output linear load power factor will be between 0.7 lag and 1.00 at fundamental frequency.

The equipment rating must allow further compensation for a non-linear load consisting of switch mode power supplies.

The equipment shall be rated for both linear and non linear load of any proportion.


#### 4.4.8 Power Output

The UPS shall be continuously rated to supply 100% of the design load connected to the AC output power supplies distribution board. The UPS shall also be capable of supplying 150% of the design load for at least 30 seconds and 125% for 10 minutes.

The UPS shall be capable of supplying start-up surges, rms and peak operating currents associated with the non-linear load demands defined for the system.

The UPS shall be capable of operating within the specified output limits continuously during the specified time directly from the battery after failure of the electricity supply, for all of the following conditions and for all combinations of these conditions:-

- a) Any load and power factor within rated values
- b) AC output voltage variation within the stated limits
- c) Battery out of circuit and maximum battery volts
- d) Rectifier and/or battery charger out of circuit

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- e) No AC mains input
- f) The specified minimum and maximum ambient temperature variations

#### 4.5

#### DC Power System

The rectifier/battery charger DC output capacity shall be rated to:

- maintain the battery at floating charge while the inverter is on any load between zero and full load at a power factor within the inverter rating.
- charge the battery from fully discharged or agreed battery cell voltage condition to its nominal capacity within 12 hours while the inverter is on full load at any power factor within the inverter rating.

Battery arrangements, charging facilities and capacities shall be provided to meet the requirements of the battery and inverter under the worst conditions e.g. minimum and maximum operating and battery room temperature at the worst simultaneous loading conditions, whilst maintaining the DC output supply within the specified parameters. While sizing the battery, temperature correction factor and ageing factor shall be considered in addition to the maintenance factor. Factors applied shall be agreed by IOCL.

The charger shall deliver rated DC output when AC input voltages and frequency variations combine in the worst possible manner. The battery charger should be capable of maintaining about +/- 1% DC output for +/- 10% AC input voltage variation from no load to full load and over full range input frequency variation.

Rectifier/charger ripple shall be within battery manufacturers limits and should be less than 2% (ripple =  $V_{rms}$  of alternating components of load voltage waveform/DC component voltage) with the battery disconnected and through 5% to 100% UPS load.

Batteries shall be rated for the maximum ambient temperature of 42.4°C for discharge duty.


The battery life shall be stated in the Tender. The battery shall perform the full specified duty throughout its life.

#### 4.6

#### Fault Clearance

When the inverter is not synchronised to the Bypass Supply, the inverter shall deliver sufficient short circuit current to cause output circuit fuse links having current rating near to 10% of the UPS rated output current, to interrupt the short circuit current within 5 milliseconds. The main output circuit fuse links shall be in accordance with IEC 60269-2. The rated duration of maximum current limit amperes shall be stated and should preferably be one second or more at twice rated normal continuous current.

When the inverter is synchronised to the bypass supply, fault currents in excess of the current limit shall be transferred momentarily to the bypass supply for fast fault clearance within 10 milliseconds. This time shall be confirmed by the Vendor for the largest outgoing fuse. Alternatively fault

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currents need not be transferred to bypass if the above fast clearance can be achieved by the UPS.

The Vendor shall co-ordinate the characteristics of each protective device for automatic disconnection with the source impedance, factory set current limit and system earthing so as to provide a disconnection time within the maximum allowable by local regulations for fault clearance and removal of touch voltage. This applies to all protection devices both with and without transfer to bypass supply. Vendor shall advise in the tender the largest outgoing supply fuse rating which can comply with the above. Protection shall comply with IEC 62040-1-2.

Where MCCBs are specified in the requisition, the above requirements shall equally apply to MCCBs.

## 5.0 DESIGN AND CONSTRUCTION

### 5.1 General

The UPS shall be designed and constructed in accord with IEC 62040.

The system shall be designed to operate for a minimum of two years maintenance free.

The entire equipment, including batteries, battery control equipment, etc., shall be self-contained in factory assembled, metal enclosed cubicle(s) which shall be free standing and suitable for floor fixing and back to wall mounting.

Access for installation and maintenance shall be from the front. Cubicle doors shall have lockable handles.

The batteries shall be installed in a separate battery room, suitable for rack mounting and shall have isolation switch.

Battery overcurrent protection shall be supplied as Table 1 of IEC 62040-1-2.

For redundant systems, all components of one system shall be mechanically and electrically separated from other parallel systems.


It shall be possible to maintain the rectifier, battery, inverter, static switch or bypass transformer independently from each other, without affecting the UPS output and safety of personnel.

Racks shall be single or multi-tier to reduce the required floor space to a minimum. The racks shall be such that the bottom of the lowest tier, lowest step is at least 300mm above floor level.

The cubicle/racks for batteries shall permit easy inspection of all cells and shall give adequate support to the cells and resistance to corrosion by acid or alkali.

### 5.2 Degree of Protection

The degree of protection for all indoor equipment, other than large batteries mounted on racks without cubicles, shall be a minimum IP 42, to IEC 60529.

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### 5.3 Cooling

All UPS's shall be naturally cooled unless otherwise agreed by IOCL. Any special precautions required to ensure proper cooling must be specified in detail.

If forced ventilation is necessary it shall be provided to give the rated output. However, in case of failure of the forced ventilation it shall be possible to run the system at rated load for half an hour and at reduced load (about 75%) continuously without any damage to the system.

When forced ventilation is necessary the Vendor shall ensure:

- Air filters are provided
- Fan power is derived from the inverter output via Dual 100% fans
- There is sufficient clearance around the equipment
- A failure alarm is fitted
- Temperature detection shall be incorporated which will be arranged to prevent damage to the system due to over temperature in event of total fan failure

It must be possible to repair either fan with the other working and to maintain air filters without isolating equipment.

### 5.4 Rectifier/Battery Charger

The rectifier shall be of the constant-voltage, current-limiting type, suitably protected against over-loading, with floating output (free from earth) and shall be capable of supplying the inverter with the battery disconnected, the inverter output voltage remaining within the specified tolerance.

The battery charger shall be provided with automatic current limit control.

Means shall be provided (e.g. by blocking diodes) to prevent the inverter voltage moving outside the specified tolerance as a result of faults on the rectifier, battery or battery charger.


The arrangement shall be combined rectifier and battery charger for feeding the inverter.

Only the inverter will be connected to the rectifier/battery terminals. The rectifier shall be able to charge the battery to 80% capacity within 10 hours whilst also supplying 100% of the inverter load requirements.

The application of voltage-dropping diodes and parallel contactors and/or similar devices in series with the DC output to limit the voltage range is not acceptable.

A 0-72 hr equalise timer shall be provided, where applicable. Charger shall automatically return to float charge at end of time interval selected.

Float boost charge shall be manually selectable/or automatically initiated following a period of deep discharge (Ni-cad only).

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## 5.5

### Battery

The battery shall be assembled in mechanically self supporting transparent or translucent containers to form a leak-proof assembly.

Vent plugs shall be spray proof.

The battery cell terminals intercell and other connectors shall have adequate current carrying capacity and mechanical strength. Connectors shall be solid copper, and must be insulated.

The cell terminal posts shall be equipped with connector bolts having corrosion resisting nuts and shall be sealed against creepage of electrolyte.

Each battery cell or group of cells shall be numbered.

A battery monitoring system shall be provided for determining the state of batteries without affecting plant operations.

**Plante' Lead acid type to be provided for greater reliability.**

The ventilation of battery compartments shall conform to IEC 62040-1-2 and where flooded battery cells with low antimony alloy or with recombination plugs are needed to meet the requirements, it shall be stated in the Tender.

## 5.6

### Operation of Inverter and Transfer Switch

Under normal conditions the load shall be supplied continuously from the inverter with the battery floating on a float charge system.

Under 'input failed' conditions the inverter shall continue to supply the load for the period specified in the requisition with no break in output or loss of performance by deriving its supply from the battery.


In the event of any fault in the inverter, or the inverter output voltage falling below a preset value (adjustable from 80% to 95%) or rising above a preset value (adjustable from 105% to 115%). The load shall be automatically switched to a 'stand by' mains-fed 'By-pass' transformer via the transfer switch without interruption to the output voltage. Manual control of this system shall also be incorporated to enable a controlled maintenance shutdown of the inverter system to be made without disturbance of the load.

Load retransfer from the mains bypass to the inverter shall only be possible when:

- The inverter output voltage is within  $\pm 10\%$  of the nominal output voltage for more than 5 seconds, and
- The inverter output and mains bypass voltages are synchronised.

Dual redundant UPS units are combination of two single modules and will provide dual distribution scheme with associated double input source of uninterruptible power to loads. Two identical UPS (each comprising rectifier/battery/inverter/static switch/manual bypass switch and bypass transformer) operate similar to standalone single system and connected to the distribution board. The distribution board shall have two incomers and a bus coupler facility to operate 2 out of 3.



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## 5.7 Inverter

The inverter shall be of self-commutating solid static unit with electronic voltage regulation. It shall be possible to start up the inverters with power only available from the associated batteries.

Under-and over-voltage and frequency monitoring with adjustable settings shall be provided.

The inverter shall be automatically disconnected from the DC supply if the minimum allowable inverter input voltage level is reached (partially discharged battery) or when the inverter output is outside the stated voltage and frequency tolerance.

The inverter unit shall be designed to operate from the rectifier output without the battery in circuit. Filters shall be provided at the input of inverter unit to reduce the feedback from the inverter to the battery and charger if required.

Automatic adjustable current limits shall be included to protect the inverter against overloads or short circuits at the output. As long as an overload exists, the device shall limit an output current to a value which will not damage the inverter or operate its protective equipment. Once the overload is removed, the inverter shall automatically resume normal operation at full voltage.

The power supply shall have sufficient regulation to feed into a fault without dropping the voltage to a level which would prevent the faulty circuit being isolated by its protective device.

The transient behaviour (duration and magnitude) of the output voltage wave for an instantaneous change of load from no-load to full load and vice versa and from half load to full load and vice versa shall be given.

## 5.8 UPS Switches

### 5.8.1 General

UPS switches and contactor shall comply with IEC 60146-5 and IEC 60947.


Isolators and switches shall match the maximum continuous load rating of the UPS and any short term overload rating. They shall have load break, fault make capability and be fitted with ON/OFF indicators.

Mechanical Contactors shall be solenoid-operated air-break type, rated for continuous operation to class AC-3 for AC contactors and DC-2 for DC. They shall be capable of making onto peak asymmetrical let through fault current permitted by the MCCB/fuse upstream, and of holding in until the fault has been cleared by the MCCB or fuse.

### 5.8.2 Transfer Switch

A static transfer switch shall be mounted integrally within the UPS system enclosure.

The function of the switch shall be to connect the load to bypass supply, on failure or operation outside limits of the inverter, within 4 ms, i.e. an effective

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no-break. In the absence of a suitable standby supply the transfer switch shall not operate.

The load transfer switching devices may comprise either continuously rated static elements in both inverter and bypass circuits, or continuously rated electro-mechanical switching devices with short-time rated static-elements.

The bypass circuit shall have a continuous current rating equivalent to the rated output of the UPS unit and be capable of conducting the load current transients (inrush currents and fault clearing currents) and peak load.

#### 5.8.3 UPS Maintenance Bypass Switch

A manually-operated bypass switch shall be provided to bypass the transfer switch and isolate the UPS from the load for maintenance purposes. The transfer shall be made to and from the standby supply without interruption to the load, by momentarily paralleling the output of the inverter with the standby supply. The neutral shall also be switched.

Isolators shall be included to permit on-line isolation of the inverter, and static switch.

The maintenance bypass switch shall be mounted in a separate enclosure from the UPS cabinet to allow the UPS cabinet to be electrically isolated or completely removed for maintenance.

#### 5.8.4 Isolation

The FBA must have adequate means of isolating each source of supply in order that maintenance can be done in safety on each major section without interfering with the operation of other equipment.

Fully insulated withdrawable links or double pole isolating switch shall be provided for isolation of the battery supply for maintenance purposes. All incoming and outgoing switches shall have provision for locking in the "Off" position.

### 5.9 **Transformers**


Where the standby AC supply is at a different voltage from the inverter loads, and/or where additional supply stability is required, a bypass transformer shall be provided.

The bypass transformer shall be a noise-suppression dry type, of rating not less than that of the UPS, located in its own enclosure or in the bypass switch enclosure.

The bypass transformer shall be double wound with earthed screen designed to prevent primary side transients appearing on the secondary side.

Where specified, a voltage stabilising transformer meeting the UPS output static voltage criteria and the input frequency criteria shall be provided.

The converter and bypass transformers shall be designed to operate with non sinusoidal current and shall be suitably rated to supply the harmonic circuits of the non-linear load.

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## 5.10 Distribution Board

The Vendor shall provide a distribution board, either integral with the UPS or separately mounted.

All switching shall include the neutral pole unless specified otherwise.

Each branch circuit of the UPS distribution shall have a fused disconnect switch. The fuse shall be fast clearing type and fuse rating shall be co-ordinated with the rating of the UPS System. Normally the largest branch circuit load shall not exceed 25% of the UPS system rating.

Each UPS ACDB shall have at least 10% spare feeders for future use by owner.

UPS shall have dual ACDB and sized to cater to 10% future loads.

## 5.11 Indication and Alarms

### 5.11.1

#### Presentation

The following are acceptable:

- A simple line diagram on exterior of cubicles. Flush mounted controls, lamps and meters on the front of the cubicles. All indicating instruments shall be industrial grade to IEC 60051, square face type with 90 degree scales. Indicating lamps shall have a life not less than 10,000 hours when operated at maximum voltage tolerance. Alarm lamps or an annunciator with lamp test shall be provided
- A microprocessor controlled mimic panel with either a liquid crystal display or LED's. Provision for remote display on a host computer or on a remote supervisory station via a modem may be offered. The Tender shall advise details. Failure of LED or LCD shall not cause UPS maloperation or affect remote signals

### 5.11.2


#### Indication

All controls, indication and meters shall be flush mounted on the front panel, and shall demonstrate in a comprehensive manner the status of all major UPS items continuously.

The following meters or equal shall be provided on the front of the cubicles:

#### **Battery Charger/Rectifier System**

|                |  |
|----------------|--|
| D.C. voltmeter | Output Volts                                   |
| D.C. ammeter   | Battery charge/discharge current (offset zero) |
| D.C. ammeter   | Rectifier output current                       |

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### **Inverter/Static Switch System**

|                 |  |
|-----------------|--|
| A.C. voltmeter  | With selector switch for inverter output, by-pass output or static switch output |
| A.C. ammeter    | Output current.  |
| Frequency meter | Via same selector switch as for a.c. voltmeter                                   |

Three phase equipment shall have phase selection for current and voltage.

Any other indications necessary for the satisfactory operation and control of the FBA shall be provided, and should include the following:

- AC input supply 'on' (all phases)
- Inverter Synchronised      Lamp is lit when output is synchronised with input
- Sources Synchronised      Lamp is lit when normal and standby sources are in synchronism
- Static switch on-line      "Normal" is the Inverter Supply. ("Standby" is the Alternate By Pass Supply)
- By-pass on-line
- Inverter on-line
- Rectifier Healthy      Lamp extinguishes if a rectifier fuse is blown or if rectifier is in an alarm condition
- Inverter Healthy      Lamp extinguishes if an inverter protective device has operated or the inverter is in an alarm condition
- Static Switch Healthy      Lamp extinguishes if the static switch is in an alarm condition

A lamp test facility shall be included.

A simple mimic should be provided.

### 5.11.3

#### **Alarms**


Alarms shall show in which section the alarm has originated and the reason that a particular operation, (e.g. static switch operation), has taken place.

The alarm facilities offered shall be detailed in the Tender.

A common alarm shall be provided for each UPS. The common alarm shall operate a single fail-safe, flag type and hand reset relay with adjustable time delay for the Contractors external alarm. This external alarm contact shall be a changeover type, volt free and rated at 110V d.c./240V a.c., 2 amps (resistive).

The following alarm conditions shall be indicated and appropriately labelled:

- a) At each static switch:

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- i) Mains by-pass supply frequency out of limits
  - ii) By-pass supply voltage out of limits, or not available
  - iii) Static switch on bypass
  - iv) Control circuit fault
  - v) AC output supplies lost
- b) At each charger:
  - i) Loss of AC mains supply
  - ii) Earth fault on DC battery or load
  - iii) Rectifier charger failure/fuse failure
  - iv) High DC voltage, in excess of recharge voltage
  - v) Low charger output voltage
  - vi) battery isolated
  - vii) charger current limited operating
  - viii) over voltage trip for sealed recombination cells
- c) At each inverter panel:
  - i) AC output high/low voltage
  - ii) overload
  - iii) inverter failure
  - iv) output frequency out-of-limits
  - v) Inverter not in synchronism with by pass supply
- d) Cabinet high temperature:
- e) Ventilation equipment failure (where applicable)

## 5.12 Interlocks


All units shall be provided with a complete set of mechanical interlocks to prevent incorrect operation and to provide safety for personnel in addition to any external interlocks specified for operational reasons.

All necessary electrical interlocks shall be provided in addition to those specific electrical interlocks detailed in the requisition.

## 5.13 Earth Bonding

All metallic non-current carrying parts shall be effectively bonded together and connected to a high conductivity copper main earth bar which shall be electrically continuous over the entire length of the UPS.

The main earth bar shall have provision at each end for the termination of the external earth conductor.

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Particular attention shall be given to the effective earthing of all metallic parts including door mounted equipment. Reliance shall not be placed on hinges to maintain earth continuity.

#### 5.14 **Neutral to Earth Connection**

The neutral to earth connection of the UPS Output power supply system shall be accessible, removable for test purposes and clearly identified.

The output neutral connection to earth shall be taken via a removable link to a separate terminal which Contractor may connect to a different earth system from that of the input system. The equipment shall be despatched with the neutral connected to the UPS main earth point, via a removable link.

#### 5.15 **Cable Connections**

Materials for the complete termination of all incoming and outgoing cables and cores of the sizes and types specified in the requisition for power cables and protection, control, indication and alarm cables shall be provided. Cable glands for outgoing cables will be supplied by Contractor.

Facilities and materials shall be provided for equipotential bonding of the cable armour/lead sheath to the UPS protective conductor.

Cable entries shall be from the base unless specified otherwise and a suitable gland plate shall be fitted to accommodate all cables.

Unless otherwise specified, gland plates shall be removable and supplied undrilled.

All external connections between separate battery and inverter/charger system shall be made by the Contractor.

#### 5.16 **Wiring**

##### 5.16.1 General

Unless otherwise specified on the data sheet secondary wiring shall be carried out in black PVC insulated single core stranded cable to IEC 60227 with a minimum cross sectional area of 1.5 sq. mm.

All wiring taken to components on a hinged door shall be provided with additional protection such as flexible conduit.


Individual cores shall be permanently identified at both ends by means of numbered and/or lettered ferrules, or coloured coded sleeves.

Terminal blocks for external connections shall be of a suitable non-loosening type, arranged for one conductor per terminal, fitted with a crimped type connector.

Proprietary type cross-connecting links shall be used where conductors are to be 'commoned' together.

The terminal blocks shall be located to afford easy access for termination, testing, shipping and maintenance.



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Terminations shall be arranged in functional groups, each group-being clearly labelled.

Any terminals which are accessible and which of necessity are required to remain energised shall be screened-off or shrouded to prevent danger. WARNING labels shall be fitted.

Segregation shall be maintained between AC and DC circuits.

Terminals operating at different voltages or performing different functions shall be segregated from each other.

Conductor sizing and configuration shall reflect the rms or heating value of the currents with allowance for non-linear harmonics. Neutral conductors from the wye secondary of transformers supplying non-linear loads should have an ampacity of at least 1.73 times the phase conductors.

All inter panel wiring shall be provided and, wherever practical, the design shall be suitable for panels to be delivered to WORK SITE bolted together and with all their inter panel wiring connected, in order to keep WORK SITE installation work to a minimum.

#### **5.17 Circuit Breakers and Fuses**

Circuit breakers shall comply with IEC 60947-2. Fuses shall comply with IEC 60269 and shall be of the current limiting type except where fuses of a particular national or international standard are required, in the requisition. The Vendor shall provide all fuses to the required specification.

Main fuses shall be either mounted in fuse carriers or they shall be capable of switch isolation. Auxiliary fuses shall be mounted in fuse carriers.

Fuse carriers shall be such that they shall provide degree of protection IP 20 when they are being withdrawn normally or when completely withdrawn.

Fuse carriers and bases complying with IEC 60269 shall be black for fuses and white for links.

#### **5.18 Anti-Condensation Heaters**

Anti-condensation heaters shall be provided within the UPS. Anti-condensation heaters shall be thermostatically controlled if necessary to prevent overheating and shall have a power supply which is completely separate from the UPS system.


#### **5.19 Labels**

Danger or warning/cautionary notices shall attached directly to the equipment in appropriate locations.

All labels shall be indelible and attached using durable, non-corrodible fixings.

Labels shall be provided to indicate the method of operation.

All items of equipment mounted on the operating face of the UPS shall be provided with labels.

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Rating plates shall be securely fixed to the equipment to which they relate such that they are clearly visible and legible.

Battery nameplates shall also include battery voltage and where relevant type and specified gravity of electrolyte fully charged and discharged.

## **6.0 INSPECTION AND TESTING**

### **6.1 General**

Within one month of order, the Vendor shall re-submit the proposed tests for IOCL approval.

Before final inspection by the Contractor/IOCL, the Vendor shall confirm satisfactory completion of all routine tests and shop inspection.

### **6.2 Testing**

The Vendor shall carry out the complete range of routine tests and such type and additional tests as are defined herein and in the requisition. The equipment shall be type and routine tested in the factory as a complete UPS in accord with IEC 62040-3 clause 6.1.1 and 6.1.2.

Tests are to include but shall not be limited to the following:


- a) Interconnection cable check and a full visual check of the UPS
- b) Light load test (for a duration agreed with the IOCL prior to functional tests)

The UPS shall be tested using the same type of batteries as are to be used in the final installation. Tests with actual batteries will be performed at Work Site.

Where appropriate, tests shall be carried out covering all modes of operation. These shall demonstrate that the equipment performs in accordance with all the requirements of the specification including operation with the battery disconnected from the system.

- c) Checking of auxiliary devices
- d) Synchronisation (Type Test certificate only)
- e) AC input failure test
- f) AC input return test
- g) Simulation of parallel redundant UPS fault (when applicable)
- h) Transfer test
- i) Load test

One converter of each group of identical converters purchased shall have a full heat run at rated power factor for an agreed period whilst monitoring critical temperatures on SCR heat sinks, transformers and output filters. Temperature to be calculated for max ambient.

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- j) UPS efficiency (Type test certificate only)
- k) Unbalanced Load test for 3 phase units (Type Test certificate only)
- l) Output voltage unbalance (Type Test certificate only)
- m) Current division in parallel UPS (Type Test certificate only)
- n) Battery ripple current (to be part of load test)
- o) Ventilation Test (to be part of load test)
- p) Overload capability test (to be part of load test at maximum temperature)
- q) Short circuit fuse test. Fuse type and size to be agreed. All fuses required to be tested with the oscilloscope on the output remaining stable.

Special attention shall be paid to checking that fuses operate when an inverter is operating under current limit and that there will be co-ordination between fuses within the apparatus and those specified for the primary power supply.


- r) Restart (to be part of load test)
- s) Output voltage modulation (to be part of load test and shall include any load surge conditions. Load step changes shall be 0-50, 50-100 and 0-100% and vice versa Record voltage critical response time)
- t) Harmonic components (to be part of load test)
- u) Insulation tests as IEC 60146-1-1 Clause 4.2
- v) For Distribution board, routine tests as IEC 60439-1

**Note** If Type test certificate have not been supplied to Contractor, the test shall be done on one UPS.

## 7.0 DESPATCH

The Vendor must advise the Contractor how many days the battery can be safely stored off charge. The despatch of valve regulated batteries shall not proceed until it is confirmed by Contractor that suitable charging facilities will be available at Work Site before the uncharged shelf life of the battery is exceeded.


Upon despatch, a warning label shall be fitted to valve regulated batteries stating the date by which they must be connected to a charger. Batteries shall be stored on charge by the Vendor until despatch.

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## ATTACHMENT 1 STANDARDS


All relevant IEC Standards including the following specific standards.

| Standard        | Subject  |
|-----------------|--|
| IEC 62040-1-2   | Uninterruptible power systems (UPS). General and safety requirements for UPS used in restricted access locations   |
| IEC 62040-2     | Uninterruptible power systems (UPS). Electromagnetic compatibility (EMC) requirements  |
| IEC 62040-3     | Uninterruptible power systems (UPS). Method of specifying the performance and test requirements  |
| IEC 60146-1-1   | Semiconductor convertors - General requirements and line commutated convertors - Part 1-1: Specifications of basic requirements  |
| IEC 60950-1     | Safety of Information Technology Equipment- Safety – Part 1: General requirements  |
| IEC 60747/60748 | Semiconductor Devices  |
| IEC 60439-1     | Low voltage switchgear and control gear assemblies   |
| IEC 60947       | Specification of low voltage switchgear and control gear   |
| IEC 60529       | Specification for degrees of protection provided by enclosures   |
| IEC 60269       | Cartridge fuses for voltages up to and including 1000V d.c. and 1500V a.c.   |
| IEC 60076       | Power Transformers   |
| IEC 60227       | Specification PVC insulated cables for switchgear and control gear wiring  |
| IEC 60051       | Direct acting indicating analogue electrical measuring instruments and their accessories   |
| IEC 60073       | Colours of indicating lights, push buttons annunciators and digital read outs  |
| IEC 60617       | Guide for graphical symbols for electrical power, telecommunications and electronics diagrams  |
| IEC 61000-6-2   | Electromagnetic compatibility (EMC) Part 6-2: Generic standards – Immunity for industrial environments   |
| IEC 61000-6-4   | Electromagnetic compatibility (EMC) Part 6: Generic standards – Section 4: Emission standard for industrial environments   |
| IEC 61000-3-2   | Electromagnetic compatibility (EMC). Limits. Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 16 A      |
| IEC 61000-3-12  | Electromagnetic compatibility (EMC). Limits. Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16A and ≤ 75A per phase |

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## ATTACHMENT 2 INFORMATION REQUIRED

1. The Vendor shall, in his tender, itemise on a separate sheet headed  
' Deviation from Specification' every deviation from the specification together with the reasons for non-compliance. Where there are no deviations, the Vendor shall state "None".  
  
Agreed deviations from the specification shall be subject to written acceptance by Buyer.
2. The Vendor shall complete and return the data sheets which are attached to the requisition. The Vendor may copy the data sheets.
3. The Vendor shall provide the following:
  - 3.1 Evidence of type-test certificates to prove that the equipment has, been successfully tested by a recognised international testing authority. in accordance with the specific standards listed in Attachment 1 and the requisition.
  - 3.2 Evidence shall also be submitted to verify that type-tests for dielectric mechanical endurance, together with temperature rise for components and assemblies of components as a Factory Built Assembly, have been carried out satisfactorily.
  - 3.3 The Vendor shall provide Type Test Certificates for each type and rating of equipment offered, for review and acceptance by IOCL.
  - 3.4 Estimated total assembly weight and dynamic load of each UPS with overall and shipping dimensions, front and rear access space, cable entry areas and location, and foundation details.
  - 3.5 Comprehensive specification of all equipment complete with descriptive literature.
  - 3.6 Details of the proposed paint finish which shall be suitable for the specified environmental and service condition.  
  
Special finish requirements, if any, together with details of the final coat colour shall be as specified in the requisition.
  - 3.7 Full details of 'Spare Parts and Consumables'.

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### **ATTACHMENT 3     DRAWINGS, DATA AND DOCUMENTATION**


1. The Vendor shall provide all drawings data and documentation as specified in the requisition and Purchase Order.
2. The Vendor shall ensure that his drawing sizes and their title blocks satisfy IOCL requirements for the project.

Unless otherwise specified in the data sheets, Vendors shall use symbols in accordance with an accepted international standard.

This shall also apply to all drawings provided by the Vendor's sub-Vendors and materials Vendors.

3. After receipt of Purchase Order and before fabrication, the Vendor shall submit for review and acceptance the following documents in accordance with the time schedule specified in the purchase documents:
  - a) Index of drawings and documents to be issued. (Vendors Documents Index)
  - b) General arrangement drawings of the UPS and Batteries giving overall dimensions, weights, dynamic loading and identification key of major items.
  - c) Schematic diagrams.
  - d) Connection or terminal diagrams.
  - e) Panel layout drawings, including details of positions and dimensions of all cable entries and terminations.
  - f) Battery sizing calculations.
  - g) Heat losses.
  - h) Details of, and time/current curves for all protective devices.
  - i) Material list giving manufacturers and specifications of individual major bought in components.
  - j) Floor fixing details and space requirements for withdrawal and access.
4. On completion of works tests and acceptance of the equipment, the Vendor shall forward to the Contractor, the specified number of sets of the following documents:
  - a) Details of all routine test results on the UPS together with the results of any type, or special tests required by the requisition.



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- b) Operation and maintenance manuals for each rating and type of UPS included in the purchase order.

These documents shall be bound in A4 folders and shall include at least the following information:

- i) Fully descriptive index
  - ii) List of drawings issued as above
  - iii) Detailed specification for each type of UPS and Battery
  - iv) Instructions for erecting and placing in service
  - v) Instructions for routine maintenance
  - vi) List of spare parts for normal operation and maintenance
5. Vendor shall issue a procedure for the on site preservation of the equipment during the construction storage period.

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|   |                           | CLIENT                                   | INDIAN OIL CORPORATION LIMITED                        |               |              |
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## JOB SPECIFICATION FOR ELECTRICAL POWER AND CONTROL CABLES

|      |            |                   |          |         |          |            |
|------|------------|-------------------|----------|---------|----------|------------|
|      |            |                   |          |         |          |            |
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| REV. | DATE       | DESCRIPTION       | PREPARED | CHECKED | APPROVED | AUTHORIZED |

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|  |                                  | <b>CLIENT</b>                                   | <b>INDIAN OIL CORPORATION LIMITED</b>                            |              |  |
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## 1.0 INTRODUCTION

**INDIAN OIL CORPORATION LIMITED (IOCL)** has awarded Fax of Acceptance (FOA) dated 29<sup>th</sup> August 2019 to M/s. Technip India Limited (TPIL) for Consultancy services (PMC/EPCM services) for overall project management, FEED Review / FEED, Detailed Engineering, Procurement & expediting services, Tendering & award, Construction Management & Supervision, Assistance in start-up, Commissioning & performance test runs for installation of a Standby SRU of 525 TPD capacity and execution of Additional tanks for Paradip Refinery, Odisha, India.

## 2.0 DEFINITIONS & ABBREVIATIONS


Wherever used in this procedure, the following words shall have the meaning as given hereunder:

| Abbreviation     | Definition /Expanded form  |
|------------------|--|
| IOCL / CLIENT    | Indian Oil Corporation Limited   |
| PMC / CONSULTANT | Technip India Limited  |
| CONTRACTOR       | Party whose services are obtained for performing the works specified as part of LSTK / packages.                       |
| VENDOR           | Any third party supplying the equipment / materials for setting up the Plant   |
| PROJECT          | Indicates Standby SRU and Additional tanks Project, Paradip Refinery   |
| SRU              | Sulphur Recovery Unit  |
| UNIT             | Indicates any particular portion of the project to be built which can be Process related or Utilities/Offsites related |

## 3.0 GENERAL

### 3.1 Scope

This document describes the minimum requirements for the design, manufacture, testing, packing and supply of Power and Control cables for use on the IOCL Paradip Refinery Complex India.

|  |                                  |   |  |              |  |
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### 3.2 Specifications

- 3.2.1 This job specification for supply shall be read in conjunction with relevant data sheet.
- 3.2.2 If any conflict arises among the documents, the order of precedence of documents shall be as follows
- Statutory regulations.
  - Data Sheet
  - Scope of Supply
  - Job specification for supply
- 3.2.3 Manufacturer must declare in the offer any exception and / or deviation from the job specification for supply. The lack of any declaration and / or deviation shall be considered as full compliance with the job specification for supply.

### 3.3 Standards

The Power and Control Cables, Cable jointing & terminating accessories shall comply with latest edition of the following standards as applicable.

Where ever Indian standards does not exist, the relevant international standards shall apply.

|                |  |
|----------------|--|
| IS: 209        | Specification for zinc.  |
| IS: 694        | PVC insulated cables for working voltages up to & including 1100V                                |
| IS: 1554       | PVC insulated (heavy duty) electric cables.  |
| IS: 3961 (Pt2) | Recommended current ratings for cables: Part-2 PVC insulated and PVC sheathed heavy duty cables. |
| IS: 3975       | Mild steel wires, strips and tapes for armouring of cables.                                      |
| IS: 5831       | PVC insulation and sheath of electric cables.  |
| IS: 7098-1&2   | Cross-linked polyethylene insulated PVC sheathed.  |
| IS: 8130       | Conductors for insulated electric cables and flexible cords                                      |



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|---------------------------|---|
| IS: 10418                 | Drums for electric cables.  |
| IS: 10462<br>(Pt-1)       | Fictitious calculation method for determination of dimensions of protective coverings of cables: Part-1 Elastomeric and thermoplastic insulated cables. |
| IS: 10810(Pt41)           | Methods of Test on cables. Mass of zinc coating on steel Armour.  |
| IS: 10810<br>(Pt58,61,62) | Oxygen index, flame retardant, & fire resistance test for bunched cables  |
| IS: 13573                 | Joints and terminations for polymeric cables for working voltages from 6.6 kV up to and including 33 kV, Performance requirement and type tests.        |
| IEC: 60183                | Guide to the selection of High Voltage Cables.  |
| IEC: 60228                | Conductor for insulated cables.   |
| IEC: 60331                | Fire Resisting characteristics of electric cables.  |
| IEC: 60332                | Tests on electric and optical fibre cables under fire conditions. Set of standards (332-1 & 332-3C).  |
| IEC: 60502                | Extruded solid dielectric insulated power cables for rated voltages from 1 kV up to 30 kV (Um36kV).   |
| IEC: 60540 &<br>60540A    | Test methods for insulation & sheaths of electric cables.   |
| IEC: 60754                | Test on gases evolved during combustion of materials from cables.   |
| IEC: 60811                | Electric and optical fibre cables. Test methods for non-metallic materials. All applicable parts.   |
| IEC.60840                 | Power cables with extruded insulation for rated voltages 30 to 150 kV.  |
| IEC: 61034                | Measurement of smoke density of electric cables burning under defined conditions.   |
| EN ISO 4589               | Oxygen Index Method   |
| ASTM: D2863               | Standard method of test for flammability of plastic using oxygen index method.  |

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|                             |   |
|-----------------------------|---|
| ICEA S-61-402<br>/ NEMA-WC5 | Thermoplastic insulated wire and cable for transmission and distribution of electrical energy   |
| ICEA S-66-524<br>/ NEMA-WC7 | Cross linked thermosetting polyethylene insulated wire and cable for transmission and distribution of electrical energy                                   |
| BS 5467                     | Thermo setting insulated cables 600 to 1000 volt grade  |
| BS 6387                     | Test method for Resistance to fire for cables   |
| BS 7846                     | Electric cables – 600/1000V armoured fire resistant cables having thermosetting insulation & low emission of smoke & corrosive gases when affected by air |

The cables shall also conform to the provision of Indian Electricity rules and CEA / CEIG regulations and other statutory regulations currently in force in the country.

### 3.4 Abbreviations


The acronyms used in this document have the meaning defined below:

|      |   |
|------|---|
| AC   | Alternating Current                       |
| DC   | Direct Current                            |
| IS   | Indian Standards                          |
| IEC  | International Electrotechnical Commission |
| PVC  | Polyvinyl Chloride                        |
| DGMS | Director General of Mines and Safety      |
| MV   | Medium Voltage                            |
| HV   | High Voltage                              |
| XLPE | Cross-linked polyethylene                 |

## 4.0 GENERAL REQUIREMENTS

### 4.1 Ambient Conditions

- 4.1.1 All cables shall be suitable for indoor & outdoor installation and satisfactory continuous operation in typical refinery or chemical plant atmosphere (humid, salt laden, dusty and corrosive) and for the site conditions as defined in data sheet.

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4.1.2 Cables installed outdoors shall be able to withstand prolonged exposure to direct sunlight and high atmospheric temperatures.

4.1.3 Cables installed below ground in hydrocarbon areas shall be suitably sheathed and shall be hydrocarbon resistant.

## 4.2 General Characteristics

4.2.1 All cables shall be suitable for following type of installations:

- Above ground fastened to cable racks or trays in the open air exposed to direct sunlight.
- Direct buried in the ground (including water/chemical logged ground).
- In underground ducts / trench filled with sand.
- Below ground in enclosed air-filled trenches, fastened to cable racks or trays.

4.2.2 The requirements listed in this specification are to be considered as the minimum requirements.

4.2.3 All cables shall be circular in cross section and compact. Vendor shall advise when cables are not circular and substantially compact, as these cables will require barrier type glands

4.2.4 Fillers shall be extruded and non hygroscopic.

4.2.5 Cables connected in parallel shall be of the same type, cross-section and terminations.

4.2.6 All power and control cables shall be in single continuous lengths (except for long feeder where the length of such feeder is above the manufacturing range of approved cable manufacturers) without any splices or intermediate joints. In no case the joint shall be located in hazardous area.

4.2.7 The cables shall be rodent proof and underground cables shall be termite proof where necessary and type of termite proofing subject to approval.


## 4.3 Special Characteristics

4.3.1 When required, cables shall have all or some of the following characteristics. The characteristics shall be established with the successful outcome of the test laid down in reference codes.

- Flame retardancy complying with the standard IEC 60332-1.

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- Flame Retardant/fire propagation complying with the standard IEC 60332-3.
- Fire resistance complying with the standard IEC 60331.
- Low level of smoke emission complying with the standard IEC 61034-1 and 2.
- Amount of halogen acid gas complying with the standard IEC 60754-1.
- Low limit of acidity of gases complying with the standard IEC 60754-2.
- Hydrocarbon resistance: the non-metallic external sheath shall be resistant to hydrocarbons, in accordance with standards like DIN-VDE 0472-803, ENI 0181.00, etc.

Such specific requirements as applicable shall be indicated in the data sheet.


## 5.0 CONSTRUCTION AND FABRICATION

### 5.1 General

- 5.1.1 The outer sheath of all cables covered in this specification shall possess flame non-propagation, self-extinguishing characteristics in accordance with IEC 60332 and IS-10810 part 61-64, unless otherwise specified in the data sheet. The outer sheath shall also be UV resistant.
- 5.1.2 The minimum value of oxygen index shall be 29% at (27 + 2) °C.
- 5.1.3 The overall diameter of the cable in millimetres (mm) shall be strictly as per the value declared by the manufacturer in the technical information subject to a maximum tolerance of ±2 mm up to overall diameter of 60mm and ±3 mm for beyond 60mm.
- 5.1.4 PVC/ Rubber end caps shall be supplied free of cost for each drum with a minimum of eight per thousand-meter length. In addition, end of the cables shall be properly sealed with caps to avoid ingress of water during transportation and storage. Drums shall be suitable for long term outdoor storage at site.
- 5.1.5 Cable ends shall be sealed and fixed to the drum so that both ends are accessible.
- 5.1.6 To protect the cable during shipment battens shall be fitted around the entire periphery of the drum.
- 5.1.7 Cable shall have a minimum design lifetime of 25 years.
- 5.1.8 The cables shall be protected against solvent penetration and corrosive attack. In addition, suitable chemicals shall be added into the PVC compound of the outer sheath to protect the cable against

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rodent and termite attack. The finished cable shall be compact, the insulation and other components shall be concentric, of uniform thickness and easily separable using simple procedures without damaging the underlying components. Fillers shall occupy the whole space between cable cores.

- 5.1.9 Thickness at any point may be less than the specified value provided that the difference does not exceed 0.1mm +10% of the specified value.

## 5.2 Conductors



- 5.2.1 Conductors shall be either aluminium or copper as specified in data sheet.
- 5.2.2 If aluminium is specified, it shall be plain aluminium of grade H2 or H4 as per IS 8130 / IEC 60228.
- 5.2.3 If copper is specified, it shall be high conductivity annealed copper as per IS 8130 / IEC 60228.
- 5.2.4 For all power and lighting cables, the conductors shall be stranded compacted circular conductors.
- 5.2.5 All control cables shall be XLPE, armoured type with copper conductors, FRLS PVC outer sheath twisted pair overall shielded type.
- 5.2.6 The vendor shall manufacture all cables with circular conductors; any deviation from this to shaped conductors is not acceptable without prior approval.
- 5.2.7 Cable feeding mobile equipment shall be class 5.

**Special Note:** The cables used in installation under the jurisdiction of Director General of Mines and Safety (DGMS), shall be of copper conductor only and shall have valid DGMS approvals for the specified locations. The word "Mining Cable" shall be embossed / engraved on the cable outer sheath as per the applicable Indian standards.

## 5.3 Cross sections

- 5.3.1 Minimum cross sections shall be:
- 2.5 mm<sup>2</sup> copper conductor for MV Power, Control and Lighting cables
  - 25 mm<sup>2</sup> Aluminium conductor for MV Power cable
  - Minimum power cable size for HV cables shall be determined based on short circuit levels.
- 5.3.2 Maximum cross sections shall be:
- 300 mm<sup>2</sup> for multicore armoured cables, unless otherwise specified in datasheet.
  - As specified in the data sheet / BOQ for single core cables

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5.3.3 Cross sections of reduced neutral shall be as per table -1 of IS 1554-1 for PVC insulated cables and Table-2 of IS-7098 -1 for XLPE insulated cables.

#### 5.4 Conductor screening

5.4.1 All cables rated above 1.9/3.3 kV shall be provided with conductor screening. The conductors shall be provided with non-metallic extruded semi conducting screen. Semiconductor layers shall be easily distinguishable from the insulation.

#### 5.5 Insulation

5.5.1 Insulation shall be extruded cross linked polyethylene insulation (XLPE) for all cables.

5.5.2 The insulation shall be applied over the conductor by extrusion and shall conform to the requirements of applicable standard as indicated below:

- XLPE insulation for conductor operating temperature of 90°C shall confirm to IS 7098-1 / IS7098-2 as applicable.

#### 5.6 Insulation screening

5.6.1 All cables rated above 1.9/3.3 kV shall be provided with insulation screening. The insulation screen shall have two parts namely non-metallic part and non-magnetic part.



5.6.2 Non-metallic part shall be applied directly over the insulation of each core and shall consist of a non-metallic extruded semiconducting compound.

5.6.3 The non-magnetic copper screen/tape (metallic part) shall be applied over the non-metallic part of all the three cores together. Unless specified otherwise, this copper screen/tape shall be capable of carrying the single line to ground fault current value and the duration as specified in the data sheet.

5.6.4 The conductor screen, XLPE insulation and insulation screen shall be extruded in one operation by triple extrusion process to ensure perfect bonding between the layers. The core identification shall be as per clause 5.10.3

#### 5.7 Inner sheath

5.7.1 The inner sheath shall be applied over the laid-up cores by extrusion and shall be of PVC conforming to the requirements of IS 5831 / IS 1554 / 7098 as indicated below.

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- For XLPE insulated Cable
  - i. Inner sheath material: Type ST2 Compound as per IS 5831
  - ii. Thickness of inner sheath: as per IS 7098-1 / 7098-2 as applicable

5.7.2 Single core cables (without screening) shall have no inner sheath. In case of cables with screening, there shall be extruded inner sheath between insulation metallic screen and armouring.

## 5.8 Armouring

5.8.1 The cable armouring shall be one of the following types:

- Metal wire armour;
- Metal tape armour;
- Metal braid armour.

5.8.2 For single-core cables armour shall be of non-magnetic material.

5.8.3 Armour construction shall be made in accordance with applicable Indian / International standards. Unless otherwise specified round wires made of galvanized steel shall be used. Metal wire armour shall consist of wires, which form a helix. Wires shall be wound closely together in order to have an almost closed and uniform cylindrical surface. Where the diameter under armour does not exceed 13 mm, round wire shall be used, however for greater than 13 mm flat wire armour may be used.

5.8.4 Requirement and methods of tests for armour material and uniformity of galvanization shall be as per IS-3975 and IS-10810 (Part 41). The dimensions of armour shall be as per IS-1554-1 / IS-7098 (Part-1 & 2, Method (b)) as applicable.

5.8.5 Armour of single core cable shall be H4 grade hard drawn aluminium round wire.



5.8.6 For mining cables, the size and type of armour shall be such that the combined conductance of armour shall be equivalent to 75% of the conductance of the largest conductor of the cable.

5.8.7 If tape armour is specified, it shall consist of two tapes wound in the same direction and forming an open helix. When requested tapes will be galvanized.

## 5.9 Outer sheath

5.9.1 The outer sheath shall be applied over the armouring by extrusion and shall be of PVC conforming to



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the requirements of IS 5831 / IS 1554 / 7098 as indicated below. The extruded PVC Outer sheath shall be of FRLS type.

- For XLPE insulated Cable
  - i. outer sheath material: Type ST2 Compound as per IS5831
  - ii. Thickness of inner sheath: as per IS 7098-1 / 7098-2 as applicable

5.9.2 The outer sheath of all cables covered in this specification shall possess flame non-propagation, self-extinguishing characteristics in accordance with IEC 60332 and IS-10810 part 61-64, unless otherwise specified in the data sheet.

5.9.3 The Fire-resistant cables shall meet the following additional requirement. The cables to Fire Proof MOVs shall be of "Fire Resistant" type.



- The cable shall have mica glass tape below or above insulation
- The cable shall meet requirement of circuit integrity test for a minimum period of 3 hours exposure at maximum temperature of 750°C or 950°C suitable for the application.

## 5.10 Marking and Identification Colours

5.10.1 The following information shall be indelibly marked or engraved on outer surface of all cables and it shall be marked along the entire length of cables at every 1m interval:

- Manufacturer's name and year of manufacture
- Type of cable
- Number of conductors and cross-section
- Core/Pair numbering
- Voltage Grade
- Manufacturing specification
- Material of outer sheath
- Fire-resistance class according to standard
- Sequential marking of the length of cables in meters.

The embossing / engraving shall be legible and indelible

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#### 5.10.2 Outer sheath identification colours:

Unless otherwise specified colours of the outer sheaths shall be black.

#### 5.10.3 Core identification colours;

Power cable: Red, Yellow, Blue for phases and Black for reduced neutral core unless specified otherwise in the data sheet. For single phase services with phase, neutral and PE, colour identification shall be Red for phase, Black for neutral and Green/Yellow for PE, unless specified otherwise in the data sheet.

Control cable: Black with sequential numbering indelibly marked from 5 conductors and above, while same as for phase identification of power cable up to 4 conductors, unless specified otherwise in the data sheet.

### 5.11 Lengths Tolerance

5.11.1 Negative tolerance on cable length of cable drums is not acceptable. Positive tolerance allowed shall not be more than 2% unless specified otherwise in the data sheet. No payment shall be made for excess length of cable above the allowed positive tolerance.

## 6.0 CABLE ACCESSORIES



6.1 The termination and straight through jointing kits for use on the system shall be suitable for the type of cables offered as per this specification.

6.2 The accessories shall be supplied in kit form. Each component of the kit shall carry the manufacturer's mark of origin.

6.3 The kit shall include all stress grading, insulating and sealing materials apart from conductor fittings and consumable items. An installation instruction sheet shall also be included in each kit.

6.4 The content of the accessories kit including all consumable shall be suitable for storage without deterioration at a temperature of 45°C, with shelf life extending to more than 5 years.

6.5 Terminating kits: The terminating kits shall be suitable for termination of the cables to an indoor switchgear or to a weatherproof cable box of an outdoor mounted transformer/motor. For outdoor terminations, weather shields/ sealing ends and any other accessories required shall also form part of

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the kit. The terminating kits shall be from one of the makes/types mentioned in the data sheet.

- 6.6** Jointing kits: The straight through jointing kits shall be suitable for installation on overhead trays, concrete lined trenches, and ducts for unground burial with uncontrolled backfill and possibility of flooding by water and chemicals. These shall have protection against any mechanical damage and suitably designed to be protected against rodent and termite attack. The inner sheath similar to that provided for cables shall be provided as part of straight through joint. The jointing kits shall be from one of the makes/types mentioned in the data sheet.

Proper voltage grade of end terminations and cable jointing kits shall be provided. For example, in 6.6kV (UE) system, 11 kV (E) grade to be used.



## **7.0 INSPECTION AND TESTS**

### **7.1 Fabrication and Quality Control Plan and Inspections**

- 7.1.1 Inspection and testing activities shall be defined by the Manufacturer on the Fabrication and quality control plan based on the minimum requirements established on Technip Inspection and Test Plan (ITP).
- 7.1.2 During the manufacturing period, the Cables could be subject to inspection, to ascertain that only quality raw material is used, by Technip inspectors or by others appointed by Technip or by the Client.
- 7.1.3 The Manufacturer shall allow free access of workshop to the inspector, shall give all information required and shall make available all copies of internal orders to other sub-suppliers.
- 7.1.4 These tests shall be performed either on all finished cable lengths or on samples of completed cables

### **7.2 Test Procedure**



- 7.2.1 The tests shall be carried out in Manufacturer workshop at his care and expense. Even in case Technip waives to witness the tests, the Manufacturer shall draw up the certificate of the tests carried out containing a full report and all the results and the measures of the tests.
- 7.2.2 The tests shall be carried out in accordance with the requirements of IS / IEC codes and of the Inspection and Test Plan.

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## 8.0 PACKING

- 8.1** Cables shall be dispatched in non-returnable wooden/ steel drums of suitable barrel diameter, securely battened with take-off end fully protected against mechanical damage. The wood used for construction of the drum shall be properly seasoned and free from defects and wood preservative shall be applied to the entire drum. All ferrous parts shall be treated with a suitable rust preventive coating to avoid rusting during transit or storage. Cable drums shall conform to IS: 10418 (Specification for drums of electric cables).
- 8.2** Cables shall be wound in continuous single lengths in drums and shall be delivered in standard manufacturing drum length unless specific length is required. Cables shall be properly protected against damage during transportation and storage. Cable ends shall be fixed to the drum. Cables ends shall be sealed and protected prior to fixing the drum. Drums shall be covered with suitable material, to provide physical protection during transit.
- 8.3** The internal diameter of drums shall be not less than twice the minimum permissible bending radius.
- 8.4** The cables may be stored outdoor for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains / high ambient temperature, unless otherwise agreed.
- 8.5** Drum length shall be continuous. Cable or conductor jointing in any form is not acceptable
- 8.6** Cable ends shall be fitted with a heat shrink cap to prevent entry of moisture inside the cable and shall be fixed to the drum
- 8.7** Cable Drum;
- Cable drums shall be indelibly marked as follows;
- Drum Number (Assigned by CONTRACTOR)
  - Requisition Number and Project Name
  - Requisition Item Number
  - Rated Voltage
  - Cable Type

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- Manufacturer's name and year & month of manufacture
- Number and cross-section of Cores / Pairs
- Length of cable on the drum (in Metres)
- Net & Gross weight
- Any special marking / identification in compliance with codes such as BIS certification mark, shall be printed

An arrow shall be printed on the drum with suitable instruction to show the direction of rotation of the drum on both the flanges.

Unless otherwise specified, Cables shall be supplied in drum lengths as follows

|     |   |       |
|-----|---|-------|
| i   | MV Cables (1.1 kV Grade)  |       |
|     | Multicore power cables up to 6 mm <sup>2</sup>                            | 1000m |
|     | Multicore power cables from 10 mm <sup>2</sup> up to 300 mm <sup>2</sup>  | 500 m |
|     | Single core power cables up to 630 mm <sup>2</sup>                        | 1000m |
|     | Control cables up to 61 cores   | 1000m |
| ii  | HV power cables – up to 11 kV (UE) grade                                  |       |
|     | Three core cables up to 300 mm <sup>2</sup>                               | 500 m |
|     | Single core cables up to 400 mm <sup>2</sup>                              | 1000m |
|     | Single core cables above 400mm <sup>2</sup> and up to 630mm <sup>2</sup>  | 750 m |
| iii | HV Power cables – Above 11kV (UE) grade and up to 33kV(UE) grade          |       |
|     | Three core cables up to 300 mm <sup>2</sup>                               | 350 m |
|     | Single core cables up to 400 mm <sup>2</sup>                              | 1000m |
|     | Single core cables above 400mm <sup>2</sup> and up to 1000mm <sup>2</sup> | 500 m |

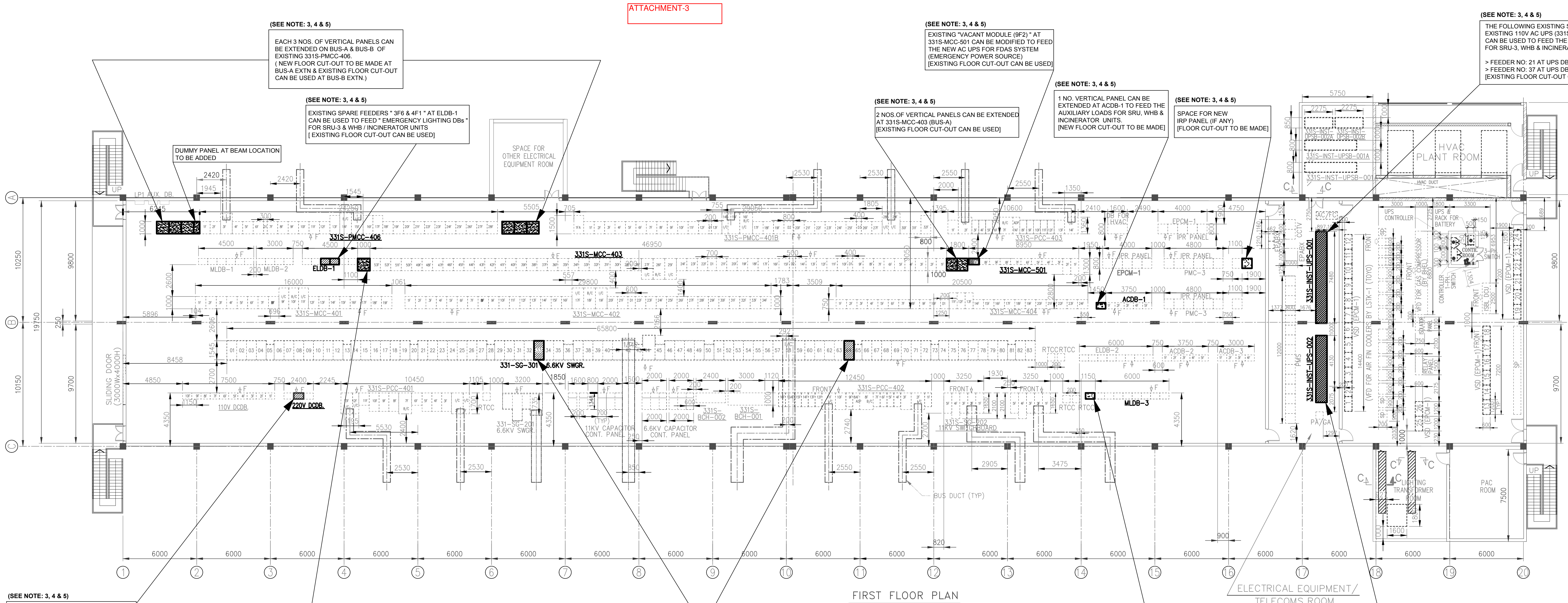
- 8.8** Drum with short non-standard lengths are liable for rejection. If non-standard drum lengths are specified in the data sheet, the same shall be supplied.

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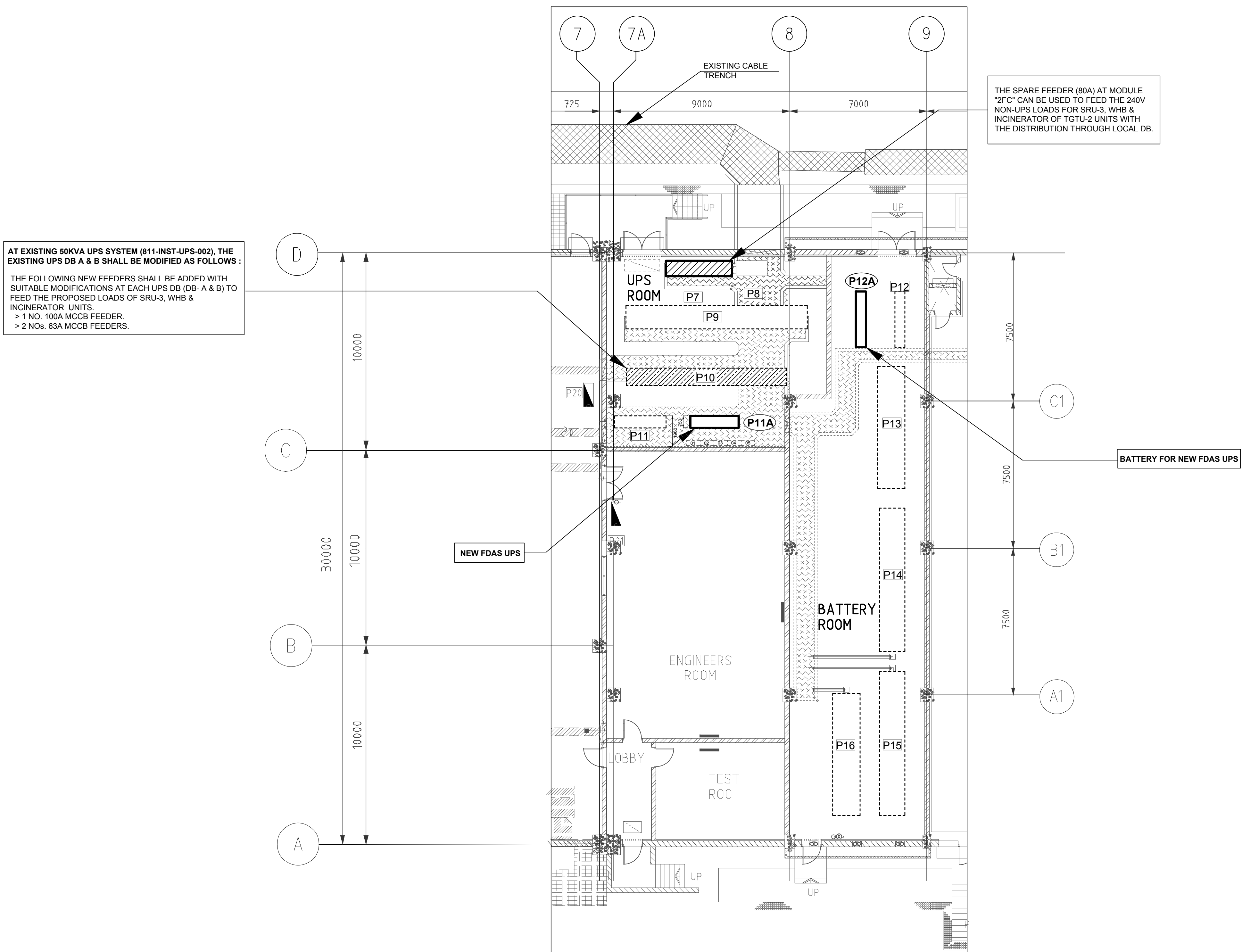
## 9.0 VENDOR DOCUMENTATION

Vendor shall submit the drawings and documents as listed in “Vendor Documentation Schedule” / “Supply Requisition (SR)” attached to the Material Requisition for CONTRACTOR / OWNER's Approval prior to manufacturing.





SUBSTATION EQUIPMENT LAYOUT (SS-331S) [SEE NOTE : 2]



UPS / BATTERY ROOM LAYOUT AT EXISTING SRR-811  
(SEE NOTE : 2)

NOTES:

- ALL DIMENSIONS ARE IN MM., UNLESS OTHERWISE SPECIFIED.
- THE INTENT ON THIS DRAWING IS TO SHOW THE LOCATION OF PROPOSED ELECTRICAL EQUIPMENT FOR 'SRU, WHB & INCINERATOR OF TGTU-2 UNITS' IN EXISTING SUBSTATION BUILDING (SS-331S) / SRR-811 AND CONCEPTUAL CABLE ROUTING INSIDE SUBSTATION & SRR-811 BUILDING.
- THE PROPOSED EQUIPMENT LOCATION & RESPECTIVE CABLE ROUTING INSIDE SUBSTATION BUILDING / SRR-811 SHOWN IN THIS DRAWING IS INDICATIVE AND FOR GUIDANCE PURPOSE ONLY. THE SAME SHALL BE REVALIDATED / MODIFIED BY LSTK CONTRACTOR ACCORDING TO ACTUAL REQUIREMENT AND SITE CONDITIONS DURING DETAIL ENGINEERING.
- THE PROPOSED SUBSTATION EQUIPMENT TO BE EXTENDED (OR) MODIFIED ON EXISTING SWITCHBOARD SHALL BE OF SAME MAKE/MODEL AND IDENTICAL W.R.T THE RATING & DIMENSIONS OF EXISTING SWITCHBOARD.  
FOR THE DETAILS OF MODIFICATIONS ON EXISTING SWITCHBOARDS, REFER FOLLOWING DOCUMENTS ATTACHED WITH TENDER.  
> 080557C-088-JSS-1652-001 : TECHNICAL SPECIFICATION FOR HV SWITCHGEAR MODIFICATIONS.  
> 080557C-088-JSS-1654-001 : TECHNICAL SPECIFICATION FOR MV SWITCHGEAR MODIFICATIONS.
- FOR THE PROPOSED EQUIPMENT, THE EXISTING FLOOR CUT-OUT SHALL BE USED TO THE EXTENT POSSIBLE. WHEREVER THERE IS NO FLOOR CUT-OUTS ARE AVAILABLE, REQUIRED FLOOR CUT-OUT SHALL BE PROVIDED BY LSTK CONTRACTOR IN CONSULTATION WITH SITE ENGINEERING IN-CHARGE.

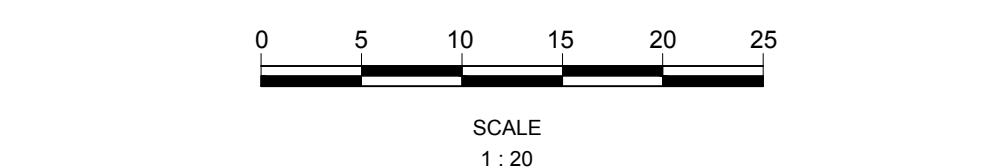
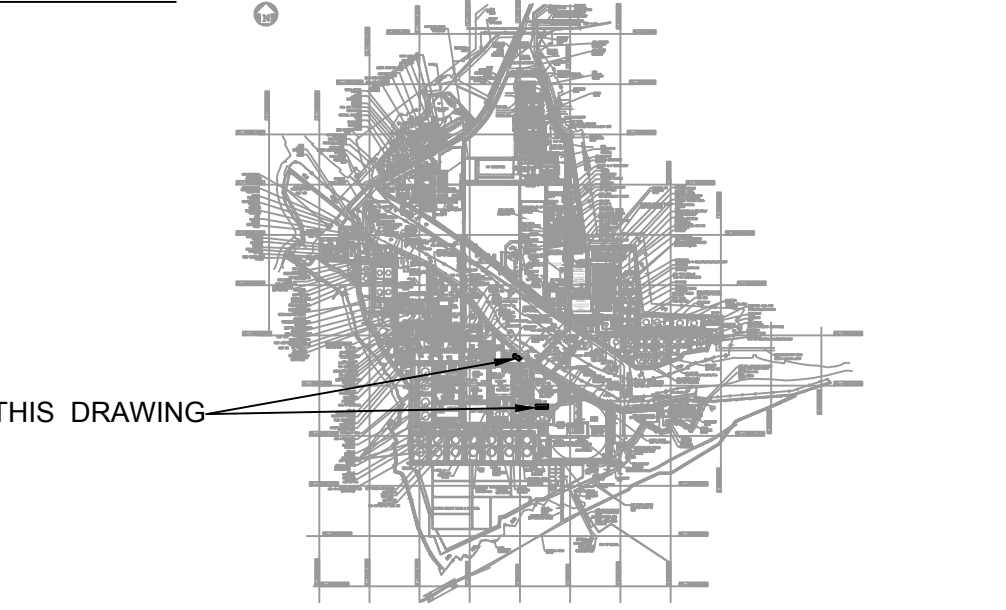
LEGENDS

- EXISTING EQUIPMENT
- NEW EQUIPMENT
- \* NEW VERTICAL PANELS \* TO BE EXTENDED ON EXISTING SWITCHBOARD TO FEED PROPOSED LOADS
- \* EXISTING SPARE FEEDER \* AT EXISTING SWITCHBOARD TO FEED PROPOSED LOADS
- \* EXISTING EQUIPMENT TO BE MODIFIED TO FEED PROPOSED LOADS
- PROPOSED CABLE TRENCH
- EXISTING CABLE TRENCH
- EXISTING CABLE LEDDERS
- PROPOSED CABLE TRAY ROUTING IN EXISTING SUBSTATION

REFERENCE DOCUMENTS / DRAWINGS

| DRAWING NO.               | DRAWING TITLE   |
|---------------------------|---|
| 080557C-088-JSD-1600-001  | ELECTRICAL DESIGN BASIS   |
| 080557C-000-STD-1682-001  | POWER INSTALLATION STANDARDS  |
| 080557C-088-DW-1622-001   | CONCEPTUAL ELECTRICAL INTERFACE CABLE ROUTING GUIDE DRAWING (SRU-3, WHB & INCINERATOR OF TGTU-2 (UNIT-088 & 090)) |
| PDPR0275-8532-72-811-0001 | POWER & EARTHING LAYOUT SRR-811   |
| 080557C-088-DW-1500-001   | CONCEPTUAL LAYOUT FOR INSTRUMENT MAIN CABLE WAY (SRU-3 (088), WHB & INCINERATOR OF TGTU-2 (090))                  |

KEY PLAN



| Rev   | Date       | Description of Issue | Written by                         | Checked by | Approved by | Authorized by |
|---|------------|----------------------|------------------------------------|------------|-------------|---------------|
| A   | 09.12.2019 | ISSUED FOR DESIGN    | BR                                 | CG         | SV          | JMC           |
| DOCUMENT CATEGORY                               |            |                      | DOCUMENT REVIEW STATUS (BY CLIENT) |            |             |               |
| (USE "X" MARK)                                  |            |                      |                                    |            |             |               |
| <input type="checkbox"/> APPROVAL               |            |                      |                                    |            |             |               |
| <input type="checkbox"/> REVIEW                 |            |                      |                                    |            |             |               |
| <input checked="" type="checkbox"/> INFORMATION |            |                      |                                    |            |             |               |

PROJECT  
**STANDBY SRU & ADDITIONAL TANKS**  
IOCL PARADIP REFINERY, ODISHA, INDIA

OWNER  
**INDIAN OIL CORPORATION LTD.**

PMC  
**TechnipFMC**  
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TITLE  
CONCEPTUAL EQUIPMENT & CABLE ROUTING LAYOUT  
EXISTING SUBSTATION SS-331S & UPS / BATTERY ROOM AT SRR-811  
(THE - IN FOR SRU-3, WHB & INCINERATOR OF TGTU-2 UNITS) (UNITS- 088 & 090))

| SCALE | DRAWING NO.             | PAGE | REV.     |
|-------|-------------------------|------|----------|
| 1:20  | 080557C-088-DW-1625-001 | 001  | 01 OF 02 |







| REV | DATE       | DESCRIPTION       | WRITTEN | CHECKED | APPROVED | AUTHORIZED |
|-----|------------|-------------------|---------|---------|----------|------------|
| C   | 29.05.2020 | ISSUED FOR DESIGN | SRT     | CG      | SV       | JMC        |
| B   | 10.03.2020 | ISSUED FOR DESIGN | SB      | CG      | SV       | JMC        |
| A   | 10.12.2019 | ISSUED FOR DESIGN | NM      | CG      | SV       | JMC        |

**DATA SHEET FOR AC UPS**

|  |  |
|--|--|
| PROJECT : STANDBY SRU & ADDITIONAL TANKS, IOCL - PARADIP REFINERY<br>CLIENT : INDIAN OIL CORPORATION LIMITED | PROJECT N°. 080557C001    UNIT 000    DOCT. CODE SP 1671    SERIAL N° 001    REV C    SHEET 1 of 3 |
|--|--|

TO BE COMPLETED BY PURCHASER

|    |  |   |      |         |
|----|--|---|------|---------|
| 1  | General specification:                                       | 080557C-000-JSS-1671-001  |      |         |
| 2  | Manufacturer:  |   |      |         |
| 3  |  |   |      |         |
| 4  | <b>ENVIRONMENTAL CONDITIONS</b>                              |   |      |         |
| 5  | Installation (indoor/outdoor) / Ambient Type                 | Indoor  |      |         |
| 6  | Ambient Temperature  | Max: 42.4 °C  | Min: | 11.3 °C |
| 7  | Design Ambient Temperature                                   | 42.4 °C   |      |         |
| 8  | Altitude (if > 1000m)/Relative Humidity                      | 3.91 m above Indian mean sea level (IMSL)   |      | 95%     |
| 9  |  |   |      |         |
| 10 | <b>GENERAL REQUIREMENTS</b>                                  |   |      |         |
| 11 | System Voltage/Frequency and variation/Phases                | 415 ± 6% V   50 ± 3% Hz   N°: 3   |      |         |
| 12 | System fault level   | 50 / 65 kA for 1 second   |      |         |
| 13 | System neutral earthing / Distributed neutral                | Solid earthing <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  |      |         |
| 14 | Upstream protection (supplied by others)                     | CB  |      |         |
| 15 | Operating conditions   | Stand alone <input type="checkbox"/> Parallel <input checked="" type="checkbox"/> Dual redundant <input type="checkbox"/>               |      |         |
| 16 | Input isolation transformer requirement                      | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 17 | Changeover inverter / by-pass                                | Manual <input checked="" type="checkbox"/> Automatic <input type="checkbox"/>   |      |         |
| 18 | Output power at PF=0.8                                       |   |      |         |
| 19 | Output Voltage/Frequency/Phases                              | 110 ± 1% V   50 ± 1% Hz   No: Single  |      |         |
| 20 | Output neutral system / Distributed neutral                  | Earthed <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>                                    |      |         |
| 21 | Overall efficiency of the system at 100% loading             | > 80%   |      |         |
| 22 | PF of the system at the input side                           | 0.8   |      |         |
| 23 | <b>GENERAL CHARACTERISTICS</b>                               |   |      |         |
| 24 | <b>Battery-charger</b>                                       |   |      |         |
| 25 | Quantity / sizing  | 1 no. for each UPS  |      | 100 %   |
| 26 | Auto. changeover floating / recharging                       | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 27 |  |   |      |         |
| 28 | <b>Inverter</b>  |   |      |         |
| 29 | Quantity / sizing  | 1 no. for each UPS  |      | 100 %   |
| 30 |  |   |      |         |
| 31 | <b>By-pass / Static switch</b>                               |   |      |         |
| 32 | Manual by-pass switch  | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 33 | Quantity of by-pass switch / Type                            | 1 no. for each UPS  |      |         |
| 34 |  |   |      |         |
| 35 | <b>Bypass stabilizer</b>                                     |   |      |         |
| 36 | Back-up transformer rated primary voltage                    | 415 V   |      |         |
| 37 | No. of phases primary / secondary                            |   |      |         |
| 38 | Connection symbol and vector group                           |   |      |         |
| 39 | Off circuit tap changer / Tap range & NO. of steps           | Yes <input type="checkbox"/> No <input type="checkbox"/>  |      |         |
| 40 | Voltage regulator type at output (static, servo-controlled)  | Static  |      |         |
| 41 |  |   |      |         |
| 42 | <b>Battery</b>   |   |      |         |
| 43 | Battery quantity / sizing (100%)                             | 1 no.   |      | 100 %   |
| 44 | Battery automatic switching-off upon end of discharge        | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 45 | Type (vented, gas recombination,...) / (Lead acid, Ni-Cd)    | Vented <input checked="" type="checkbox"/> Ni-CAD <input type="checkbox"/>  |      |         |
| 46 | Battery life time / Autonomy                                 | 24 hours and 5 minutes  |      |         |
| 47 | Nominal cell voltage   | 1.2 VDC   |      |         |
| 48 | End of discharge voltage                                     | 1.1 VDC   |      |         |
| 49 | Delivery cells (filled, dry) / electrolyte (liquid, dry)     |   |      |         |
| 50 | Location / mounting (cubicle, stands) / No. of tiers & steps | Stands <input type="checkbox"/>   |      |         |
| 51 | Battery isolating breaker or switch / Type / location        | yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 52 | Isolating breaker shunt trip coil / external reset switch    | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> |      |         |
| 53 | Battery earthing   | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 54 | <b>Distribution board</b>                                    |   |      |         |
| 55 | Location   |   |      |         |
| 56 | Main breaker qty / type per board                            |   |      |         |
| 57 | Bus-tie / Automatic transfer sequence                        |   |      |         |
| 58 | Outgoer qty / type per board                                 | As per JSS  |      |         |
| 59 | Outgoer with tripping coils/earth protection                 | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> |      |         |
| 60 | Output isolation transformer                                 | yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 61 |  |   |      |         |
| 62 | <b>CONTROL</b>   |   |      |         |
| 63 | Battery-charger On/off                                       | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 64 | Changeover switch- float charging / recharging               | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 65 | Recharging adjustable current set value                      | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 66 | Recharging adjustable voltage set value                      | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 67 | Recharging operation duration timer                          | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 68 | Battery disconnecting switch                                 | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 69 | Inverter output adjustable voltage set value                 | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 70 | Inverter output adjustable frequency set value               | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 71 | System isolation/ maintenance switch (make before break)     | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 72 | Battery capacity testing facility from UPS                   | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 73 | Inverter On/off  | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |
| 74 | AC output voltage adjustment/synchro. range adjustment       | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>   |      |         |

**DATA SHEET FOR AC UPS**

PROJECT : STANDBY SRU & ADDITIONAL TANKS, IOCL - PARADIP REFINERY  
CLIENT: INDIAN OIL CORPORATION LIMITED

PROJECT N°. 080557C001 UNIT 000 DOCT. CODE SP 1671 SERIAL N° 001 REV C SHEET 2 of 3

|     |  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
|-----|--|--------------------------------------|-------------------------------------|--------|-------------------------------------|-----|-------------------------------------|----|--------------------------|-----|-------------------------------------|----|--------------------------|
| 75  | <b>MEASUREMENT</b>                                       |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 76  | Voltmeter with selector switch for mains                 | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 77  | Ammeter with selector switch for mains                   | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 78  | Frequency meter for mains                                | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 79  |  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 80  | <b>Battery-charger</b>                                   |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 81  | Voltmeter/ Ammeter for DC output                         | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            | Yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |     |                                     |    |                          |
| 82  | Battery current  | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 83  |  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 84  | <b>Inverter</b>  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 85  | Voltmeter/ Ammeter for output                            | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            | Yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |     |                                     |    |                          |
| 86  | Frequency meter / Output power kW and KVA                | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            | Yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |     |                                     |    |                          |
| 87  |  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 88  | <b>By pass stabilizer</b>                                |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 89  | Voltmeter/ Ammeter for output                            | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            | Yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |     |                                     |    |                          |
| 90  | Frequency meter / Output power kW and KVA                | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            | Yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |     |                                     |    |                          |
| 91  |  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 92  | <b>Distribution board</b>                                |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 93  | Ammeter / voltmeter / frequency meter                    | yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            | yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> | yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |
| 94  | Powerfactor meter / powermeter                           | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            | Yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |     |                                     |    |                          |
| 95  | Multifunction meter with RS-485 or fibre optic cable     | At each incomer of UPS ACDB          |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 96  | <b>MONITORING AND SIGNALLING</b>                         |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 97  | <b>General</b>   |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 98  | Indication lamp  | LED type                             |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 99  | AC mains ON -UPS/ AC mains ON- Bypass                    | yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 100 | Load on inverter/by-pass                                 | yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 101 | AC UPS general fault                                     | yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 102 | Type of remote signal / serial link communication        | RS 232/ RS485/ FO port               |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 103 | General mimic diagram                                    | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 104 | Main supply failure / Common failure alarm               | Local                                | <input checked="" type="checkbox"/> | Remote | <input checked="" type="checkbox"/> |     |                                     |    |                          |     |                                     |    |                          |
| 105 |  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 106 | <b>Battery-charger</b>                                   |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 107 | Battery-charger running                                  | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 108 | Operation modes (floating, recharging, initial charge)   | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 109 | Manual / Automatic operation                             | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 110 | Operation on battery / imminent discharged battery       | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 111 | AC mains undervoltage / Battery-charger failure          | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 112 | DC undervoltage  | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 113 | Battery-ON   | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 114 | Battery-fault  | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 115 | DC earth fault   | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 116 |  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 117 | <b>Inverter</b>  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 118 | DC input ON / Inverter running                           | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 119 | By-pass available  | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 120 | Output voltage normal                                    | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 121 | Synchronizing status                                     | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 122 | Inverter failure   | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 123 | Operation on emergency transfo. / emergency supply fault | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 124 | Inverter overload  | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 125 | Inverter overvoltage/ under voltage                      | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 126 | Static switch failure                                    | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 127 | Cooling fan failure                                      | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 128 | ON line fault diagnostic unit                            | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 129 |  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 130 | <b>Distribution board</b>                                |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 131 | Earth fault detection                                    | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 132 | Circuit breaker tripping                                 | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 133 |  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 134 | <b>FABRICATION DATA</b>                                  |                                      |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 135 | Degree of protection                                     | IP 42                                |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 136 | Cable entry (top, bottom) / access (front, rear)         | Bottom front                         |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 137 | Anti-condensation heaters                                | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            |     |                                     |    |                          |     |                                     |    |                          |
| 138 | Densimeter / Automatic filling device for battery        | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            | Yes | <input type="checkbox"/>            | No | <input type="checkbox"/> |     |                                     |    |                          |
| 139 | Thermometer / Nameplate / connections                    | yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            | yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> | yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |
| 140 | Portable voltmeter / portable earth fault detector       | Yes                                  | <input checked="" type="checkbox"/> | No     | <input type="checkbox"/>            | Yes | <input type="checkbox"/>            | No | <input type="checkbox"/> |     |                                     |    |                          |
| 141 | Painting (Mfr standard,... / color)                      | Manufacturer standard, colour - HOLD |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |
| 142 | Noise level at full load                                 | As per JSS db(A) at m                |                                     |        |                                     |     |                                     |    |                          |     |                                     |    |                          |

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**DATA SHEET FOR AC UPS**

PROJECT : STANDBY SRU & ADDITIONAL TANKS, IOCL - PARADIP REFINERY  
CLIENT: INDIAN OIL CORPORATION LIMITED

PROJECT N°: 080557C001 UNIT: 000 DOCT. CODE: SP 1671 SERIAL N°: 001 REV: C SHEET: 3 of 3

| MANUFACTURER DATA |   |  |   |            |         |                          |       |                          |    |  |
|-------------------|---|--|---|------------|---------|--------------------------|-------|--------------------------|----|--|
| 143               |   |  |   |            |         |                          |       |                          |    |  |
| 144               | <b>General</b>  |  |   |            |         |                          |       |                          |    |  |
| 145               | Bus bar (main and earth) material and size                    | Copper <input type="checkbox"/> Aluminium <input type="checkbox"/> |   |            |         |                          |       |                          |    |  |
| 146               | Heat losses (overall Battery-charger & inverter cubicles)     |  |   |            |         |                          |       |                          |    |  |
| 147               | Efficiency  | 4/4  | % | 3/4        | %       | 2/4                      | %     |                          |    |  |
| 148               | Length / Width / Height (overall)                             |  |   | mm         |         |                          | mm    |                          |    |  |
| 149               | Weight (overall)  |  |   |            |         |                          |       | kg                       |    |  |
| 150               | Overall system MTBF / MTTR                                    |  |   |            |         |                          |       |                          |    |  |
| 151               |   |  |   |            |         |                          |       |                          |    |  |
| 152               | <b>Battery-charger</b>  |  |   |            |         |                          |       |                          |    |  |
| 153               | Execution (Thyristor, Transistor) / 3, 6, 12 pulse            |  |   |            | Npulse: |                          |       |                          |    |  |
| 154               | Rated power in floating mode with fan / without fan           |  |   |            | kW      |                          |       |                          |    |  |
| 155               | Maximum absorbed power / Input peak current                   |  |   |            | kW      |                          |       |                          |    |  |
| 156               | Output rated current  |  |   |            |         |                          | A     |                          |    |  |
| 157               | Output voltage in floating / recharging / initial charge mode |  |   | VDC        |         |                          | VDC   |                          |    |  |
| 158               | Type of cooling / fans redundancy                             |  |   |            | Yes     | <input type="checkbox"/> | No    | <input type="checkbox"/> |    |  |
| 159               | Current limitation at 10mn, 3mn, 1mn, 10s                     |  |   |            |         |                          |       |                          |    |  |
| 160               | Ripple voltage with battery / without battery                 |  |   |            | %       |                          | %     |                          |    |  |
| 161               | Residual ripple battery current                               |  |   |            |         |                          | %     |                          |    |  |
| 162               | Current Harmonics at full load                                | 2nd level:   |   | 5th level: |         | 11th level:              |       |                          |    |  |
| 163               |   | 4th level:   |   | 7th level: |         | 13th level:              |       |                          |    |  |
| 164               | Immunity class / Radiofrequency interference class            |  |   |            |         |                          |       |                          |    |  |
| 165               | Intermediate DC voltage range                                 |  |   |            | VDC     |                          |       |                          |    |  |
| 166               |   |  |   |            |         |                          |       |                          |    |  |
| 167               | <b>Inverter</b>   |  |   |            |         |                          |       |                          |    |  |
| 168               | Technology  |  |   |            |         |                          |       |                          |    |  |
| 169               | Rated power with fan / without fan                            |  |   |            | kW      |                          |       |                          |    |  |
| 170               | Type of cooling / fans redundancy                             |  |   |            | Yes     | <input type="checkbox"/> | No    | <input type="checkbox"/> |    |  |
| 171               | Output voltage regulation steady / step load / recovery time  |  |   |            | %       |                          |       |                          | ms |  |
| 172               | Output voltage adjustment                                     |  |   |            |         |                          |       |                          | %  |  |
| 173               | Frequency regulation network synchronised/unsynchronised      |  |   |            | %       |                          |       |                          | %  |  |
| 174               | Frequency adjustment  |  |   |            |         |                          |       |                          | %  |  |
| 175               | Output voltage harmonics with linear / non linear load        |  |   |            | %       |                          |       |                          | %  |  |
| 176               | Minimum acceptable crest factor                               |  |   |            |         |                          |       |                          |    |  |
| 177               | Semi-conductor max t° (125% rating)/Max current (120% rating) |  |   |            | °C      |                          |       |                          | A  |  |
| 178               | Inverter current limitation at 10mn, 3mn, 1mn, 10s            |  |   |            |         |                          |       |                          |    |  |
| 179               | Allowable overload  |  |   |            |         |                          |       |                          |    |  |
| 180               |   |  |   |            |         |                          |       |                          |    |  |
| 181               | <b>By-pass / Static switch</b>                                |  |   |            |         |                          |       |                          |    |  |
| 182               | Maximum allowable short-circuit current                       |  |   |            | kA      |                          |       |                          |    |  |
| 183               |   |  |   |            |         |                          |       |                          |    |  |
| 184               | <b>Bypass stabilizer</b>                                      |  |   |            |         |                          |       |                          |    |  |
| 185               | Manufacturer / type   |  |   |            |         |                          |       |                          |    |  |
| 186               | Rated power / rated secondary voltage at no load              |  |   |            | kVA     |                          |       |                          |    |  |
| 187               | No load losses / total losses                                 |  |   |            | kW      |                          |       |                          |    |  |
| 188               | Short-circuit impedance at 75°C / Peak current                |  |   |            | %       |                          |       |                          |    |  |
| 189               | Type of insulation / Insulation class / Type of cooling       |  |   |            |         |                          |       |                          |    |  |
| 190               | Transfo. Panel cooling / fans redundancy                      |  |   |            |         |                          |       |                          |    |  |
| 191               | Type of enclosure (transfo box, in panel)                     |  |   |            |         |                          |       |                          |    |  |
| 192               |   |  |   |            |         |                          |       |                          |    |  |
| 193               | <b>Battery</b>  |  |   |            |         |                          |       |                          |    |  |
| 194               | Manufacturer / type   |  |   |            |         |                          |       |                          |    |  |
| 195               | Rated voltage / No. of cells                                  |  |   |            | VDC     |                          |       |                          |    |  |
| 196               | Voltage per cell floating / boost                             |  |   |            | VDC     |                          |       |                          |    |  |
| 197               | Capacity battery fully charged /after hours of discharge      |  |   |            | Ah      |                          | hours |                          | Ah |  |
| 198               | Charging time in recharging mode at 80% / 100% capacity       |  |   |            |         |                          |       |                          |    |  |
| 199               | Charging time in initial charge mode at 80% / 100% capacity   |  |   |            |         |                          |       |                          |    |  |
| 200               | Charging current float/recharge/initial charge                | A  |   | A          |         | A                        |       |                          |    |  |
| 201               | Short-circuit current battery fully charged/end of discharge  |  |   |            | A       |                          |       |                          | A  |  |
| 202               | Battery hydrogen emission floating/recharging/initial charge  |  |   |            |         |                          |       |                          |    |  |
| 203               | Duration of battery first charge                              |  |   |            |         |                          |       |                          |    |  |
| 204               | Battery mounting  | Cubicle/ Stand   |   |            |         |                          |       |                          |    |  |
| 205               | Length / Width / Height per cell                              |  |   | mm         |         |                          | mm    |                          |    |  |
| 206               | Weight per cell with electrolyte / Volume of electrolyte      |  |   |            | kg      |                          |       |                          | kg |  |
| 207               | Length / Width / Height (overall battery)                     |  |   | mm         |         |                          | mm    |                          |    |  |
| 208               | Weight (overall battery)                                      |  |   |            |         |                          |       |                          | kg |  |
| 209               | Heat dissipation / Required ventilation floating mode         |  |   |            |         |                          |       |                          |    |  |
| 210               | Heat dissipation / Required ventilation recharging mode       |  |   |            |         |                          |       |                          |    |  |
| 211               | Heat dissipation / Required ventilation initial charge mode   |  |   |            |         |                          |       |                          |    |  |
| 212               |   |  |   |            |         |                          |       |                          |    |  |
| 213               |   |  |   |            |         |                          |       |                          |    |  |
|                   | Notes:  |  |   |            |         |                          |       |                          |    |  |
|                   |   |  |   |            |         |                          |       |                          |    |  |
|                   |   |  |   |            |         |                          |       |                          |    |  |
|                   |   |  |   |            |         |                          |       |                          |    |  |

**PROJECT:**  
**STANDBY SRU (525 TPD)**

**ANNEXURE-II TO PY55465**

**CUSTOMER:**  
**IOCL, PARADIP**

Rev No. 00

**BHEL ENQUIRY NO.:**

**PRICE OFFER NO.:**

**BIDDER:**

**DATE:**

## PRICE SCHEDULE FOR 110V UPS SYSTEM PACKAGE

### SECTION - 1: Common Notes

- This document details the price schedule for the enquiry. Bidder shall fill up in this format only. No other format will be entertained.
- 1 No cognizance will be taken of any changes made by vendor with respect to format issued by BHEL in the description of any item in price format.
  - 2a Duly signed & stamped unpriced price schedule format shall be submitted by vendor as a token of their concurrence that the price schedule is submitted in this format. If not submitted in this format or any field is left blank, the offer will be liable for rejection.
  - 2b All the blank fields shall be filled irrespective of applicability of any item for this Project. If any item is not in bidder's manufacturing range or not available in market (for bought-outs) then "Not Applicable/NA" shall be mentioned in the field. If the bidder mentions "Not Applicable/ NA" against any item and if need arises during order execution for such item, then the same shall be supplied free of cost. If any item is left unfilled, it shall be deemed that the price is included in any of the other quoted items / package and hence, price will be considered as zero for evaluation/additions. Also, for such items, unit rates for deletions will be at the discretion of BHEL.
  - 3 Vendor shall fill up prices of various items and submit to BHEL as part of price offer. Applicable taxes and duties shall also be indicated separately.
  - 4 The format contains THREE sections:
    - 4a Section-1: Common Notes
    - 4b Section-2: Price Schedule for Main Equipment for the 110V UPS System Package
    - 4d Section-3: Price Schedule for the Recommended Spares 110V UPS System Package
  - 5 Tender evaluation priority / criteria shall be as per the Landed cost to BHEL based on Grand Total in Section-2 i.e. "Price Schedule for 110V UPS System". However, in case of any mis-match in values quoted by the bidder, final decision will be at the discretion of BHEL.
  - 6 Components/ Items/ Spares shall be identical to the main equipment.
  - 7 All rates of Section-2 shall be valid up to execution of the contract and handing over to end user except CAPWAMC mentioned at S/N: 3(a) to 3(e). CAPWAMC prices shall be valid till March 2030.
  - 8 BHEL reserves the right to order part quantity or short close if any item/main equipment is not needed during execution.
  - 9 Bidder to also quote prices for the optional items listed in Section-3 with the offer.  
BHEL reserves the right to order these items along with main equipment or separately or not at all.  
Bidder is requested to provide a detailed list of 2 years recommended O&M spares along with unit price of each item. BHEL reserves the right to order full/partial quantity of the 2 years recommended O&M spares along with the main equipment or separately or not at all.  
Validity of all the above prices shall be kept firm till execution of order or till 18 months from the date of P.O, whichever is later.

PROJECT:  
STANDBY SRU (525 TPD)  
CUSTOMER:  
IOCL, PARADIP  
BHEL ENQUIRY NO.:

ANNEXURE-II TO PY55465

Rev No. 00

PRICE OFFER NO.:

BIDDER:

DATE:

## PRICE SCHEDULE FOR 110V UPS SYSTEM

| SECTION - 2: Price Schedule for 110V UPS System   |  |               |       |  |  |                                      |
|---|--|---------------|-------|--|--|--------------------------------------|
| S/N   | ITEM   | MATERIAL CODE | QTY.  | UNIT PRICE<br>INCLUDING P&F<br>AND FREIGHT<br>(INR)<br>Refer Note-1                  | TOTAL PRICE<br>INCLUDING P&F<br>AND FREIGHT<br>(INR) | PRICE<br>WEIGHTAGE IN<br>TOTAL PRICE |
| <b>110V UPS SYSTEM - MAIN SUPPLY</b>              |  |               |       |  |  |                                      |
| 1   | 110V AC Parallel Redundant UPS System & 1X100% UPS Battery(Ni-Cd)  | PY9755465006  | 1 Set | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.468                                |
| <b>110V UPS SYSTEM - SERVICES</b>                 |  |               |       |  |  |                                      |
| 1   | <b>Supervision Services for Erection &amp; Commissioning of 110V UPS System Package by Supplier at site.</b>   |               |       |  |  |                                      |
| a   | Lumpsum price for travel by 110V UPS System Package OEM/Supplier to and from Site per visit. (1 Set = 2 Visits)  | PY9755465022  | 1 Set | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.009                                |
| b   | Lumpsum price including Lodging, Boarding etc. for Supervision Services for Erection & Commissioning of 110V UPS System Package by Supplier at site. (1 Set = 15 Days) [Total No. of days for 2 Visits]                | PY9755465030  | 1 Set | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.029                                |
| 2   | <b>Supervision Services for Erection &amp; Commissioning of 110V UPS System Package by Supplier at site.</b>   |               |       |  |  |                                      |
| a   | Training to owner's personnel at site Lump sum price for training services of UPS System Package OEM for TEN OWNER's Engineers for a period of at least seven days at Site (1 Set = 1 visit)                           | PY9755465049  | 1 Set | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.021                                |
| b   | Lump sum price for Travel, Lodging, Boarding etc. of UPS System Package OEM at site for training services of UPS System Package for TEN OWNER's Engineers for a period of at least seven days at Site (1 Set = 7 Days) | PY9755465057  | 1 Set | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.051                                |
| 3   | <b>Comprehensive Post Warranty Annual Maintenance Contract(CPWAMC) for 5 years of 110V UPS System Package including UPS System Battery:</b>  |               |       |  |  |                                      |
| a   | First year after expiry of defect liability  | PY9755465065  | 1 Set | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.070                                |
| b   | Second year after expiry of defect liability   | PY9755465073  |       | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.075                                |
| c   | Third year after expiry of defect liability  | PY9755465081  |       | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.080                                |
| d   | Fourth year after expiry of defect liability   | PY9755465090  |       | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.084                                |
| e   | Fifth year after expiry of defect liability  | PY9755465103  |       | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.094                                |
| <b>110V UPS SYSTEM - SPARES &amp; ACCESSORIES</b> |  |               |       |  |  |                                      |
| 1   | MANDATORY SPARES FOR UPS SYSTEM  | PY9755465014  | 1 Set | Shall be calculated by BHEL based on the weightages given in the column on the right |  | 0.019                                |
|   | <b>GRAND TOTAL</b><br>[To be quoted by bidder in Part-2 of the offer (Price is inclusive of Packing, Forwarding, Freight charges)]   |               |       |  |  |                                      |

**Note 1** Evaluation shall be done on overall Package Basis i.e Grand Total(A+B+C above).

**Note 2** Unit means 1 No. or 1 Set or 1 Visit or 1 Day. Accordingly Unit Prices shall be quoted.

**Note 3** Actual Visits, No. of days needed at site will depend on site fronts availability and amount of work involved. For quoting purpose, the Visits, No. of days are as specified above. However, number of No. of days, Visits or both may change on either side based on actual site requirements. Payment shall be made for actual services provided.

The charges quoted above at item nos. B1(a) & B1(b) shall be used for deriving per visit/ per day charges. These will be used for making payment for services offered for actual no. of visits/No. of days. Also, actual visits made and services provided need to be certified by BHEL's Site Office.

**Note 4** This includes the price of Battery Isolation box, Commissioning Spares, Special Tools, O&M Manuals, As-Manufactured Drawings, As-Built Drawings for the entire 110V UPS System Package.

PROJECT:  
STANDBY SRU (525 TPD)

ANNEXURE-II TO PY55465

CUSTOMER:  
IOCL, PARADIP  
BHEL ENQUIRY NO.:

Rev No. 00

PRICE OFFER NO.:

BIDDER:

DATE:

### OPTIONAL PRICES: RECOMMENDED SPARES (SECTION-3) FOR 110V UPS SYSTEM PACKAGE

#### SECTION - 3: Price Schedule of Optional 2-Years Recommended Spares for 110V UPS System Package

| S/N | ITEM   | MATERIAL CODE | QTY. | UNIT PRICE INCLUDING P&F AND FREIGHT (INR) | TOTAL PRICE INCLUDING P&F AND FREIGHT (INR) | PRICE WEIGHTAGE IN TOTAL PRICE | REMARKS |
|-----|--|---------------|------|--|---|--------------------------------|---------|
| 1   | Price for recommended spares for 2 years operation with BOM (insert more rows as required) |               |      |  |   |                                |         |
| a   |  |               |      |  |   |                                |         |
| b   |  |               |      |  |   |                                |         |
| c   |  |               |      |  |   |                                |         |
| d   |  |               |      |  |   |                                |         |
| 2   | Per Man-day charges for additional stay/ additional visit inclusive of travel expense      |               |      | Per Manday                                 |   |                                |         |



|                      |   |  |                                    |    |
|----------------------|---|--|------------------------------------|----|
| ESP-001-2A<br>Rev.00 |  | <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b><br>[TECHNICAL SPECIFICATION FOR 110V UPS SYSTEM] | Std./ Doc. Number                  |    |
|                      |   |  | <b>ANNEXURE-III<br/>TO PY55465</b> |    |
|                      |   |  | Rev. No.                           | 00 |
|                      |   |  | Sheet 1 of 2                       |    |

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## ANNEXURE-III TO PY55465

### DEVIATION FORMAT

**PROJECT : STANDBY SRU (525 TPD) TRAIN**

**CUSTOMER : INDIAN OIL CORPORATION LIMITED (IOCL)**

**CONSULTANT : TECHNIP INDIA LIMITED, CHENNAI**

|                       |   |  |                                    |    |
|-----------------------|---|--|------------------------------------|----|
| ESP-001-2A<br>Rev. 00 |  | <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b><br>([TECHNICAL SPECIFICATION FOR 110V UPS SYSTEM]) | Std./ Doc. Number                  |    |
|                       |   |  | <b>ANNEXURE-III<br/>TO PY55465</b> |    |
|                       |   |  | Rev. No.                           | 00 |
|                       |   |  | Sheet 2 of 2                       |    |

**ENQUIRY NUMBER** \_\_\_\_\_ **NAME OF BIDDER** \_\_\_\_\_

**ITEM** \_\_\_\_\_ **OFFER REF NUMBER** \_\_\_\_\_

| Sl. No. | Clause/ Spec Number | Description | Deviation | Nature of Deviation | Remarks |
|---------|---------------------|-------------|-----------|---------------------|---------|
| 1       |                     |             |           |                     |         |
| 2       |                     |             |           |                     |         |
| 3       |                     |             |           |                     |         |

**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** \_\_\_\_\_

**DATE** \_\_\_\_\_

**COMPANY SEAL**

|                      |   |  |                                   |    |
|----------------------|---|--|-----------------------------------|----|
| ESP-001-2A<br>Rev.00 |  | <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b><br><br>[TECHNICAL SPECIFICATION FOR 110V UPS SYSTEM] | Std./ Doc. Number                 |    |
|                      |   |  | <b>ANNEXURE-IV<br/>TO PY55465</b> |    |
|                      |   |  | Rev. No.                          | 00 |
|                      |   |  | Sheet 1 of 2                      |    |

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## ANNEXURE-IV TO PY55465

### CHECKLIST FOR BID SUBMISSION

**PROJECT : STANDBY SRU (525 TPD) TRAIN**

**CUSTOMER : INDIAN OIL CORPORATION LIMITED (IOCL)**

**CONSULTANT : TECHNIP INDIA LIMITED, CHENNAI**


**PROJECT ENGINEERING & SYSTEMS DIVISION**  
**[TECHNICAL SPECIFICATION FOR 110V UPS SYSTEM]****CHECK LIST FOR BID SUBMISSION**


| Sl. No. | Description  | Bidder Confirmation | Comments/ Remarks |
|---------|--|---------------------|-------------------|
| 1       | Bidder has read <b>each</b> Clause of the Main Technical Specification ( <b>PY55465</b> ) and <b>all</b> its Annexures.  | <b>YES/ NO</b>      |                   |
| 2       | Bidder has <b>explicitly provided</b> the nature and extent of Deviation against any Clause (referred above in Point 1) in the Deviation Schedule (i.e. Annexure-III to Specification PY55465).  | <b>YES/ NO</b>      |                   |
| 3       | 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.  | <b>YES/ NO</b>      |                   |
| 4       | Any conflict between provisions of the Specification has been included by the Bidder in the Deviation Schedule itself.   | <b>YES/ NO</b>      |                   |
| 5       | Bidder confirms that Bill of materials (if furnished with the offer) is <b>only for information</b> . Bidder shall supply all the necessary materials to meet the performance & technical requirements as per Specification PY55465 & its Annexures. | <b>YES/ NO</b>      |                   |
| 6       | 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.   | <b>YES/ NO</b>      |                   |
| 7       | Bidder confirms that complete set of relevant test certificates have been included in the Offer.   | <b>YES/ NO</b>      |                   |
| 8       | Bidder confirms to the Sub-vendor List/ Make of components as per Specification PY55465.   | <b>YES/ NO</b>      |                   |
| 9       | Bidder confirms that all the documents as per Cl. 9.1 of Specification PY55465 have been included in the Offer.  | <b>YES/ NO</b>      |                   |
| 10      | Bidder confirms that all the documents shall be submitted during detailed engineering as per Specification PY55465.  | <b>YES/ NO</b>      |                   |


**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**

|  |          |  |  |   |
|--|----------|--|--|---|
| TD-201<br>Rev No. 00   | Form No. | <br>HYDERABAD | <b>PRODUCT STANDARD</b><br>PROJECT ENGINEERING & SYSTEMS DIVISION<br>HYDERABAD | ANNEXURE-V<br>to PY55465<br>Rev No. 00<br>Page 1 of 3 |
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|   |   |  |                                       |
|---|---|--|---------------------------------------|
| Form No.  | <br>HYDERABAD   | <b>PRODUCT STANDARD</b><br>PROJECT ENGINEERING & SYSTEMS DIVISION<br>HYDERABAD | ANNEXURE<br>Rev No. 00<br>Page 2 of 3 |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .<br>It must not be used directly or indirectly in any way detrimental to the interest of the company. | <p style="text-align: center;"><b><u>GUIDELINES TO VENDORS FOR<br/>PREPARATION OF QUALITY ASSURANCE PLAN</u></b></p> <ol style="list-style-type: none"> <li>QAP shall be made in landscape mode on A4 size paper as per the format enclosed.<br/>Font size shall be minimum 10.</li> <li>Each page of QAP shall contain the following information.           <ol style="list-style-type: none"> <li>Vendor's name &amp; address.</li> <li>Customer: BHEL, Hyderabad.</li> <li>Project.</li> <li>BHEL Product Standard Number/revision number as referred in P.O.</li> <li>BHEL Purchase Order Number &amp; Date.</li> <li>Product as per P.O. description.</li> <li>QAP Number (unique and shall not repeat)/revision number/date.</li> <li>Page number and number of pages</li> </ol> </li> <li>QAP shall contain four parts / stages as follows.           <ol style="list-style-type: none"> <li>Raw materials and bought out items.</li> <li>In process Control / Inspection.</li> <li>Final assembly, Inspection &amp; Testing.</li> <li>Painting, preservation &amp; packing.</li> </ol> </li> <li>Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc).</li> <li>Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.)</li> <li>Under 'Class', indicate minor, major or critical depending on the importance of characteristic.</li> <li>Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.)</li> <li>Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.)</li> <li>Under 'Reference document' and 'Acceptance norms', appropriate National &amp; 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 &amp; approval by our Engineering dept.</li> <li>Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc.</li> </ol> |  |                                       |
|   | 11. Please refer 'Agency' in QAP format.<br>Under P: Perform, W: Witness, V: Verify<br>Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR<br>2: (Vendor / Sub vendor)   |  |                                       |



|   |  |   |                                       |
|---|--|---|---------------------------------------|
| Form No.  | <br>HYDERABAD  | <div style="text-align: center;"> <b>PRODUCT STANDARD</b><br/> PROJECT ENGINEERING &amp; SYSTEMS DIVISION<br/> HYDERABAD </div> | ANNEXURE<br>Rev No. 00<br>Page 3 of 3 |
| <div style="writing-mode: vertical-rl; transform: rotate(180deg);"> <b>COPYRIGHT AND CONFIDENTIAL</b><br/> The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .<br/> It must not be used directly or indirectly in any way detrimental to the interest of the company. </div> | <p>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 code1.</p> <p>12. Under 'D' please put ( <input type="checkbox"/> Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification.</p> <p>13. Vendor's signature &amp; stamp should be available on each page of QAP.</p> <p>14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification &amp; Approved Drawings.</p> <p>15.The following operations/characteristics/check points may be included (AS APPROPRIATE)</p> <ol style="list-style-type: none"> <li>a) Visual check</li> <li>b) Dimensional check</li> <li>c) Mechanical and Chemical properties.</li> <li>d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.)</li> <li>e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc.</li> <li>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.</li> <li>g) Verification of test certificate for protection class for the enclosures.</li> <li>h) Mechanical functioning of switches.</li> <li>i) Continuity of earthing and provision of earth points.</li> <li>j) Colour coding of wiring, size, tightness &amp; dressing of wiring.</li> <li>k) Review of test certificates of assembled items, raw materials, internal test reports etc.</li> <li>l) Witness of functional checks, which may include mechanical run &amp; electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc.</li> <li>m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc.</li> <li>n) Material identification ( for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.)</li> <li>o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non Destructive Tests.</li> <li>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)</li> <li>q) All tests as per BHEL Product Standard &amp; approved drawings including Type tests and Routine tests on individual items and on System as a whole.</li> <li>r) Packing and Preservation.</li> </ol> <p>16. <b>QAP Format enclosed.</b></p> <p>17. <b>Typical Manufacturing QAP is attached.</b></p> |   |                                       |
|   | Ref. Doc   |   |                                       |



|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
|--|------------|---|-------|---------------|--|--------------------|------------------|------------------|-----|--------------|--|---------|
| VENDOR'S NAME & ADDRESS:   |            | MANUFACTURING QUALITY PLAN                              |       |               |  |                    |                  | QP. NO.:         |     |              |  |         |
|  |            | CUSTOMER: BHEL, HYDERABAD – 32.<br>PROJECT:<br>PRODUCT: |       |               | BHEL P.O.NO.:<br>P.O.DATE:<br>BHEL SPEC: |                    |                  | REV. NO:         |     | DATE:        |  |         |
|  |            |   |       |               |  |                    |                  | PAGE 1 OF 1      |     |              |  |         |
| SL NO  | COMPONENTS | CHARACTERISTICS   | CLASS | TYPE OF CHECK | QUANTUM OF CHECK                         | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | * D | AGENCY P W V |  | REMARKS |
| 1.0 RAW MATERIALS & BOUGHT OUT ITEMS   |            |   |       |               |  |                    |                  |                  |     |              |  |         |
|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
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|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
| 2.0 INPROCESS INSPECTION   |            |   |       |               |  |                    |                  |                  |     |              |  |         |
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|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
| 3.0 FINAL INSPECTION & TESTING   |            |   |       |               |  |                    |                  |                  |     |              |  |         |
|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
| 4.0 PRESERVATION & PACKING   |            |   |       |               |  |                    |                  |                  |     |              |  |         |
|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
|  |            |   |       |               |  |                    |                  |                  |     |              |  |         |
| VENDOR TO NOTE: THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP. |            |   |       |               |  |                    |                  |                  |     |              |  |         |

|  |  |                           |                              |             |
|--|--|---------------------------|------------------------------|-------------|
| LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR 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. |  | PREPARED BY               | APPROVED BY                  | APPROVED BY |
| VENDOR'S SIGNATURE & STAMP   |  | BHEL QA SIGNATURE & STAMP | CUSTOMER'S SIGNATURE & STAMP |             |

|   |          |   |  |  |
|---|----------|---|--|--|
| TD-201<br>Rev No. 00  | Form No. |  | <div data-bbox="581 117 1140 216"> <p align="center"> <b>PRODUCT STANDARD</b><br/>           PROJECT ENGINEERING &amp; SYSTEMS DIVISION<br/>           HYDERABAD         </p> </div> | <div data-bbox="1295 90 1425 117">ANNEXURE-</div> <div data-bbox="1295 201 1393 228">Page of</div> |
| <div data-bbox="172 646 253 1587"> <p> <b>COPYRIGHT AND CONFIDENTIAL</b><br/>           The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,<br/>           It must not be used directly or indirectly in any way detrimental to the interest of the company.         </p> </div> <div data-bbox="418 506 1352 558"> <h2 align="center"><u>QUALITY ASSURANCE REQUIREMENTS</u></h2> </div> <div data-bbox="345 663 1406 732"> <p><b>The vendor shall prepare &amp; submit Quality Assurance Plan (QAP) for respective package /equipment in customer QAP format.</b></p> </div> <div data-bbox="354 766 1409 905"> <p>A customer standard QAP/typical QAP in customer format /BHEL format attached for respective equipment /package is a reference document for the vendor for future use by vendor for preparation and submission of QAP in customer format. <b>Hence, no deviation to such document is acceptable.</b></p> </div> <div data-bbox="354 938 1409 1041"> <p>Any, additional type or special tests or routine tests or acceptance test if found necessary to establish the intended quality after detailed engineering then the same shall have to be incorporated in the QAP without any commercial implication.</p> </div> <div data-bbox="354 1075 1088 1110"> <p>Customer QAP format is enclosed along with this document.</p> </div> <div data-bbox="354 1144 1258 1180"> <p><b>Note : Vendor shall submit QAP with in 07 days from PO receipt date.</b></p> </div> |          |   |  |  |

|   |            |  |          |               |           |      |        |
|---|------------|--|----------|---------------|-----------|------|--------|
|   | PROJECT:   | STANDBY SRU & ADDITIONAL TANKS IOCL - PARADIP REFINERY |          |               |           |      |        |
|   | CLIENT:    | INDIAN OIL CORPORATION LIMITED                         |          |               |           |      |        |
| INSPECTION AND TEST PLAN (ITP) FOR<br>AC UPS  | Project N° | Unit   | Doc Type | Material Code | Serial N° | Rev. | Page   |
|   | 080557C001 | 000  | ITP      | 1671          | 001       | A    | 1 of 3 |

## 1 SCOPE

This Inspection and test plan is an engineering document which defines for each type of equipment:

- > The type and extent of CONTRACTOR and PMC / OWNER involvement in each phase of fabrication, control and testing requiring an inspection.
- > The resulting vendor's contractual obligations, in accordance with applicable Project General Purchase Conditions.

**Note:** The inspection and test plan may under no circumstances be used as a substitute for the vendor's Quality Control Plan.

## 2 GENERAL DEFINITIONS

**EXTENT OF INSPECTION :** The extent of inspection activities is defined as follows;

### H: (Hold) Point

The Supplier cannot carry out the specified controls and tests without Inspector attendance.

Consequently, the attendance to witnessing is mandatory. The Supplier must notify CONTRACTOR / PMC / OWNER by fax of the dedicated inspection activity at least fifteen (15) days in advance.

The Supplier cannot deviate from this rule unless written approval has been given by involved operating center.

### W: (Witness)

The Supplier must notify dedicated inspection activity at least fifteen (15) days in advance. CONTRACTOR / PMC / OWNER witnessing is not mandatory, but optional. If CONTRACTOR / PMC / OWNER does not elect to be present, the supplier may proceed with the intended activity, provided controls and test reports are made available for the inspector's review during his subsequent visit.

### R: (Review) - Review of Documents

The Supplier has either to submit to Inspector for comments the documents required prior to the performance of the dedicated activity or to transmit or make available for the review of Inspector the results of the controls and tests conducted, as the case may be.

## 3 SUPPLIER'S FABRICATION AND QUALITY CONTROL PLAN

- > The Supplier must issue a Fabrication and Quality Control Plan for each Equipment / Machinery / Package/ Bulk Item
- > The Supplier's Fabrication and Quality Control Plan is a document which defines in a chronological manner the list of the operations of fabrication, controls and tests in accordance with his own "know-how" and with the requirements specified in MR.

Following information shall be clearly specified against each operation:

- Reference documents (drawings, procedures, etc.)
- Acceptance criteria (code, etc.)
- Recording documents for controls and tests
- Involvement of the Quality Control department of the Supplier and/or his subsupplier

This Supplier's Fabrication and Quality Control Plan will have to include all inspection activities defined in Inspection and Test Plan as well as all inspection activities scheduled by Independent Inspection Authority and/or the Client





## 4 INSPECTION RELEASE CERTIFICATE



This document issued by CONTRACTOR/TPIA, permits the Vendor to proceed with the packing and to notify the shipment



## 5 QUALITY CONTROL MANUFACTURING DOSSIER "QCMD" (ex Inspection Book)

This document must be completely reviewed during the final Inspection. Preliminary Copy (Waiting for CLIENT final approval), checked and signed by the Inspector, must be shipped together with the goods and indicated in the relevant Packing List.

### INSPECTION CATEGORY : 2

|     |            |                      |   |   |   |   |
|-----|------------|----------------------|---|---|---|---|
|     |            |                      |  <b>Written By</b><br>Gopi Chellappa<br>2019.11.26<br>10:54:52 +05'30' |  <b>Checked By</b><br>Mathivanan Ganesan<br>2019.11.26 17:49:43<br>+05'30' |  <b>Approved By</b><br>Vidhusagan Shanmugam<br>2019.11.26 18:19:08 +05'30' |  <b>Authorized By</b><br>Mamashanathan<br>Jesumartan<br>2019.11.29 19:51:44<br>+05'30' |
| A   | 26.11.2019 | ISSUED FOR QUOTATION | CG  | GM  | SV  | JMC   |
| REV | DATE       | DESCRIPTION          | PREPARED BY   | CHECKED BY  | APPROVED BY   | AUTHORISED BY   |

|    |  | PROJECT:  | STANDBY SRU & ADDITIONAL TANKS IOCL - PARADIP REFINERY |   |                     |                   |               |        |
|--|--|---|--|---|---------------------|-------------------|---------------|--------|
|  |  | CLIENT:   | INDIAN OIL CORPORATION LIMITED                         |   |                     |                   |               |        |
| INSPECTION AND TEST PLAN (ITP) FOR AC UPS  |  | Project N°  | Unit   | Doc Type  | Material Code       | Serial N°         | Rev.          | Page   |
|  |  | 080557C001  | 000  | ITP   | 1671                | 001               | A             | 2 of 3 |
| <b>1.0 SCOPE</b><br>This Inspection and test Plan covers the minimum testing requirement of AC UPS System<br><br><b>2.0 REFERENCE DOCUMENTS</b><br>PO/PR & Standards referred there in / Job specification / Approved documents<br><br><b>3.0 INSPECTION AND TEST REQUIREMENTS</b> |  |   |  |   |                     |                   |               |        |
| SL. No   | STAGE  | CHARACTERISTICS   | QUANTUM OF CHECK                                       | RECORD  | SCOPE OF INSPECTION |                   |               |        |
|  |  |   |  |   | SUPPLIER            | CONTRACTOR / TPIA | PMC           | OWNER  |
| 1  | Incoming materials like fabricated items, Electronic components, PCBs, Relays, Indicating Instruments, Switches, MCCBs, Contactors etc | Visual, Dimensional, Operational checks etc (as applicable)   | 100%   | Supplier's TC / Test Records                        | W                   | R                 | -             | -      |
| 2  | General  | > Visual check including layout, Tag plates, Paint shade & thickness, Bus marking, Identification and location of components, operational functions etc<br>> Dimension check including operational height, Bus size, Termination arrangement, Clearances, Interconnection cable check etc<br>> Bill of materials / Make of components   | 100%   | Supplier's TC / Test Records                        | W                   | R                 | -             | -      |
| 3  | Acceptance Test  | > Burn-in test at 50 Deg C<br>> Full load test<br>> Proper functioning of all measuring instruments, alarms, indications, protection and controls as per requirement.<br>> Measurement of steady state parameters at no-load and full load<br>> Measurement of transient parameters for load changes by load step test<br>> Voltage regulation test due to input voltage and load variation<br>> Measurement of total harmonic distortion<br>> UPS specification test<br>> UPS efficiency and power factor at 50% & 100% load<br>> Operational check for auto/manual transfer for different transfer modes<br>> Dynamic response test<br>> Load Transfer test<br>> Synchronization test<br>> AC input failure / return test<br>> Insulation resistance before and after HV test for power, control and auxiliary circuits.<br>> High voltage withstand test for power, control and main circuits.<br>> Audible noise test & Inrush current test<br>> Battery ripple current measurement<br>> Parallel operation of inverters and load sharing (if specified)<br>> Verification of various protections/alarm and indications by circuit simulations.<br>> Current sharing test of inverters in parallel<br>> Unbalance load test / output voltage unbalance<br>> Short circuit test (protective device operations) | 100%   | Inspection Test Records                             | W                   | W                 | R<br>(Note 7) | -      |
| 4  | AC Distribution Board  | Visual, Dimensions, Feeder Tag Plates, Functional checks, IR and HV test  | 100%   | Supplier's Test Records / Inspection witness record | W                   | W                 | R<br>(Note 7) | -      |
| 5  | Battery  | > Battery performance (design capacity, discharge voltage per cell after the specified discharge time)  | 1 No on each type                                      | Supplier's Test Records / Inspection witness record | W                   | W / R             | R             | -      |
| 6  | Type Test (#)  | > Overload capability test<br>> Short-circuit test<br>> Temperature rise test of 24 Hrs. for UPS  | 1 No on each type                                      | Supplier's Test Records                             | W                   | R<br>(Note 6)     | R             | -      |

|    |   | PROJECT: <b>STANDBY SRU &amp; ADDITIONAL TANKS IOCL - PARADIP REFINERY</b>  |                     |  |                     |                   |               |               |
|--|---|---|---------------------|--|---------------------|-------------------|---------------|---------------|
|  |   | CLIENT: <b>INDIAN OIL CORPORATION LIMITED</b>   |                     |  |                     |                   |               |               |
| <b>INSPECTION AND TEST PLAN (ITP) FOR AC UPS</b>   |   | Project N°  | Unit                | Doc Type   | Material Code       | Serial N°         | Rev.          | Page          |
|  |   | <b>080557C001</b>   | <b>000</b>          | <b>ITP</b>   | <b>1671</b>         | <b>001</b>        | <b>A</b>      | <b>3 of 3</b> |
| SL. No   | STAGE                                   | CHARACTERISTICS   | QUANTUM OF CHECK    | RECORD   | SCOPE OF INSPECTION |                   |               |               |
|  |   |   |                     |  | SUPPLIER            | CONTRACTOR / TPIA | PMC           | OWNER         |
| 7  | Other Tests (*)<br>(*) Only if required | > Harmonic components test<br>> Earth fault test<br>> RF generated interference and conducted noise<br>> EMC test   | 1 No on each type * | Supplier's Test Records / Inspection witness record  | W                   | R / W             | R<br>(Note 7) | -             |
| 8  | Painting                                | Visual and DFT check  | 100%                | Supplier's Test Records / Inspection Witness Record. | H                   | W                 | -             | -             |
| 9  | Packing                                 | > Visual<br>> Suitable protection to prevent entry of foreign material.<br>> Proper packing with suitable plugs to prevent ingress of moisture and any damage during Transportation and Storage | 100%                | Supplier's Test Records / Inspection Witness Record. | H                   | W                 | -             | -             |
| 10   | MDRB Review                             | > Compilation of test reports/test records as per Project Procedure   | 100%                | Supplier's Test Records / Inspection Witness Record. | H                   | H                 | -             | -             |
| <p># Prototype test certification only is required. If prototype test certification is not available, type tests shall be performed on no. 1 UPS for each UPS type and to be witnessed by CONTRACTOR / PMC / OWNER. Selected UPS for type tests shall be the largest one among the relevant type.</p> <p>* Only if required from specifications (prototype test certification or performance)</p> <p>- Supplier to submit internal test reports before offering items for inspection to CONTRACTOR / PMC / OWNER.</p> <p><b>LEGEND:-</b><br/> <b>CCE or CCOE</b>- Chief controller of Explosives, <b>DT</b> - Destructive testing, <b>HT</b> - Heat treatment, <b>H</b> - Hold (Do not proceed without approval), <b>IBR</b> - Indian Boiler Regulations, <b>ITP</b> - Inspection Test Plan, <b>NDT</b> - Non Destructive Testing, <b>P</b> - Perform, <b>PESO</b> - Petroleum and Explosives Safety Organisation, <b>PO</b> - Purchase Order, <b>PR</b> - Purchase Requisition, <b>PQR</b> - Procedure Qualification Record, <b>QAP</b> - Quality Assurance Plan, Random-10% (min 1no) of each size and type of bulk item, <b>R</b> - Review, <b>RT</b> - Radiography Testing, <b>RW</b> - Random Witness, <b>TC</b> - Test Certificate, <b>TPI</b> or <b>TPIA</b> - Third Party Inspection Agency, <b>VDR</b> - Vendor Data Requirements, <b>WPS</b> - Welding Procedure Specification, <b>WPQ</b> - Welders Performance Qualification, <b>W</b> - Witness (Give due notice, work may proceed after scheduled date), <b>MDRB</b> - Manufacturer's Data/Record Book, <b>DFT</b> - Dry Film Thickness</p> <p><b>Notes (As applicable)</b></p> <ol style="list-style-type: none"> <li>Whenever W/R or H/W is indicated, CONTRACTOR / PMC / OWNER Inspection engineer shall decide the option to be exercised for the particular stage and supplier.</li> <li>Supplier's in house procedures may be accepted in case CONTRACTOR / PMC / OWNER is satisfied with adequacy of procedures to comply with the purchase order/specifications requirements, in case of non availability of suitable procedures fresh procedures may be qualified under CONTRACTOR / PMC / OWNER witness.</li> <li>In case of conflict between purchase specification, contract documents and ITP more stringent conditions shall be applicable.</li> <li>This document describes generally the requirements pertaining to all types of the item. Requirements specific to PO and the item are only applicable.</li> <li>Acceptance norms for all the activities shall be as per PO/PR/STANDARDS referred therein / Job specification / Approved documents.</li> <li>If test certificate is not available, this will be witnessed.</li> <li>Witness of the test shall be carried out by PMC / owner, if felt necessary</li> </ol> |   |   |                     |  |                     |                   |               |               |