| Land considered in unit | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land Details | Pipalia Kumar | Madhopur | Ladwan | Kesdi Dehariya | Karwa Khedi | Dudhpura | Bijrakhedi | Sum (Ha) |
| Govt. Land | 34.803 | 15.765 | 168.320 | 28.300 | 155.089 | 98.382 | 56.983 | 556.642 |
| Private Land | 5.060 | 0.000 | 2.800 | 0.000 | 0.000 | 43.587 | 0.000 | 51.447 |
| Sum (including sub-station) (Ha) | 39.863 | 15.765 | 171.120 | 28.300 | 155.089 | 141.969 | 56.983 | 608.089 |

The Net Usable Area for Unit -4 is 407.240 Ha. The deductions on account of transmission line, high gradient land portions >5 degrees, Water bodies and WTG Shadows are deducted from total area within unit to derive the Net Usable Area. Request Bidders to refer the unit area statements for obtaining the area of these respective deductions.

CUMULATIVE EXCLUDED AREA OF CLUSTER - 0.347Ha

BIJNAKHEDI

THIS CLUSTER OF HABITANT IS EXCLUDED FROM THE UNIT BOUNDARY. CUMULATIVE HABITANT CLUSTER AREA - (0.546+0.077+0.010)Ha AREA OF ACCESS SPACE - 0.085Ha

WATER BODY IS EXCLUDED FROM THE UNIT BOUNDARY. EXCLUDED AREA _0.3465Ha

MADHOPUR

KARWA KHEDI

WATER BODY IS EXCLUDED FROM THE UNIT ,EXCLUDED AREA_3.22HA

POND

WATER BODY IS EXCLUDED FROM THE UNIT BOUNDARY . EXCLUDED AREA_1.22HA

KASAI KEHARIYA

Pond

SMALL AREA OF TALAI IS NOT ALLOTTED FOR UNIT. THEREFORE ACCESS SPACE IS PROVIDED FOR TALAI. AREA OF TALAI WITH ACCESS SPACE IS EXCLUDED FROM UNIT BOUNDARY.EXCLUDED AREA _0.0984Ha (Gov) + 0.0331Ha (Pvt)

TALAI

WATER BODY IS EXCLUDED FROM THE UNIT BOUNDARY. EXCLUDED AREA _1.6750HA

POND

THIS ISOLATED SINGLE STRUCTURE IS CONSIDERED INSIDE THE UNIT.

HABITANT

DUDHPURA

THIS STRUCTURE FOUND NEAR THE WTG IS EXCLUDED FROM THE UNIT. EXCLUDED AREA - 0.1172HA

PIPLIYA KUMHAR

Proposed ISTS Substation

220kV PROPOSED TRANSMISSION LINE FROM UNIT 4 TO ISTS SUB -STATION

ISTS SUBSTATION
23° 43' 11.928" N
76° 7' 11.964"E

kh 184min 1 and 7min1 are unallotted,and boundaries are marked tentatively,Assuming unallocated area is for WTG maintenance

kh 34 min 1 is unallotted and boundary is marked tentatively,Assuming unallocated area is for WTG maintenance

LADWAN

33/220kV UNIT SUB -STATION (Proposed)
23°43'55.10"N 76° 7'35.58"E

Existing Village Road

NALA

212.24

366

LAYOUT _ UNIT4 (200MW ) OF AGAR SOLAR PARK

DISCLAIMER

The purpose of this layout is solely to provide the Bidders with may be useful to them in the preparation and submission of facilitate better assessment and analysis of the Project by information contained in this layout is indicative in nature and assumptions and assessment undertaken by the firm carrying out there is any inconsistency between the contents of this layout an contracts to be issued, the draft project contracts shall prevail.

The layout include statements which reflect various assumptions arrived at by RUMSL and its advisors for the three Madhya Pr namely, Neemuch Solar Park, Agar Solar Park and Shajapur assumptions, assessments and statements do not purport to information that the Bidders may require. The information conta may not be appropriate for all Persons and it is not possible employees or advisors to consider the investment objectives, and particular needs of each Person who reads the layout. assessments, statements and information contained in the la complete, accurate, adequate or correct. Each Bidder should the own investigations and analysis and should check the acc correctness, reliability and completeness of the assumptio statements and information contained in the layout. Bidders a visit and examine the solar parks and acquaint themselves of any or details as may be necessary for preparation and submission of

RUMSL and its employees and advisors make no representation will have no liability to any Person, including any Bidder, unde rules or regulations or tort or otherwise for any loss, damage which may arise from or that may be incurred or suffered on ac contained in the layout or otherwise, including the acc correctness, completeness or reliability of the layout and assumption, statement or information contained in the layout o part of the layout or arising in any way.

RUMSL and its employees and advisors also accept no liabil whether resulting from negligence or otherwise, however ca reliance of any Bidder upon the content of the layout .

RUMSL may, in its absolute discretion but without being under do so, update, amend or supplement the information, assessme assumptions contained in the layout .

LEGEND

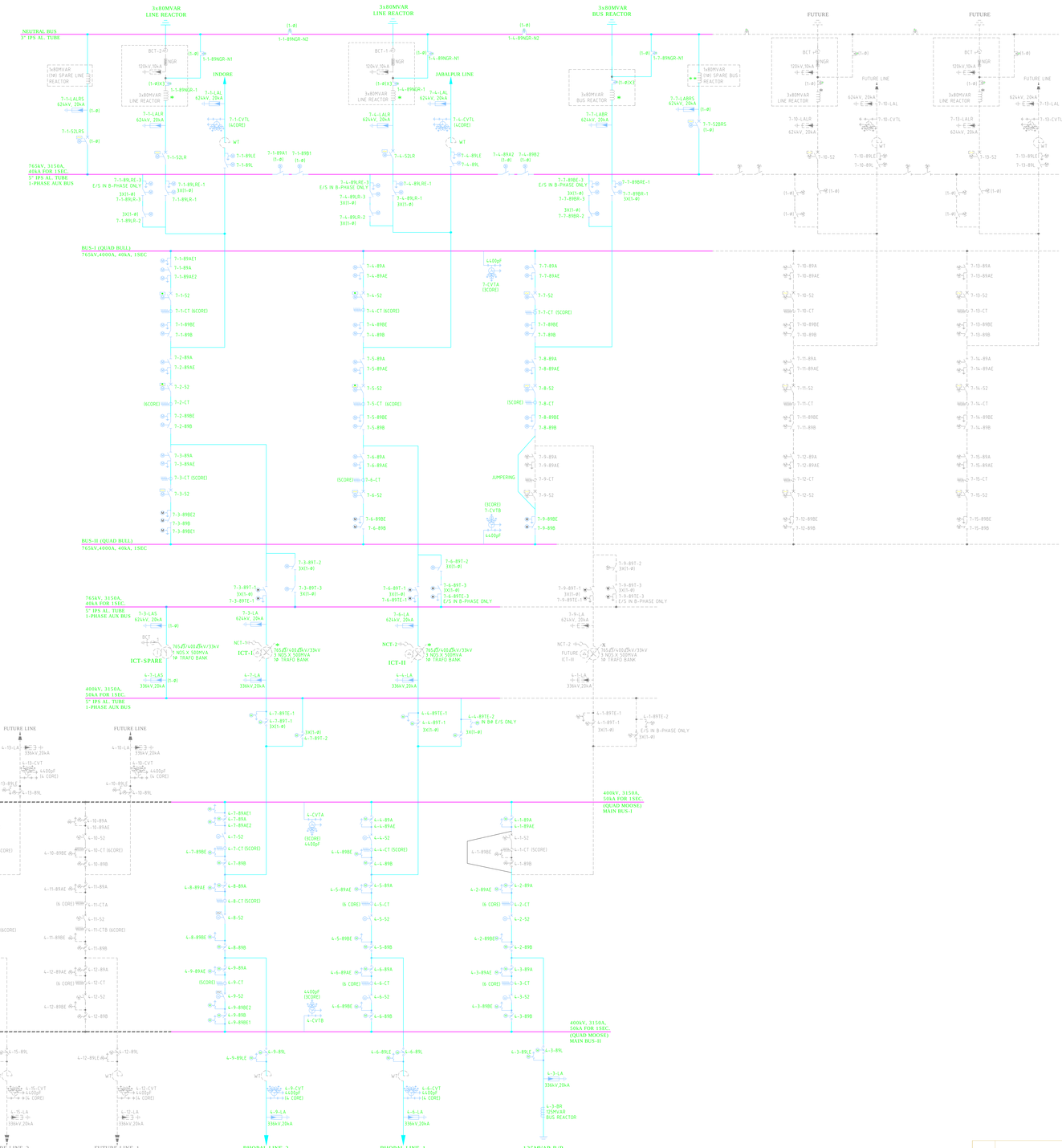
| Sr. No. | Symbol | Description |
|---|---|---|
| 1. | | Village Road |
| 2.1 | | Govt. land |
| 2.2 | | New allotted Govt. land |
| 3. | | Private land |
| 4. | | Water body |
| 5. | | Khasara Boundary |
| 6. | 66 | Khasara No. |
| 7. | | Windmill Road |
| 8. | | Habitant |
| 9. | | Wind Mill & it's Shadow |
| 10. | | Nala (Natural Stream) |
| 11. | | Substation |
| 12. | | Unit boundary |
| 13. | | Village Boundary |
| 14. | | Proposed 220KV transmissic line to ISTS sub-station |
| 15. | | Cluster boundary 5m offset to habitant Habitant |
| 16. | | Transmission Lines With Pol (For WTG and village road)_ findings from drone output |
| 17. | | ISTS Sub-station |
| 18. | | Road from unit sub-station to existing village road |
| 19. | | Existing Transmission Line shadow_Drone findings |

TITLE:
LAYOUT - AGAR UNIT4 (20
OF AGAR SOLAR PARK (5

DATE : 07-05-2021

DISCLAIMER
"LAYOUTS ARE INDICATIVE AND ARE SUB. CHANGE POST ISSUE OF FINAL REPORTS ENVIRONMENT SOCIAL IMPACT ASSESSM STUDIES OF THE SOLAR PARK.".

DRAWING NO.:5429PS060-BHO-E-SYD-SLD-0401




## BILL OF QUANTITY OF 765kV EQUIPMENTS

| Sl.No. | SYMBOL | IDENTIFICATION | DESCRIPTION | MAKE | QTY AS PER CONTRACT |
|---|---|---|---|---|---|
| 1A | | 7-1-52, 7-8-52, 7-3-52, 7-6-52 | 765kV,3150A,40kA,1sec,SF6,3P CIRCUIT BREAKER WITH CONTROL SWITCHING ONLY | ALSTOM | 04 |
| 1B | | 7-2-52, 7-5-52 | 765kV,3150A,40kA,1sec,SF6,3P CIRCUIT BREAKER WITH CLOSING RESISTOR & CONTROL SWITCHING | ALSTOM | 02 |
| 1C | | 7-1-52, 7-4-52 | 765kV,3150A,40kA,1sec,SF6,3P CIRCUIT BREAKER WITH CLOSING RESISTOR ONLY. | ALSTOM | 02 |
| 1D | | 7-1-52LR, 7-4-52LR | 765kV,3150A,40kA,1sec,SF6,3P CIRCUIT BREAKER WITH CONTROL SWITCHING ONLY(SUITABLE FOR 1-PHASE REACTOR SWITCHING) | ALSTOM | 02 |
| 1E | | 7-1-52LRS, 7-7-52BRS | 765kV,3150A,40kA,1sec,SF6,3P CIRCUIT BREAKER WITH CONTROL SWITCHING ONLY(SUITABLE FOR 1-PHASE REACTOR SWITCHING) | ALSTOM | 02 |
| 2A | | 7-1-89L, 7-1-89B, 7-2-89A, 7-2-89B 7-3-89A, 7-4-89L, 7-4-89A, 7-4-89B, 7-5-89A, 7-5-89B, 7-6-89A, 7-6-89B, 7-7-89A, 7-7-89B, 7-8-89A, 7-8-89B, 7-9-89B, | ISOLATOR WITH 1 EARTH SWITCH, VERTICAL KNEE TYPE, 765kV, 3P, 3150A, 40kA FOR 1 sec, ELECTRICALLY GANGED | ALSTOM | 77 |
| 2B | | 7-1-89A, 7-3-89B | ISOLATOR WITH 2 EARTH SWITCH, VERTICAL KNEE TYPE, 765kV, 3P, 3150A, 40kA FOR 1 sec, ELECTRICALLY GANGED | ALSTOM | 02 |
| 2C | | 7-1-89LR-R1,7-1-89LR-Y1,7-1-89LR-B1 7-3-89T-R1,7-3-89T-Y1,7-3-89T-B1 7-4-89LR-R1,7-4-89LR-Y1,7-4-89LR-B1, 7-6-89T-R1,7-6-89T-Y1,7-6-89T-B1, 7-7-89BR-R1,7-7-89BR-Y1,7-7-89BR-B1, | ISOLATOR WITH 1 EARTH SWITCH, VERTICAL KNEE TYPE, 765kV, 3P, 2000A, 40kA FOR 1 sec, ELECTRICALLY GANGED (ALL MASTER) | ALSTOM | 15 |
| 2D.1 | | 7-1-89LR-B2, 7-4-89LR-B2 7-6-89T-B2, 7-7-89BR-B2 | ISOLATOR WITHOUT EARTH SWITCH, VERTICAL KNEE TYPE, 765kV, 3P, 2000A, 40kA FOR 1 sec, ELECTRICALLY GANGED (WITH SPECIAL OPERATING MECHANISM ACTING AS ' MASTER' ABLE TO COMBINE THE SIGNALS COMING FROM THE TWO SEPARATE AND INDEPANDENT OPERATING MECHANISM) | ALSTOM | 04 |
| 2D.2 | | 7-1-89LR-B3, 7-4-89LR-B3 7-6-89T-B3, 7-7-89BR-B3, | ISOLATOR WITH ONE EARTH SWITCH, VERTICAL KNEE TYPE, 765kV, 3P, 2000A, 40kA FOR 1 sec, ELECTRICALLY GANGED (WITH SPECIAL OPERATING MECHANISM ACTING AS ' SLAVE' ABLE TO COMBINE THE SIGNALS COMING FROM THE TWO SEPARATE AND INDEPANDENT OPERATING MECHANISM) | ALSTOM | 04 |
| 2E.1 | | 7-1-89LR-R2, 7-1-89LR-Y2, 7-1-89A1 7-3-89T-R2, 7-3-89T-Y2, 7-3-89T-B2 7-4-89LR-R2, 7-4-89LR-Y2, 7-4-89BT 7-6-89T-R2, 7-6-89T-Y2, 7-7-89BR-R2, 7-7-89BR-Y2 | ISOLATOR WITHOUT EARTH SWITCH, VERTICAL KNEE TYPE, 765kV, 3P, 2000A, 40kA FOR 1 sec, ELECTRICALLY GANGED (WITH SPECIAL OPERATING MECHANISM ACTING AS ' MASTER' ABLE TO COMBINE THE SIGNALS COMING FROM THE TWO SEPARATE AND INDEPANDENT OPERATING MECHANISM) | ALSTOM | 13 |
| 2E.2 | | 7-1-89LR-B3, 7-1-89LR-Y3, 7-1-89A2, 7-3-89T-B3, 7-3-89T-Y3, 7-3-89T-B3 7-4-89LR-B3, 7-4-89LR-Y3, 7-4-89B2 7-6-89T-B3, 7-6-89T-Y3 7-7-89BR-B3, 7-7-89BR-Y3 | ISOLATOR WITHOUT EARTH SWITCH, VERTICAL KNEE TYPE, 765kV, 3P, 2000A, 40kA FOR 1 sec, ELECTRICALLY GANGED (WITH SPECIAL OPERATING MECHANISM ACTING AS ' SLAVE' ABLE TO COMBINE THE SIGNALS COMING FROM THE TWO SEPARATE AND INDEPANDENT OPERATING MECHANISM) | ALSTOM | 13 |
| 3A | | 7-1-CT, 7-2-CT, 7-4-CT,7-5-CT | CURRENT TRANSFORMER, 765kV, 6 CORE, 3000A 40kA for 3sec 120% EXTENDED CURRENT RATING | ALSTOM | 12 |
| 3B | | 7-3-CT, 7-6-CT, 7-7-CT, 7-8-CT | CURRENT TRANSFORMER,765kV FEEDERS, 5 CORE, 3000A, 1-PH, 40kA for 1sec 120% EXTENDED CURRENT RATING | ALSTOM | 12 |
| 4A | | 7-1-CVTL, 7-4-CVTL | 765kV, 1-PH CVT (4400pF), 1 CORE, 3P/3P/0.2 | ALSTOM | 06 |
| 4B | | 7-CVTA, 7-CVTB | 765kV, 1-PH CVT (4400pF), 1 CORE, 3P/3P/0.2 | ALSTOM | 06 |
| 5 | | 7-1-LAL, 7-1-LAGE, 7-3-LA, 7-4-LAL, 7-5-LAGE, 7-6-LA, 7-8-LAGE, 7-3-LABE, 7-3-LAS, 7-1-LABRS, 7-7-LABRS, | 624kV, LIGHTNING ARRESTER (5-Ø) DISCHARGE CURRENT 20kA | XIAN | 24 |

## ## CURRENT TRANSFORMER RATING, 765kV

| LOCATION | CORE NO. | RATIO (Amp.) | PROTECTION TYPE | BURDEN | ACCURACY CLASS |
|---|---|---|---|---|---|
| 765kV BUS REACTOR | 1 | 3000-2000-500/1 | REC.OFF./SPARE | - | TPS |
| 7-1-CT, | 2 | 3000-2000-500/1 | TEED PROT | - | TPS |
| | 3 | 3000-2000-500/1 | SPARE | # | 0.25 |
| | 4 | 3000-2000-500/1 | BB PROT. | - | TPS |
| | 5 | 3000-2000-500/1 | BB PROT | - | TPS |
| 765kV LINE FEEDER | 1 | 3000-2000-500/1 | DIST. PROT | - | TPS |
| 7-1-CT,7-4-CT | 2 | 3006-2000-500/1 | DIST. PROT | - | TPS |
| | 3 | 3000-2000-500/1 | TARIFF MTR./REV METERING | # | 0.25 |
| | 4 | 3000-2000-500/1 | SPARE | # | 0.25 |
| | 5 | 3000-2000-500/1 | BB PROT | - | TPS |
| | 6 | 3000-2000-500/1 | BB PROT | - | TPS |
| INTERCONNECTING TRANSFOMER | 1 | 3000-2000-500/1 | DIFF. PROT | - | TPS |
| 7-3-CT,7-6-CT | 2 | 3000-2000-500/1 | BACKUP/DIFF.PROT | - | TPS |
| | 3 | 3000-2000-500/1 | TARIFF MTR./REV METERING | # | 0.25 |
| | 4 | 3000-2000-500/1 | BB PROT | - | TPS |
| | 5 | 3000-2000-500/1 | BB PROT | - | TPS |
| TIE (LINE &CT) | 1 | 3000-2000-500/1 | DIFF. PROT | - | TPS |
| 7-2-CT, 7-5-CT | 2 | 3000-2000-500/1 | BACKUP | - | TPS |
| | 3 | 3000-2000-500/1 | METERING | # | 0.25 |
| | 4 | 3000-2000-500/1 | METERING LINE | # | 0.25 |
| | 5 | 3000-2000-500/1 | DIST. PROT | - | TPS |
| | 6 | 3000-2000-500/1 | DIST. PROT | - | TPS |
| TIE (B/R FUTURE) | 1 | 3000-2000-500/1 | DIFF. PROT | - | TPS |
| 7-8-CT | 2 | 3000-2000-500/1 | BACKUP | - | TPS |
| | 3 | 3000-2000-500/1 | TARIFF METER | # | 0.25 |
| | 4 | 3000-2000-500/1 | METERING | # | 0.25 |
| | 5 | 3000-2000-500/1 | DIST. PROT | - | TPS |

## CAPACITOR VOLTAGE TRANSFORMER (3CORE) 765kV,4400PF

| LOCATION | RATIO | PURPOSE | ACCURACY CLASS |
|---|---|---|---|
| 7-CVTA 7-CVTB | PRIMARY VOLTAGE 765/√3 | | |
| | SECONDARY VOLTAGE 110√3 | METERING | 0.2 |
| | 110√3 | PROTECTION | 3P |
| | 110√3 | PROTECTION | 3P |

## CAPACITOR VOLTAGE TRANSFORMER (4CORE) 765kV,4400pF

| LOCATION | RATIO | PURPOSE | ACCURACY CLASS |
|---|---|---|---|
| 7-1-CVTL 7-4-CVTL | PRIMARY VOLTAGE 765/√3 | | |
| | SECONDARY VOLTAGE 110√3 | TARIFF METER | 0.2 |
| | 110√3 | METERING | 0.2 |
| | 110√3 | PROTECTION | 3P |
| | 110√3 | PROTECTION | 3P |

## SYSTEM PARAMETERS

| Sl.No. | DESCRIPTION OF PARAMETER | UNIT | 765kV SYSTEM | 400kV SYSTEM |
|---|---|---|---|---|
| 1 | SYSTEM OPERATING VOLTAGE | kV | 765kV | 400kV |
| 2 | MAX. OPERATING VOLTAGE OF THE SYSTEM (rms) | kV | 800kV | 420kV |
| 3 | LIGHTING IMPULSE WITHSTAND VOLTAGE | kVp | 2100 | 1550 |
| 4 | SWITCHING IMPULSE WITHSTAND VOLTAGE | kVp | 1550 | 1050 |
| 5 | POWER FREQUENCY WITHSTAND VOLTAGE FOR 1MIN | kV | 830 | 630 |
| 6 | EXTERNAL CREEPAGE | mm | 20000 | 10500 |
| 7 | SHORT CIRCUIT CURRENT (FOR 1 SEC) | kA | 40 | 50 |
| 8 | FREQUENCY | Hz | 50 | 50 |
| 9 | CORONA EXTINCTION VOLTAGE | kV | 508 | 320 |
| 10 | DESIGN MAXIMUM AMBIENT TEMPERATURE | °C | 50 | 50 |

## # # CURRENT TRANSFORMER RATING, 400kV

| LOCATION | CORE NO. | RATIO | PROTECTION TYPE | BURDEN | ACCURACY CLASS |
|---|---|---|---|---|---|
| 400kV BUS REACTOR | 1 | 3000-2000-500/1 | DIFF. PROT | - | TPS |
| 4-3-CT | 2 | 3000-2000-500/1 | SPARE | - | TPS |
| | 3 | 3000-2000-500/1 | SPARE | # | 0.25 |
| | 4 | 3000-2000-500/1 | BB PROT | - | TPS |
| | 5 | 3000-2000-500/1 | BB PROT | - | TPS |
| 400kV LINE FEEDER | 1 | 3000-2000-500/1 | DIST. PROT | - | TPS |
| 4-5-CT, 4-9-CT | 2 | 3000-2000-500/1 | DIST. PROT | - | TPS |
| | 3 | 3000-2000-500/1 | METERING/TARIFF METERING | # | 0.25 |
| | 4 | 3000-2000-500/1 | SPARE | # | 0.25 |
| | 5 | 3000-2000-500/1 | BB PROT | - | TPS |
| | 6 | 3000-2000-500/1 | BB PROT | - | TPS |
| INTERCONNECTING TRANSFOMER | 1 | 3000-2000-500/1 | DIFF. PROT | - | TPS |
| 4-3-CT,7-4-CT | 2 | 3000-2000-500/1 | BACKUP | - | TPS |
| | 3 | 3000-2000-500/1 | SPARE | # | 0.25 |
| | 4 | 3000-2000-500/1 | BB PROT | - | TPS |
| | 5 | 3000-2000-500/1 | BB PROT | - | TPS |
| TIE (LINE &CT) | 1 | 3000-2000-500/1 | DIFF. PROT | - | TPS |
| 4-5-CT | 2 | 3000-2000-500/1 | BACKUP | - | TPS |
| | 3 | 3000-2000-500/1 | BCU | # | 0.25 |
| | 4 | 3000-2000-500/1 | METERING | # | 0.25 |
| | 5 | 3000-2000-500/1 | DIST. PROT | - | TPS |
| | 6 | 3000-2000-500/1 | DIST. PROT | - | TPS |
| TIE (LINE) | 1 | 3000-2000-500/1 | DIST. PROT | - | TPS |
| 4-8-CT | 2 | 3000-2000-500/1 | DIST. PROT | - | TPS |
| | 3 | 3000-2000-500/1 | METERING LINE | # | 0.25 |
| | 4 | 3000-2000-500/1 | SPARE | # | 0.25 |
| | 5 | 3000-2000-500/1 | BB PROTECTION | - | TPS |
| | 6 | 3000-2000-500/1 | BB PROTECTION | - | TPS |
| TIE (BR ICT) | 1 | 3000-2000-500/1 | REACTOR DIFF | - | TPS |
| 4-2-CT | 2 | 3000-2000-500/1 | SPARE | - | TPS |
| | 3 | 3000-2000-500/1 | BCU | # | 0.25 |
| | 4 | 3000-2000-500/1 | BACKUP | - | TPS |
| | 5 | 3000-2000-500/1 | DIFF. PROT. (ICT) | - | TPS |
| | 6 | 3000-2000-500/1 | DIST. PROT. | - | TPS |

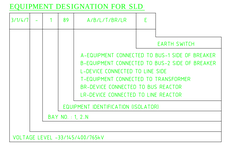
## CAPACITOR VOLTAGE TRANSFORMER (3CORE) 400kV,4400pF

| LOCATION | RATIO | PURPOSE | ACCURACY CLASS |
|---|---|---|---|
| 4-CVTA, 4-CVTB | PRIMARY VOLTAGE 400/√3 | | |
| | SECONDARY VOLTAGE 110√3 | METERING | 0.2 |
| | 110√3 | PROTECTION | 3P |
| | 110√3 | PROTECTION | 3P |

## CAPACITOR VOLTAGE TRANSFORMER (4CORE) 400kV,4400pF

| LOCATION | RATIO | PURPOSE | ACCURACY CLASS |
|---|---|---|---|
| 4-6-CVT, 4-9-CVT | PRIMARY VOLTAGE 400/√3 | | |
| | SECONDARY VOLTAGE 110√3 | TARIFF METER | 0.2 |
| | 110√3 | METERING | 0.2 |
| | 110√3 | PROTECTION | 3P |
| | 110√3 | PROTECTION | 3P |

## EQUIPMENT DESIGNATION FOR SLD




## BILL OF QUANTITY OF 400kV EQUIPMENTS

| Sl.No. | SYMBOL | IDENTIFICATION | DESCRIPTION | MAKE | QTY AS PER CONTRACT |
|---|---|---|---|---|---|
| 6A | | 4-2-52, 4-3-52 | CIRCUIT BREAKER, 420kV, 3150A, 50kA for 1 sec, SF6, 3P, WITH CONTROLLED SWITCHING | ALSTOM | 02 |
| 6B | | 4-1-52, 4-4-52 4-5-52, 4-6-52, 4-8-52, 4-9-52 | CIRCUIT BREAKER, 420kV, 3150A, 50kA for 1 sec, SF6, 3P, WITHOUT CONTROLLED SWITCHING | ALSTOM | 06 |
| 7A | | 4-1-89B, 4-2-89A, 4-2-89B, 4-3-89A, 4-3-89B, 4-4-89A, 4-4-89B, 4-5-89A, 4-5-89B, 4-6-89A, 4-6-89B, 4-8-89A, 4-8-89B, 4-9-89A, 4-9-89B, | 400kV,3150A,50kA,1sec, 3-PHASE HDB TYPE ISOLATOR WITH ONE EARTH SWITCH (WITH MASTER SLAVE OPERATION) | ALSTOM | 18 |
| 7B | | 4-1-89A, 4-3-89B | 420kV,3150A,50kA,1sec, 3-PHASE HDB TYPE ISOLATOR WITH TWO EARTH SWITCH (WITH MASTER SLAVE OPERATION) | ALSTOM | 02 |
| 7C | | 4-1-89T-R1, 4-1-89T-Y1, 4-1-89T-B1 4-4-89T-R1, 4-4-89T-Y1, 4-4-89T-B1, 4-4-89T-B2 | ISOLATOR WITH 1 EARTH SWITCH, HDB TYPE, 400kV, 1P, 3150A, 50kA FOR 1 sec, ELECTRICALLY GANGED (ALL MASTER) | ALSTOM | 07 |
| 7D | | 4-1-89T-B2, 4-1-89T-Y2, 4-1-89T-B2, 4-4-89T-B2, 4-4-89T-Y2 | ISOLATOR WITHOUT EARTH SWITCH, HDB TYPE, 400kV, 1P, 3150A, 50kA FOR 1 sec, ELECTRICALLY GANGED (ALL MASTER) | ALSTOM | 05 |
| 8 | | 4-5-CT, 4-6-CT,4-8-CT, 4-9-CT | CURRENT TRANSFORMER,1-Ø 400kV,6 CORE, 3000A 50kA for 3sec 120% EXTENDED CURRENT RATING | ALSTOM | 12 |
| 8A | | 4-1-CT, 4-2-CT, 4-3-CT, 4-4-CT | CURRENT TRANSFORMER,1-Ø 400kV,5 CORE, 3000A 50kA for 1sec 120% EXTENDED CURRENT RATING | ALSTOM | 12 |
| 9 | | 4-6-CVT, 4-9-CVT, | 400kV, 50kA, 1 Sec 1-PH CVT (4400pF) 3CORE 3P/3P/0.2/0.2 | ALSTOM | 06 |
| 9A | | 4-CVTA, 4-CVTB | 400kV, 50kA, 1 Sec 1-PH CVT (4400pF) 3CORE 3P/3P/0.2 | ALSTOM | 06 |
| 10 | | 4-1-LA, 4-1-LAS, 4-3-LA, 4-4-LA, 4-5-LA, 4-7-LA | 336kV LIGHTNING ARRESTER (1-Ø) DISCHARGE CURRENT 20kA | -- | 16 |

## BILL OF QUANTITY OF 145kV EQUIPMENTS

| Sl.No. | SYMBOL | IDENTIFICATION | DESCRIPTION | MAKE | QTY AS PER CONTRACT |
|---|---|---|---|---|---|
| 11 | | 1-1-89NGR-R1,1-1-89NGR-Y1, 1-1-89NGR-B1,1-1-89NGR-N1, 1-1-89NGR-N2,1-4-89NGR-R1, 1-4-89NGR-Y1,1-4-89NGR-B1, 1-4-89NGR-N1,1-4-89NGR-N2, 1-7-89NGR-R1,1-7-89NGR-Y1, 1-7-89NGR-B1,1-7-89NGR-N1 | 145kV HCB 1P ISOLATOR WITHOUT E/S | -- | 36 |

## BILL OF QUANTITY OF 33kV EQUIPMENTS (INSULATION LEVEL OF 72.5kV CLASS)

| Sl.No. | SYMBOL | IDENTIFICATION | DESCRIPTION | MAKE | QTY AS PER CONTRACT |
|---|---|---|---|---|---|
| 12 | | 6-3-89T-R, 6-3-89T-Y, 6-3-89T-B 6-6-89T-R, 6-6-89T-Y, 6-6-89T-B 6-5-89TS-R, 6-5-89TS-Y, 6-5-89TS-B 6-8-89TS-R, 6-8-89TS-Y, 6-8-89TS-B | 72.5KV HCB 3P,600A, ISOLATOR WITHOUT E/S MOTOR OPERATED | -- | 12 |

## BILL OF QUANTITY OF 33kV EQUIPMENTS

| Sl.No. | SYMBOL | IDENTIFICATION | DESCRIPTION | MAKE | QTY AS PER CONTRACT |
|---|---|---|---|---|---|
| 13 | | NCT-1, NCT-2 | 33kV NEUTRAL CT (400/1A) | --- | 02 |
| 14 | | 3-1-89-NGT-1, 3-6-89-NGT-1 | 33KV HCB, 1P, 400A, ISOLATOR WITHOUT E/S MOTOR OPERATED | --- | 02 |
| 15 | | 3-1-89A, 3-3-89Y, 3-3-89B, 3-6-89A, 3-6-89Y, 3-6-89B, | 33kV HCB, 3P, 400A, ISOLATOR WITHOUT E/S MANUAL OPERATED | --- | 06 |

## EQUIPMENT TO BE SUPPLIED BY CUSTOMER (NOT IN ALSTOM SCOPE).

| Sl.No. | SYMBOL | IDENTIFICATION | DESCRIPTION | MAKE | QUANTITY |
|---|---|---|---|---|---|
| 16 | | ICT-I,ICT-II | INTERCONNECTING TRANSFORMER, 500MVA (SINGLE PHASE), 765/400kV, | --- | 6+1 (SPARE) |
| 17 | | 7-1-LR, 7-4-LR | LINE SHUNT REACTOR, 80MVAR (SINGLE PHASE) 765kV | --- | 6+1 (SPARE) |
| 18 | | 7-7-BR | BUS SHUNT REACTOR, 80MVAR (SINGLE PHASE) 765kV | --- | 3+1 (SPARE) |
| 19 | | 1-1-NGR, 1-4-NGR | NEUTRAL GROUNDING REACTOR 145kV, 1200 KVAR (WITH BCT) | --- | 02 |
| 20 | | 1-1-LA NGR, 1-4-LA NGR | 120kV LIGHTNING ARRESTER (1-Ø) DISCHARGE CURRENT 10kA | --- | 02 |
| 21 | | 4-1-BR | 125MVAR BUS REACTOR | --- | 01 |

## TABLE FOR BUS CONFIGURATION

| Sl.No. | DESCRIPTION | CONTINUOUS CURRENT RATING | SHORT TIME CURRENT RATING | CONDUCTOR TYPES |
|---|---|---|---|---|
| 1. | 765kV MAIN BUS-1 & 2 | 4000Amp | 40kA/1Sec | QUAD AAC BULL |
| 2. | 765kV LINE & ICT JACK BUS CIRCUIT | 3150Amp | 40kA/1Sec | QUAD AAC BULL |
| 3. | 765kV EQUIPMENT TO EQUIPMENT CONNECTION BUS | 3150Amp | 40kA/1Sec | 5" IPS AL TUBE |
| 4. | 400kV MAIN BUS-1 & 2 | 3150Amp | 50kA/1Sec | QUAD ACSR MOOSE |
| 5. | 400kV LINE & ICT JACK BUS CIRCUIT | 3150Amp | 50kA/1Sec | QUAD ACSR MOOSE |
| 6. | 400kV EQUIPMENT TO EQUIPMENT CONNECTION BUS | 3150Amp | 50kA/1Sec | 5" IPS AL TUBE |
| 7. | TRANSFORMER TERTIARY CONNECTIONS | 400A | 50kA/1Sec | 3" IPS AL TUBE |
| 8. | 765kV DROPPER & JUMPER SIZES | 3150Amp | 40kA/1Sec | QUAD AAC BULL |
| 9. | 400kV DROPPER & JUMPER SIZES | 3150Amp | 50kA/1Sec | QUAD ACSR MOOSE |
| 10. | 765kV DROPPER FOR REACTORS | 2000A | 40kA/1Sec | QUAD AAC BULL |

LEGENDS:-
- PRESENT SCOPE
- FUTURE
- NOT IN ALSTOM SCOPE

NOTES:-
1. SPARE UNITS MENTIONED UNDER THIS BOQ REFERS TO THE EQUIPMENTS CONCERNING SPARE ICT/REACTOR. MANDATORY SPARES DEFINED UNDER THE CONTRACT ARE NOT INCLUDED IN THIS BOQ.
2. # VA BURDEN REQUIREMENT SHALL BE FINALIZED ALONG WITH KNEE POINT VOLTAGE REQUIREMENT AT THE TIME OF FINALISATION OF PROTECTION SYSTEMS.
3. *SINCE THESE ICT/REACTORS WILL BE SUPPLIED BY CUSTOMER , THEREFOR MAKE & DETAILS OF SAME (LIKE VECTOR GROUP,BUSHING CT) SHALL BE FURNISHED BY CUSTOMER.
4. # # THE PROTECTION DETAILS ARE INDICATIVE ONLY . FOR DETAILED PROTECTION & METERING REFER PROTECTION SLD DRAWING .
5 CORE CT IS USED WHERE BUSHING CT IS USED FOR METERING PURPOSE.
5. **DURING ADDITION OF THE FUTURE LINES, THE EXISTING SECOND SPARE REACTOR SHALL BE INCLUDED INTO THE NEXT LINE REACTOR BANK AND THE 1-PH. UNIT OF THE LAST LINE REACTOR BANK SHALL BE USED AS THE SECOND SPARE REACTOR.

AS-BUILT

| REV. | DESCRIPTION | DRAWN | ELECT. | PM CHECKED | APPROVED | STATUS |
|---|---|---|---|---|---|---|
| | | Name | | | | |
| | | Date | | | | |
| | | Sign. | | | | |
| | | Name | | | | |
| | | Date | | | | |
| | | Sign. | | | | |
| | | Name | | | | |
| | | Date | | | | |
| | | Sign. | | | | |
| R2 | AS-BUILT | Name | KSV | DPK | PTK | AS-BUILT |
| | | Date | 08.01.14 | 08.01.14 | 08.01.14 | |
| | | Sign. | | | | |
| R1 | REVISED AS PER CUSTOMER COMMENTS | Name | KSV | DPK | PTK | FOR APPROVAL |
| | | Date | 27.12.11 | 27.12.11 | 27.12.11 | |
| | | Sign. | | | | |
| R0 | FIRST ISSUE | Name | KSV | DPK | PTK | FOR APPROVAL |
| | | Date | 14.12.12 | 14.12.12 | 14.12.12 | |
| | | Sign. | | | | |

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

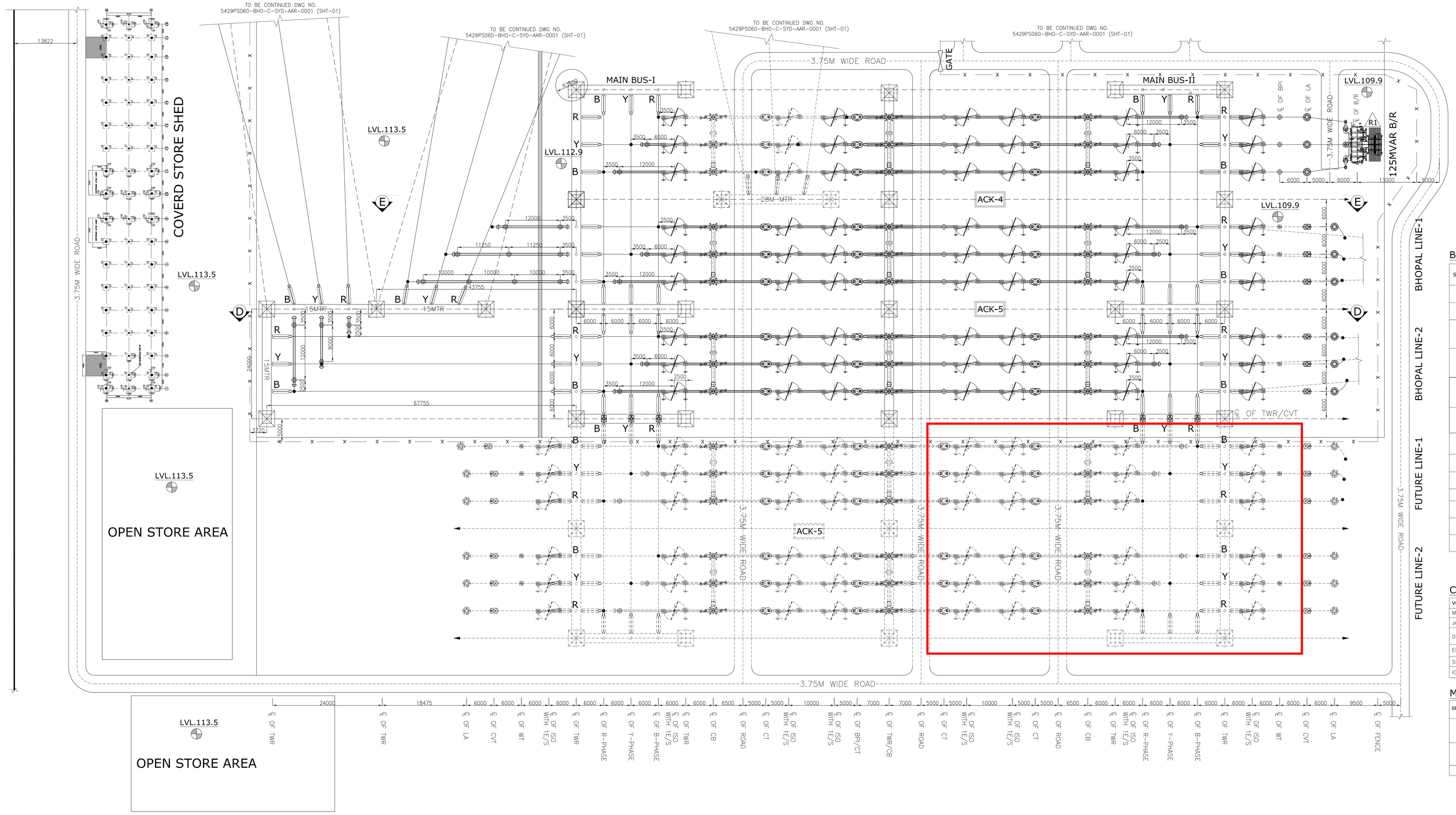
TITLE: SINGLE LINE DIAGRAM FOR 765/400kV BHOPAL SUBSTATION

| TENDER DWG. | 3-LINE 800KV REACTOR SWITCHING SCHEME(OPTION-B) | | |
|---|---|---|---|
| REFR. DRG. NO. | DESCRIPTION | | |

A0 | SCALE: NTS | ALSTOM T&D INDIA LTD. (Formerly ALSTOM T&D INDIA LTD) A-7, SECTOR-65, NOIDA - 201301, UTTAR PRADESH (INDIA). | DRAWING NO.: 5429PS060-BHO-E-SYD-SLD-0401 | SHEET NO: 01 02

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## SYSTEM PARAMETERS (TABLE-1)

| Sl.No. | DESCRIPTION | 400kV SYSTEM |
|---|---|---|
| 1 | SYSTEM OPERATING VOLTAGE | 400kV |
| 2 | MAX. OPERATING VOLTAGE OF THE SYSTEM (rms) | 420kV |
| 3 | RATED FREQUENCY | 50Hz |
| 4 | NO. OF PHASES | 3 |
| 5 | RATED INSULATION LEVELS<br>i) FULL WAVE LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2/50microsec.)<br>ii) SWITCHING IMPULSE WITHSTAND VOLTAGE (250/2500microsec.) DRY & WET<br>iii) ONE MINUTE POWER FREQUENCY DRY & WET WITH STAND VOLTAGE (rms) | 1425kVp<br>1050kV<br>630kV |
| 6 | MIN. CREEPAGE DISTANCE | 10500mm |
| 7 | CORONA EXTINCTION VOLTAGE | 320kV |
| 8 | MAX. RADIO INTERFERENCE VOLTAGE LEVEL AT CORONA EXTINCTION VOLTAGE (rms). | 1000 micro volts |
| 9 | RATED 3-PH. SYMMETRICAL SHORT CIRCUIT CURRENT WITHSTAND CAPACITY | 50kA/1sec. |
| 10 | SYSTEM NEUTRAL EARTHING | EFFECT. EARTHED |

## BILL OF QUANTITY OF 400kV EQUIPMENTS (TABLE-2)

| Sl.No. | SYMBOL | DESCRIPTION | MAKE | QTY AS PER CONTRACT |
|---|---|---|---|---|
| 1 | | CIRCUIT BREAKER, 400kV, 3150A, 50kA for 1 sec, SF6, 3P, WITH CONTROLLED SWITCHING | ALSTOM | 02 |
| 2 | | CIRCUIT BREAKER, 400kV, 3150A, 50kA for 1 sec, SF6, 3P, WITHOUT CONTROLLED SWITCHING | ALSTOM | 06 |
| 3 | | 400kV,3150A,50kA,1sec, 3-PHASE HDB TYPE ISOLATOR WITH ONE EARTH SWITCH (WITH MASTER SLAVE OPERATION) | ALSTOM | 18 |
| 4 | | 400kV,3150A,50kA,1sec, 3-PHASE HDB TYPE ISOLATOR WITH TWO EARTH SWITCH (WITH MASTER SLAVE OPERATION) | ALSTOM | 02 |
| 5 | | ISOLATOR WITH 1 EARTH SWITCH, HDB TYPE, 400KV, 1P, 3150A, 50kA FOR 1 sec, ELECTRICALLY GANGED (ALL MASTER) | ALSTOM | 07 |
| 6 | | ISOLATOR WITHOUT EARTH SWITCH, HDB TYPE, 400KV, 1P, 3150A, 50kA FOR 1 sec, ELECTRICALLY GANGED (ALL MASTER) | ALSTOM | 05 |
| 7 | | CURRENT TRANSFORMER,(1-ø) 400kV,6CORE,3000A 50kA for 1sec 120% EXTENDED CURRENT RATING | ALSTOM | 12 |
| 8 | | CURRENT TRANSFORMER,(1-ø) 400kV, 5 CORE, 3000A 50kA for 1sec 120% EXTENDED CURRENT RATING | ALSTOM | 12 |
| 9 | | 400kV, 50KA, 1 Sec 1-PH CVT (4400pF) 4CORE 3P/3P/0.2/0.2 | ALSTOM | 06 |
| 10 | | 400kV, 50KA, 1 Sec 1-PH CVT (4400pF) 3CORE 3P/3P/0.2 | ALSTOM | 06 |
| 11 | | 336kV LIGHTENING ARRESTER (1-ø) DISCHARGE CURRENT 20kA | -- | 16 |
| 12 | | 400kV HIGH BUS POST INSULATOR 1.3MTR HEIGHT | ADITYA BIRLA | 13 |
| 13 | | 400kV LOW BUS POST INSULATOR .8MTR HEIGHT | ADITYA BIRLA | 62 |

## CONDUCTOR DETAIL OF SWITCHYARD (TABLE-3)

| VOLTAGE LEVEL-400kV | |
|---|---|
| MAIN BUS-1 & BUS-II | QUAD MOOSE ACSR CONDUCTOR |
| JACK BUS/STRINGING CONNECTION | QUAD MOOSE ACSR CONDUCTOR |
| DROPPERS/JUMPERS | TWIN MOOSE ACSR CONDUCTOR (FOR LA,CVT)<br>QUAD MOOSE ACSR CONDUCTOR FOR OTHERS |
| EQUIPMENT INTERCONNECTION | 5" IPS AL. TUBE |
| SHIELD WIRE | 7/3.66mm GI WIRE (10.98mm DIA) |
| ICT TERTIARY FORMATION | 3" IPS AL. TUBE |

## MINIMUM AIR CLEARANCE (TABLE-4)

| Sl.No. | DESCRIPTION | 400kV SYSTEM |
|---|---|---|
| 1 | PHASE TO PHASE<br>CONDUCTOR TO CONDUCTOR<br>ROD TO STRUCTURE | 4000<br>4200 |
| 2 | PHASE TO GROUND<br>CONDUCTOR TO STRUCTURE<br>ROD TO STRUCTURE | 3500 |
| 3 | SECTIONAL CLEARENCE | 6400 |

LEGEND:-
- PRESENT SCOPE
- FUTURE
- BOUNDARY LINE
- LEVEL INDICATIONS

NOTES:-
1. ALL DIMENSION ARE IN MM
2. DEAD END TOWER STRINGING & CONDUCTOR NOT IN ALSTOM SCOPE.

| REFR. DRG. NO. | DESCRIPTION |
|---|---|
| 5429PS060-BHO-C-SYD-AAR-1000 | COMBINED ELECTRICAL LAYOUT PLAN FOR 765/400kV BHOPAL |
| 5429PS060-BHO-E-SYD-SLD-0401 | SINGLE LINE DIAGRAM FOR 765/400kV BHOPAL SUBSTATION |

| REV. | DESCRIPTION | DRAWN | CHECKED (ELECT. / PM) | APPROVED | STATUS |
|---|---|---|---|---|---|
| R3 | INTERNAL UPDATION | KSV 07.05.13 | DPK 07.05.13 | PTK 07.05.13 | FOR APPROVAL |
| R2 | REVISED AS PER CUSTOMER COMMENTS | KSV 20.03.13 | DPK 20.03.13 | PTK 20.03.13 | FOR APPROVAL |
| R1 | REVISED AS PER CUSTOMER COMMENTS | KSV 07.02.13 | DPK 07.02.13 | PTK 07.02.13 | FOR APPROVAL |
| R0 | FIRST ISSUE | KSV 28.01.13 | DPK 28.01.13 | PTK 28.01.13 | FOR APPROVAL |

ALL DIMENSIONS ARE IN MM

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

TITLE: 400kV ELECTRICAL LAYOUT PLAN FOR BHOPAL SUBSTATION

A1 | SCALE 1:475 | ALSTOM T&D INDIA LTD. (Formerly AREVA T&D INDIA LTD) A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH (INDIA).

DRAWING NO.: 5429PS060-BHO-C-SYD-AAR-0001 | SHEET NO 002 | 002

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DRAWING NO. : 5429PS060-BHO-C-SYD-EAR-0202

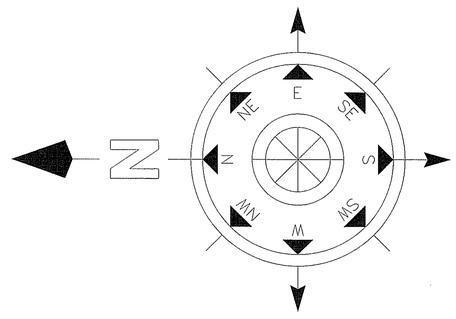

F.G.L. (113.5M)
F.G.L. (112.9M)
F.G.L. (111.25M)
F.G.L. (109.9M)
MAIN BUS-I
MAIN BUS-II
GATE
3.75M WIDE ROAD
3.75M WIDE ROAD
3.75M WIDE ROAD
3.75M WIDE ROAD
3.75M WIDE ROAD
ACK-5
ACK-4
ACK-5
SPR-1
℄ OF TRANSFORMER/CVT
℄ OF BUS COUPLER
℄ BPI
℄ LA
℄ OF B/R
P. LVL. 113.200
P. LVL. 113.200
P. LVL. 112.353
P. LVL. 111.709
P. LVL. 111.379
P. LVL. 110.619
PL.112.545
PL.111.903
62525
24000
18475
37000
8350
23875
36000
29500
28500
7200
8000
6000
9500
6000
6000
6000

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DF009

DRAWING NO. : 5429PS060-BHO-C-SYD-EAR-0202



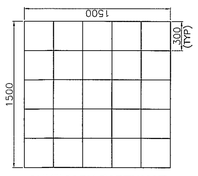




## 765kV LEGEND & BOQ OF EARTHMAT (TABLE NO-1)

| S.NO. | DESCRIPTION | UOM | TOTAL QTY |
|---|---|---|---|
| 1. | 32MM DIA MS ROD FOR MAIN EARTHMAT | mtrs | 11179 |
| 2. | 3m LONG ROD ELECTRODE OF 32MM DIA WITH UNTREATED EARTH PIT | NOS. | 66 |
| 3. | 3m LONG PIPE ELECTRODE OF 32MM DIA WITH TREATED EARTH PIT | NOS. | 10 |

## ROD ELECTRODE (TABLE NO-2)

| S.NO. | DESCRIPTION | UOM | TOTAL QTY |
|---|---|---|---|
| 1. | (LA) E1 TO E24 | NOS. | 24 |
| 2. | (CVT) E25 TO E36 | NOS. | 12 |
| 3. | (PEAK TOWER) E37 TO E64 | NOS. | 28 |
| 4. | (LM) E65 TO E66 | NOS. | 02 |




AUXILIARY EARTHMAT

## NOTES

1. THE EARTHMAT SHALL BE MADE WITH 32mm DIA MS ROD.
2. EARTHING CONDUCTORS SHALL BE BURIED 600mm BELOW FGL UNLESS OTHERWISE SPECIFIED.
3. WHEREVER EARTHING CONDUCTOR CROSS CABLE TRENCH UNDER GROUND SERVICES DUCTS PIPES, TUNNELS, RAILWAY TRACKS ETC. IT SHALL BE LAID ATLEAST 300mm BELOW THEM AND SHALL BE REROUTED IN CASE IT FOULS WITH EQUIPMENT/STRUCTURE FOUNDATION.
4. EARTHING CONDUCTORS CROSSING THE ROAD SHALL BE LAID AT 1m DEPTH FROM FGL.
5. ALL GROUND CONNECTIONS SHALL BE MADE BY ELECTRIC ARC WELDING. ALL WELDED JOINTS SHALL BE ALLOWED TO COOL DOWN GRADUALLY TO ATMOSPHERIC TEMPERATURE BEFORE PUTTING ANY LOAD ON IT. ARTIFICIAL COOLING SHALL NOT BE ALLOWED.
6. ALL EQUIPMENT & STRUCTURES SHALL BE GROUNDED AS PER EQUIPMENT EARTHING PHILOSOPHY die : DOC NO 5429PS060-BHO-E-SYD-EAR-0203
7. THE LOCATION OF EARTHING CONDUCTOR, EARTHPITS AND GROUND RODS ARE INDICATIVE AND MAY BE MODIFIED TO SUIT SITE CONDITION.
8. EARTHING CONDUCTOR SHALL BE BURRIED 2000MM OUTSIDE THE SWITCHYARD FENCE. AND ALL THE GATES EVERY ALTERNATE POST OF FENCING SHALL BE CONNECTED TO MAIN EARTHING GRID.
9. FIRE FIGHTING PIPE LINE AND ANY OTHER PIPING SYSTEM RUNNING THROUGH THE 765kV YARD SHALL BE GROUNDED WITH 765kV YARD EARTHMAT.
10. EARTHING LAYOUT FOR SWITCHYARD BUILDINGS SHALL BE SUBMITTED SEPARATELY.
11. AUXILIARY EARTH MAT SHALL BE 1500X1500 SPACING OF 300MM
12. MINIMUM SPACE BETWEEN TWO EARTH ELECTRODES SHALL BE 6MTRS
13. @REACTOR NEUTRAL AND ICT TERTIARY,,LT YARD. DETAILED..EARTHING LAYOUT TO BE SUBMITTED SEPARATELY.
14. THE PIT NUMBERS SHALL BE WRITTEN BOLDLY ON THE EARTH PIT AS PER THE LAYOUT AND TABLE NO-2

B.D.T.C.L.
CAT-A APPROVED
Signed:
Date: 16.03.2013
This approval does not absolve the contractor/Supplier of his contractual responsibility to engineer an efficient design and successful performance of the Project/Equipment.
16/03/2013

CONTROLLED COPY

| | |
|---|---|
| ☑ APPROVAL | ☐ AS BUILT |
| ☐ PROTO | ☐ CONSTRUCTION |
| ☐ PLANNING | ☐ REFERENCE |
| ☐ MANUFACTURING | ☐ INDENT |
| ☐ RECORD | ☐ EXECUTION |

DT. 16/3/13 ALSTOM T&D INDIA LTD. SIGN.

ALL DIMENSIONS ARE IN MM

| REFR. DRG. NO. | DESCRIPTION |
|---|---|
| 5429PS060-BHO-C-SYD-ARR-1053 | 765kV FOUNDATION LAYOUT FOR BHOPAL SUBSTATION |
| 5429PS060-BHO-C-SYD-AAR-1000 | COMBINED ELECTRICAL LAYOUT PLAN FOR 765/400kV BHOPAL SUBSTATION. |
| 5429PS060-BHO-C-SYD-AAR-0001 | 765/400kV LAYOUT PLAN & SECTION FOR BHOPAL SUBSTATION |
| 5429PS060-BHO-C-SYD-ARR-1051 | 400kV STRUCTURAL LAYOUT FOR BHOPAL SUBSTATION. |

| REV. | DESCRIPTION | DRAWN | SIGN | CHECKED | SIGN | APPROVED | SIGN | STATUS |
|---|---|---|---|---|---|---|---|---|
| R1 | REVISED AS PER CUSTOMER COMMENTS | KSV 14.03.13 | | DPK 14.03.13 | | PTK 14.03.13 | | FOR APPROVAL |
| R0 | FIRST ISSUE | KSV 22.02.13 | | DPK 22.02.13 | | PTK 22.02.13 | | FOR APPROVAL |

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

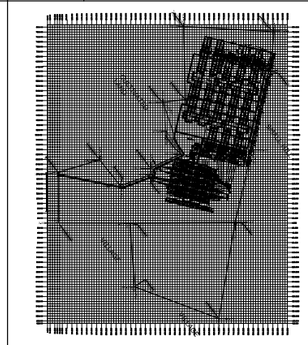
CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

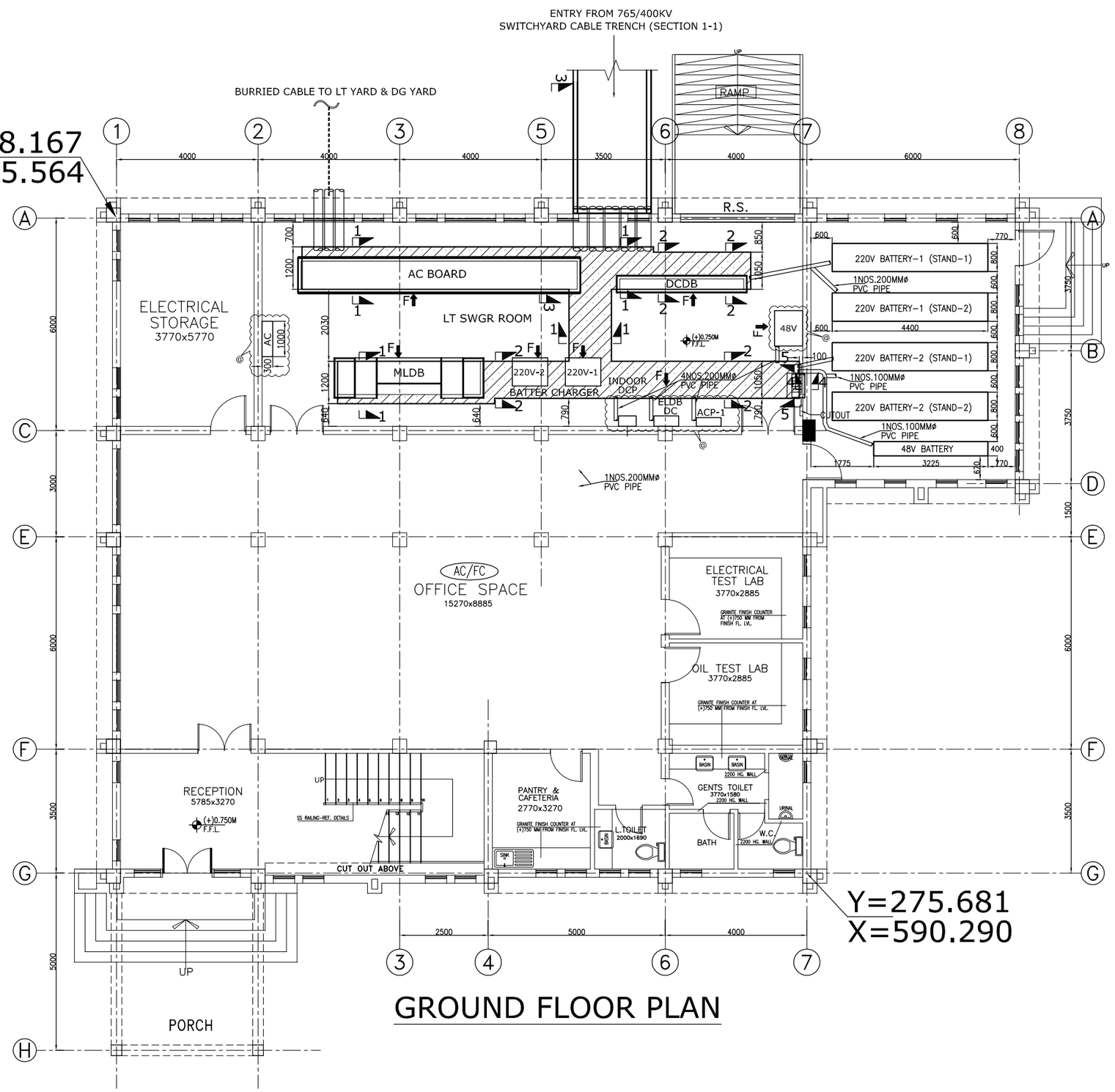
TITLE: 765kV EARTHMAT LAYOUT OF BHOPAL SUBSTATION

| SCALE | ALSTOM T&D INDIA LTD. (Formerly AREVA T&D INDIA LTD) A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH (INDIA). | DRAWING NO.: | SHEET NO |
|---|---|---|---|
| A0 1:475 | ALSTOM | 5429PS060-BHO-C-SYD-EAR-0202 | 001 001 |

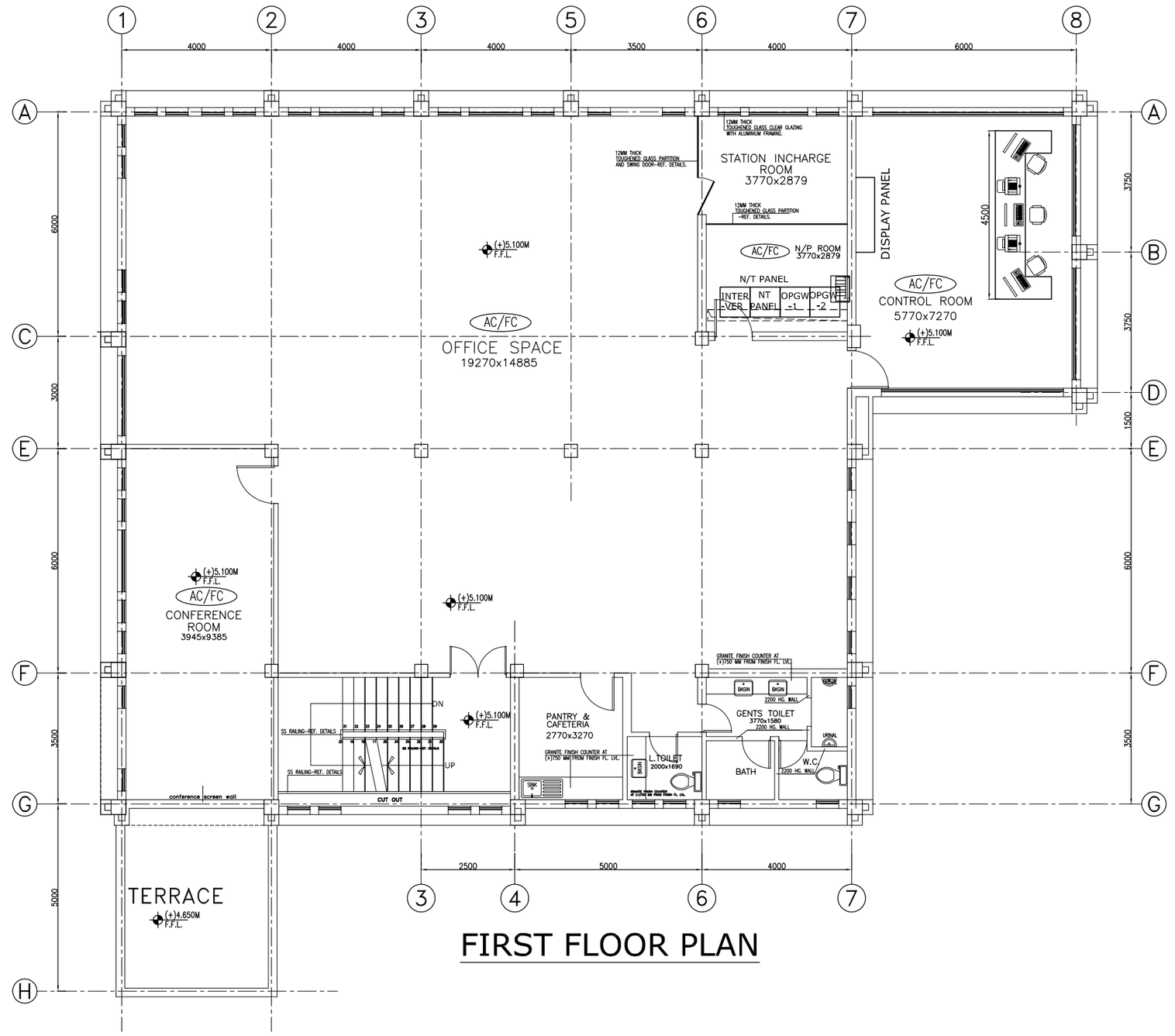
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DRAWING NO.:5429PS060-DHU-E-SYD-CAB-0127




GROUND FLOOR PLAN




FIRST FLOOR PLAN

ALL DIMENSIONS ARE IN MM

**LEGEND**

- CABLE TRENCH
- CHEQURED PLATE
- CUTOUT (FOR PANEL)
- PVC PIPE
- BURRIED CABLE TRENCH ROUTE

**NOTES**

1. ALL DIMENSIONS ARE IN MM.
2. @ WALL MOUNTED PANEL.

| REFR. DRG. NO. | DESCRIPTION |
|---|---|
| 5429PS060-DHU-E-SYD-ARR-0030 | 765/400KV CONTROL ROOM BUILDING FOR DHULE S/S |

| REV. | DESCRIPTION | | DRAWN | CHECKED | | APPROVED | STATUS |
|---|---|---|---|---|---|---|---|
| | | Name | | | | | |
| | | Date | | | | | |
| | | Sign. | | | | | |
| | | Name | | | | | |
| | | Date | | | | | |
| | | Sign. | | | | | |
| | | Name | | | | | |
| | | Date | | | | | |
| | | Sign. | | | | | |
| | | Name | | | | | |
| | | Date | | | | | |
| | | Sign. | | | | | |
| R0 | FIRST ISSUE | Name | KSV | DPK | | PTK | FOR APPROVAL |
| | | Date | 29.10.12 | 29.10.12 | | 29.10.12 | |
| | | Sign. | | | | | |

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

TITLE: 765/400KV CONTROL ROOM BUILDING
INDOOR CABLE TRENCH LAYOUT FOR DHULE SUBSTATION

| SCALE | ALSTOM T&D INDIA LTD. (Formerly AREVA T&D INDIA LTD) A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH (INDIA). | DRAWING NO.: | SHEET NO | |
|---|---|---|---|---|
| A2 1:125 | | 5429PS060-DHU-E-SYD-CAB-0127 | R0 | 001 |

DF001

DRAWING NO.: 5429PS060-DHU-E-SYD-SCH-3427

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ALL DIMENSIONS ARE IN MM

| REFR. DRG. NO. | DESCRIPTION |
|---|---|
| | |

| REV. | DESCRIPTION | DRAWN | ELECT. | PM CHECKED | APPROVED | STATUS |
|---|---|---|---|---|---|---|
| | | Name / Date / Sign. | | | | |
| ZA | ASBUILT DRAWINGS | ACS 17.08.15 | ACS 17.08.15 | | SSS 17.08.15 | |
| Z | ASBUILT DRAWINGS | ACS 11.12.12 | ACS 11.12.12 | | SSS 11.12.12 | |
| B | SECOND ISSUE | ACS 03.07.12 | ACS 03.07.12 | | SSS 03.07.12 | |
| A | FIRST ISSUE | ACS 18.04.12 | ACS 18.04.12 | . . | SSS 18.04.12 | FOR APPROVAL |

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

INVITN/AAL P.O REF: LOA No.: SCI/EI100138/PCP/01

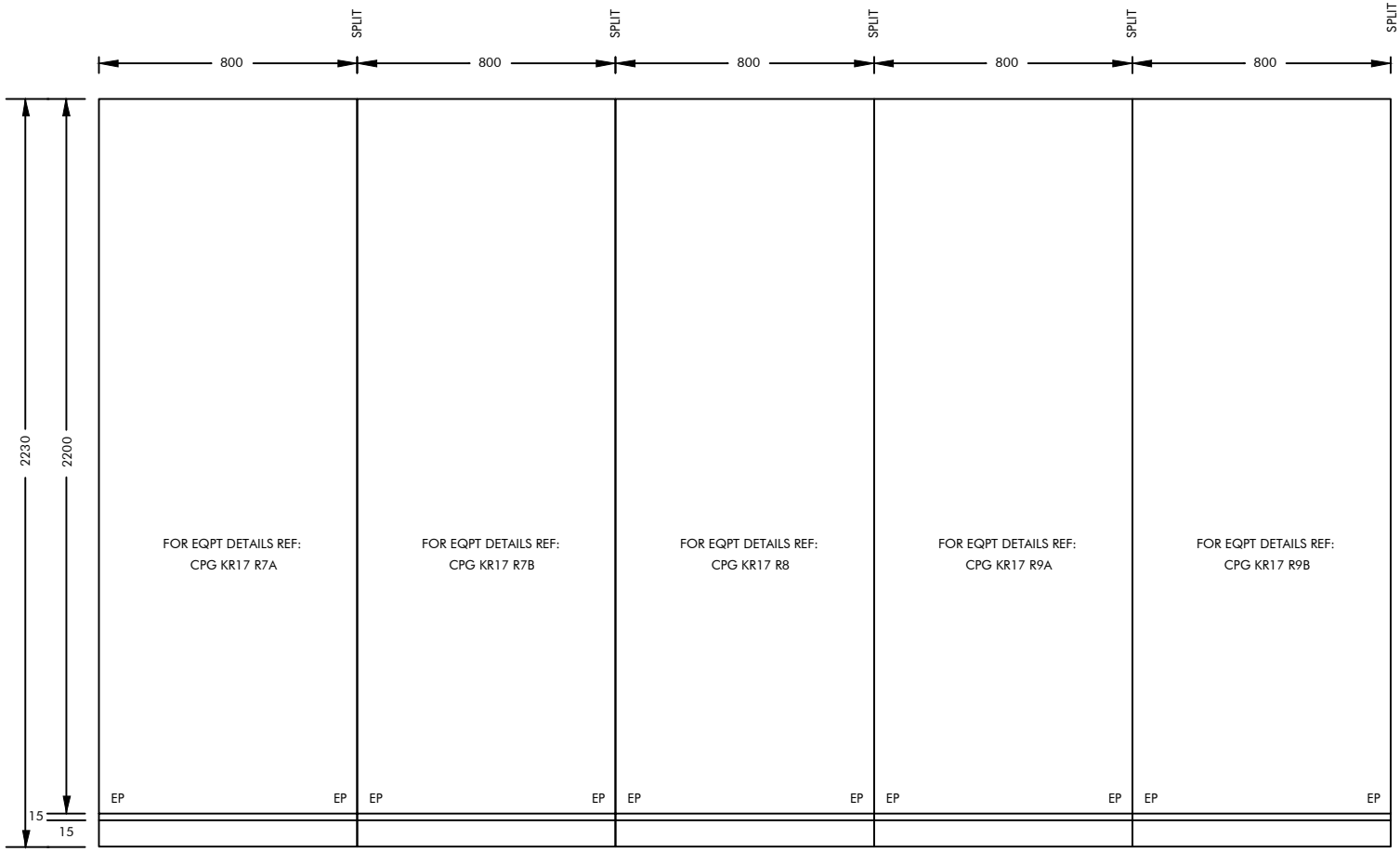
TITLE: 400KV BUSBAR PROTECTION 765/400KV DHULE S/S

SCALE: A0 1:700

ALSTOM T&D INDIA LTD. A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH (INDIA).

DRAWING NO.: 5429PS060-DHU-E-SYD-SCH-3427

SHEET NO: 32 KR17 27




| PANEL TYPE | R7A | R7B | R8 | R9A | R9B |
|---|---|---|---|---|---|
| PANEL REF | R7A | R7B | R8 | R9A | R9B |
| CIRCUIT LABEL | 400KV SIDE OF 765/400KV ICT-1 BAY-4-7 | 400KV SIDE OF 765/400KV ICT-1 BAY-4-7 | 400KV TIE BAY-4-8 | 400KV DHULE(MSETCL) LINE-2 BAY-4-9 | 400KV DHULE(MSETCL) LINE-2 BAY-4-9 |

OVERALL LENGTH OF THE BOARD: 6400MM

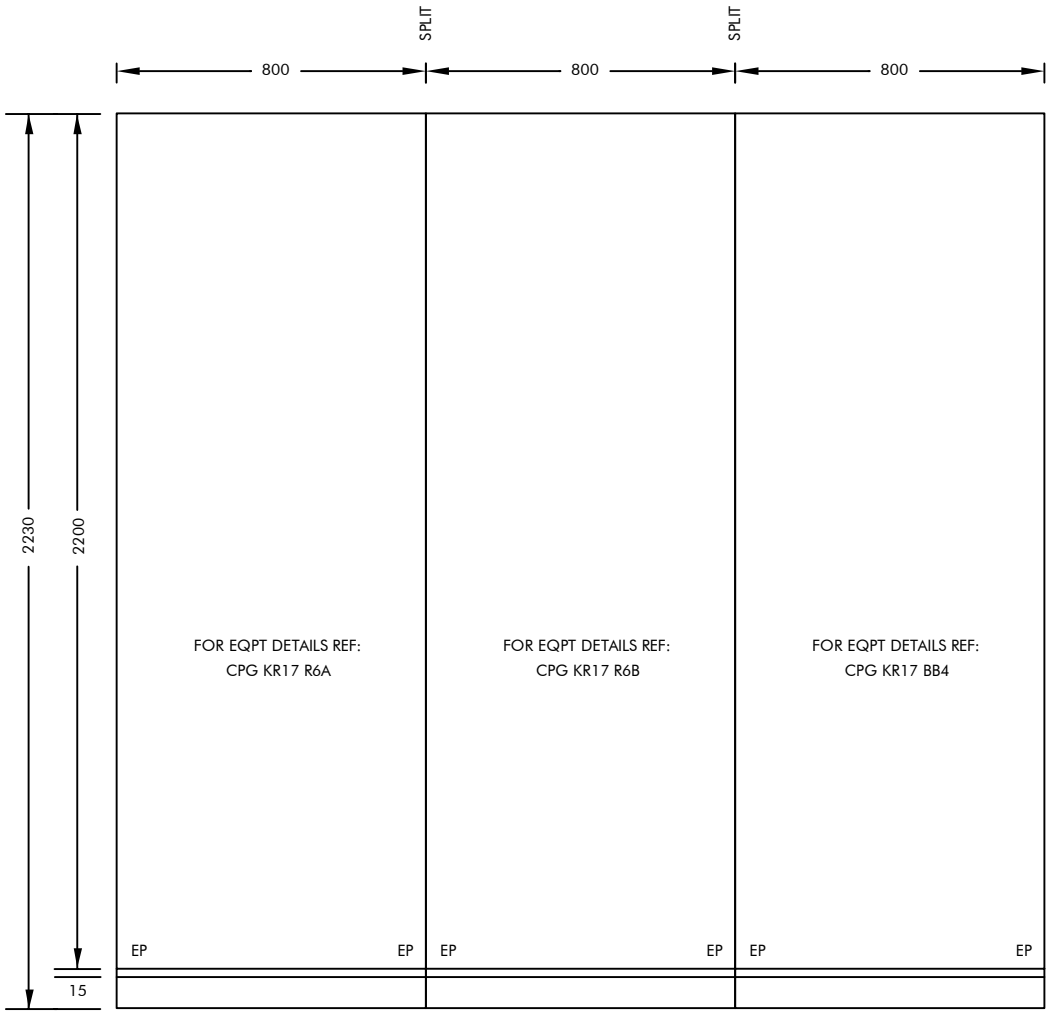
4 NOS. LIFTING HOOKS (EYE BOLTS) TO BE PROVIDED FOR ONE SPLIT

AUXILIARY VOLTAGE: 220V DC
CT SECONDARY: 1A

EP REFERS TO END PANEL WITH EXTERNAL SHADE

PANEL STRUCTURE: SIMPLEX
PANEL DEPTH: 800

| | | | | |
|---|---|---|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 | CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD. | ALSTOM T&D India Limited - AUTOMATION SAS PALLAVARAM CHENNAI 600043 | BOARD FORMATION DRAWING PANEL TYPES: R7A R7B R8 R9A R9B FILE:KR17B7A TITLE: 765/400KV DHULE SUBSTATION 400KV RELAY PANELS-KIOSK-4 | PREPARED BY: ACS / REVISION: ZA |
| PANEL CONSTRUCTIONAL DETAILS: | KR17PC1 | PROJECT: CONST. OF 765 / 400KV DHULE S/S | | | CHECKED BY: ACS / DATE: 17.08.2015 |
| | | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 Dated 01.08.11 | | | APPROVED BY: SSS / SCALE: --- |
| SALES ORDER: 3269017500 | | | | | DRG. NO.: CPD KR17 BF7 SHT 1 OF 2 |




| PANEL TYPE | R6A | R6B | BB4 |
|---|---|---|---|
| PANEL REF | R6A | R6B | BB4 |
| CIRCUIT LABEL | 400KV DHULE(MSETCL) LINE-1 BAY-4-6 | 400KV DHULE(MSETCL) LINE-1 BAY-4-6 | 400KV BUSBAR |

OVERALL LENGTH OF THE BOARD: 6400MM

4 NOS. LIFTING HOOKS (EYE BOLTS) TO BE PROVIDED FOR ONE SPLIT

AUXILIARY VOLTAGE: 220V DC
CT SECONDARY: 1A

EP REFERS TO END PANEL WITH EXTERNAL SHADE

PANEL STRUCTURE: SIMPLEX
PANEL DEPTH: 800

| | |
|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 |
| PANEL CONSTRUCTIONAL DETAILS: | KR17PC1 |
| **SALES ORDER:3269017500** | |

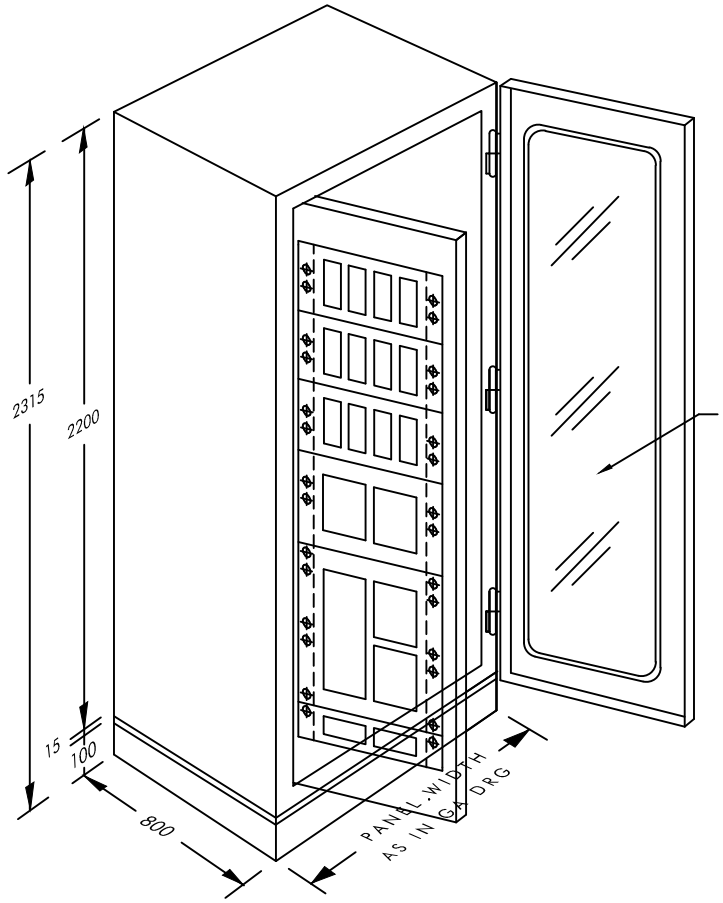
**CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.**
PROJECT: CONST. OF 765 / 400KV DHULE S/S
P.O.NO.: LOA No.: SCI/EI100138/PCP/01
Dated 01.08.11

ALSTOM
**ALSTOM T&D India Limited - AUTOMATION SAS**
PALLAVARAM CHENNAI 600043

**BOARD FORMATION DRAWING**
PANEL TYPES: R6A R6B BB4 FILE:KR17B7A
TITLE: 765/400KV DHULE SUBSTATION
400KV RELAY PANELS-KIOSK-4

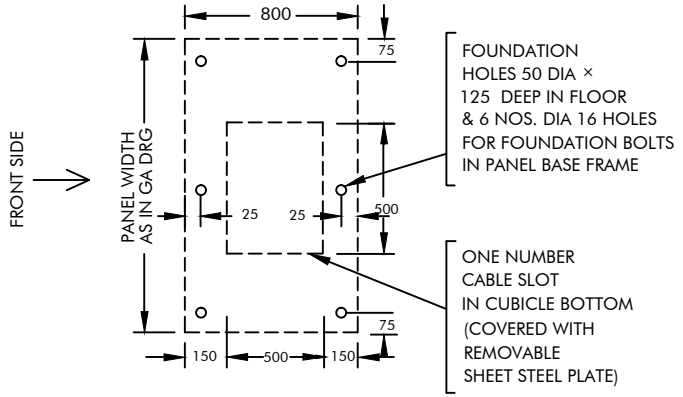
| | |
|---|---|
| PREPARED BY: ACS | REVISION: ZA |
| CHECKED BY: ACS | DATE: 17.08.2015 |
| APPROVED BY: SSS | SCALE: --- |

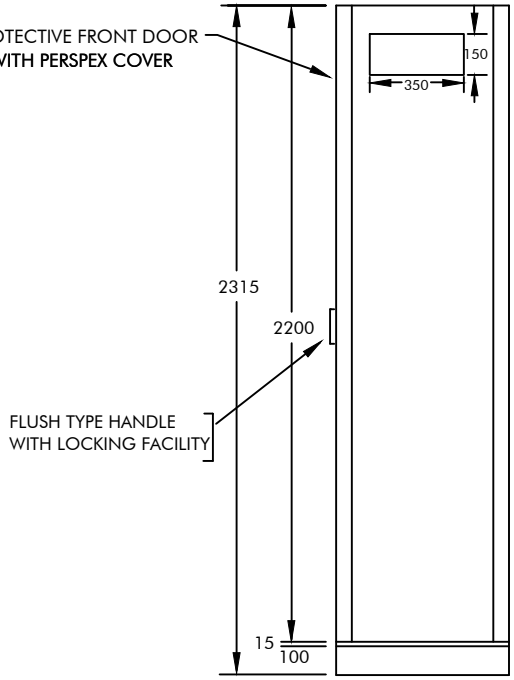
**DRG. NO.: CPD KR17 BF7 SHT 2 OF 2**




3D VIEW

FLOOR PLAN




END VIEW

| | | | | | |
|---|---|---|---|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 | CUSTOMER:BHOPAL DHULE TRANS COMPANY LTD<br>PROJECT: 765/400/220KV DHULE S/s New<br>P.O.NO.: LOA No.: SCI/EI100138/PCP/01<br>Dated 01.08.11 | ALSTOM<br>**ALSTOM T&D India Limited - AUTOMATION SAS**<br>PALLAVARAM CHENNAI 600043 | PANEL CONSTRUCTIONAL DETAILS (VIEWS)<br>PANEL STRUCTURE: SIMPLEX FILE: KR17PC1<br>TITLE: 765,400KV PROTECTION PANELS | PREPARED BY: ACS / REVISION: ZA |
| FINISHED GOOD: . | | | | | CHECKED BY: ACS / DATE: 17.08.2015 |
| . | | | | | APPROVED BY: SSS / SCALE: -- |
| SALES ORDER: 3269017500 | | | | | DRG. NO.: CPG KR17 PC1 SHT 1 OF 2 |

## CONSTRUCTION:

PANELS WILL BE OF FREE STANDING UNITISED CONSTRUCTION WITH MEMBERS FOLDED & BOLTED
LOAD BEARING MEMBERS (FRONT PANEL, BASE FRAME, DOOR FRAME) WILL BE 3MM THICK
NON-LOAD BEARING MEMBERS (SIDE PANEL, CUBICLE ROOF, DOOR) WILL BE 2MM THICK)
CUBICLE BOTTOM WILL BE CLOSED AND HAVE CABLE SLOTS COVERED BY DETACHABLE PLATES
REAR BLANK
WEIGHT OF 1 RELAY PANEL WILL BE 600KGS (APPROX.)
PANELS WILL COMPLY WITH INGRESS PROTECTION DEGREE IP55 AS PER IS 13947
ALL DOORS WILL BE PROVIDED WITH NEOPRENE GASKETS. ALL REMOVABLE COVERS WILL BE
- PROVIDED WITH ONE SIDED SILICON FOAM ADHESIVE GASKET FOR BETTER IP
15mm THICK ANTI-VIBRATION PAD WILL BE PROVIDED BETWEEN PANEL AND BASE FRAME
RELAY PANELS WILL BE RACK MOUNTING (FRAME) TYPE WITH PERSPEX DOOR IN THE FRONT

## AUXILIARY SUPPLIES

DC AUXILIARY VOLTAGE: 220V DC
AC AUXILIARY VOLTAGE: 240V AC
CT SECONDARY: 1A
PT SECONDARY (PH-PH): 110V AC

## PANEL STANDARD EQUIPMENTS

1 NO. COMPACT FLUORESCENT TUBE LIGHT (240V AC, 11W) WILL BE PROVIDED IN EACH PANEL
1 NO. 240V AC 5/15A 3 PIN POWER SOCKET WILL BE PROVIDED IN EACH PANEL
1 NO. 240V AC 60W HEATER WILL BE PROVIDED IN EACH PANEL
1 NO. HEATER CIRUIT ON-OFF SWITCH WILL BE PROVIDED IN EACH PANEL
1 NO. 240V AC 30-85 DEG C THERMOSTAT WILL BE PROVIDED IN EACH PANEL
.

## PAINTING AND FINISH

PANELS WILL BE COATED WITH PLAIN SEMI-GLOSSED PAINTS
EXTERIOR: RAL7032
INTERIOR: RAL7032
BASE FRAME: BLACK
U-MOUNTING/BLANKING/INTERNAL MOUNTING PLATE: BLACK/BLACK/WHITE
PAINT THICKNESS: 50 MICRONS

## ACCURACY CLASS OF METERS/TRANSDUCERS

NOT APPLICABLE

## WIRING

WIRING WILL BE DONE USING PVC INSULATED FLEXIBLE UNTINNED PVC COPPER WIRES AS PER IS 694
ALL CT/PT CKTS WILL BE WIRED USING 2.5 sq.mm. WIRES
240VAC CKTS WILL BE WIRED USING 2.5 sq.mm. WIRES
ALL OTHER CKTS WILL BE WIRED USING 1.5 sq.mm. WIRES
R/Y/B/BLK WIRES WITH BLACK PROTECTIVE SLEEVES WILL BE USED FOR PH/NEUT.IN CT/PT CKTS
BLACK WIRES WITH BLACK PROTECTIVE SLEEVES WILL BE USED FOR 240VAC CKTS
GREY WIRES WITH BLACK PROTECTIVE SLEEVES WILL BE USED FOR ALL OTHER CKTS
ALL WIRES WILL BE ROUTED THROUGH PVC TROUGHS WITH DETACHABLE COVERS
ALL WIRING TERMINATIONS ARE DONE USING TINNED COPPER LUGS WITH HEAT SHRINKABLE SLEEVES FOR INSULATION
WHITE FERRULES WITH BLACK LETTERING WILL BE USED FOR DENOTING WIRE NUMBERS
TWO RUNS OF 2.5 sq mm WIRES WILL BE USED FOR ENERGYMETER VT CIRCUIT

## EARTHING

2 NO. COPPER BAR OF SIZE 25x3mm WILL BE RUN THROUGHOUT THE BOARD
EARTHING BETWEEN EQPTS WILL BE LOOPED & FINALLY TERMINATED IN EARTH BAR BY 2.5 sq.mm. GREEN WIRES
EARTH BAR COUPLING LINK OF COPPER WILL BE PROVIDED BETWEEN ADJACENT PANELS
1MOhm RESISTOR CONNECTED BETWEEN EARTH BAR AND EARTH LINK FOR ELECTRO STATIC DISCHARGE

## TERMINAL BOARD

TERMINAL BOARD (TB) FOR CT/PT CKTS WILL BE OF DISCONNECTING TYPE CDTTS
TERMINAL BOARD (TB) FOR ALL OTHER CKTS WILL BE OF STUD TYPE CSTSB4
BUS-WIRE BOARD (BB) FOR INTERCONNECTION BETWEEN ADJACENT PANELS WILL BE OF CONNECTOR \CSTSB4\CSTU6 TYPE
TERMINAL BOARD FOR INTERCONNECTION BETWEEN ADJACENT PANELS (TBX) WILL BE OF TYPE CSTSB4\CONNECTOR
20% SPARE TBs SHALL BE PROVIDED

## MIMIC

NOT APPLICABLE

| VOLTAGE LEVEL | COLOUR |
|---|---|
| NOT APPLICABLE | NOT APPLICABLE |

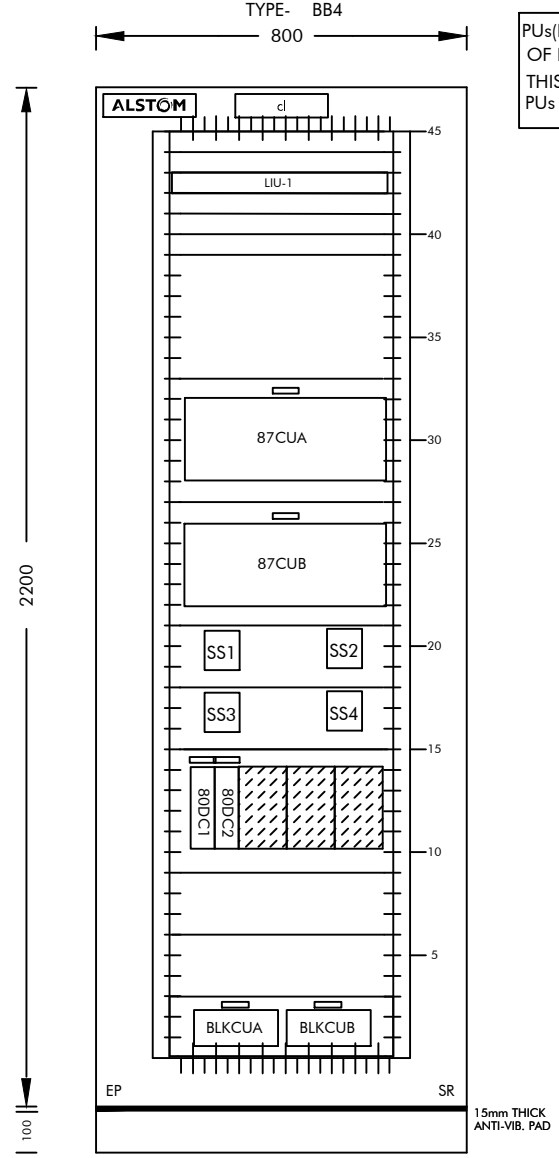
## SPECIAL NOTES:

ALL WIRES AT TB END DIRECTLY CONNECTED TO TRIP CB WILL BE PROVIDED WITH RED COLOURED "T" FERRULE

| LABEL NAME | LABEL SIZE | LABEL MATERIAL | LABEL INSCRIPTIONS |
|---|---|---|---|
| CIRCUIT LABEL | 203x51mm (FRONT); 203x40mm (BASE FRAME) | ANODISED ALUMINIUM: BLACK BACKGROUND/WHITE INSCRIPTIONS | CKT REFERENCE |
| EQPT IDENTFN. LABEL | 57x12mm | ANODISED ALUMINIUM: BLACK BACKGROUND/WHITE INSCRIPTIONS | DEVICE FUNCTION/REFERENCE |
| FUSE/LINK LABEL | 25x25mm | ANODISED ALUMINIUM: BLACK BACKGROUND/WHITE INSCRIPTIONS | FUSE/LINK REFERENCE/RATING/VOLT/CKT |
| INTERNAL STICKER LABEL | 25x12mm | PVC PLOTTED: WHITE BACKGROUND/BLACK LETTERING | DEVICE REFERENCE |

| | | | | | |
|---|---|---|---|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 | CUSTOMER:BHOPAL DHULE TRANS COMPANY LTD | ALSTOM | PANEL CONSTRUCTIONAL DETAILS (NOTES) | PREPARED BY: ACS / REVISION: ZA |
| FINISHED GOOD: . | | PROJECT: 765/400/220KV DHULE S/s New | ALSTOM T&D India Limited - AUTOMATION SAS | PANEL STRUCTURE: SIMPLEX FILE: KR17PC1 | CHECKED BY: ACS / DATE: 17.08.2015 |
| . | | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 Dated 01.08.11 | PALLAVARAM CHENNAI 600043 | TITLE: 765,400KV PROTECTION PANELS | APPROVED BY: SSS / SCALE: -- |
| SALES ORDER: 3269017500 | | | | | DRG. NO.: CPG KR17 PC1 SHT 2 OF 2 |

TYPE- BB4




*NOTE:

PUs(PERIPHERAL UNITS) SHOWN IN THE RESPECTIVE BAY PANELS ARE AN INTEGRAL PART OF BUS BAR SCHEME. ALL THE PUs (PERIPHERAL UNITS) WILL BE SUPPLIED ALONG WITH THIS PANEL WHERE 87CUA & 87CUB (CENTRAL UNITS) ARE MOUNTED AND THE PUs (PERIPHERAL UNITS) SHALL BE MOUNTED IN RESPECTIVE PANELS FOR BAY.

| | | | | | |
|---|---|---|---|---|---|
| SCHEME REF.: DR1774 | ENGG.REF.NO.: KR17 | CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD. | **ALSTOM** | GENERAL ARRANGEMENT DRAWING (FRONT VIEW) | PREPARED BY: KB | REVISION: ZA |
| NETWORK NO.: . | | PROJECT: CONST. OF 765 / 400KV DHULE S/S | **ALSTOM T&D India Limited - AUTOMATION SAS** | PANEL TYPE: BB4 PHANTOM: CPKR17BB4 FILE: KR17BB4 | CHECKED BY: ACS | DATE: 17.08.2015 |
| FINISHED GOOD: . | | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 | PALLAVARAM CHENNAI 600043 | TITLE: 400KV BUSBAR PROTECTION | APPROVED BY: SSS | SCALE: 1:15 IN A4 |
| SALES ORDER-ITEM: 3269017500 | | Dated 01.08.2011 | | . | DRG. NO.: CPG KR17 BB4 | (F) SHT 1 OF 1 |

| DEV REF. | MATERIAL NAME | MAKE | DESCRIPTION |
|---|---|---|---|
| 80DC1 | MVAAM11B1CJ1015A | ALSTOM | DC SUPPLY SUPERVISION RELAY - DC SOURCE-1<br>4B SR : FLAG-REV : 220-250V DC : 80-120 mS TDDO WD:Z1MVAAM11009SHT1 |
| 80DC2 | MVAAM11B1CJ1015A | ALSTOM | DC SUPPLY SUPERVISION RELAY - DC SOURCE-2<br>4B SR : FLAG-REV : 220-250V DC : 80-120 mS TDDO WD:Z1MVAAM11009SHT1 |
| 87CUA | P74133AA6M0510K | ALSTOM | INTEGRATED BUSBAR PROTN-CENTRAL UNIT; CASE SIZE 80TE; 8OPTO INPUTS, 8 O/Ps, 3 COMMUNICATION BOARDS; AUX. VOLTAGE: 110-250V DC; PROTOCOL: IEC61850; ETHERNET 100 MPBS MAIN-1 (SUITABLE FOR 8 BAYS) |
| 87CUB | P74133AA6M0510K | ALSTOM | INTEGRATED BUSBAR PROTN-CENTRAL UNIT; CASE SIZE 80TE; 8OPTO INPUTS, 8 O/Ps, 3 COMMUNICATION BOARDS; AUX. VOLTAGE: 110-250V DC; PROTOCOL: IEC61850; ETHERNET 100 MPBS MAIN-2 (SUITABLE FOR 8 BAYS) |
| BLKCUA | MPGTESTBLOCK | ALSTOM | TEST BLOCK 87CUA<br>STANDARD TEST BLOCK |
| BLKCUB | MPGTESTBLOCK | ALSTOM | TEST BLOCK 87CUB<br>STANDARD TEST BLOCK |
| SS1 | S08LF90SPPM102 | ALSTOM | SELECTOR SWITCH - BUSBAR PROTN.MAIN-1 - Z1-IN/OUT<br>SELECTOR SWITCH 8 WAY LOCKABLE STAYPUT |
| SS2 | S08LF90SPPM102 | ALSTOM | SELECTOR SWITCH - BUSBAR PROTN. MAIN-1 - Z2-IN/OUT<br>SELECTOR SWITCH 8 WAY LOCKABLE STAYPUT |
| SS3 | S08LF90SPPM102 | ALSTOM | SELECTOR SWITCH - BUSBAR PROTN.MAIN-2- Z1-IN/OUT<br>SELECTOR SWITCH 8 WAY LOCKABLE STAYPUT |
| SS4 | S08LF90SPPM102 | ALSTOM | SELECTOR SWITCH - BUSBAR PROTN.MAIN-2- Z2-IN/OUT<br>SELECTOR SWITCH 8 WAY LOCKABLE STAYPUT |
| LIU-1 | GB54143002400001 | GENTECH | LINE INTERFACE UNIT |

**INTERNALLY MOUNTED EQUIPMENTS**

| | | | |
|---|---|---|---|
| CIL | GBCPE0000600 | IMTECH | COMPACT FLOURESCENT LAMP - 11W 230V AC |
| HS | GBCPF0500901 | SWITRON | HEATER SWITCH |
| HT | GBCPA0178101 | SOFIA | HEATER 230V AC 50HZ, 60W |
| PS | GBCPE0000344 | ANCHOR | POWER SOCKET 5/15A WITH SWITCH + PLUG 3PIN 230V AC |
| TH | GBCPE0000612 | MAVIS / APT CTRLS | THERMOSTAT 230V AC, 30 - 80 DEG C |
| MCB91 | CMB7225100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/240V AC 16A |
| MCB1 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB11 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB12 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |

| | | | | | |
|---|---|---|---|---|---|
| SCHEME REF: SC27 ENGG.REF.NO KR17 | CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD. | ALSTOM T&D India Limited - AUTOMATION SAS<br>PALLAVARAM CHENNAI 600043 | LEGEND TO GA DRAWING | PREPARED BY: GKA | REVISION: ZA |
| NETWORK NO.: . | PROJECT: CONST. OF 765 / 400KV DHULE S/S | | PANEL TYPE: BB4 FILE: KR17BB4 | CHECKED BY: ACS | DATE: 17.08.2015 |
| FINISHED GOOD: . | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 Dated 01.08.2011 | | TITLE: 400KV BUSBAR PROTECTION . | APPROVED BY: SSS | SCALE: NIL |
| SALES ORDER-ITEM: 3269017500 | | | | DRG. NO.: CPG KR17 BB4 (L) | SHT 1 OF 2 |

**INTERNALLY MOUNTED EQUIPMENTS**

| | | | |
|---|---|---|---|
| MCB13 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB14 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB15 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB16 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB17 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB18 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB19 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB20 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB41 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB51 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB52 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB53 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB54 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB55 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB56 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB57 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB58 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB59 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |
| MCB60 | CMB7212100A | LEGRAND | MCB DOUBLE POLE WITH AUX CONTACT: 1 CHANGE OVER ; 110/220V DC 4A |

# SCHEMATIC DRAWING

## 400KV BUSBAR

## PANEL TYPES: BB4


1 STANDARD SCHEMATIC SYMBOLS
2 KEY DIAGRAM
3 AC DISTRIBUTION
4 DC DISTRIBUTION
5 DC DISTRIBUTION
6 CENTRAL UNIT - MAIN-1
7 CENTRAL UNIT - MAIN-2
8 SWITCH CONTACT DISTRIBUTION
9 FIBER OPTIC INTERFACE CIRCUIT
10 BUS-1 CVT CIRCUIT
11 BUS-2 CVT CIRCUIT


| | | | | | |
|---|---|---|---|---|---|
| FOR ALSTOM REF: ENGG.REF.NO.: KR17 | **CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.** | ALSTOM | **SCHEMATIC DRAWING** | PREPARED BY: GKA | REVISION: ZA |
| SCHEME TYPE: BUSBAR | PROJECT: CONST. OF 765 / 400KV DHULE S/S | **ALSTOM T&D India Limited - AUTOMATION SAS** | PANEL TYPES: BB4 FILE: DR172700 | CHECKED BY: ACS | DATE: 17/08/2015 |
| BASE FILE: BASE FILE | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 Dated 01.08.11 | PALLAVARAM CHENNAI 600043 | **TITLE: 400KV BUSBAR LIST OF DRAWINGS** | APPROVED BY: SSS | SCALE: -- |
| **SALES ORDER: 3269017500** | | | | **DRG. NO.: CPD KR17 SC27 SHT 00 OF 11** | |

| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|---|---|
| | MAKE CONTACT | | RELAY COIL - GENERAL SYMBOL | DS | CUB.ILLUMN.LAMP WITH D/S |
| | MAKE CONTACT - DELAYED PICKUP | | RELAY COIL - SLOW RELEASING | | HEATER |
| | MAKE CONTACT - DELAYED DROP OFF | | | | |
| | MAKE CONTACT WITH BLOWOUT MAGNET | | RELAY COIL - SLOW OPERATING | | HEATER SWITCH |
| | MAKE CONTACT - HAND RESET | | | | POWER SOCKET |
| | MAKE CONTACT - THYRISTOR | | FLASHER RELAY | | THERMOSTAT |
| | | | | | FUSE |
| | BREAK CONTACT | | RELAY COIL - HAND RESET | | LINK |
| | BREAK CONTACT - DELAYED PICKUP | | | | TEST BLOCK - MPG |
| | | | | | RESISTOR |
| | BREAK CONTACT - DELAYED DROP OFF | | FLAG INDICATOR | | STABILISING RESISTOR |
| | BREAK CONTACT WITH BLOWOUT MAGNET | | DISCONNECTING TB AT C&R PANLES | | METROSIL SURGE DIVERTOR |
| | BREAK CONTACT - HAND RESET | | TERMINAL BOARD AT C&R PANLES | | CONTROL/SEL SW.-TYPE ODS |
| | | | TERMINAL BOARD AT CT/VT KIOSK /PLCC PANEL | | INDICATING LAMP |
| | CHANGE OVER CONTACT | | TERMINAL BOARD AT CIRCUIT BREAKER | | SEMAPHORE INDICATOR |
| | CHANGE OVER CONTACT - HAND RESET | | TERMINAL BOARD AT BAY MASHALLING KIOSK | | ELECTRIC BELL |
| | CHANGE OVER CONTACT - DELAYED PICKUP | | TERMINAL BOARD AT ISOLATOR | | ELECTRIC HOOTER |
| | CHANGE OVER CONTACT - DELAYED DROP OFF | | | | BUSWIRE |

## FERRULE NUMBERING STANDARDS

FERRULE - "A" : CT CIRCUIT - MAIN PROTECTION

FERRULE - "B" : CT CIRCUIT - BUSBAR PROTECTION

FERRULE - "C" : CT CIRCUIT - BACKUP PROTECTION

FERRULE - "D" : CT CIRCUIT - METERING

FERRULE - "E" : VT CIRCUIT - PROTECTION/METERING

FERRULE - "G" : VT CIRCUIT - SYNCHRONISING

FERRULE - "H" : AUXILIARY AC CIRCUIT

FERRULE - "J" : AUXILIARY DC CIRCUIT

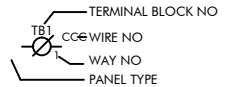
FERRULE - "K" : CONTROL CIRCUITS

FERRULE - "L" : INDICATION & ALARM CIRCUITS

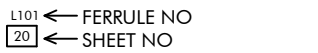
FERRULE - "P" : DC CIRCUIT - BUSBAR PROTECTION CIRCUITS

FERRULE - "S" : EVENT LOGGER/DAS/SCADA CIRCUITS

FERRULE - "U" : SPARE CONTACTS



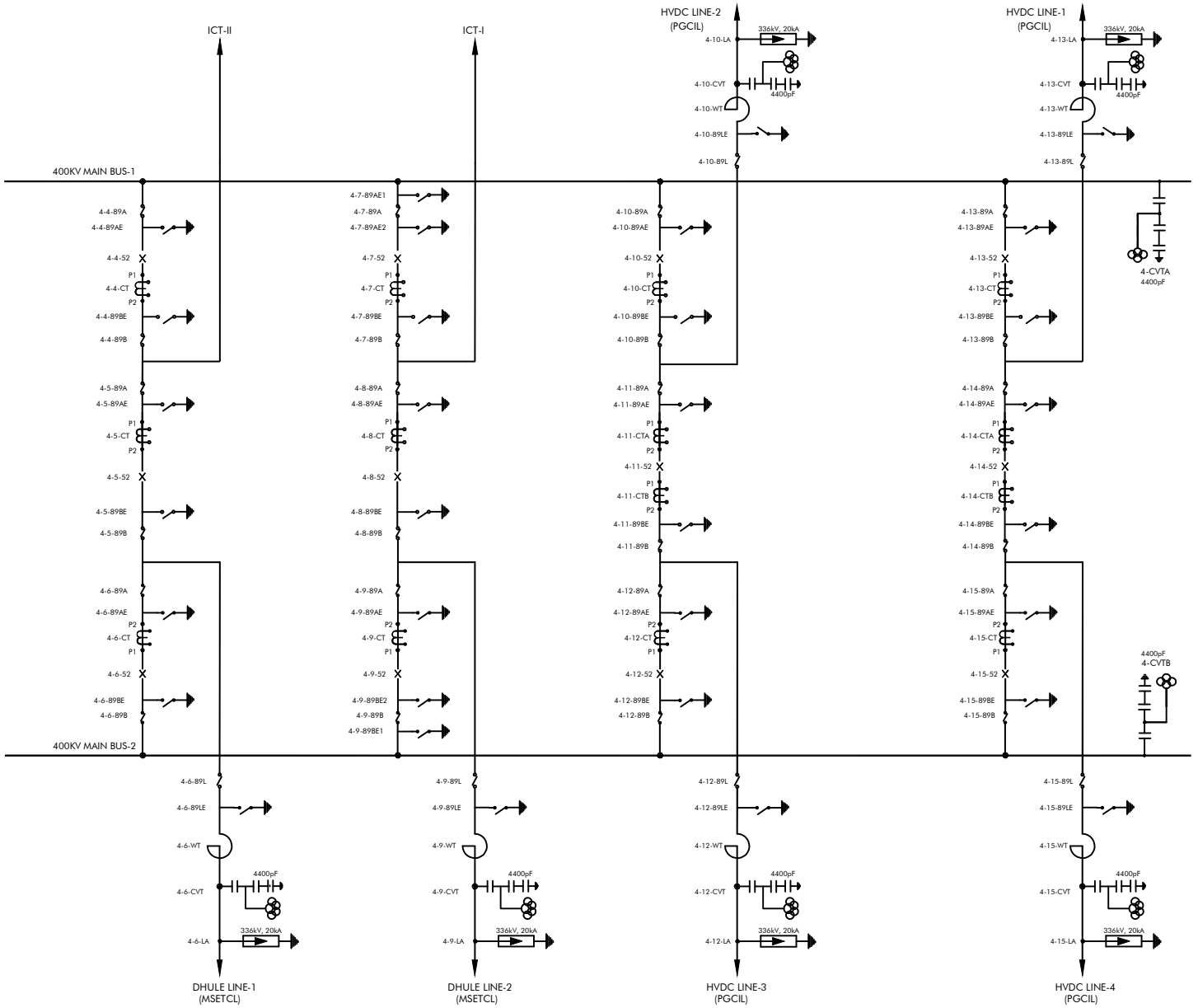

## WIRE CROSS REFERENCE STANDARDS



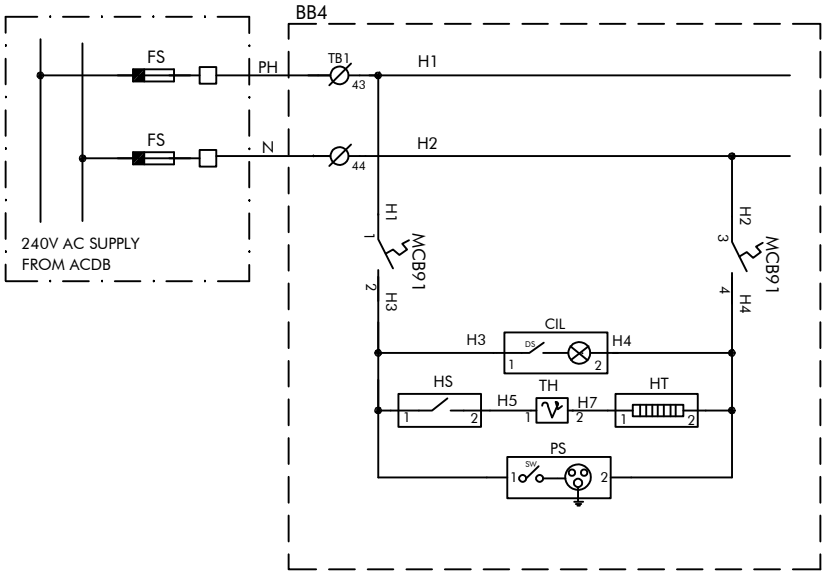

## NOTE:-

1. SCHEMATIC SYMBOLS GENERALLY COMPLY WITH IEC STANDARDS.
2. RELAY CONTACTS SHOWN WITH COIL DE-ENERGISED CONDITION.
3. SHT NO. REPRESENTATION OF CROSS REFRENCES BETWEEN SHEETS.

| | | | | | |
|---|---|---|---|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 | **CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.** | **ALSTOM** | **SCHEMATIC DRAWING** | PREPARED BY: KB / REVISION: ZA |
| SCHEME TYPE: BUSBAR | | PROJECT: CONST. OF 765 / 400KV DHULE S/S | **ALSTOM T&D India Limited - AUTOMATION SAS** | PANEL TYPES: BB4 | CHECKED BY: ACS / DATE: 17/08/2015 |
| BASE FILE: BASE FILE | | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 Dated 01.08.11 | PALLAVARAM CHENNAI 600043 | **TITLE: 400KV BUSBAR LIST OF SYMBOLS** FILE: DR172701 | APPROVED BY: SSS / SCALE: -- |
| **SALES ORDER: 3269017500** | | | | | **DRG. NO.: CPD KR17 SC27 SHT 01 OF 11** |

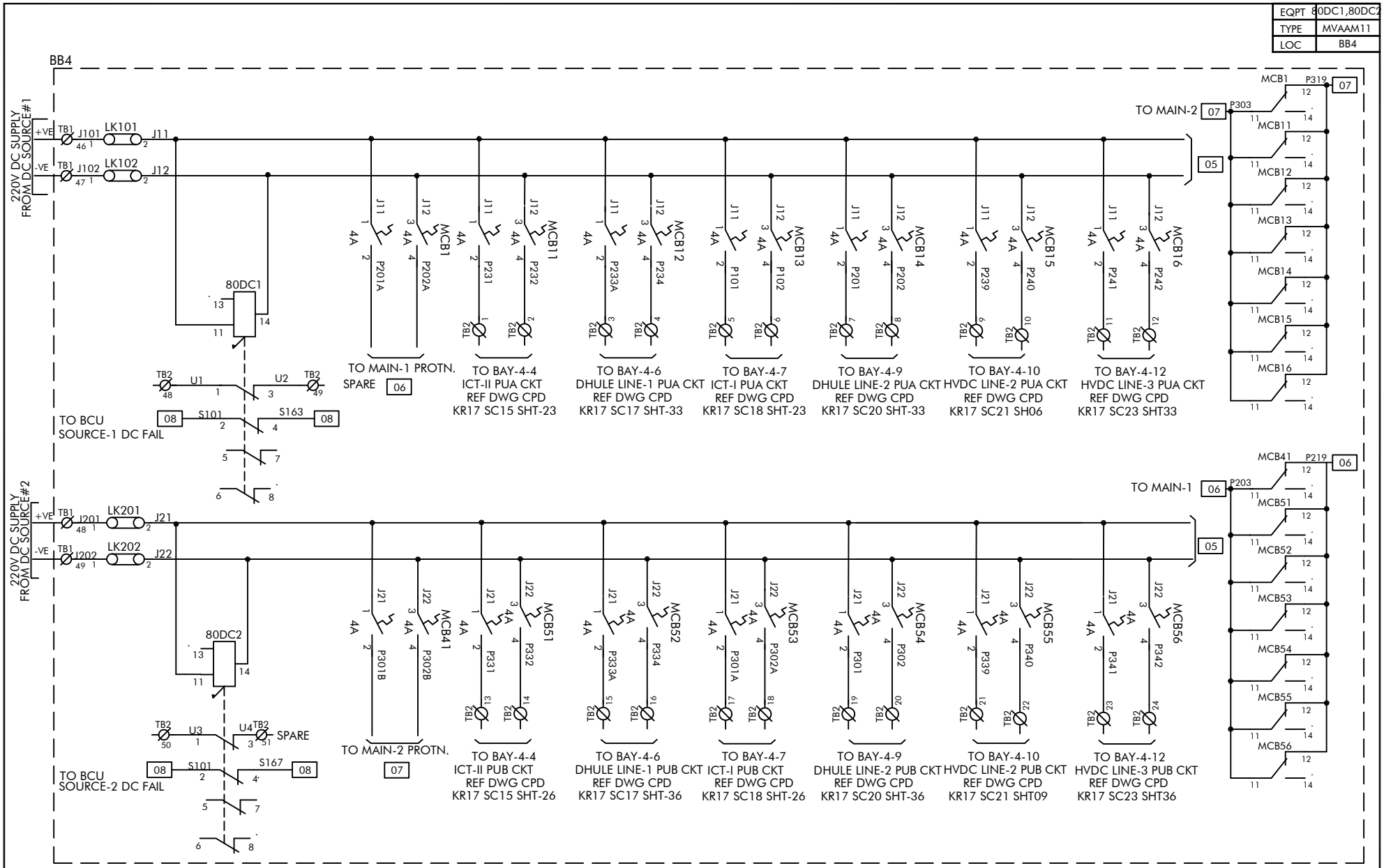



| | | | | |
|---|---|---|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 | **CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.** | **SCHEMATIC DRAWING** | PREPARED BY: GKA / REVISION: ZA |
| SCHEME TYPE: BUSBAR | | PROJECT: CONST. OF 765 / 400KV DHULE S/S | PANEL TYPES: BB4 FILE: DR172702 | CHECKED BY: ACS / DATE: 17/08/2015 |
| BASE FILE: BASE FILE | | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 Dated 01.08.11 | **TITLE: 400KV BUSBAR KEY DIAGRAM** | APPROVED BY: SSS / SCALE: -- |
| **SALES ORDER: 3269017500** | | **ALSTOM** ALSTOM T&D India Limited - AUTOMATION SAS PALLAVARAM CHENNAI 600043 | | **DRG. NO.: CPD KR17 SC27 SHT 02 OF 11** |




| | | | | | |
|---|---|---|---|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 | **CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.** | **ALSTOM** | **SCHEMATIC DRAWING** | PREPARED BY: GKA / REVISION: ZA |
| SCHEME TYPE: BUSBAR | | PROJECT: CONST. OF 765 / 400KV DHULE S/S | **ALSTOM T&D India Limited - AUTOMATION SAS** | PANEL TYPES: BB4 FILE: DR172703 | CHECKED BY: ACS / DATE: 17/08/2015 |
| BASE FILE: BASE FILE | | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 | PALLAVARAM CHENNAI 600043 | **TITLE: 400KV BUSBAR AC DISTRIBUTION** | APPROVED BY: SSS / SCALE: -- |
| **SALES ORDER: 3269017500** | | Dated 01.08.11 | | | **DRG. NO.: CPD KR17 SC27 SHT 03 OF 11** |

| | |
|---|---|
| EQPT | 80DC1,80DC2 |
| TYPE | MVAAM11 |
| LOC | BB4 |




| | |
|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 |
| SCHEME TYPE: BUSBAR | |
| BASE FILE: BASE FILE | |
| **SALES ORDER: 3269017500** | |

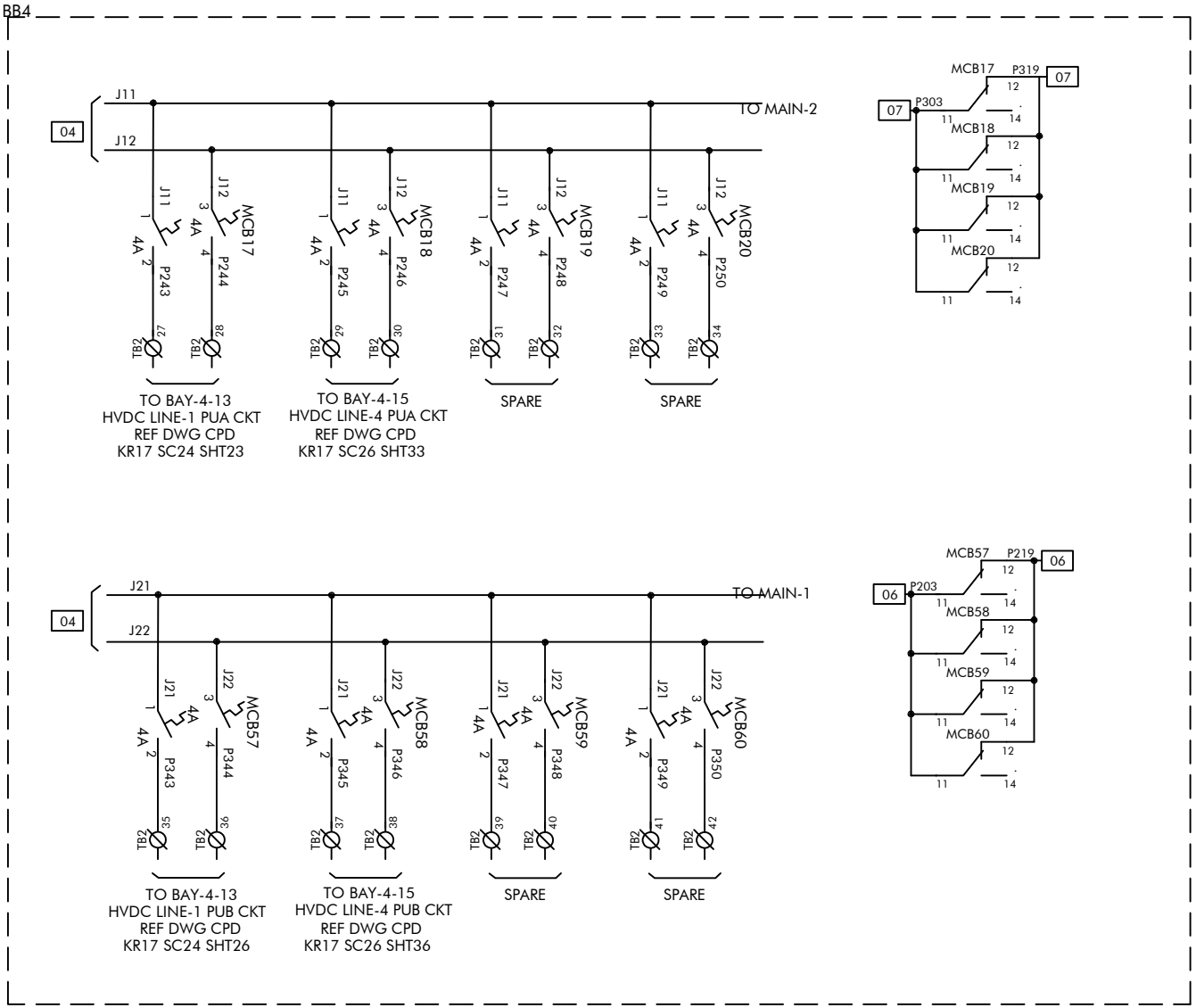
**CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.**
PROJECT: CONST. OF 765 / 400KV DHULE S/S
P.O.NO.: LOA No.: SCI/EI100138/PCP/01
Dated 01.08.11

**ALSTOM**
**ALSTOM T&D India Limited - AUTOMATION SAS**
PALLAVARAM CHENNAI 600043

**SCHEMATIC DRAWING**
PANEL TYPES: BB4
FILE: DR172704
**TITLE: 400KV BUSBAR DC DISTRIBUTION**

| | |
|---|---|
| PREPARED BY: GKA | REVISION: ZA |
| CHECKED BY: ACS | DATE: 17/08/2015 |
| APPROVED BY: SSS | SCALE: -- |

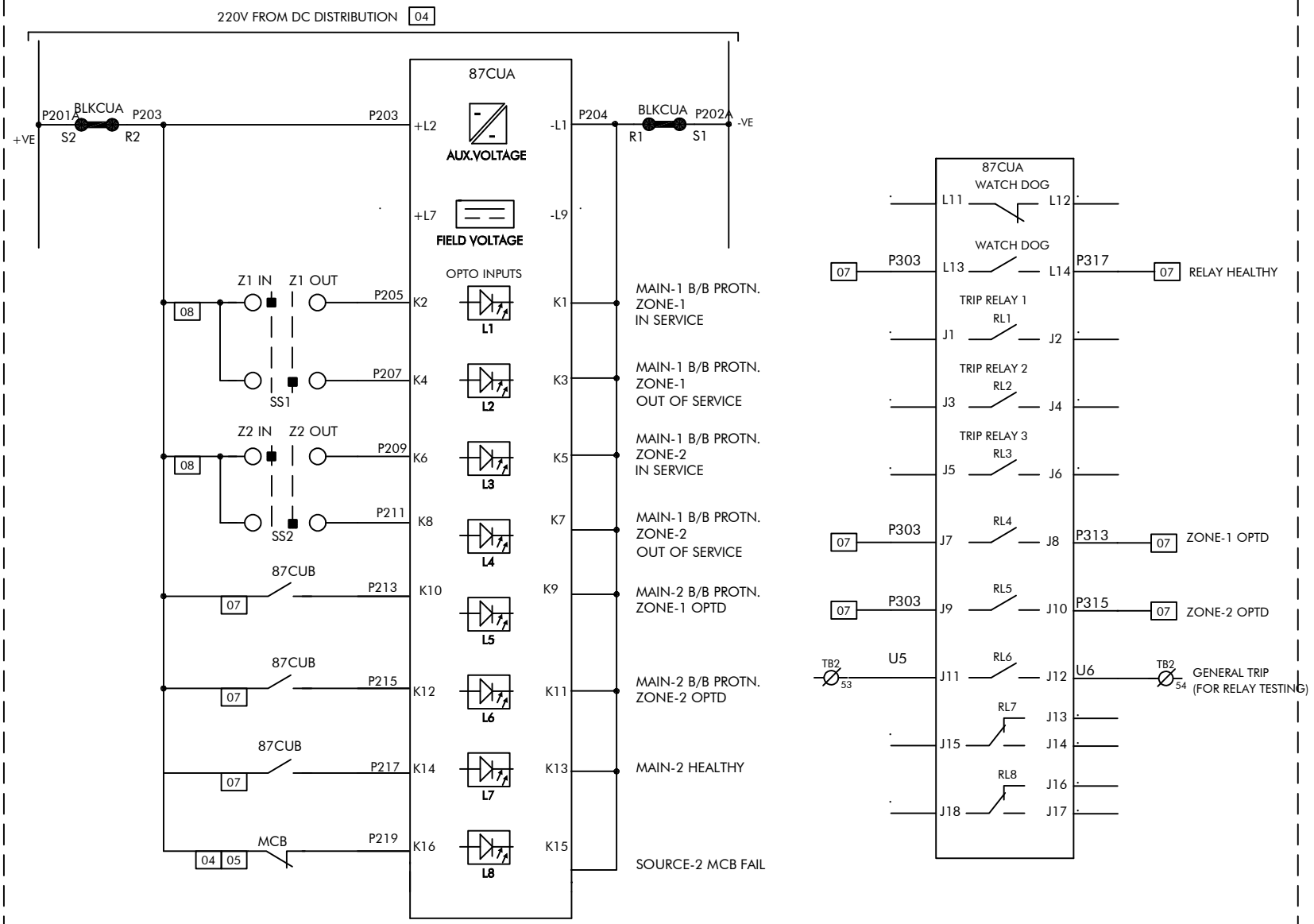
**DRG. NO.: CPD KR17 SC27 SHT 04 OF 11**




| | | | | | |
|---|---|---|---|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 | **CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.** | **ALSTOM** | **SCHEMATIC DRAWING** | PREPARED BY: GKA / REVISION: ZA |
| SCHEME TYPE: BUSBAR | | PROJECT: CONST. OF 765 / 400KV DHULE S/S | **ALSTOM T&D India Limited - AUTOMATION SAS** | PANEL TYPES: BB4 | CHECKED BY: ACS / DATE: 17/08/2015 |
| BASE FILE: BASE FILE | | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 Dated 01.08.11 | PALLAVARAM CHENNAI 600043 | **TITLE: 400KV BUSBAR DC DISTRIBUTION** FILE: DR172705 | APPROVED BY: SSS / SCALE: -- |
| **SALES ORDER: 3269017500** | | | | | **DRG. NO.: CPD KR17 SC27 SHT 05 OF 11** |

BB4

| EQPT | 87CUA |
|---|---|
| TYPE | MICOM P741 |
| LOC | BB4 |




| | |
|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 |
| SCHEME TYPE: BUSBAR | |
| BASE FILE: BASE FILE | |
| **SALES ORDER: 3269017500** | |

**CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.**
PROJECT: CONST. OF 765 / 400KV DHULE S/S
P.O.NO.: LOA No.: SCI/EI100138/PCP/01
Dated 01.08.11

**ALSTOM**
**ALSTOM T&D India Limited - AUTOMATION SAS**
PALLAVARAM CHENNAI 600043

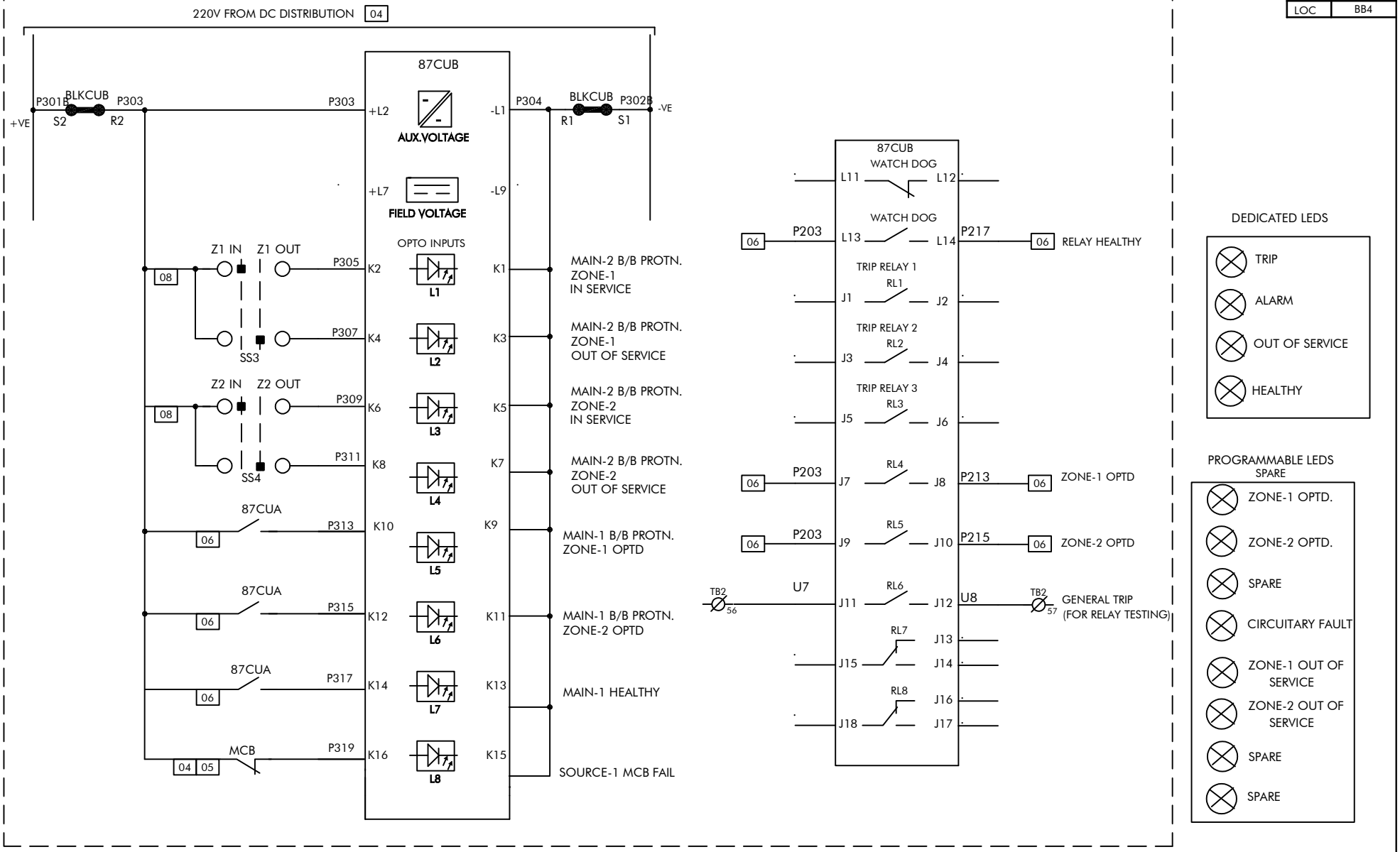
**SCHEMATIC DRAWING**
PANEL TYPES: BB4
FILE: DR172706
**TITLE: 400KV BUSBAR**
**CENTRAL UNIT - MAIN-1**

| | |
|---|---|
| PREPARED BY: GKA | REVISION: ZA |
| CHECKED BY: ACS | DATE: 17/08/2015 |
| APPROVED BY: SSS | SCALE: -- |

**DRG. NO.: CPD KR17 SC27 SHT 06 OF 11**

BB4

| EQPT | 87CUB |
|---|---|
| TYPE | MICOM P741 |
| LOC | BB4 |




| | |
|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 |
| SCHEME TYPE: BUSBAR | |
| BASE FILE: BASE FILE | |
| **SALES ORDER: 3269017500** | |

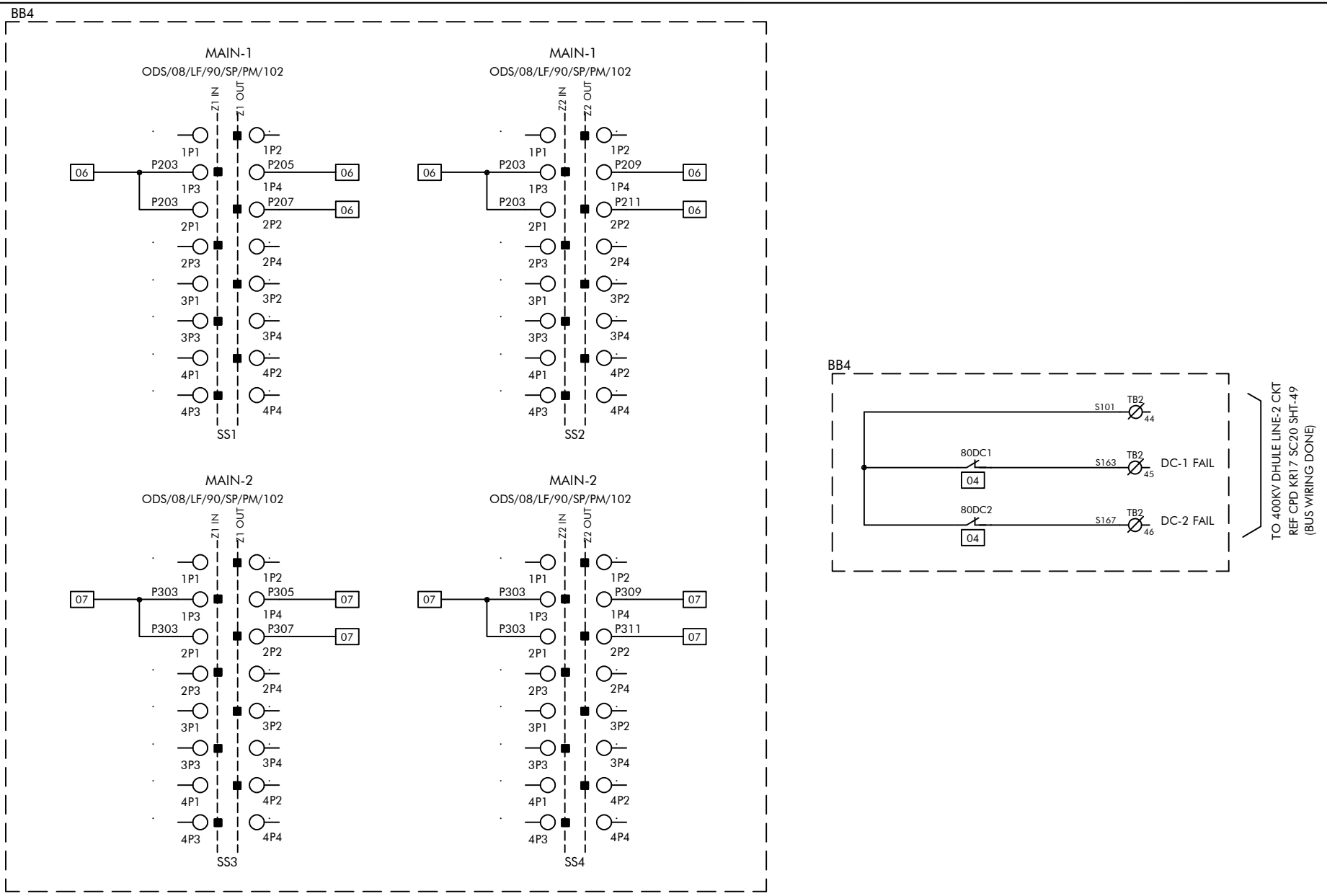
**CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.**
PROJECT: CONST. OF 765 / 400KV DHULE S/S
P.O.NO.: LOA No.: SCI/EI100138/PCP/01
Dated 01.08.11

**ALSTOM**
**ALSTOM T&D India Limited - AUTOMATION SAS**
PALLAVARAM CHENNAI 600043

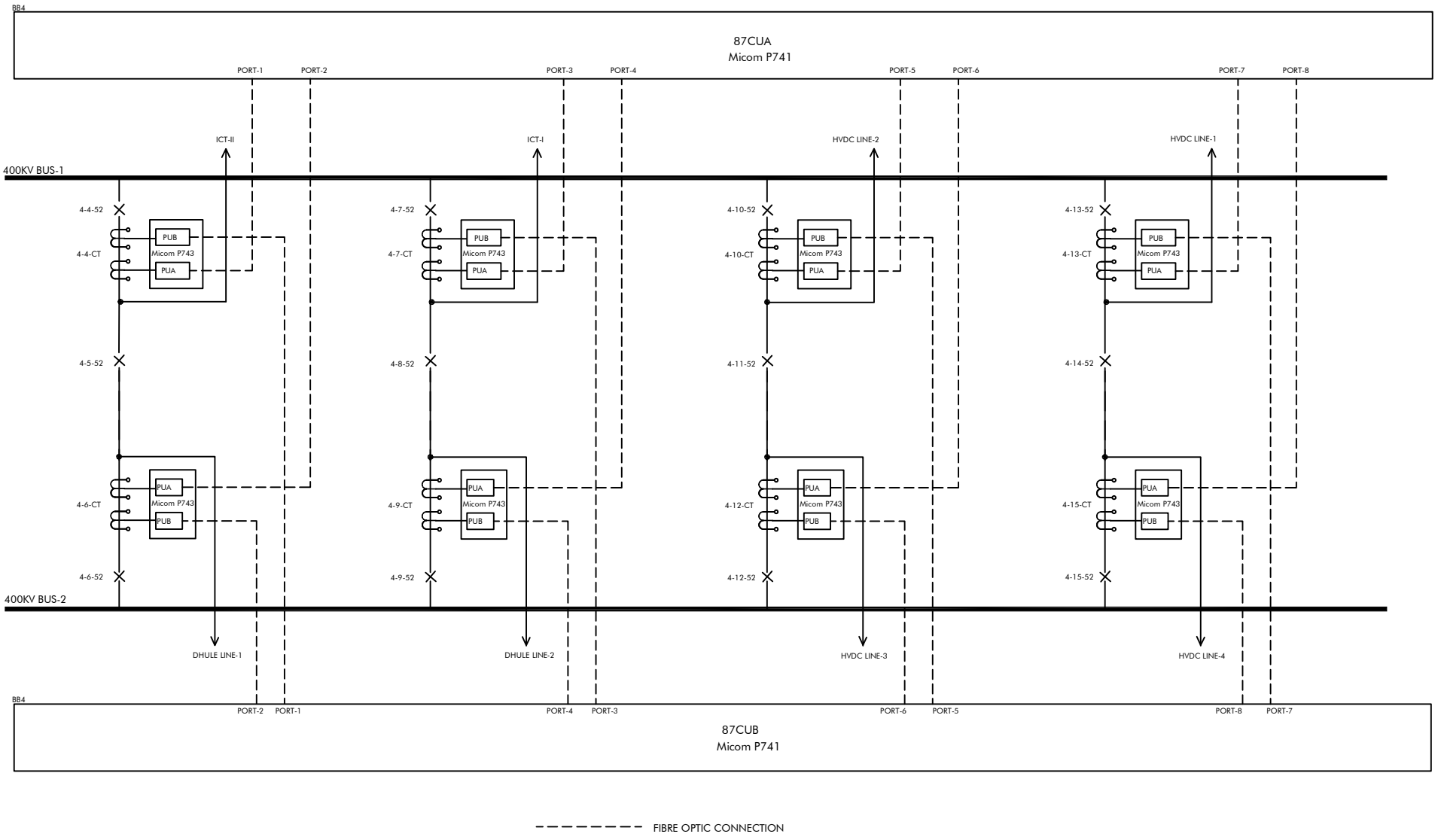
**SCHEMATIC DRAWING**
PANEL TYPES: BB4
FILE: DR172707
**TITLE: 400KV BUSBAR**
**CENTRAL UNIT - MAIN-2**

| | |
|---|---|
| PREPARED BY: GKA | REVISION: ZA |
| CHECKED BY: ACS | DATE: 17/08/2015 |
| APPROVED BY: SSS | SCALE: -- |

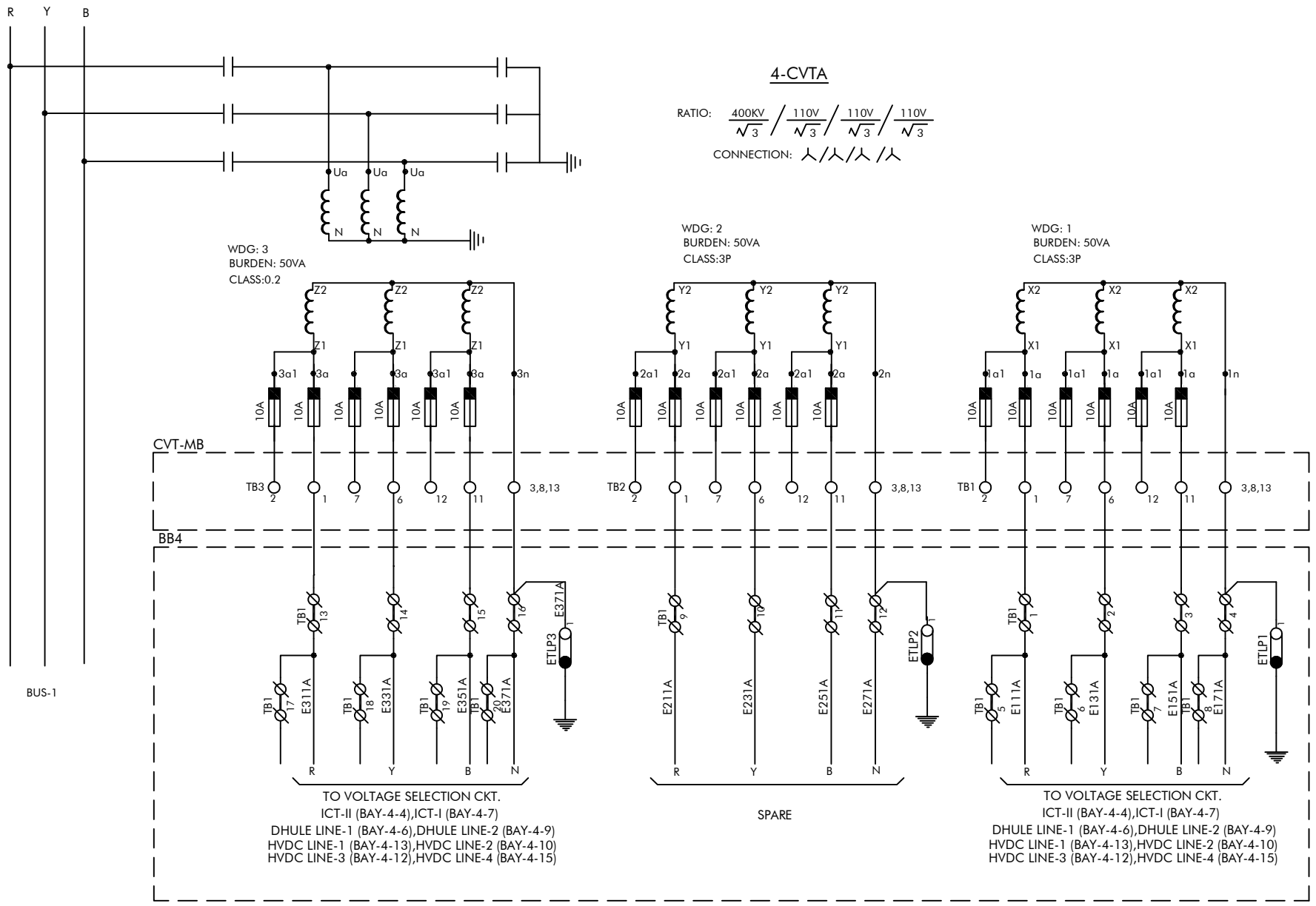
**DRG. NO.: CPD KR17 SC27 SHT 07 OF 11**




| | | | | | |
|---|---|---|---|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 | **CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.** | **ALSTOM** | **SCHEMATIC DRAWING** | PREPARED BY: GKA / REVISION: ZA |
| SCHEME TYPE: BUSBAR | | PROJECT: CONST. OF 765 / 400KV DHULE S/S | **ALSTOM T&D India Limited - AUTOMATION SAS** | PANEL TYPES: BB4 FILE: DR172708 | CHECKED BY: ACS / DATE: 17/08/2015 |
| BASE FILE: BASE FILE | | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 Dated 01.08.11 | PALLAVARAM CHENNAI 600043 | **TITLE: 400KV BUSBAR SWITCH CONTACT DISTRIBUTION** | APPROVED BY: SSS / SCALE: -- |
| **SALES ORDER: 3269017500** | | | | | **DRG. NO.: CPD KR17 SC27 SHT 08 OF 11** |




| | | | | | |
|---|---|---|---|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 | **CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.** | **ALSTOM** | **SCHEMATIC DRAWING** | PREPARED BY: GKA / REVISION: ZA |
| SCHEME TYPE: BUSBAR | | PROJECT: CONST. OF 765 / 400KV DHULE S/S | **ALSTOM T&D India Limited - AUTOMATION SAS** | PANEL TYPES: BB4 FILE: DR172709 | CHECKED BY: ACS / DATE: 17/08/2015 |
| BASE FILE: BASE FILE | | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 Dated 01.08.11 | PALLAVARAM CHENNAI 600043 | **TITLE: 400KV BUSBAR FIBRE OPTIC INTERFACE CIRCUIT** | APPROVED BY: SSS / SCALE: -- |
| **SALES ORDER: 3269017500** | | | | | **DRG. NO.: CPD KR17 SC27 SHT 09 OF 11** |




| | |
|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 |
| SCHEME TYPE: BUSBAR | |
| BASE FILE: BASE FILE | |
| **SALES ORDER: 3269017500** | |

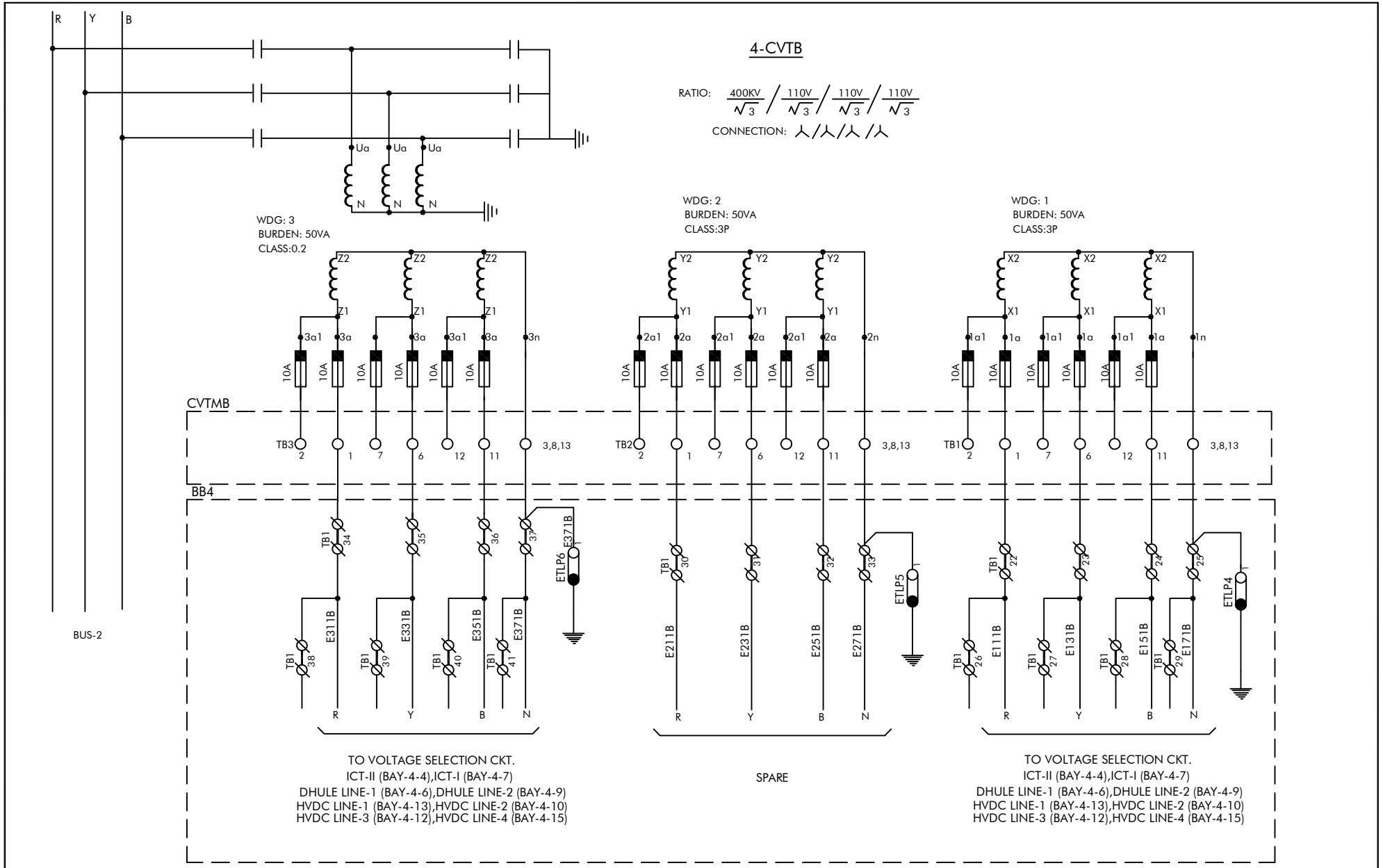
**CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.**
PROJECT: CONST. OF 765 / 400KV DHULE S/S
P.O.NO.: LOA No.: SCI/EI100138/PCP/01
Dated 01.08.11

**ALSTOM**
**ALSTOM T&D India Limited - AUTOMATION SAS**
PALLAVARAM CHENNAI 600043

**SCHEMATIC DRAWING**
PANEL TYPES: BB4
FILE: DR172710
**TITLE: 400KV BUSBAR**
**BUS-1 CVT CIRCUIT**

| | |
|---|---|
| PREPARED BY: GKA | REVISION: ZA |
| CHECKED BY: ACS | DATE: 17/08/2015 |
| APPROVED BY: SSS | SCALE: -- |

**DRG. NO.: CPD KR17 SC27 SHT 10 OF 11**




| | | | | | |
|---|---|---|---|---|---|
| FOR ALSTOM REF: | ENGG.REF.NO.: KR17 | **CUSTOMER: BHOPAL DHULE TRANS. COMP. LTD.** | **ALSTOM** | **SCHEMATIC DRAWING** | PREPARED BY: GKA / REVISION: ZA |
| SCHEME TYPE: BUSBAR | | PROJECT: CONST. OF 765 / 400KV DHULE S/S | **ALSTOM T&D India Limited - AUTOMATION SAS** | PANEL TYPES: BB4 FILE: DR172711 | CHECKED BY: ACS / DATE: 17/08/2015 |
| BASE FILE: BASE FILE | | P.O.NO.: LOA No.: SCI/EI100138/PCP/01 Dated 01.08.11 | PALLAVARAM CHENNAI 600043 | **TITLE: 400KV BUSBAR BUS-2 CVT CIRCUIT** | APPROVED BY: SSS / SCALE: -- |
| **SALES ORDER: 3269017500** | | | | | **DRG. NO.: CPD KR17 SC27 SHT 11 OF 11** |

**ALSTOM T&D INDIA LTD.**

| **Job no.** | KR17 | **Equipment Wise Schedule** | **File** | ER17BB4 |
|---|---|---|---|---|
| **Cust.** | | **Panel type** BB4 | **Date** | 17/08/2015 |

| **Equipment** | **Terminal** | **Wire no** | **Equipment** | **Terminal** | **Wire no** | **Equipment** | **Terminal** | **Wire no** |
|---|---|---|---|---|---|---|---|---|
| CIL | 1 | H3 | 87CUA | K7 | P204 | 87CUB | K15 | P304 |
| CIL | 2 | H4 | 87CUA | K8 | P211 | 87CUB | K16 | P319 |
| TH | 1 | H5 | 87CUA | K9 | P204 | 87CUB | L13 | P203 |
| TH | 2 | H7 | 87CUA | K10 | P213 | 87CUB | L14 | P217 |
| SS4 | 1P3 | P303 | 87CUA | K11 | P204 | 87CUB | -L1 | P304 |
| SS4 | 1P4 | P309 | 87CUA | K12 | P215 | 80DC1 | 1 | U1 |
| SS4 | 2P1 | P303 | 87CUA | K13 | P204 | 80DC1 | 2 | S101 |
| SS4 | 2P2 | P311 | 87CUA | K14 | P217 | 80DC1 | 3 | U2 |
| SS3 | 1P3 | P303 | 87CUA | K15 | P204 | 80DC1 | 4 | S163 |
| SS3 | 1P4 | P305 | 87CUA | K16 | P219 | 80DC1 | 11 | J11 |
| SS3 | 2P1 | P303 | 87CUA | L13 | P303 | 80DC1 | 14 | J12 |
| SS3 | 2P2 | P307 | 87CUA | L14 | P317 | 80DC1 | E | EARTH |
| SS1 | 1P3 | P203 | 87CUA | -L1 | P204 | 80DC2 | 1 | U3 |
| SS1 | 1P4 | P205 | 87CUB | +L2 | P303 | 80DC2 | 2 | S101 |
| SS1 | 2P1 | P203 | 87CUB | E | EARTH | 80DC2 | 3 | U4 |
| SS1 | 2P2 | P207 | 87CUB | J7 | P203 | 80DC2 | 4 | S167 |
| SS2 | 1P3 | P203 | 87CUB | J8 | P213 | 80DC2 | 11 | J21 |
| SS2 | 1P4 | P209 | 87CUB | J9 | P203 | 80DC2 | 14 | J22 |
| SS2 | 2P1 | P203 | 87CUB | J10 | P215 | 80DC2 | E | EARTH |
| SS2 | 2P2 | P211 | 87CUB | J11 | U7 | BLKCUB | R1 | P304 |
| 87CUA | +L2 | P203 | 87CUB | J12 | U8 | BLKCUB | R2 | P303 |
| 87CUA | E01 | EARTH | 87CUB | K1 | P304 | BLKCUB | S1 | P302B |
| 87CUA | E02 | ELOOP | 87CUB | K2 | P305 | BLKCUB | S2 | P301B |
| 87CUA | J7 | P303 | 87CUB | K3 | P304 | BLKCUA | R1 | P204 |
| 87CUA | J8 | P313 | 87CUB | K4 | P307 | BLKCUA | R2 | P203 |
| 87CUA | J9 | P303 | 87CUB | K5 | P304 | BLKCUA | S1 | P202A |
| 87CUA | J10 | P315 | 87CUB | K6 | P309 | BLKCUA | S2 | P201A |
| 87CUA | J11 | U5 | 87CUB | K7 | P304 | BB2 | 9 | E111A |
| 87CUA | J12 | U6 | 87CUB | K8 | P311 | BB2 | 10 | E131A |
| 87CUA | K1 | P204 | 87CUB | K9 | P304 | BB2 | 11 | E151A |
| 87CUA | K2 | P205 | 87CUB | K10 | P313 | BB2 | 12 | E171A |
| 87CUA | K3 | P204 | 87CUB | K11 | P304 | BB2 | 13 | E311A |
| 87CUA | K4 | P207 | 87CUB | K12 | P315 | BB2 | 14 | E331A |
| 87CUA | K5 | P204 | 87CUB | K13 | P304 | BB2 | 15 | E351A |
| 87CUA | K6 | P209 | 87CUB | K14 | P317 | BB2 | 16 | E371A |
| 87CUA | K7 | P204 | 87CUB | K15 | P304 | BB2 | 17 | E111B |

**ALSTOM T&D INDIA LTD.**

| **Job no.** | KR17 | | **Equipment Wise Schedule** | | | **File** | ER17BB4 | |
|---|---|---|---|---|---|---|---|---|
| **Cust.** | | | | **Panel type** | BB4 | **Date** | 17/08/2015 | |
| **Equipment** | **Terminal** | **Wire no** | **Equipment** | **Terminal** | **Wire no** | **Equipment** | **Terminal** | **Wire no** |
| BB2 | 18 | E131B | MCB11 | 4 | P232 | MCB17 | 3 | J12 |
| BB2 | 19 | E151B | MCB11 | 11 | P303 | MCB17 | 4 | P244 |
| BB2 | 20 | E171B | MCB11 | 12 | P319 | MCB17 | 11 | P303 |
| BB2 | 21 | E311B | MCB12 | 1 | J11 | MCB17 | 12 | P319 |
| BB2 | 22 | E331B | MCB12 | 2 | P233A | MCB18 | 1 | J11 |
| BB2 | 23 | E351B | MCB12 | 3 | J12 | MCB18 | 2 | P245 |
| BB2 | 24 | E371B | MCB12 | 4 | P234 | MCB18 | 3 | J12 |
| BB11 | 1 | P101 | MCB12 | 11 | P303 | MCB18 | 4 | P246 |
| BB11 | 2 | P102 | MCB12 | 12 | P319 | MCB18 | 11 | P303 |
| BB11 | 3 | P301A | MCB13 | 1 | J11 | MCB18 | 12 | P319 |
| BB11 | 4 | P302A | MCB13 | 2 | P101 | MCB19 | 1 | J11 |
| BB11 | 5 | P201 | MCB13 | 3 | J12 | MCB19 | 2 | P247 |
| BB11 | 6 | P202 | MCB13 | 4 | P102 | MCB19 | 3 | J12 |
| BB11 | 7 | P301 | MCB13 | 11 | P303 | MCB19 | 4 | P248 |
| BB11 | 8 | P302 | MCB13 | 12 | P319 | MCB19 | 11 | P303 |
| BB11 | 9 | S101 | MCB14 | 1 | J11 | MCB19 | 12 | P319 |
| BB11 | 10 | S163 | MCB14 | 2 | P201 | MCB20 | 1 | J11 |
| BB11 | 11 | S167 | MCB14 | 3 | J12 | MCB20 | 2 | P249 |
| BB11 | 12 | P233A | MCB14 | 4 | P202 | MCB20 | 3 | J12 |
| BB11 | 13 | P234 | MCB14 | 11 | P303 | MCB20 | 4 | P250 |
| BB11 | 14 | P333A | MCB14 | 12 | P319 | MCB20 | 11 | P303 |
| BB11 | 15 | P334 | MCB15 | 1 | J11 | MCB20 | 12 | P319 |
| MCB91 | 1 | H1 | MCB15 | 2 | P239 | ETLP1 | 1 | E171A |
| MCB91 | 2 | H3 | MCB15 | 3 | J12 | ETLP1 | E | EARTH |
| MCB91 | 3 | H2 | MCB15 | 4 | P240 | ETLP2 | 1 | E271A |
| MCB91 | 4 | H4 | MCB15 | 11 | P303 | ETLP2 | E | EARTH |
| MCB1 | 1 | J11 | MCB15 | 12 | P319 | ETLP3 | 1 | E371A |
| MCB1 | 2 | P201A | MCB16 | 1 | J11 | ETLP3 | E | EARTH |
| MCB1 | 3 | J12 | MCB16 | 2 | P241 | ETLP4 | 1 | E171B |
| MCB1 | 4 | P202A | MCB16 | 3 | J12 | ETLP4 | E | EARTH |
| MCB1 | 11 | P303 | MCB16 | 4 | P242 | ETLP5 | 1 | E271B |
| MCB1 | 12 | P319 | MCB16 | 11 | P303 | ETLP5 | E | EARTH |
| MCB11 | 1 | J11 | MCB16 | 12 | P319 | ETLP6 | 1 | E371B |
| MCB11 | 2 | P231 | MCB17 | 1 | J11 | ETLP6 | E | EARTH |
| MCB11 | 3 | J12 | MCB17 | 2 | P243 | PS | 1 | H3 |
| MCB11 | 4 | P232 | MCB17 | 3 | J12 | PS | 2 | H4 |

**ALSTOM T&D INDIA LTD.**

| **Job no.** | KR17 | | **Equipment Wise Schedule** | | | **File** | ER17BB4 | |
|---|---|---|---|---|---|---|---|---|
| **Cust.** | | | | **Panel type** | BB4 | **Date** | 17/08/2015 | |
| **Equipment** | **Terminal** | **Wire no** | **Equipment** | **Terminal** | **Wire no** | **Equipment** | **Terminal** | **Wire no** |
| PS | E | EARTH | MCB55 | 3 | J22 | LK101 | 2 | J11 |
| HS | 1 | H3 | MCB55 | 4 | P340 | LK102 | 1 | J102 |
| HS | 2 | H5 | MCB55 | 11 | P203 | LK102 | 2 | J12 |
| MCB41 | 1 | J21 | MCB55 | 12 | P219 | LK201 | 1 | J201 |
| MCB41 | 2 | P301B | MCB56 | 1 | J21 | LK201 | 2 | J21 |
| MCB41 | 3 | J22 | MCB56 | 2 | P341 | LK202 | 1 | J202 |
| MCB41 | 4 | P302B | MCB56 | 3 | J22 | LK202 | 2 | J22 |
| MCB41 | 11 | P203 | MCB56 | 4 | P342 | TB1 | 1 | E111A |
| MCB41 | 12 | P219 | MCB56 | 11 | P203 | TB1 | 2 | E131A |
| MCB51 | 1 | J21 | MCB56 | 12 | P219 | TB1 | 3 | E151A |
| MCB51 | 2 | P331 | MCB57 | 1 | J21 | TB1 | 4 | E171A |
| MCB51 | 3 | J22 | MCB57 | 2 | P343 | TB1 | 5 | E111A |
| MCB51 | 4 | P332 | MCB57 | 3 | J22 | TB1 | 6 | E131A |
| MCB51 | 11 | P203 | MCB57 | 4 | P344 | TB1 | 7 | E151A |
| MCB51 | 12 | P219 | MCB57 | 11 | P203 | TB1 | 8 | E171A |
| MCB52 | 1 | J21 | MCB57 | 12 | P219 | TB1 | 9 | E211A |
| MCB52 | 2 | P333A | MCB58 | 1 | J21 | TB1 | 10 | E231A |
| MCB52 | 3 | J22 | MCB58 | 2 | P345 | TB1 | 11 | E251A |
| MCB52 | 4 | P334 | MCB58 | 3 | J22 | TB1 | 12 | E271A |
| MCB52 | 11 | P203 | MCB58 | 4 | P346 | TB1 | 13 | E311A |
| MCB52 | 12 | P219 | MCB58 | 11 | P203 | TB1 | 14 | E331A |
| MCB53 | 1 | J21 | MCB58 | 12 | P219 | TB1 | 15 | E351A |
| MCB53 | 2 | P301A | MCB59 | 1 | J21 | TB1 | 16 | E371A |
| MCB53 | 3 | J22 | MCB59 | 2 | P347 | TB1 | 17 | E311A |
| MCB53 | 4 | P302A | MCB59 | 3 | J22 | TB1 | 18 | E331A |
| MCB53 | 11 | P203 | MCB59 | 4 | P348 | TB1 | 19 | E351A |
| MCB53 | 12 | P219 | MCB59 | 11 | P203 | TB1 | 20 | E371A |
| MCB54 | 1 | J21 | MCB59 | 12 | P219 | TB1 | 22 | E111B |
| MCB54 | 2 | P301 | MCB60 | 1 | J21 | TB1 | 23 | E131B |
| MCB54 | 3 | J22 | MCB60 | 2 | P349 | TB1 | 24 | E151B |
| MCB54 | 4 | P302 | MCB60 | 3 | J22 | TB1 | 25 | E171B |
| MCB54 | 11 | P203 | MCB60 | 4 | P350 | TB1 | 26 | E111B |
| MCB54 | 12 | P219 | MCB60 | 11 | P203 | TB1 | 27 | E131B |
| MCB55 | 1 | J21 | MCB60 | 12 | P219 | TB1 | 28 | E151B |
| MCB55 | 2 | P339 | LK101 | 1 | J101 | TB1 | 29 | E171B |
| MCB55 | 3 | J22 | LK101 | 2 | J11 | TB1 | 30 | E211B |

**ALSTOM T&D INDIA LTD.**

| **Job no.** | KR17 | | **Equipment Wise Schedule** | | | **File** | ER17BB4 | |
|---|---|---|---|---|---|---|---|---|
| **Cust.** | | | | **Panel type** | BB4 | **Date** | 17/08/2015 | |
| **Equipment** | **Terminal** | **Wire no** | **Equipment** | **Terminal** | **Wire no** | **Equipment** | **Terminal** | **Wire no** |
| TB1 | 31 | E231B | TB2 | 19 | P301 | BB1 | 1 | H1 |
| TB1 | 32 | E251B | TB2 | 20 | P302 | BB1 | 2 | H2 |
| TB1 | 33 | E271B | TB2 | 21 | P339 | EBAR | 1 | EARTH |
| TB1 | 34 | E311B | TB2 | 22 | P340 | EBAR | 2 | ELOOP |
| TB1 | 35 | E331B | TB2 | 23 | P341 | | | |
| TB1 | 36 | E351B | TB2 | 24 | P342 | | | |
| TB1 | 37 | E371B | TB2 | 27 | P243 | | | |
| TB1 | 38 | E311B | TB2 | 28 | P244 | | | |
| TB1 | 39 | E331B | TB2 | 29 | P245 | | | |
| TB1 | 40 | E351B | TB2 | 30 | P246 | | | |
| TB1 | 41 | E371B | TB2 | 31 | P247 | | | |
| TB1 | 43 | H1 | TB2 | 32 | P248 | | | |
| TB1 | 44 | H2 | TB2 | 33 | P249 | | | |
| TB1 | 46 | J101 | TB2 | 34 | P250 | | | |
| TB1 | 47 | J102 | TB2 | 35 | P343 | | | |
| TB1 | 48 | J201 | TB2 | 36 | P344 | | | |
| TB1 | 49 | J202 | TB2 | 37 | P345 | | | |
| TB2 | 1 | P231 | TB2 | 38 | P346 | | | |
| TB2 | 2 | P232 | TB2 | 39 | P347 | | | |
| TB2 | 3 | P233A | TB2 | 40 | P348 | | | |
| TB2 | 4 | P234 | TB2 | 41 | P349 | | | |
| TB2 | 5 | P101 | TB2 | 42 | P350 | | | |
| TB2 | 6 | P102 | TB2 | 44 | S101 | | | |
| TB2 | 7 | P201 | TB2 | 45 | S163 | | | |
| TB2 | 8 | P202 | TB2 | 46 | S167 | | | |
| TB2 | 9 | P239 | TB2 | 48 | U1 | | | |
| TB2 | 10 | P240 | TB2 | 49 | U2 | | | |
| TB2 | 11 | P241 | TB2 | 50 | U3 | | | |
| TB2 | 12 | P242 | TB2 | 51 | U4 | | | |
| TB2 | 13 | P331 | TB2 | 53 | U5 | | | |
| TB2 | 14 | P332 | TB2 | 54 | U6 | | | |
| TB2 | 15 | P333A | TB2 | 56 | U7 | | | |
| TB2 | 16 | P334 | TB2 | 57 | U8 | | | |
| TB2 | 17 | P301A | HT | 1 | H7 | | | |
| TB2 | 18 | P302A | HT | 2 | H4 | | | |
| TB2 | 19 | P301 | BB1 | 1 | H1 | | | |

**ALSTOM T&D INDIA LTD.**

**Job no.** KR17 **Wire Wise Schedule**

**Cust.**

**Panel type** BB4

| Wire no. | Colour | Connection pattern |
|---|---|---|
| E111A | RD | **BB2(9)- TB1(1)- TB1(5)** |
| E111B | RD | **BB2(17)- TB1(22)- TB1(26)** |
| E131A | YL | **BB2(10)- TB1(2)- TB1(6)** |
| E131B | YL | **BB2(18)- TB1(23)- TB1(27)** |
| E151A | BL | **BB2(11)- TB1(3)- TB1(7)** |
| E151B | BL | **BB2(19)- TB1(24)- TB1(28)** |
| E171A | BK | **BB2(12)- ETLP1(1)- TB1(4)- TB1(8)** |
| E171B | BK | **BB2(20)- ETLP4(1)- TB1(25)- TB1(29)** |
| E211A | RD | **TB1(9)** |
| E211B | RD | **TB1(30)** |
| E231A | YL | **TB1(10)** |
| E231B | YL | **TB1(31)** |
| E251A | BL | **TB1(11)** |
| E251B | BL | **TB1(32)** |
| E271A | BK | **ETLP2(1)- TB1(12)** |
| E271B | BK | **ETLP5(1)- TB1(33)** |
| E311A | RD | **BB2(13)- TB1(13)- TB1(17)** |
| E311B | RD | **BB2(21)- TB1(34)- TB1(38)** |
| E331A | YL | **BB2(14)- TB1(14)- TB1(18)** |
| E331B | YL | **BB2(22)- TB1(35)- TB1(39)** |
| E351A | BL | **BB2(15)- TB1(15)- TB1(19)** |
| E351B | BL | **BB2(23)- TB1(36)- TB1(40)** |
| E371A | BK | **BB2(16)- ETLP3(1)- TB1(16)- TB1(20)** |
| E371B | BK | **BB2(24)- ETLP6(1)- TB1(37)- TB1(41)** |
| EARTH | GN | **87CUA(E01)- 87CUB(E)- 80DC1(E)- 80DC2(E)- ETLP1(E)- ETLP2(E)- ETLP3(E)- ETLP4(E)- ETLP5(E)- ETLP6(E)- PS(E)- EBAR(01)** |
| ELOOP | GN | **87CUA(E02)- EBAR(02)** |
| H1 | BK | **MCB91(1)- TB1(43)- BB1(1)** |
| H2 | BK | **MCB91(3)- TB1(44)- BB1(2)** |
| H3 | BK | **CIL(1)- MCB91(2)- PS(1)- HS(1)** |
| H4 | BK | **CIL(2)- MCB91(4)- PS(2)- HT(2)** |
| H5 | BK | **TH(1)- HS(2)** |
| H7 | BK | **TH(2)- HT(1)** |
| J101 | GY | **LK101(1)- TB1(46)** |
| J102 | GY | **LK102(1)- TB1(47)** |
| J11 | GY | **80DC1(11)- MCB1(1)- MCB11(1)- MCB12(1)- MCB13(1)- MCB14(1)- MCB15(1)- MCB16(1)- MCB17(1)- MCB18(1)- MCB19(1)- MCB20(1)- LK101(2)** |
| J12 | GY | **80DC1(14)- MCB1(3)- MCB11(3)- MCB12(3)- MCB13(3)- MCB14(3)- MCB15(3)- MCB16(3)- MCB17(3)- MCB18(3)- MCB19(3)- MCB20(3)- LK102(2)** |
| J201 | GY | **LK201(1)- TB1(48)** |
| J202 | GY | **LK202(1)- TB1(49)** |
| J21 | GY | **80DC2(11)- MCB41(1)- MCB51(1)- MCB52(1)- MCB53(1)- MCB54(1)- MCB55(1)- MCB56(1)- MCB57(1)- MCB58(1)- MCB59(1)- MCB60(1)- LK201(2)** |
| J22 | GY | **80DC2(14)- MCB41(3)- MCB51(3)- MCB52(3)- MCB53(3)- MCB54(3)- MCB55(3)- MCB56(3)- MCB57(3)- MCB58(3)- MCB59(3)- MCB60(3)- LK202(2)** |
| P101 | GY | **BB11(1)- MCB13(2)- TB2(5)** |
| P102 | GY | **BB11(2)- MCB13(4)- TB2(6)** |
| P201 | GY | **BB11(5)- MCB14(2)- TB2(7)** |
| P201A | GY | **BLKCUA(S2)- MCB1(2)** |
| P202 | GY | **BB11(6)- MCB14(4)- TB2(8)** |
| P202A | GY | **BLKCUA(S1)- MCB1(4)** |
| P203 | GY | **SS1(1P3)- SS1(2P1)- SS2(1P3)- SS2(2P1)- 87CUA(+L2)- 87CUB(J7)- 87CUB(J9)- 87CUB(L13)- BLKCUA(R2)- MCB41(11)- MCB51(11)- MCB52(11)- MCB53(11)- MCB54(11)- MCB55(11)- MCB56(11)- MCB57(11)- MCB58(11)- MCB59(11)- MCB60(11)** |
| P204 | GY | **87CUA(K1)- 87CUA(K3)- 87CUA(K5)- 87CUA(K7)- 87CUA(K9)- 87CUA(K11)- 87CUA(K13)- 87CUA(K15)- 87CUA(-L1)- BLKCUA(R1)** |
| P205 | GY | **SS1(1P4)- 87CUA(K2)** |
| P207 | GY | **SS1(2P2)- 87CUA(K4)** |
| P209 | GY | **SS2(1P4)- 87CUA(K6)** |
| P211 | GY | **SS2(2P2)- 87CUA(K8)** |
| P213 | GY | **87CUA(K10)- 87CUB(J8)** |
| P215 | GY | **87CUA(K12)- 87CUB(J10)** |
| P217 | GY | **87CUA(K14)- 87CUB(L14)** |
| P219 | GY | **87CUA(K16)- MCB41(12)- MCB51(12)- MCB52(12)- MCB53(12)- MCB54(12)- MCB55(12)- MCB56(12)- MCB57(12)- MCB58(12)- MCB59(12)- MCB60(12)** |
| P231 | GY | **MCB11(2)- TB2(1)** |
| P232 | GY | **MCB11(4)- TB2(2)** |
| P233A | GY | **BB11(12)- MCB12(2)- TB2(3)** |

**Job no.** KR17 **Wire Wise Schedule**

**Cust.**

**Panel type** BB4

| Wire no. | Colour | Connection pattern |
|---|---|---|
| P234 | GY | **BB11(13)- MCB12(4)- TB2(4)** |
| P239 | GY | **MCB15(2)- TB2(9)** |
| P240 | GY | **MCB15(4)- TB2(10)** |
| P241 | GY | **MCB16(2)- TB2(11)** |
| P242 | GY | **MCB16(4)- TB2(12)** |
| P243 | GY | **MCB17(2)- TB2(27)** |
| P244 | GY | **MCB17(4)- TB2(28)** |
| P245 | GY | **MCB18(2)- TB2(29)** |
| P246 | GY | **MCB18(4)- TB2(30)** |
| P247 | GY | **MCB19(2)- TB2(31)** |
| P248 | GY | **MCB19(4)- TB2(32)** |
| P249 | GY | **MCB20(2)- TB2(33)** |
| P250 | GY | **MCB20(4)- TB2(34)** |
| P301 | GY | **BB11(7)- MCB54(2)- TB2(19)** |
| P301A | GY | **BB11(3)- MCB53(2)- TB2(17)** |
| P301B | GY | **BLKCUB(S2)- MCB41(2)** |
| P302 | GY | **BB11(8)- MCB54(4)- TB2(20)** |
| P302A | GY | **BB11(4)- MCB53(4)- TB2(18)** |
| P302B | GY | **BLKCUB(S1)- MCB41(4)** |
| P303 | GY | **SS4(1P3)- SS4(2P1)- SS3(1P3)- SS3(2P1)- 87CUA(J7)- 87CUA(J9)- 87CUA(L13)- 87CUB(+L2)- BLKCUB(R2)- MCB1(11)- MCB11(11)- MCB12(11)- MCB13(11)- MCB14(11)- MCB15(11)- MCB16(11)- MCB17(11)- MCB18(11)- MCB19(11)- MCB20(11)** |
| P304 | GY | **87CUB(K1)- 87CUB(K3)- 87CUB(K5)- 87CUB(K7)- 87CUB(K9)- 87CUB(K11)- 87CUB(K13)- 87CUB(K15)- 87CUB(-L1)- BLKCUB(R1)** |
| P305 | GY | **SS3(1P4)- 87CUB(K2)** |
| P307 | GY | **SS3(2P2)- 87CUB(K4)** |
| P309 | GY | **SS4(1P4)- 87CUB(K6)** |
| P311 | GY | **SS4(2P2)- 87CUB(K8)** |
| P313 | GY | **87CUA(J8)- 87CUB(K10)** |
| P315 | GY | **87CUA(J10)- 87CUB(K12)** |
| P317 | GY | **87CUA(L14)- 87CUB(K14)** |
| P319 | GY | **87CUB(K16)- MCB1(12)- MCB11(12)- MCB12(12)- MCB13(12)- MCB14(12)- MCB15(12)- MCB16(12)- MCB17(12)- MCB18(12)- MCB19(12)- MCB20(12)** |
| P331 | GY | **MCB51(2)- TB2(13)** |
| P332 | GY | **MCB51(4)- TB2(14)** |
| P333A | GY | **BB11(14)- MCB52(2)- TB2(15)** |
| P334 | GY | **BB11(15)- MCB52(4)- TB2(16)** |
| P339 | GY | **MCB55(2)- TB2(21)** |
| P340 | GY | **MCB55(4)- TB2(22)** |
| P341 | GY | **MCB56(2)- TB2(23)** |
| P342 | GY | **MCB56(4)- TB2(24)** |
| P343 | GY | **MCB57(2)- TB2(35)** |
| P344 | GY | **MCB57(4)- TB2(36)** |
| P345 | GY | **MCB58(2)- TB2(37)** |
| P346 | GY | **MCB58(4)- TB2(38)** |
| P347 | GY | **MCB59(2)- TB2(39)** |
| P348 | GY | **MCB59(4)- TB2(40)** |
| P349 | GY | **MCB60(2)- TB2(41)** |
| P350 | GY | **MCB60(4)- TB2(42)** |
| S101 | GY | **80DC1(2)- 80DC2(2)- BB11(9)- TB2(44)** |
| S163 | GY | **80DC1(4)- BB11(10)- TB2(45)** |
| S167 | GY | **80DC2(4)- BB11(11)- TB2(46)** |
| U1 | GY | **80DC1(1)- TB2(48)** |
| U2 | GY | **80DC1(3)- TB2(49)** |
| U3 | GY | **80DC2(1)- TB2(50)** |
| U4 | GY | **80DC2(3)- TB2(51)** |
| U5 | GY | **87CUA(J11)- TB2(53)** |
| U6 | GY | **87CUA(J12)- TB2(54)** |
| U7 | GY | **87CUB(J11)- TB2(56)** |
| U8 | GY | **87CUB(J12)- TB2(57)** |
| | | |

## BUS WIRE SCHEDULE

**Job No.:** KR17

**Panel Types:** R7A R7B R8 R9A R9B R6A R6B BB4

**Wiring Notes:** R/Y/B/BLK colour wires with BLK sleeves to be used for CT/PT ckts and Grey Wires with BLK sleeves for others. Tag: PIN

**Special Instructions:** 2BA TAG FOR (CT/PT WIRES-A,B,C,D,E) AND REMAINING PIN TYPE TAG

**Prepared By:** KB

**Date:** #####

**File:** \\cpcad\bom\pisoftsd\kr17bw2.xls

| S.No. | BB Ref. | Wire No. | Wire Col. | Size | Length | Panel Sequence (as viewed from rear of the board) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | R7A | R7B | R8 | R9A | R9B | R6A | R6B | BB4 | | | | | | | | |
| 1 | BB1(1) | H1 | BLK | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 2 | BB1(2) | H2 | BLK | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 3 | BB1(3) | J13 | GY | 2.5 | | | | x | x | x | x | x | | | | | | | | | |
| 4 | BB1(4) | J14 | GY | 2.5 | | | | x | x | x | x | x | | | | | | | | | |
| 5 | BB1(5) | J23 | GY | 2.5 | | | | x | x | x | | | | | | | | | | | |
| 6 | BB1(6) | J24 | GY | 2.5 | | | | x | x | x | | | | | | | | | | | |
| 7 | BB2(1) | E211 | R | 2.5 | | x | x | x | x | x | | | | | | | | | | | |
| 8 | BB2(2) | E231 | Y | 2.5 | | x | x | x | x | x | | | | | | | | | | | |
| 9 | BB2(3) | E251 | B | 2.5 | | x | x | x | x | x | | | | | | | | | | | |
| 10 | BB2(4) | E271 | BLK | 2.5 | | x | x | x | x | x | | | | | | | | | | | |
| 11 | BB2(5) | E311 | R | 2.5 | | x | x | x | x | x | | | | | | | | | | | |
| 12 | BB2(6) | E331 | Y | 2.5 | | x | x | x | x | x | | | | | | | | | | | |
| 13 | BB2(7) | E351 | B | 2.5 | | x | x | x | x | x | | | | | | | | | | | |
| 14 | BB2(8) | E371 | BLK | 2.5 | | x | x | x | x | x | | | | | | | | | | | |
| 15 | BB2(9) | E111A | R | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 16 | BB2(10) | E131A | Y | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 17 | BB2(11) | E151A | B | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 18 | BB2(12) | E171A | BLK | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 19 | BB2(13) | E311A | R | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 20 | BB2(14) | E331A | Y | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 21 | BB2(15) | E351A | B | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 22 | BB2(16) | E371A | BLK | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 23 | BB2(17) | E111B | R | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 24 | BB2(18) | E131B | Y | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 25 | BB2(19) | E151B | B | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 26 | BB2(20) | E171B | BLK | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 27 | BB2(21) | E311B | R | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 28 | BB2(22) | E331B | Y | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 29 | BB2(23) | E351B | B | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |
| 30 | BB2(24) | E371B | BLK | 2.5 | | x | x | x | x | x | x | x | x | | | | | | | | |

| S.No. | BB Ref. | Wire No. | Wire Col. | Size | Length | Panel Sequence (as viewed from rear of the board) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | R7A | R7B | R8 | R9A | R9B | R6A | R6B | BB4 | | | | | | | | |
| 31 | BB3(1) | E931 | Y | 2.5 | | x | | x | | x | | | | | | | | | | | |
| 32 | BB3(2) | E971 | BLK | 2.5 | | x | | x | | x | | | | | | | | | | | |
| 33 | BB3(3) | K301 | GY | 1.5 | | x | | | x | | | | | | | | | | | | |
| 34 | BB3(3) | K301B | GY | 1.5 | | | | x | | | | | | | | | | | | | |
| 35 | BB3(4) | K310A | GY | 1.5 | | x | | x | | x | | | | | | | | | | | |
| 36 | BB3(5) | K501 | GY | 1.5 | | x | | | x | | | | | | | | | | | | |
| 37 | BB3(5) | K501B | GY | 1.5 | | | | x | | | | | | | | | | | | | |
| 38 | BB3(6) | K510A | GY | 1.5 | | x | | x | | x | | | | | | | | | | | |
| 39 | BB4(1) | A111 | R | 2.5 | | | | x | | x | | | | | | | | | | | |
| 40 | BB4(2) | A131 | Y | 2.5 | | | | x | | x | | | | | | | | | | | |
| 41 | BB4(3) | A151 | B | 2.5 | | | | x | | x | | | | | | | | | | | |
| 42 | BB4(4) | A171 | BLK | 2.5 | | | | x | | x | | | | | | | | | | | |
| 43 | BB4(7) | K405 | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 44 | BB4(8) | K423A | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 45 | BB4(9) | K423B | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 46 | BB4(10) | K423C | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 47 | BB4(11) | K423 | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 48 | BB4(12) | K101 | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 49 | BB4(13) | K103 | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 50 | BB4(14) | K201 | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 51 | BB4(15) | K203 | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 52 | BB4(16) | K131 | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 53 | BB4(17) | K133 | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 54 | BB4(18) | K137 | GY | 1.5 | | | | x | | x | | | | | | | | | | | |
| 55 | BB4(19) | K231 | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 56 | BB4(20) | K233 | GY | 1.5 | | | | x | | x | | x | | | | | | | | | |
| 57 | BB4(21) | K237 | GY | 1.5 | | | | x | | x | | | | | | | | | | | |

| S.No. | BB Ref. | Wire No. | Wire Col. | Size | Length | Panel Sequence (as viewed from rear of the board) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | R7A | R7B | R8 | R9A | R9B | R6A | R6B | BB4 | | | | | | | | | |
| 58 | BB5(1) | K105 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 59 | BB5(2) | K150 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 60 | BB5(3) | K205 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 61 | BB5(4) | K915 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 62 | BB5(5) | K403 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 63 | BB5(6) | K403A | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 64 | BB5(7) | K403B | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 65 | BB5(8) | K403C | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 66 | BB5(9) | K453 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 67 | BB5(10) | K453A | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 68 | BB5(11) | K453B | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 69 | BB5(12) | K453C | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 70 | BB5(13) | K441 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 71 | BB5(14) | K445 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 72 | BB5(15) | S227 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 73 | BB5(16) | S221 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 74 | BB5(17) | S223 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 75 | BB5(18) | S225 | GY | 1.5 | | | | x---- | ----x | ---- | x---- | ----x | | | | | | | | | | |
| 76 | BB5(19) | S201 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | | |
| | BB5(19) | S401 | GY | 1.5 | | | | x | | | | | | | | | | | | | | |
| 77 | BB5(20) | S231 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | | |
| | BB5(20) | S497A | GY | 1.5 | | | | x | | | | | | | | | | | | | | |
| 78 | BB6(1) | J23 | GY | 2.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 79 | BB6(2) | J24 | GY | 2.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 80 | BB6(3) | K3 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 81 | BB6(4) | K3A | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 82 | BB6(5) | K3B | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 83 | BB6(6) | K3C | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 84 | BB6(7) | K301 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 85 | BB6(8) | K303 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 86 | BB6(9) | K310 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 87 | BB6(10) | K43 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 88 | BB6(11) | K49 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 89 | BB6(12) | K53 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 90 | BB6(13) | K53A | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 91 | BB6(14) | K53B | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 92 | BB6(15) | K53C | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 93 | BB6(16) | K501 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 94 | BB6(17) | K503 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 95 | BB6(18) | K510 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 96 | BB6(20) | K93 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 97 | BB6(21) | P305 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |
| 98 | BB6(22) | P325 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.No. | BB Ref. | Wire No. | Wire Col. | Size | Length | Panel Sequence (as viewed from rear of the board) | | | | | | | | | | | | | | | |
| | | | | | | R7A | R7B | R8 | R9A | R9B | R6A | R6B | BB4 | | | | | | | | |
| 99 | BB7(1) | S101 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | |
| 100 | BB7(2) | S109 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | |
| 101 | BB7(3) | S113 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | |
| 102 | BB7(4) | S119 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | |
| 103 | BB7(5) | S135 | GY | 1.5 | | x---- | ----x | | | | | | | | | | | | | | |
| 104 | BB8(1) | D15 | R | 2.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 105 | BB8(2) | D35 | Y | 2.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 106 | BB8(3) | D55 | B | 2.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 107 | BB8(4) | D73 | BLK | 2.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 108 | BB8(5) | K102 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 109 | BB8(6) | K107 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 110 | BB8(7) | K127 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 111 | BB8(8) | K135 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 112 | BB8(9) | K13B | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 113 | BB8(10) | K13C | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 114 | BB8(11) | K151 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 115 | BB8(12) | K169 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 116 | BB8(13) | K171 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 117 | BB8(14) | K175 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 118 | BB8(15) | K177 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 119 | BB8(16) | K179 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 120 | BB8(17) | K19 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 121 | BB8(18) | K1A | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 122 | BB8(19) | K201S | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 123 | BB8(20) | K202 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 124 | BB8(21) | K207 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 125 | BB8(22) | K21 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |

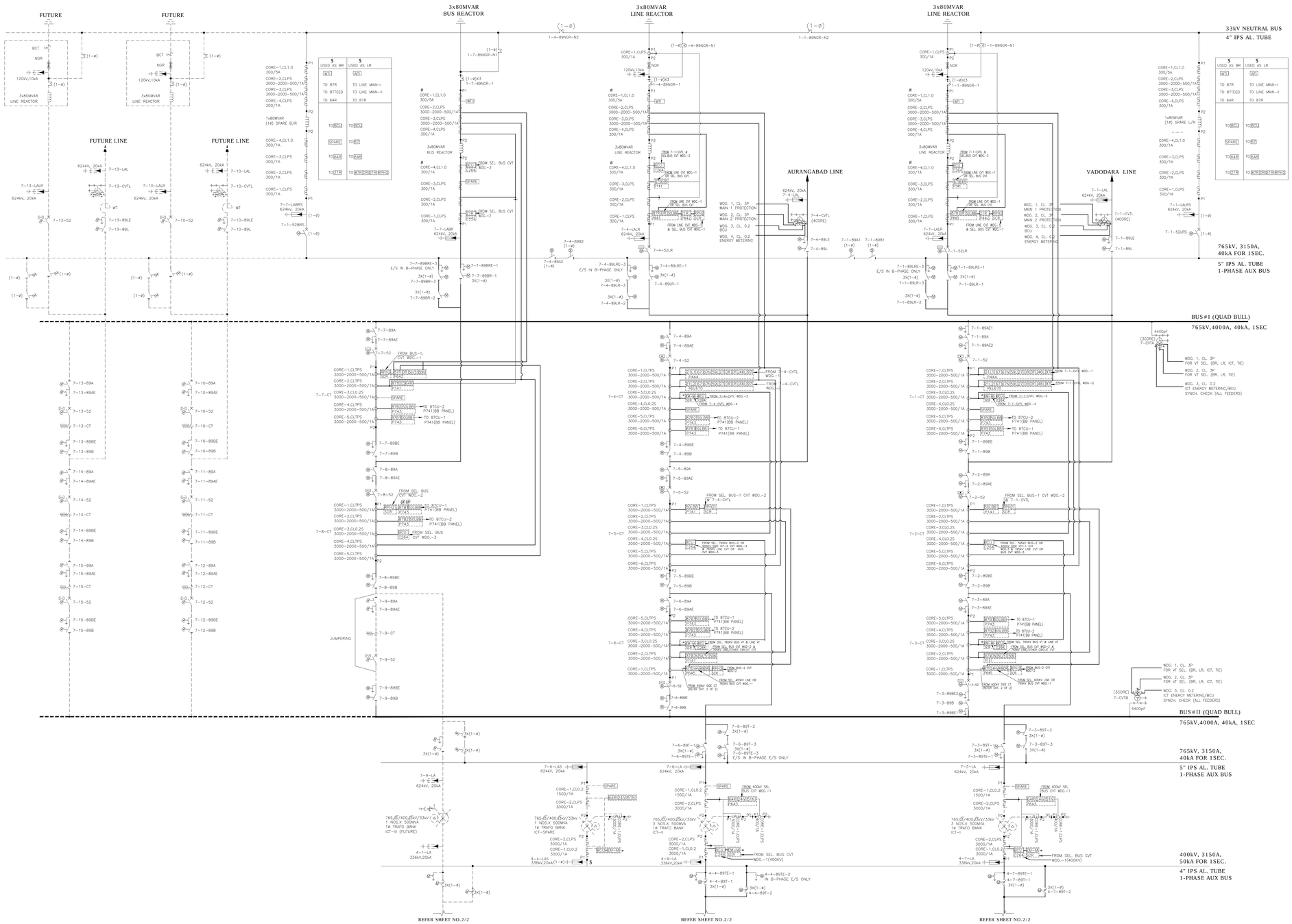
| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.No. | BB Ref. | Wire No. | Wire Col. | Size | Length | | Panel Sequence (as viewed from rear of the board) | | | | | | | | | | | | | | |
| | | | | | | R7A | R7B | R8 | R9A | R9B | R6A | R6B | BB4 | | | | | | | | |
| 126 | BB9(1) | K23 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 127 | BB9(2) | K227 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 128 | BB9(3) | K235 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 129 | BB9(4) | K25A | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 130 | BB9(5) | K3 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 131 | BB9(6) | K3A | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 132 | BB9(7) | K3B | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 133 | BB9(8) | K3C | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 134 | BB9(9) | K53 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 135 | BB9(10) | K53A | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 136 | BB9(11) | K53B | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 137 | BB9(12) | K53C | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 138 | BB9(13) | K410 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 139 | BB9(14) | K601 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 140 | BB9(15) | K602 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 141 | BB9(16) | K609 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 142 | BB9(17) | K801 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 143 | BB9(18) | K802 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 144 | BB9(19) | K903 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 145 | BB9(20) | K911 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 146 | BB9(21) | K921 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 147 | BB9(22) | K925 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |

| S.No. | BB Ref. | Wire No. | Wire Col. | Size | Length | Panel Sequence (as viewed from rear of the board) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | R7A | R7B | R8 | R9A | R9B | R6A | R6B | BB4 | | | | | | | | |
| 148 | BB10(1) | P205 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 149 | BB10(2) | P225 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 150 | BB10(3) | P231 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 151 | BB10(4) | P233 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 152 | BB10(5) | P235 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 153 | BB10(6) | P305 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 154 | BB10(7) | P327 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 155 | BB10(8) | P331 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 156 | BB10(9) | P333 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 157 | BB10(10) | P335 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 158 | BB10(11) | S101 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 159 | BB10(12) | S115 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 160 | BB10(13) | S119 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 161 | BB10(14) | S123 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 162 | BB10(15) | S125 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 163 | BB10(16) | S127 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 164 | BB10(17) | S129 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 165 | BB10(18) | S131 | GY | 1.5 | | | | | x---- | ----x | x---- | ----x | | | | | | | | | |
| 166 | BB11(1) | P101 | GY | 1.5 | | x---- | ----x | ----x | ----x | ----x | ----x | ----x | ----x | | | | | | | | |
| 167 | BB11(2) | P102 | GY | 1.5 | | x---- | ----x | ----x | ----x | ----x | ----x | ----x | ----x | | | | | | | | |
| 168 | BB11(3) | P301A | GY | 1.5 | | | x---- | ----x | ----x | ----x | ----x | ----x | ----x | | | | | | | | |
| 169 | BB11(4) | P302A | GY | 1.5 | | | x---- | ----x | ----x | ----x | ----x | ----x | ----x | | | | | | | | |
| 170 | BB11(5) | P201 | GY | 1.5 | | | | | x---- | ----x | ----x | ----x | ----x | | | | | | | | |
| 171 | BB11(6) | P202 | GY | 1.5 | | | | | x---- | ----x | ----x | ----x | ----x | | | | | | | | |
| 172 | BB11(7) | P301 | GY | 1.5 | | | | | | x---- | ----x | ----x | ----x | | | | | | | | |
| 173 | BB11(8) | P302 | GY | 1.5 | | | | | | x---- | ----x | ----x | ----x | | | | | | | | |
| 174 | BB11(9) | S101 | GY | 1.5 | | | | | | x---- | ----x | ----x | ----x | | | | | | | | |
| 175 | BB11(10) | S163 | GY | 1.5 | | | | | | x---- | ----x | ----x | ----x | | | | | | | | |
| 176 | BB11(11) | S167 | GY | 1.5 | | | | | | x---- | ----x | ----x | ----x | | | | | | | | |
| 177 | BB11(12) | P233A | GY | 1.5 | | | | | | | x---- | ----x | ----x | | | | | | | | |
| 178 | BB11(13) | P234 | GY | 1.5 | | | | | | | x---- | ----x | ----x | | | | | | | | |
| 179 | BB11(14) | P333A | GY | 1.5 | | | | | | | | x---- | ----x | | | | | | | | |
| 180 | BB11(15) | P334 | GY | 1.5 | | | | | | | | x---- | ----x | | | | | | | | |

| 0 | TB1 | TB2 | BB1 | BB2 | BB11 |
|---|---|---|---|---|---|
| 1 | E111A (10) | P231 (04) | H1 (03) | | P101 (04) |
| 2 | E131A (10) | P232 (04) | H2 (03) | | P102 (04) |
| 3 | E151A (10) | P233A (04) | | | P301A (04) |
| 4 | E171A (10) | P234 (04) | | | P302A (04) |
| 5 | E111A (10) | P101 (04) | | | P201 (04) |
| 6 | E131A (10) | P102 (04) | | | P202 (04) |
| 7 | E151A (10) | P201 (04) | | | P301 (04) |
| 8 | E171A (10) | P202 (04) | | | P302 (04) |
| 9 | E211A (10) | P239 (04) | | E111A (10) | S101 (08) |
| 10 | E231A (10) | P240 (04) | | E131A (10) | S163 (08) |
| 11 | E251A (10) | P241 (04) | | E151A (10) | S167 (08) |
| 12 | E271A (10) | P242 (04) | | E171A (10) | P233A (04) |
| 13 | E311A (10) | P331 (04) | | E311A (10) | P234 (04) |
| 14 | E331A (10) | P332 (04) | | E331A (10) | P333A (04) |
| 15 | E351A (10) | P333A (04) | | E351A (10) | P334 (04) |
| 16 | E371A (10) | P334 (04) | | E371A (10) | |
| 17 | E311A (10) | P301A (04) | | E111B (11) | |
| 18 | E331A (10) | P302A (04) | | E131B (11) | |
| 19 | E351A (10) | P301 (04) | | E151B (11) | |
| 20 | E371A (10) | P302 (04) | | E171B (11) | |
| 21 | | P339 (04) | | E311B (11) | |
| 22 | E111B (11) | P340 (04) | | E331B (11) | |
| 23 | E131B (11) | P341 (04) | | E351B (11) | |
| 24 | E151B (11) | P342 (04) | | E371B (11) | |
| 25 | E171B (11) | | | | |
| 26 | E111B (11) | | | | |
| 27 | E131B (11) | P243 (05) | | | |
| 28 | E151B (11) | P244 (05) | | | |
| 29 | E171B (11) | P245 (05) | | | |
| 30 | E211B (11) | P246 (05) | | | |
| 31 | E231B (11) | P247 (05) | | | |
| 32 | E251B (11) | P248 (05) | | | |
| 33 | E271B (11) | P249 (05) | | | |
| 34 | E311B (11) | P250 (05) | | | |
| 35 | E331B (11) | P343 (05) | | | |
| 36 | E351B (11) | P344 (05) | | | |
| 37 | E371B (11) | P345 (05) | | | |
| 38 | E311B (11) | P346 (05) | | | |
| 39 | E331B (11) | P347 (05) | | | |
| 40 | E351B (11) | P348 (05) | | | |
| 41 | E371B (11) | P349 (05) | | | |
| 42 | | P350 (05) | | | |
| 43 | H1 (03) | | | | |
| 44 | H2 (03) | S101 (08) | | | |
| 45 | | S163 (08) | | | |
| 46 | J101 (04) | S167 (08) | | | |
| 47 | J102 (04) | | | | |
| 48 | J201 (04) | U1 (04) | | | |
| 49 | J202 (04) | U2 (04) | | | |
| 50 | | U3 (04) | | | |
| 51 | | U4 (04) | | | |
| 52 | | | | | |
| 53 | | U5 (06) | | | |
| 54 | | U6 (06) | | | |
| 55 | | | | | |
| 56 | | U7 (07) | | | |
| 57 | | U8 (07) | | | |

DRAWING NO.:5429PS060-DHU-E-SYD-SLD-0451

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## PROTECTION DETAILS

THIS IS INDICATIVE LIST OF RELAY TO BE USED IN THE PROTECTION SYSTEM.

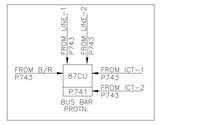
| SL. No | CIRCUIT | SLD DEVICE REF. | RELAY TYPE | PROTECTION COVERED |
|---|---|---|---|---|
| 1 | LINE BAY | 21L1 | P444 | MAIN 1 LINE DISTANCE PROTECTION, LOCAL O/V-U/V, DIR & NON DIR, O/C-E/F, OPEN JUMPER, DR, FAULT LOCATOR. |
| | | 21L2 | REL670 | MAIN 2 LINE DISTANCE PROTECTION, LOCAL O/V-U/V, DIR & NON DIR, O/C-E/F, OPEN JUMPER, DR, FAULT LOCATOR. |
| | | BCU | C264 | INDICATION METERING, CONTROL & INTERLOCK SYNC. CHECK, A/R. |
| 2 | LINE REACTOR | 87R,DR,50LBB | P643 | REACTOR DIFFRENTIAL PROTN,REACTOR TROUBLE TRIPS DISTURBANCE RECORDER, LBB PROTECTION |
| | | 21R | P442 | BACK UP IMP. PROTECTION |
| | | 67,64R | P141 | DIR. OVER CURRENT PROT., HIGH IMP. REF PROTECTION |
| | | BCU | C264 | INDICATION METERING, CONTROL & INTERLOCK SYNC. CHECK,REACTOR TROUBLE ALARMS |
| 3 | TIE – CB WITH A/R | 50 LBB | P141 | BREAKER FAILURE – TIE CB |
| | | BCU | C264 | INDICATION METERING, CONTROL & INTERLOCK SYNC. CHECK, A/R. |
| 4 | ICT | 87T,24HV,49,DR | P645 | TRANSFORMER DIFFERENTIAL PROTECTION,TRANSFORMER TROUBLE TRIPS,TRANSFORMER OVERFLUXING PROTECTION (HV), DR. |
| | | 24H/64R,51N | P643 | OVER FLUXING PROTECTION (V), REF & STAND BY E/F |
| | | FOR HV 67,67N,50/51,50N | P141 | DIR. O/C & E/F PROTN., BACK UP O/C, E/F PROTN. |
| | | BCU | C264 | INDICATION METERING, CONTROL & INTERLOCK SYNC. CHECK, TRAFO. TROUBLE ALARM |
| | | FOR LV 67,67N,50/51,50N | P141 | DIR. O/C & E/F PROTN., BACK UP O/C, E/F PROTN. |
| 5 | BUS REACTOR | 87R,DR,51N 50/51,50N | P643 | REACTOR DIFFRENTIAL PROTN,REACTOR TROUBLE TRIPS STAND BY E/F PROTN., DISTURBANCE RECORDER BACK UP O/C-E/F PROTECTION |
| | | 21R | P442 | BACK UP IMP. PROTECTION |
| | | ## 87TEED, 64R | P141 | TEED DIFFERENTIAL PROTECTION (HIGH IMPEDANCE) HIGH IMP. REF PROTECTION |
| | | BCU | C264 | INDICATION METERING, CONTROL & INTERLOCK SYNC. CHECK,REACTOR TROUBLE ALARMS |
| 6 | BUS BAR PROTECTION | 87B1, LBB1 | P743 | MAIN–1 BUS BAR & LBB PROTECTION |
| | | 87B2, LBB2 | P743 | MAIN–2 BUS BAR & LBB PROTECTION |

## LEGEND:-

| | | |
|---|---|---|
| 21L1 | – | LINE MAIN–I DISTANCE PROTECTION |
| 21L2 | – | LINE MAIN–II DISTANCE PROTECTION |
| 50/51 | – | BACK UP OVER CURRENT PROTECTION |
| 46L | – | LINE OPEN JUMPER PROTECTION |
| 97 | – | VT FUSE FAILURE PROTECTION |
| 79 | – | AUTO RECLOSURE MAIN CB |
| 79T | – | AUTO RECLOSURE TIE CB |
| 87B1 | – | MAIN 1 BUS BAR PROTECTION |
| 87B2 | – | MAIN 2 BUS BAR PROTECTION |
| BCU | – | BAY CONTROL UNIT |
| 50LBB | – | LOCAL BREAKER BACK UP PROTECTION |
| EM–M | – | ENERGY METER ABT (MAIN) |
| 64R | – | REF PROTECTION |
| 87R | – | REACTOR DIFFRENTIAL PROTECTION |
| 59L | – | LINE OVER VOLTAGE PROTECTION |
| 67/67N | – | DIRECTIONAL O/C E/F PROTECTION |
| 24 | – | OVER FLUXING PROTECTION |
| 87T | – | TRANSFORMER DIFFRENTIAL PROTECTION |
| 51N | – | STAND BY E/F PROTECTION |
| DR | – | DISTURBANCE RECORDER |
| DFL | – | DISTANCE TO FAULT LOCATOR |
| 87TEED | – | TEED DIFFERENTIAL PROTECTION (HIGH IMP.) |
| 49 | – | OVER LOAD PROTECTION |
| 50N | – | BACK UP E/F PROTECTION |
| RPH2 | – | POINT ON WAVE CONTROLLER (CONTROLLED SWITCHING) |
| 21R | – | BACK UP IMPEDANCE PROTECTION |
| SCR | – | SWITCHYARD CONTROL ROOM/AC KIOSK |

## FUNCTION IN BCU

| | | |
|---|---|---|
| A | – | CURRENT/ PHASE |
| V | – | VOLTAGE/ PHASE |
| F | – | FREQUENCY |
| W | – | ACTIVE POWER |
| VAR | – | REACTIVE POWER |
| 79 | – | AUTO RECLOSURE (ONLY FOR LINE & RELATED TIE CB) |
| 25 | – | SYNCHRONIZATION CHECK |




AS-BUILT

ALL DIMENSIONS ARE IN MM

NOTES

1. RELAY METER SHOWN IN THE BOX IS INBUILT FEATURE OF DEVICE.
2. $ CT SWITCHED TO RESPECTIVE PHASE OF SELECTED BAY PROTECTION RELAY.
3. ● ENERGY METERS NOT IN AREVA SCOPE OF SUPPLY ONLY CUTOUT TO BE PROVIDED IN SWITCHYARD RELAY PANEL.
4. ## TEED PROTECTION ONLY FOR 765kV BUS REACTOR.
5. FOR CT/PT PARAMETERS REFER CT/PT SIZING CALCULATION.
6. @@ BUS BAR PROTECTION RELAY TO BE SHIFTED FROM TIE PANEL TO FUTURE BAY PANEL DURING AUGMENTATION.
7. BAY ORIENTATION OF 765/400kV SYSTEM IS BASED ON SWITCHYARD LAYOUT DRG.NO.5429PS060–DHU–C–SYD–AAR–0001 (R0)
8. 51N AND 64R OF SPARE ICT ARE ENABLED IN P141 RELAY (67HV–MAIN) OF ICT–2

| REV. | DESCRIPTION | | DRAWN | ELECT. | PM | CHECKED | APPROVED | STATUS |
|---|---|---|---|---|---|---|---|---|
| | | Name | | | | | | |
| | | Date | | | | | | |
| | | Sign. | | | | | | |
| | | Name | | | | | | |
| | | Date | | | | | | |
| | | Sign. | | | | | | |
| R3 | INTERNAL UPDATION | Name | KSV | SHM | | | VVG | FOR APPROVAL |
| | | Date | 11.09.13 | 11.09.13 | | | 11.09.13 | |
| | | Sign. | | | | | | |
| R2 | REVISED AS PER CUSTOMER COMMENTS DTD. 20.12.11 | Name | KSV | SHM | | | NAG | FOR APPROVAL |
| | | Date | 26.12.11 | 26.12.11 | | | 26.12.11 | |
| | | Sign. | | | | | | |
| R1 | REVISED AS PER CUSTOMER COMMENTS DTD. 01.10.11 & MOM DATED. 05–12–11 | Name | KSV | SHM | | | NAG | FOR APPROVAL |
| | | Date | 06.12.11 | 06.12.11 | | | 06.12.11 | |
| | | Sign. | | | | | | |
| R0 | FIRST ISSUE | Name | JGS | SHM | | | NAG | FOR APPROVAL |
| | | Date | 23.09.11 | 23.09.11 | | | 23.09.11 | |
| | | Sign. | | | | | | |

| REFR. DRG. NO. | DESCRIPTION |
|---|---|
| 5429PS060–DHU–E–DYD–SLD–0401 | SINGLE LINE DIAGRAM FOR 765/400kV DHULE SUBSTATION (Rev–R5) |

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

TITLE: PROTECTION SINGLE LINE DIAGRAM FOR 765/400kV DHULE SUBSTATION

ALSTOM T&D INDIA LTD. (Formerly AREVA T&D INDIA LTD) A–7, SECTOR–65, NOIDA – 201301 UTTAR PRADESH (INDIA).

DRAWING NO.: 5429PS060–DHU–E–SYD–SLD–0451 | SHEET NO 001 | 002

A0 | SCALE NTS

DRAWING NO.:5429PS060-DHU-E-SYD-SLD-0451

DF010

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FROM 765/400kV ICT-III (FUTURE)
REFER SHEET NO.1/2

FROM 765/400kV ICT-II
REFER SHEET NO.1/2

FROM 765/400kV ICT-I
REFER SHEET NO.1/2

HVDC LINE-2
(PGCIL)

HVDC LINE-1
(PGCIL)

400kV, 3150A,
50kA FOR 1SEC.
(QUAD MOOSE)
MAIN BUS-I

400kV, 3150A,
50kA FOR 1SEC.
(QUAD MOOSE)
MAIN BUS-II

FUTURE

DHULE LINE-1
(MSETCL)

DHULE LINE-2
(MSETCL)

HVDC LINE-3
(PGCIL)

HVDC LINE-4
(PGCIL)

FUTURE

AS-BUILT

ALL DIMENSIONS ARE IN MM

| REV. | DESCRIPTION | DRAWN | ELECT. | PM CHECKED | APPROVED | STATUS |
|---|---|---|---|---|---|---|
| R3 | INTERNAL UPDATION | KSV 11.09.13 | SHM 11.09.13 | | VVG 11.09.13 | FOR APPROVAL |
| R2 | REVISED AS PER CUSTOMER COMMENTS DTD. 20.12.11 | KSV 26.12.11 | SHM 26.12.11 | | NAG 26.12.11 | FOR APPROVAL |
| R1 | REVISED AS PER CUSTOMER COMMENTS DTD. 01.10.11 & MOM DATED. 05-12-11 | KSV 06.12.11 | SHM 06.12.11 | | NAG 06.12.11 | FOR APPROVAL |
| R0 | FIRST ISSUE | JGS 23.09.11 | SHM 23.09.11 | | NAG 23.09.11 | FOR APPROVAL |

| REFR. DRG. NO. | DESCRIPTION |
|---|---|
| 5429PS060-DHU-E-DYD-SLD-0401 | SINGLE LINE DIAGRAM FOR 765/400kV DHULE SUBSTATION (Rev-R5) |

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

TITLE: PROTECTION SINGLE LINE DIAGRAM FOR 765/400kV DHULE SUBSTATION

SCALE: NTS

ALSTOM T&D INDIA LTD. (Formerly AREVA T&D INDIA LTD) A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH (INDIA).

DRAWING NO.: 5429PS060-DHU-E-SYD-SLD-0451

SHEET NO: 002 | 002

DF008

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B.D.T.C.L.
CAT - A APPROVED
Signed: .....
Date: 15-02-13 15-02-2013
This approval does not absolve the contractor/Supplier of his contractual responsibility to engineer an efficient design and successful performance of the Project/Equipment.

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AS BUILT / CONSTRUCTION / REFERENCE / INDENT / EXECUTION
ALSTOM T&D
AUTH. SIG.
Dt. 15/02/13

| REV. | DESCRIPTION | DRAWN | SIGN. | CHECKED | SIGN. | APPROVED | SIGN. | STATUS |
|---|---|---|---|---|---|---|---|---|
| | | Name | | | | | | |
| | | Date | | | | | | |
| | | Name | | | | | | |
| | | Date | | | | | | |
| | | Name | | | | | | |
| | | Date | | | | | | |
| 0 | FIRST ISSUE | Name AKRAM | | Name DM | | Name VVS | | FA |
| | | Date 27.11.12 | | Date 27.11.12 | | Date 27.11.12 | | |

OWNER :
**BHOPAL DHULE TRANSMISSION COMPANY LTD.**

OWNER ENGINEER :
**KNR ENGINEERS (INDIA) PVT.LTD**

PROJECT :
**SYSTEM STRENGTHENING SCHEME OF WR.**

CONTRACT :
**LOI NO. BDTCL/2011-12/LOA-SUBSTATION/004 DATED 28-7-2011**

INTERNAL PO REF : **LOA NO. SCI/E1100138/PCP/01**

TITLE :
# OVERALL SYSTEM ARCHITECTURE

ALSTOM
ALSTOM T&D India Limited
A-7, SECTOR-65
NOIDA-201301

TITLE : **SYSTEM ARCHITECTURE FOR BHOPAL S/S**

| DRAWING NO. | TOTAL SH 05 | SH.NO | REV. |
|---|---|---|---|
| 5429PS060-BPL-E-SYD-GAD-3301 | SCALE NTS | 01 | 0 |

FILE-KRT7-SA

DE002

| SHEET | REVISION | | | | | | | | | | DESIGNATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | | | | | | |
| 001 | X | | | | | | | | | | FRONT SHEET |
| 002 | X | | | | | | | | | | INDEX SHEET |
| 003 | X | | | | | | | | | | OVERALL SYSTEM ARCHITECTURE |
| 004 | X | | | | | | | | | | ARCHITECTURE FOR 765kV BUSBAR PROTECTION |
| 005 | X | | | | | | | | | | ARCHITECTURE FOR 400kV BUSBAR PROTECTION |

| SHEET | REVISION | | | | | | | | | | DESIGNATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |

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FILE: KR17-SA

CLIENT : BHOPAL DHULE TRANSMISSION COMPANY LTD.
PROJECT : SYSTEM STRENGTHENING SCHEME OF WR.

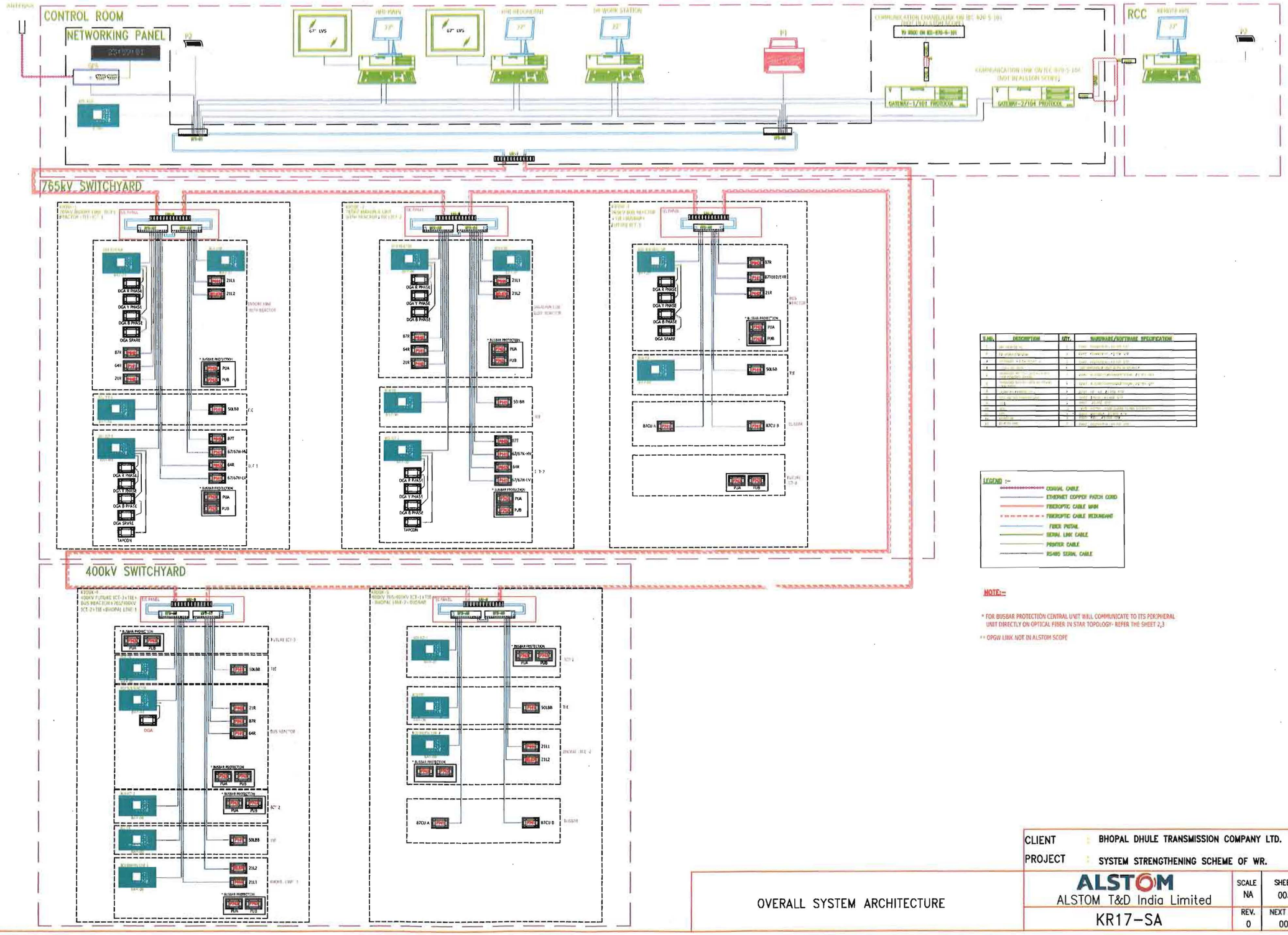
INDEX

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OVERALL SYSTEM ARCHITECTURE

| SCALE | SHEET |
|---|---|
| NA | 002 |
| REV. 0 | NEXT SH. 003 |

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| S.NO. | DESCRIPTION | QTY. | HARDWARE/SOFTWARE SPECIFICATION |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |

LEGEND :-
- COAXIAL CABLE
- ETHERNET COPPER PATCH CORD
- FIBEROPTIC CABLE MAIN
- FIBEROPTIC CABLE REDUNDANT
- FIBER PIGTAIL
- SERIAL LINK CABLE
- PRINTER CABLE
- RS485 SERIAL CABLE

NOTE:-

* FOR BUSBAR PROTECTION CENTRAL UNIT WILL COMMUNICATE TO ITS PERIPHERAL UNIT DIRECTLY ON OPTICAL FIBER IN STAR TOPOLOGY- REFER THE SHEET 2,3

** OPGW LINK NOT IN ALSTOM SCOPE

| | |
|---|---|
| CLIENT | : BHOPAL DHULE TRANSMISSION COMPANY LTD. |
| PROJECT | : SYSTEM STRENGTHENING SCHEME OF WR. |

OVERALL SYSTEM ARCHITECTURE

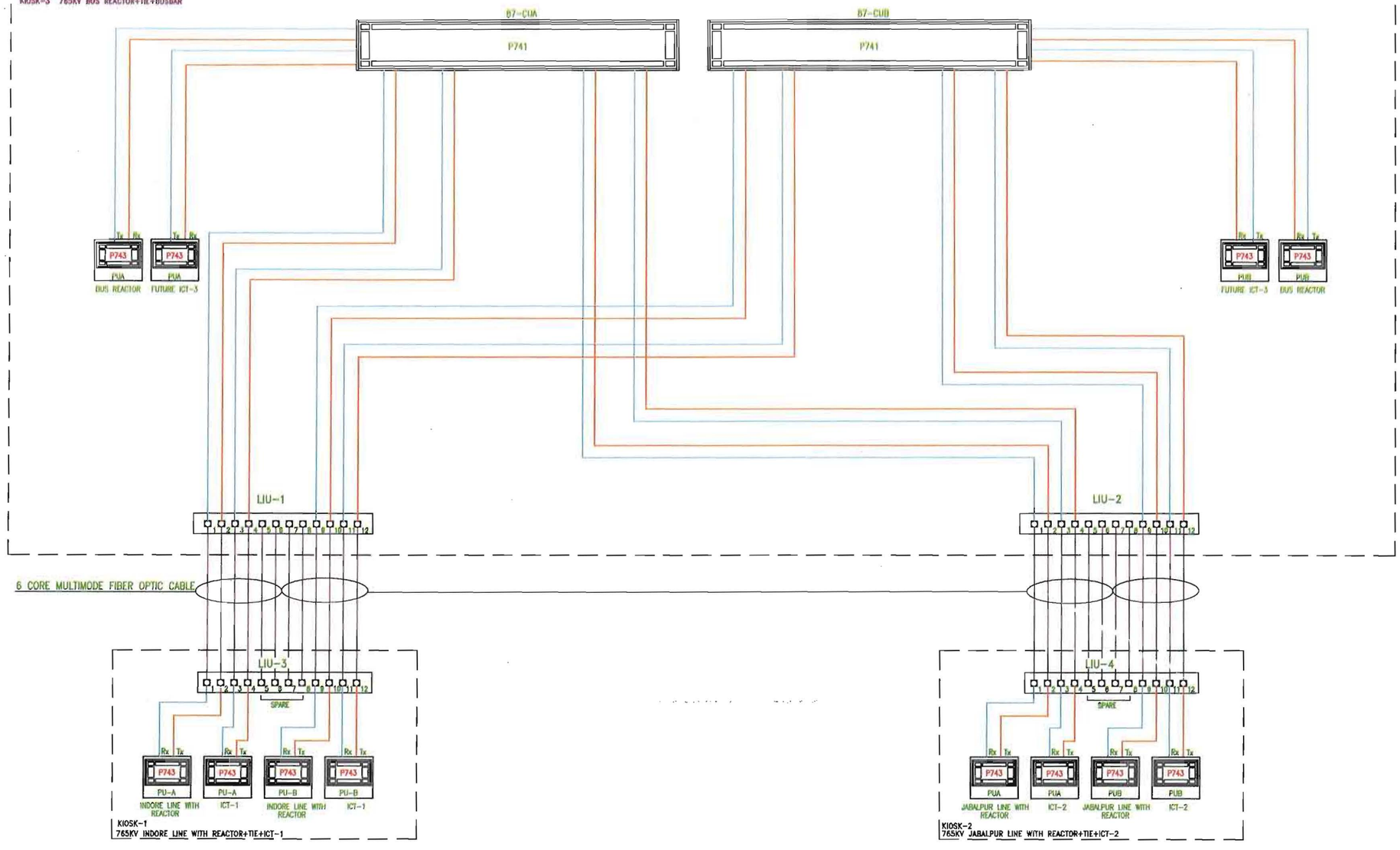
ALSTOM
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KR17-SA

| SCALE | SHEET |
|---|---|
| NA | 003 |
| REV. | NEXT SH. |
| 0 | 004 |

FILE: KR17-SA

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765kV SWITCHYARD
KIOSK-3 765kV BUS REACTOR+TIE+BUSBAR




| S.NO | EQUIP | QTY. | HARDWARE DES. |
|---|---|---|---|
| 1. | LIU-1 TO 4 | 4 | LIU WITH 12 ST PORTS |

NOTES:-

1) COMMUNICATION BETWEEN CU & PU SHALL BE ESTABLISHED USING A ST-ST MULTIMODE FIBER OPTIC LINK.
2) THE COMMUNICATION PROTOCOL IS BASED ON A PROPERETIARY PROTOCOL.

LEGEND :-

ST-ST FIBER OPTIC PATCH CORD
6 CORE MULTIMODE FIBER OPTIC CABLE

ARCHITECTURE FOR 765kV BUSBAR PROTECTION

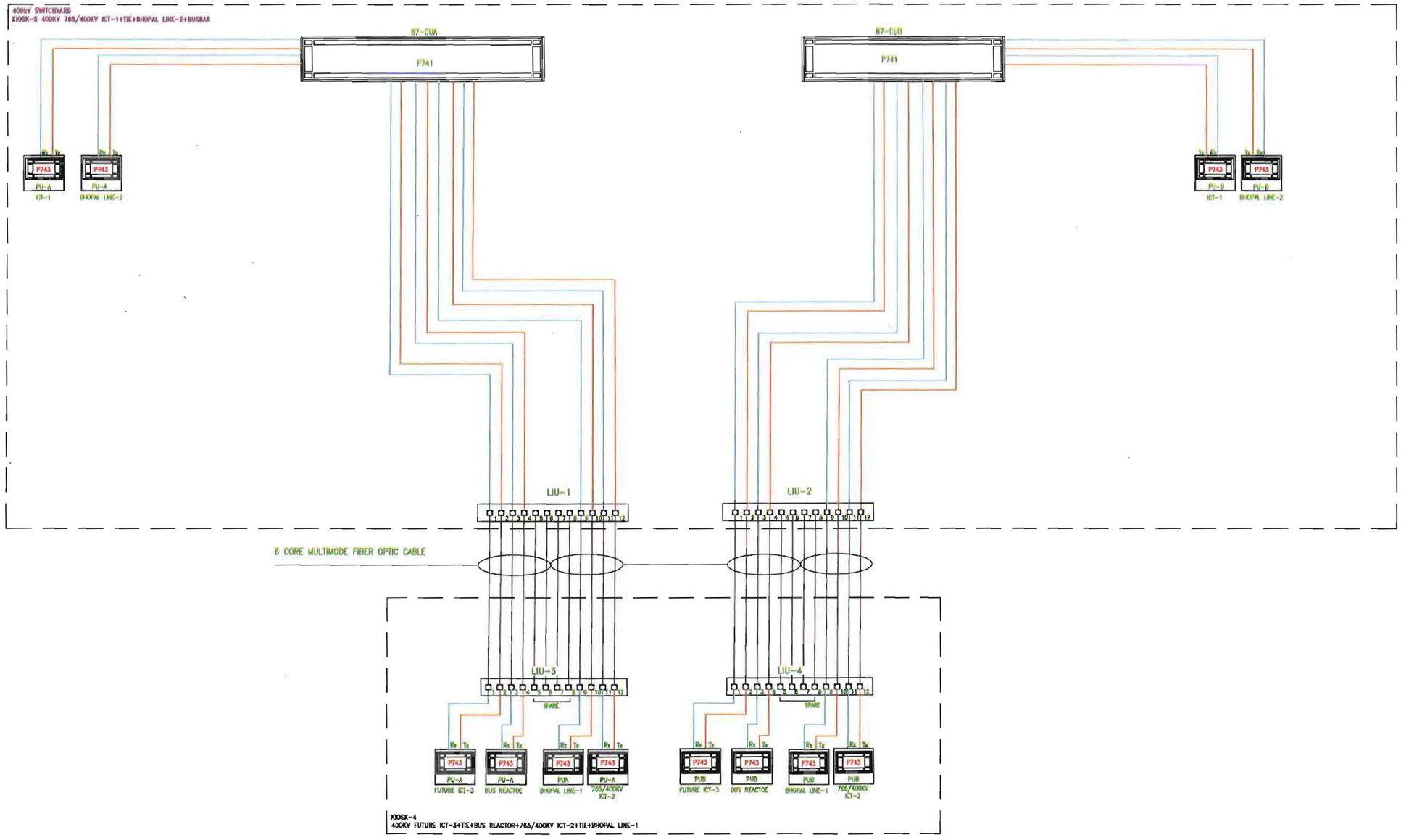
CLIENT : BHOPAL DHULE TRANSMISSION COMPANY LTD.
PROJECT : SYSTEM STRENGTHENING SCHEME OF WR.

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| SCALE | SHEET |
|---|---|
| NA | 004 |
| REV. | NEXT SH. |
| 0 | 005 |

FILE: KR17SA

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| S.NO | EQUIP | QTY. | HARDWARE DES. |
|---|---|---|---|
| 1. | LIU-1 TO 4 | 4 | LIU WITH 12 ST PORTS |

NOTES:-

1) COMMUNICATION BETWEEN CU & PU SHALL BE ESTABLISHED USING A ST-ST MULTIMODE FIBER OPTIC LINK.
2) THE COMMUNICATION PROTOCOL IS BASED ON A PROPERETIARY PROTOCOL.

LEGEND :-

ST-ST FIBER OPTIC PATCH CORD
6 CORE MULTIMODE FIBER OPTIC CABLE

| | |
|---|---|
| CLIENT | : BHOPAL DHULE TRANSMISSION COMPANY LTD. |
| PROJECT | : SYSTEM STRENGTHENING SCHEME OF WR. |

ARCHITECTURE FOR 400kV BUSBAR PROTECTION

ALSTOM T&D India Limited

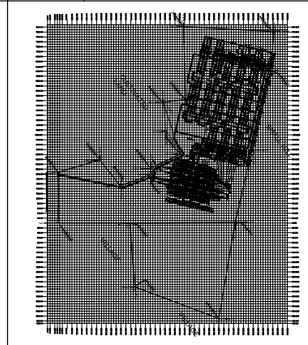
KR49-SA

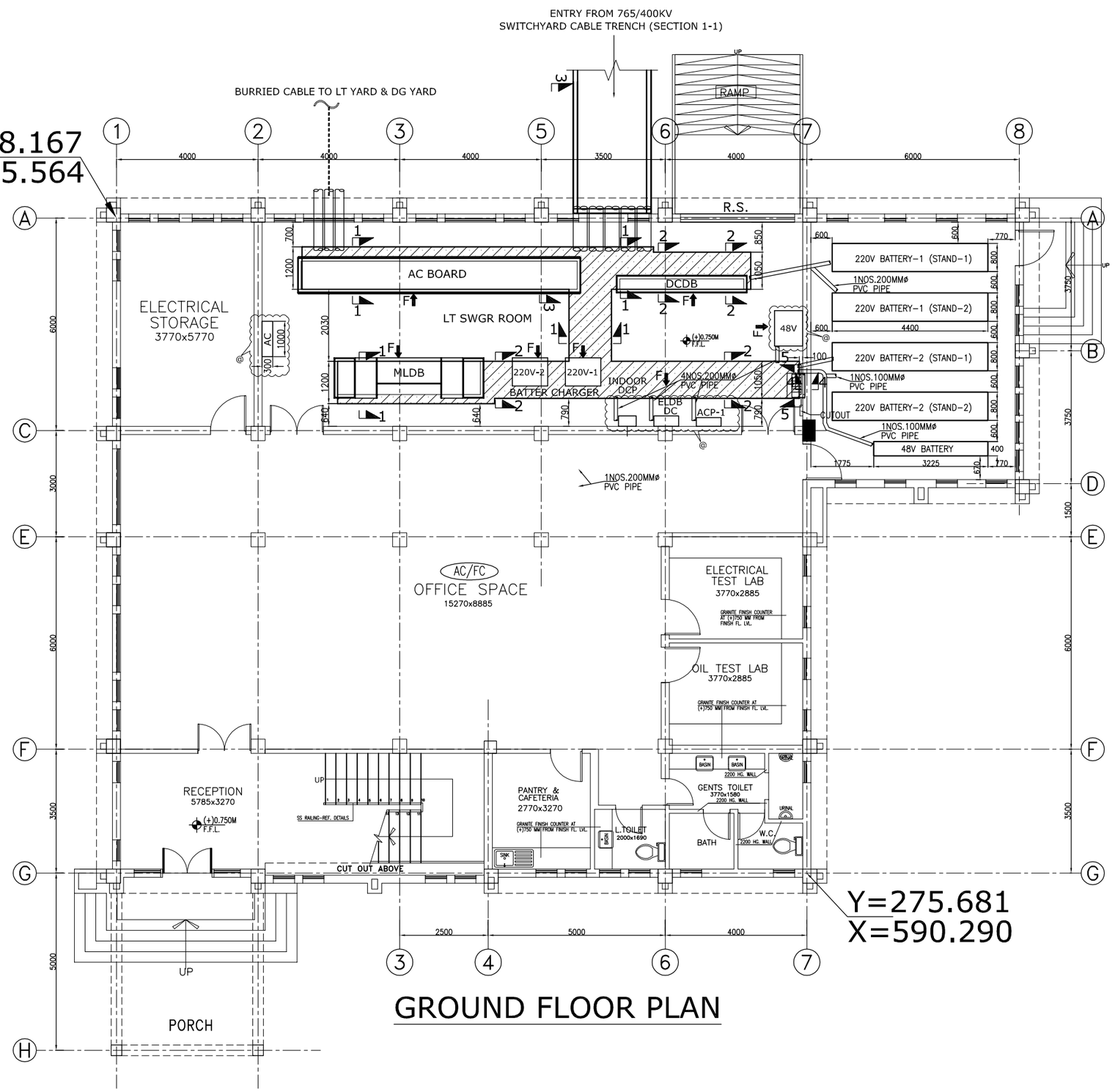
| SCALE | SHEET |
|---|---|
| NA | 005 |
| REV. | NEXT SH. |
| 0 | / |

FILE: KR17-SA

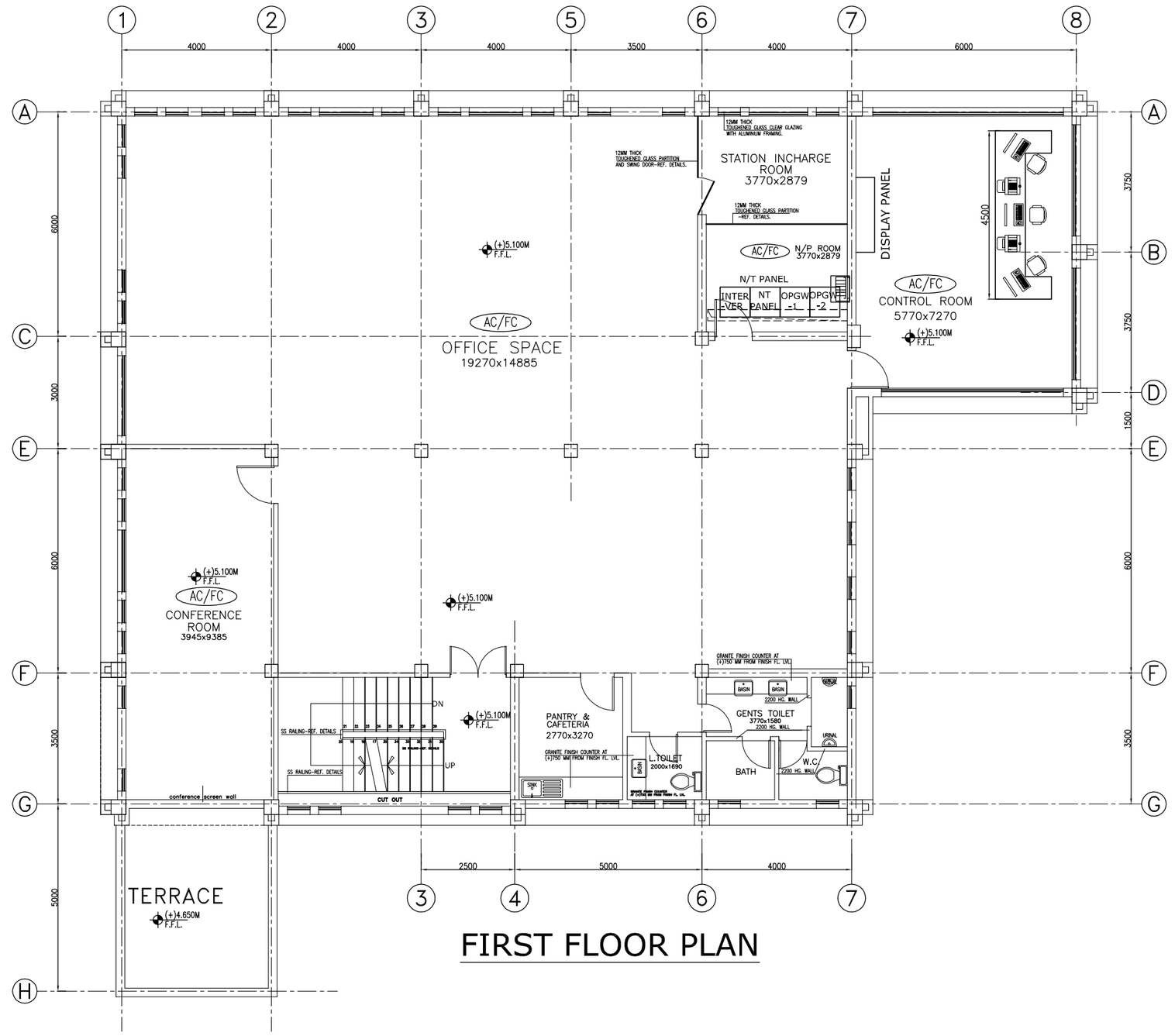
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DRAWING NO.:5429PS060-DHU-E-SYD-CAB-0127




GROUND FLOOR PLAN




FIRST FLOOR PLAN

ALL DIMENSIONS ARE IN MM

**LEGEND**

- CABLE TRENCH
- CHEQURED PLATE
- CUTOUT (FOR PANEL)
- PVC PIPE
- BURRIED CABLE TRENCH ROUTE

**NOTES**

1. ALL DIMENSIONS ARE IN MM.
2. @ WALL MOUNTED PANEL.

| REFR. DRG. NO. | DESCRIPTION |
|---|---|
| 5429PS060-DHU-E-SYD-ARR-0030 | 765/400KV CONTROL ROOM BUILDING FOR DHULE S/S |

| REV. | DESCRIPTION | | DRAWN | CHECKED | | APPROVED | STATUS |
|---|---|---|---|---|---|---|---|
| | | Name | | | | | |
| | | Date | | | | | |
| | | Sign. | | | | | |
| | | Name | | | | | |
| | | Date | | | | | |
| | | Sign. | | | | | |
| | | Name | | | | | |
| | | Date | | | | | |
| | | Sign. | | | | | |
| | | Name | | | | | |
| | | Date | | | | | |
| | | Sign. | | | | | |
| R0 | FIRST ISSUE | Name | KSV | DPK | | PTK | FOR APPROVAL |
| | | Date | 29.10.12 | 29.10.12 | | 29.10.12 | |
| | | Sign. | | | | | |

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

TITLE: 765/400KV CONTROL ROOM BUILDING
INDOOR CABLE TRENCH LAYOUT FOR DHULE SUBSTATION

| SCALE | ALSTOM T&D INDIA LTD. (Formerly AREVA T&D INDIA LTD) A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH (INDIA). | DRAWING NO.: | SHEET NO | |
|---|---|---|---|---|
| A2 1:125 | | 5429PS060-DHU-E-SYD-CAB-0127 | R0 | 001 |

| REV | STATUS | DATE | MODIFICATIONS | Estab. | Check | Appr. |
|---|---|---|---|---|---|---|
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| | | | | | | |
| 0 | FA | 06-02-2012 | Original Issue | ATP | RVA | BPR |

**Project :**

Supply of OPGW Communication System for 765/400kV Switchyard Package at Bhopal & Dhule for Bhopal Dhule Transmission Project .

**Client :**

Sterlite

**BHOPAL DHULE TRANSMISSION COMPANY LIMITED.**
**(A Wholly Owned Subsidiary of STERLITE TECHNOLOGIES LTD)**

**Contractor:** **ALSTOM T&D**

ALSTOM

**ALSTOM T & D India Ltd. , NOIDA**

Drawing number :
**BDTCL-ALTD-GEN-TEL-02**

Document Title :
**DRS of FOTE Equipment**

| Original signed by | DATE | NAME | SIGN |
|---|---|---|---|
| Established | 06-02-2011 | Amit Pandey | |
| Checked | 06-02-2012 | Rajesh Verma | |
| Approved | 06-02-2012 | Balaji Rao | |

| SCALE : / | | STANDARD : | IEC |
|---|---|---|---|

| Size : | Rev.: | Sheet N°: | Qty of Sheets: |
|---|---|---|---|
| A4 | 0 | 1 | 3 |

B.D.T.C.L.
CAT - I: INFORMATION PROVIDED HAVE BEEN NOTED.
Signed:
Date: 25/04/2013
This approval does not absolve the contractor/Supplier of his contractual responsibility to engineer an efficient design and successful performance of the Project/Equipment.

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PROTO
PLANNING
MANUFACTURING
RECORD
AS BUILT
CONSTRUCTION
REFERENCE
INDENT
EXECUTION
22 APR 2013 ALSTOM T&D
Dt.
AUTH. SIG.

B.D.T.C.L.
CAT - I: INFORMATION PROVIDED HAVE BEEN NOTED.
Signed:
Date: 25/04/2013
This approval does not absolve the contractor/Supplier of his contractual responsibility to engineer an efficient design and successful performance of the Project/Equipment.

ALSTOM

## DRS for eDXC FOTE System

| S. No. | PARAMETERS | DESCRIPTION |
|---|---|---|
| 1 | Name of Manufacturer | ALSTOM |
| 2 | Type, Model | eDXC (Enhanced Digital Cross Connect) SDH/PDH Equipment |
| 3 | List ITU-T Standards complied with: | G.703, G.704, G.707, G.783, G.784, G.958, G.823, G.826, G.957 |
| 4 | List of core (common) cards/modules: | - Power Supply: 48VDC;<br>- XCU: Controller + Matrix; |
| 5 | Cross Connect Matrix | 64k matrix, VC12/VC-3/VC4 non-blocking matrix |
| 6 | List VF interfaces available: | 2/4W E&M unit, 8 voice channels per board (slot 1-12). |
| 7 | Data interfaces available: | V24/V28 (RS232) low speed data |
| 8 | No. of plug-in slots available: | 4 High Speed Slot SDH Part<br>6 Low Speed Slot PDH Part |
| 9 | List Synchronisation Modes available | Internal clock;<br>Extracting clock from incoming STM-1, Line<br>External Input/Output 2Mbps/2MHz |
| 10 | Can the equipment be reconfigured from Terminal Multiplexer to a Drop & Insert ? To a cross-connect ? | Yes, the equipment is basically a cross-connect, so the upgrade can be done by simple addition of 2Mbit/s boards. |
| 11 | In-service software programmable ? | Yes |
| 12 | Optical Interface of Equipment | ITU–T G.957 |
| 13 | Cross-connect level | VC12/VC3/VC4 |
| 14 | Alternative fiber path switching time | < 50 ms |
| 15 | Error performance | ITU–T G.826 |
| 16 | Jitter | ITU–T G.783, G.823, G.958 |
| 17 | Diagnostics | ITU–T G.826, G.784 |
| 18 | Is E1 framing structure as per ITU-T standards ? | Yes, ITU-T G.703 |
| 19 | Encoding format:<br>Binary digits/sample:<br>Encoding law:<br>No. of quantization levels: | 8 binary digits/sample<br>A law<br>256 quantization levels |
| 20 | Companding law: | A law |
| 21 | **SIGNALLING** | |
| 21.1 | In compliance with ITU-T G.712 for allocation of Time Slot 16 ? | Yes |
| 21.2 | Signalling system: | CAS (Channel Associated Signalling), E&M |
| 21.3 | Signalling distortion: | Compliant with ITU-T G.712 |
| 21.4 | Scanning Frequency: | 8 kHz |
| 22 | **E & M Signalling** | |
| 22.1 | E & M Signalling Types supported: | Various types of signalling can be selected. 2/4W E&M unit |
| 23 | **POWER SUPPLY UNIT (DC/DC CONVERTER)** | |
| 23.1 | Nominal supply voltage: | –48 Vdc |
| 23.2 | Power supply variation: | –36 to –72 Vdc |
| 23.3 | Polarity: | Positive pole earthed |
| 24 | **MECHANICAL AND ENVIRONMENTAL PARAMETERS** | |
| 24.1 | Chassis Dimensions (W x H x D): | Width: 433 mm<br>Height: 264 mm<br>Depth: 223.5 mm |
| 24.2 | Chassis mounting options: | 19" mounting |

| | | |
|---|---|---|
| 24.3 | Temperature range<br>Guaranteed performance: | From 0°C up to +50° C |
| 24.4 | Relative humidity<br>Minimum:<br>Maximum: | 0%<br>Up to 95% non condensing. |
| **VOICE FREQUENCY (VF) SUBSCRIBER LINE UNIT PARAMETERS** | | |
| **25** | **2/4W E&M** | |
| 25.1 | No. of VF channels per card: | 8 |
| 25.2 | List Signalling type(s) options: | E&M signalling bit configuration available |
| 25.3 | If multiple signalling types: Strappable or Programmable ? | Programmable |
| 25.4 | Dialling modes supported: | Not applicable |
| 25.5 | Describe ringing arrangements: | Not applicable |
| 25.6 | Loss Adjustment level: | -21 dB to +10 dB with 0.1 dB steps |
| 25.7 | Nominal impedance: | 600 Ohm / 900 Ohm |
| **LOW-SPEED DATA SUBSCRIBER LINE UNIT PARAMETERS** | | |
| **26** | **V24(RS232) board** | |
| 26.1 | Interface | Asynchronous |
| 26.2 | List data interfaces supported: | RS232 compatible with ITU-T V.24 |
| 26.3 | Connectors: | RJ48 female connectors |
| 26.4 | Maximum distance from DTE: | About the maximum distance from the DTE: this is depend on the data interface electrical interface distance: V.28 (RS 232): up to 15 m |
| **27** | **OPTICAL INTERFACE** | |
| 27.1 | Capacity | STM-1 (155Mbit/s) |
| 27.2 | Connectors: | LC/PC |
| 27.3 | Wavelength: | 1310nm & 1550nm |
| 27.4 | Source: | Laser Diode |
| 27.5 | Automatic Laser Shutdown: | Yes |

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# e-terra*gridcom* e-DXC

## Versatile access and transmission platform

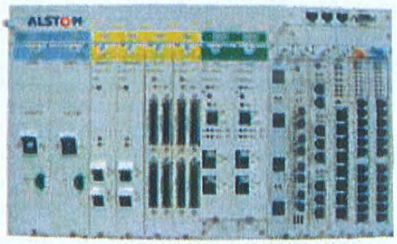
**Reliable and fast communication is vital for continuous operation of power delivery systems and their mission-critical automation services (protection, voice and data)**

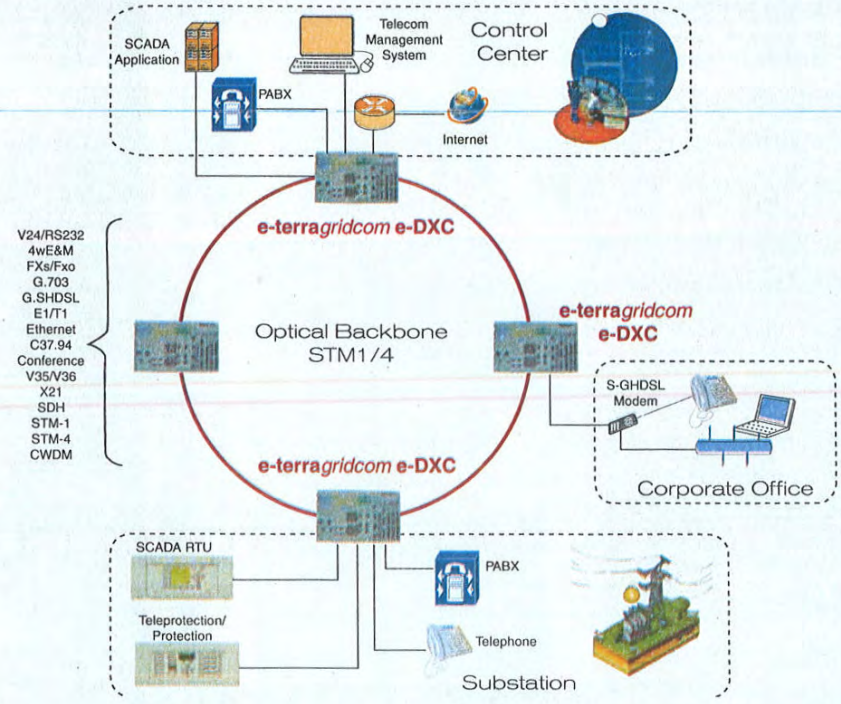
The high voltage electrical substation hosts many applications with a great number of legacy interfaces which in time may migrate to Ethernet connectivity.

ALSTOM Grid Enhanced Digital Cross-Connect (**e-terra***gridcom* **e-DXC**) equipment provides a full set of capabilities required for the provision of predictable and flexible services through a robust communication platform allowing to integrate all existing applications and yet the opportunity of smooth migration to new networked environment such as IEC61850 and TCP/IP SCADA.

The **e-terra***gridcom* **e-DXC** belongs to ALSTOM Grid is extensive range of interoperable power system telecommunication equipment and managed through a common network management platform

The **e-terra***gridcom* **e-DXC** provides enhanced capabilities on transmission and access layers and is based upon the field proven **e-terra***gridcom* **DXC** platform extensively deployed across power networks worldwide.




### Key Features

- Primary access and SDH transmission in one single platform
- Wide range of data, voice, Ethernet and optical interfaces
- Ethernet switching and IP routing functions available
- High level reliability via full redundancy
- Native SNMP standard management
- Field engineer oriented user interface and maintenance facilities
- Tested for harsh substation environment
- TDMoIP for multiplexing on native Gigabit Ethernet

GRID | ALSTOM | *we are shaping the future*

| Interfaces, Features, Management | |
|---|---|
| SDH tributary and aggregate interfaces | STM-1 and STM-4 SFP based<br>Standard SFP's<br>Long Haul SFP's up to 240/200 kms for STM1/4 |
| PDH tributary interfaces | E1, E3 |
| PCM interfaces | FXO, FXS, 2/4W E&M<br>V24, V35/V36/X21,64K G.703<br>Dry Contact I/O<br>Data and Voice Conference bridge (PMP application)<br>C37.94 Optical interfaces for Protection and Teleprotection<br>G.SHDSL<br>FOM (4*E1 optical PDH) |
| Packet interfaces | 10/100/1000 Mbps (Electrical and Optical) |
| Packet processing | Ethernet over SDH (EoS), Ethernet over PDH (EoPDH)<br>TDMoIP<br>Layer 2/3 switching, VLAN, RSTP, MSTP, QinQ, QoS |
| Power Supply | 48Vdc-(36 to-72 Vdc) |
| Equipment Protection | Power Supply, Controller, Ethernet boards 1+1 protection<br>E1 : Card, Port, Line protection |
| Network Protection | STM1/4 : MSP/SNCP<br>Ethernet : LCAS |
| Management | Centralized Management (EMS/NMS) with full FCAPS services and end-to-end circuit management |

| Other Specifications | |
|---|---|
| Physical Dimension (mm) | 433 (W) * 264 (H) * 223.5 (D) |
| Operating Temperature | 0 to 50°C (Integrated Temperature Controlled Fan Tray) |
| Operating Humidity | 0-95% RH (non-condensing) |
| Mounting | Desktop stackable, 19/23 inches rack mountable |
| Safety | IEC EN 60950-1 |
| EMI/EMC | EN55022 Class A, EN50024<br>FCC Part 15 Class A |
| Power Utility Standards Compliance | IEC 61850-3 / IEEE 1613 |

## World class expertise

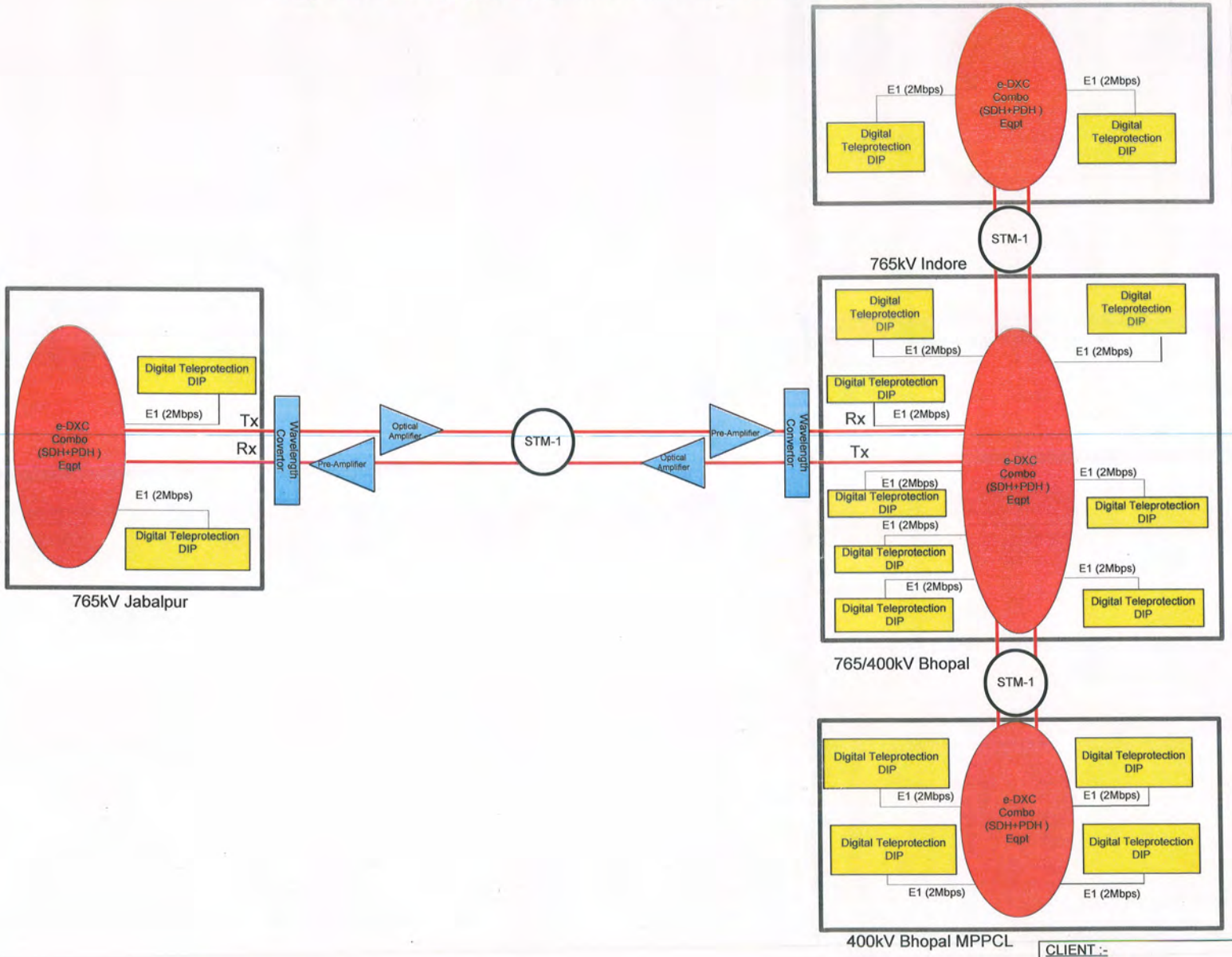
- **e-terra***gridcom* **e-DXC** brings an outstanding level of reliability and quality of service for access and transmission networks, ensuring fast, simple, robust and reliable installation and configuration.
- Encompasses the products and services for global utility solutions
- ALSTOM Grid has 50 years experience in design, manufacture and supply of a complete range of telecommunication equipment and services. Anywhere in the world, our experts can provide the solution for all of your telecom requirements, enabling you to focus on your core business.

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# Bhopal OPGW Equipment Communication Network- Bhopal Dhule Transmission project



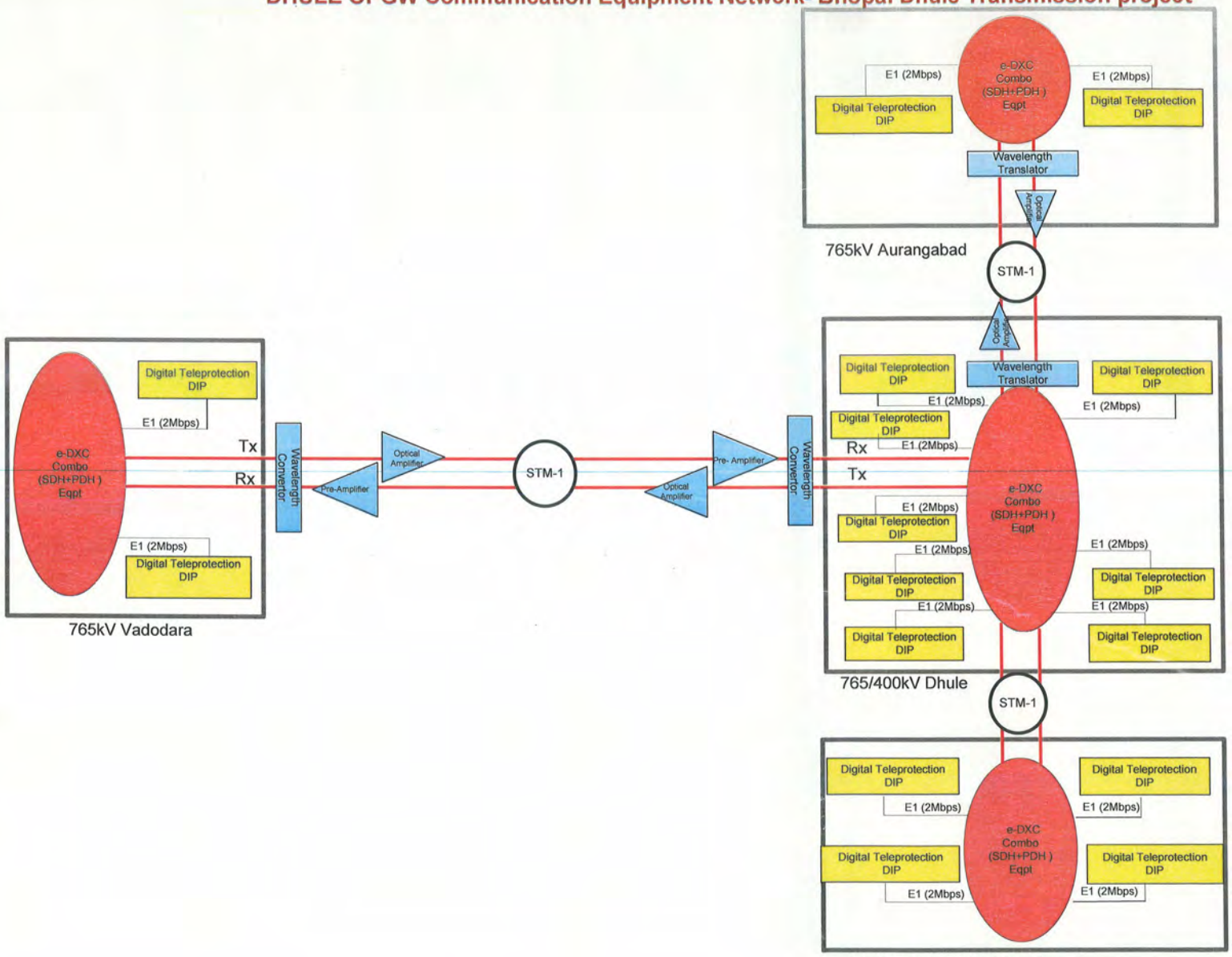


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22 APR 2013 ALSTOM T&D
Dt.


| CLIENT :- | CONTRACTOR :- |
|---|---|
| Sterlite<br>BHOPAL DHULE TRANSMISSION COMPANY LIMITED. | ALSTOM<br>ALSTOM T&D INDIA LTD |
| OPGW Communication Equipment Network for Bhopal | Doc No. BDTCL-ALTD-DES-TEL-03 Rev.0<br>Page 3 of 4 |

# DHULE OPGW Communication Equipment Network- Bhopal Dhule Transmission project




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22 APR 2013 ALSTOM T&D
Dt. AUTH. SIG.

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|---|---|
| Sterlite<br>BHOPAL DHULE TRANSMISSION COMPANY LIMITED. | ALSTOM<br>ALSTOM T&D INDIA LTD |
| OPGW Communication Equipment Network for Dhule | Doc No. BDTCL-ALTD-DES-TEL-03 Rev.1 |

| REV | STATUS | DATE | MODIFICATIONS | Estab. | Check | Appr. |
|---|---|---|---|---|---|---|
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| | | | | | | |
| 2 | FA | 18-04-13 | Revised due to change in optical Budget | ATP | RVA | RRY |
| 1 | AC | 08-04-13 | Revised due to change in optical Budget | ATP | RVA | RRY |
| 0 | AC | 06-02-12 | Original Issue | ATP | RVA | BPR |

**Project :**

Supply of OPGW Communication System for 765/400kV Switchyard Package at Bhopal & Dhule for Bhopal Dhule Transmission Project .

**Client :**

Sterlite

**BHOPAL DHULE TRANSMISSION COMPANY LIMITED.**
**(A Wholly Owned Subsidiary of STERLITE TECHNOLOGIES LTD)**

**Contractor:** **ALSTOM T&D**

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**ALSTOM T & D India Ltd. , NOIDA**

Drawing No. 5429PS060-DHU-E-SYD-GTP-3508

Vendor Drawing number :
**BDTCL-ALTD-GEN-TEL-04**

Document Title :
**DRS of Optical Amplification System**
1. **DRS of Optical Amplifier (1RU-P24)/(1RU-P15)**
2. **DRS of Pre-Amplifier (1RU-P35)**
3. **DRS of Wavelength Convertor (1RU-WC1)**
4. **DRS of Wavelength Convertor (1RU-WT1)**

| Original signed by | DATE | NAME | SIGN |
|---|---|---|---|
| Established | 18-04-2013 | Amit Pandey | |
| Checked | 18-04-2013 | Rajesh Verma | |
| Approved | 18-04-2013 | Rajasekhar Reddy | |

| SCALE : / | | STANDARD : | IEC |
|---|---|---|---|
| Size : **A4** | Rev.: **2** | Sheet N°: **1** | Qty of Sheets: 6 |

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| DRS OF OPTICAL AMPLIFIER | | |
|---|---|---|
| **SR. No** | **Parameters** | **Guaranteed Particulars** |
| | **Name of Manufacturer** | **MPB** |
| **1** | **Type and Model** | **1RU-P24** |
| **2** | **Optical Parameter:** | |
| 2.1 | Wavelength Range: | 1530 -1565nm |
| 2.2 | Output power @ 1550nm (EOL) : | 22 dBm – 24dBm |
| 2.3 | Input Operating range (EOL) : | -5 to +10 dBm |
| 2.4 | Noise Figure @ 1550nm: | ≤5 dB@-5dBm input |
| 2.5 | Isolation(Input & output ports): | >32 dB |
| 2.6 | Optical Connectors: | SC/PC |
| **3** | **Electrical Parameter:** | |
| 3.1 | Supply Voltage: | -48 VDC (+/- 15%) |
| 3.2 | Power Consumption: | 22W max, 15W typ. |
| 3.3 | Alarms Contact: | Earth Free Loop 30 mA, 100 VDC max |
| 3.4 | External Inputs: | 75 VDC max |
| 3.5 | Craft Terminal Interface: | RS-232 |
| **4** | **Environmental Parameters:** | |
| 4.1 | Storage Temperature: | -40 °C to +70 °C |
| 4.2 | Ambient Operating Temperature: | -5 °C to +55 °C |
| 4.3 | Storage Humidity: | Up to 95% RH non-condensing |
| 4.4 | Operating Humidity: | Between 5% & 90% RH depending on working temperature |
| **5** | **Physical Specifications:** | |
| 5.1 | Package: | 19" or 23 " rack or ETSI 600 x 300 mm deep compatible rack |
| 5.2 | Unit Weight: | < 9 lbs (4 kg) |
| **6** | **Equipment Management:** | |
| 6.1 | Craft terminal Interface: | Proprietary through RS-232 serial link |
| 6.2 | Alarm Outputs: | Relay contact for alarms |

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| DRS OF OPTICAL AMPLIFIER | | |
|---|---|---|
| **SR. No** | **Parameters** | **Guaranteed Particulars** |
| | **Name of Manufacturer** | **MPB** |
| **1** | **Type and Model** | **1RU-P15** |
| **2** | **Optical Parameters:** | |
| 2.1 | Wavelength Range: | 1530 -1565nm |
| 2.2 | Output power @ 1550nm (EOL) : | +15 dBm |
| 2.3 | Input Operating range (EOL) : | -5 to +7 dBm |
| 2.4 | Noise Figure @ 1550nm: | ≤5 dB@-5dBm input |
| 2.5 | Isolation(Input & output ports): | >32 dB |
| 2.6 | Optical Connectors: | SC/PC |
| **3** | **Electrical Parameter:** | |
| 3.1 | Supply Voltage: | -48 VDC (-36 to 72VDC) |
| 3.2 | Power Consumption: | 8W max, 5W typ. |
| 3.3 | Alarms Contact: | Earth Free Loop 30 mA, 100 VDC max |
| 3.4 | External Inputs: | 75 VDC max |
| 3.5 | Craft Terminal Interface: | RS-232 |
| **4** | **Environmental Parameters:** | |
| 4.1 | Storage Temperature: | -40 °C to +70 °C |
| 4.2 | Ambient Operating Temperature: | -5 °C to +55 °C |
| 4.3 | Storage Humidity: | Up to 95% RH non-condensing |
| 4.4 | Operating Humidity: | Between 5% & 90% RH depending on working temperature |
| **5** | **Physical Specifications:** | |
| 5.1 | Package: | 19" or 23" rack or ETSI 600 x 300 mm deep compatible rack |
| 5.2 | Unit Weight: | < 9 lbs (4 kg) |
| **6** | **Equipment Management:** | |
| 6.1 | Craft terminal Interface: | Proprietary through RS-232 serial link |
| 6.2 | Alarm Outputs: | Relay contact for alarms |

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| DRS OF OPTICAL PRE-AMPLIFIER | | |
|---|---|---|
| **SR. No** | **Parameters** | **Guaranteed Particulars** |
| | **Name of Manufacturer** | **MPB** |
| **1** | **Type and Model** | **1RU-R35** |
| **2** | **Optical Parameters:** | |
| 2.1 | Wavelength Range (C-band): | 1530- 1565nm |
| 2.2 | Input Overload | -10 dBm |
| 2.3 | Input Operating Range(EOL): | -50 dBm/-25 dBm (min/max) |
| **3** | **Output Power @1550 nm (EOL)** | |
| 3.1 | STM-1 | -15dBm / -8dBm |
| 3.2 | Noise Figure @ 1550nm | ≤3.5 dB @ -35 dBm input |
| **4** | **Input Rx Sensitivity*(BER< 1 x 10 )** | |
| 4.1 | STM-1 | -49 dBm |
| **5** | **Electrical Parameter:** | |
| 5.1 | Supply Voltage: | -48 VDC (+/- 15%) |
| 5.2 | Power Consumption: | 8 W max, 5 W typ. |
| 5.3 | Alarms Contact: | Earth free loop, 30 mA, 100 VDC max |
| 5.4 | External Inputs: | 75 VDC max |
| 5.5 | Craft Terminal Interface: | RS-232 |
| **6** | **Environmental Parameters:** | |
| 6.1 | Storage Temperature: | -40 °C to +70 °C |
| 6.2 | Ambient Operating Temperature: | -5 °C to +55 °C |
| 6.3 | Storage Humidity: | Up to 95% RH non-condensing |
| 6.4 | Operating Humidity: | Between 5% & 90% RH, depending on working temperature |
| **7** | **Physical Specifications:** | |
| 7.1 | Package: | 19" or 23" rack or ETSI 600 x 300 mm deep compatible rack |
| 7.2 | Unit Weight: | < 9 lbs (4 kg) |
| **8** | **Equipment Management:** | |
| 8.1 | Craft terminal Interface: | Proprietary through RS-232 serial link |
| 8.2 | Alarms Outputs: | Relay contact for alarms |

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| DRS OF WAVELENGTH CONVERTER | | |
|---|---|---|
| **SR. No** | **Parameters** | **Guaranteed Particulars** |
| | **Name of Manufacturer** | **MPB** |
| **1** | **Type and Model** | **1RU-WC-1** |
| **2** | **Optical Parameters:** | |
| 2.1 | Data Rate: | 155 Mb/s (STM-1) |
| **3** | **Line optical Interface:** | |
| 3.1 | Line Input Sensitivity (BER < 1x10-10) | -34dBm |
| 3.2 | Line Input Overload | -6dBm |
| 3.3 | Line Output Wavelength | 1552.52 nm (Standard) |
| 3.4 | Line Output Power(EOL) | 5 - 10dBm |
| **4** | **Tributary optical Interface Compliance** | ITU S-1.1 |
| 4.1 | Input Wavelength Range | 1100-1600 nm |
| 4.2 | Output Wavelength(nominal) | 1310 nm |
| 4.3 | Output Power (EOL) (min/max) | -15 / -8dBm |
| 4.4 | Dispersion Tolerance | 51,200 ps |
| **5** | **Electrical Parameter:** | |
| 5.1 | Supply Voltage: | -48 VDC (+/- 15%) |
| 5.2 | Power Consumption: | 8 W max, 5 W typ. |
| 5.3 | Alarms Contact: | Earth free loop, 30 mA, 100 VDC max |
| 5.4 | External Inputs: | 75 VDC max |
| 5.5 | Craft Terminal Interface: | RS-232 |
| **6** | **Environmental Parameters:** | |
| 6.1 | Storage Temperature: | -40 °C to +70 °C |
| 6.2 | Ambient Operating Temperature: | -5 °C to +55 °C |
| 6.3 | Storage Humidity: | Up to 95% RH non-condensing |
| 6.4 | Operating Humidity: | Between 5% & 90% RH, depending on working temperature |
| **7** | **Physical Specifications:** | |
| 7.1 | Package: | 19" or 23" rack or ETSI 600 x 300 mm deep compatible rack |
| 7.2 | Unit Weight: | < 9 lbs (4 kg) |
| **8** | **Equipment Management:** | |
| 8.1 | Craft terminal Interface: | Proprietary through RS-232 serial link |
| 8.2 | Alarms Outputs: | Relay contact for alarms |

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| DRS OF WAVELENGTH TRANSLATOR | | |
|---|---|---|
| SR. No | Parameters | Guaranteed Parameters |
| | **Name of Manufacturer** | **MPB** |
| 1 | **Type and Model** | **1RU-WT-1** |
| 2 | **Optical parameters:** | |
| 2.1 | Data Rate: | 155 Mb/s (STM-1/OC-3) |
| 3 | **Line Optical Interface:** | |
| 3.1 | Line Input Sensitivity: (BER ≤ 1x10-10) | -42 dBm |
| 3.2 | Line Input Overload: | -8 dBm |
| 3.3 | Line Output Wavelength: | 1544 - 1558 nm |
| 3.4 | Line Output Power: (EOL) | 0 dBm |
| 3.5 | Line Tx Dispersion: Tolerance | 25,600 ps |
| 4 | **Tributary Optical Interface compliance:** | **ITU G.957** |
| 4.1 | Input Wavelength Range: | 1100 - 1600 nm |
| 4.2 | Output Wavelength: (nominal) | 1310 nm |
| 4.3 | Output Power (EOL): (min / max) | -15 / -8 dBm |
| 4.4 | Optical Connectors | LC |
| 5 | **Electrical Parameters:** | |
| 5.1 | Supply Voltage: | -48 VDC (-36 to –72 VDC) |
| 5.2 | Power Consumption: | 8 W max, 5 W typ. |
| 5.3 | Alarms Contact: | Earth free loop, 30 mA, 100 VDC max |
| 5.4 | External Inputs: | 75 VDC max |
| 5.5 | Craft Terminal Interface: | RS-232 |
| 6 | **Environmental Parameters:** | |
| 6.1 | Storage Temperature: | -40°C to +70°C |
| 6.2 | Ambient Working Temperature: | -5°C to 55°C |
| 6.3 | Storage Humidity: | Up to 95% RH non-condensing |
| 6.4 | Operating Humidity: | Between 5% and 90% RH, depending on working temperature |
| 7 | **Physical Specifications:** | |
| 7.1 | Package: | 19" or 23" rack or ETSI 600 x 300 mm deep compatible rack |
| 7.2 | Unit Weight: | < 9 lbs (4 kg) |
| 8 | **Equipment Management:** | |
| 8.1 | Craft Terminal Interface: | Proprietary through RS-232 serial link |
| 8.2 | Alarms Outputs: | Relay contact for alarms |

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| 1 | FA | 03-04-13 | Revised as per Customer Comments | ATP | RVA | RRY |
| 0 | AC | 16-02-2012 | Original Issue | ATP | RVA | BPR |
| REV | STATUS | DATE | MODIFICATIONS | Estab. | Check | Appr. |

**Project :**

Supply of OPGW Communication System for 765/400kV Switchyard Package at Bhopal & Dhule for Bhopal Dhule Transmission Project .

**Client :**

Sterlite

**BHOPAL DHULE TRANSMISSION COMPANY LIMITED.**
**(A Wholly Owned Subsidiary of STERLITE TECHNOLOGIES LTD)**

**Contractor:** **ALSTOM T&D**

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**ALSTOM T & D India Ltd. , NOIDA**

**Drawing No.** 5429PS060-DHU-E-SYD-GAD-3502-1

Vendor Drawing number :

**BDTCL-ALTD-DES-TEL-03**

Document Title :

**OPGW Communication Equipment Network for Bhopal & Dhule**

| Original signed by | DATE | NAME | SIGN |
|---|---|---|---|
| Established | 03-04-2013 | Amit Pandey | |
| Checked | 03-04-2013 | Rajesh Verma | |
| Approved | 03-04-2013 | Rajasekhar Reddy | |

| SCALE : / | | STANDARD : | IEC |
|---|---|---|---|
| Size : A4 | Rev.: 1 | Sheet N°: 1 | Qty of Sheets: 4 |

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**Project :**

Supply of OPGW Communication System for 765/400kV Switchyard Package at Bhopal & Dhule for Bhopal Dhule Transmission Project .

**Client :**

Sterlite

**BHOPAL DHULE TRANSMISSION COMPANY LIMITED.**
**(A Wholly Owned Subsidiary of STERLITE TECHNOLOGIES LTD)**

**Contractor:** **ALSTOM T&D**

ALSTOM

**ALSTOM T & D India Ltd. , NOIDA**

**Drawing No.** 5429PS060-DHU-E-SYD-BOQ-3501

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| Checked | 16-04-2013 | Rajesh Verma | |
| Approved | 16-04-2013 | Rajasekhar Reddy | |

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**Station wise Bill of Quantity for OPGW Communication Equipment**

| Item | Description | Unit | Site Name | | | | | | | | Total Qty. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BHOPAL | BHOPAL MPPCL | INDORE | JABALPUR | DHULE | DHULE (MSETCL) | AURANGABAD | VADODARA | |
| A | **FOTE Equipment** | | | | | | | | | | |
| **1** | **ALSTOM e-DXC SDH/PDH Combo Multiplexer** | | | | | | | | | | |
| 1.1 | Sub Rack with Fan Unit | Nos. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| 1.2 | 48VDC Power Supply Board | Nos. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 16 |
| 1.3 | Controller/Matrix board (XCU/Cross-Connect Unit) | Nos. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 16 |
| 1.4 | Connector Board | Nos. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| 1.5 | 16E1 Board | Nos. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| 1.6 | Ethernet Interface Board | Nos. | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 4 |
| 1.7 | 12-Port FXS Board | Nos. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| 1.8 | 8-Port RS-232 Async Board | Nos. | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 4 |
| **2** | **Optical SFP & Optical Amplification System** | | | | | | | | | | |
| 2.1 | ALSTOM SFP | | | | | | | | | | |
| 2.1.1 | S1.1 SFP | Nos. | 2 | 1 | 0 | 1 | 3 | 1 | 1 | 1 | 10 |
| 2.1.2 | U1.2e | Nos. | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| 2.2 | Optical Amplifier | | | | | | | | | | |
| 2.2 | Optical Amplifier 1 RU-P15 | Nos. | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 |
| 2.2 | Optical Amplifier 1 RU-P24 | Nos. | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 4 |
| 2.3 | Pre- Amplifier 1 RU-P35 | Nos. | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 4 |
| 2.4 | Wavelength Convertor 1RU-WC1 | Nos. | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 4 |
| 2.4 | Wavelength Convertor 1RU-WT1 | Nos. | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 |
| **3** | **Teleprotection Signaling Equipment (4 Command)** | | | | | | | | | | |
| 3.1 | Sub Rack | Nos. | 8 | 4 | 2 | 2 | 8 | 4 | 2 | 2 | 16 |
| 3.2 | 48VDC Power Supply Board | Nos. | 8 | 4 | 2 | 2 | 8 | 4 | 2 | 2 | 16 |
| 3.3 | 4 Commands I/O Board | Nos. | 8 | 4 | 2 | 2 | 8 | 4 | 2 | 2 | 16 |
| 3.4 | G.703 2Mbps Interface Board | Nos. | 8 | 4 | 2 | 2 | 8 | 4 | 2 | 2 | 16 |
| **4** | **Analogue Telephone Set Beetel B11** | Nos. | 6 | 2 | 2 | 2 | 6 | 2 | 2 | 2 | 24 |
| **5** | **19" Cubicle, IP31, Exterior Colour** : RAL7032, Interior Colour : RAL7032 | Nos. | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 11 |

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| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B | **Miscellaneous** | | | | | | | | | | |
| 1 | **Ancillaries** | | | | | | | | | | |
| 1.1 | FODP 19" Rack Mountable 24 Fiber | Nos. | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 6 |
| 1.2 | FODP 19" Rack Mountable 72 Fiber | Nos. | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |
| 1.3 | Fiber Optic Approach Cable 24 Fiber | Km | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 4 |
| 1.4 | Joint Box 24 Fiber | Nos. | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 12 |
| 1.5 | Craft Terminal Laptop | Nos. | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |

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**Contractor:** **ALSTOM T&D**

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**ALSTOM T & D India Ltd. , NOIDA**

**Drawing No.** 5429PS060-DHU-E-SYD-GAD-3502

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# Telecom Network Design Document

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# 1 REFERENCES

1. BDTCL Tender No. BDTCL/04/001
2. BDTCL/04/001/17 dated 18.05.2011 Calrifications on Technical specifications
3. BDTCL LOA BDTCL/2011-12/LOA-Substations/004 dated 28-07-2011.

# 2 INTRODUCTION

The aim of this document is to present the Telecom Network Design & Fibre Optic Communication Network for DHULE under Supply of OPGW Communication System for 765/400kV Switchyard Package for Bhopal Dhule Transmission Project.

# 3 TELECOM EQUIPMENTS OVERVIEW

The ALSTOM e-DXC (Enhanced-DXC) is an SDH/PDH access and transmission multiplexer designed to provide integrated accesses to STM-1/4 optical lines through either a non-blocking VC12/VC3/VC4 crossconnect with High Speed modules or through an additional non-blocking DS0 64K cross-connect with Low Speed modules.

e-DXC belongs to the family of Integrated Multi-Services Access Platform combining functions of first order PDH multiplexer and NG-SDH ADM.

The equipment can be used to accommodate mixed traffic of telephony, data or Ethernet, and to achieve special configurations like terminal, drop and insert or cross-connect application.

The ALSTOM DIP Teleprotection System is designed to transfer protection commands coming, in most cases, from distance protection relay contacts to one remote location through a Communication medium. Communication between Teleprotection equipment is a point to-point communication.

The logical schematic of the Telecom Network is shown on the next page.

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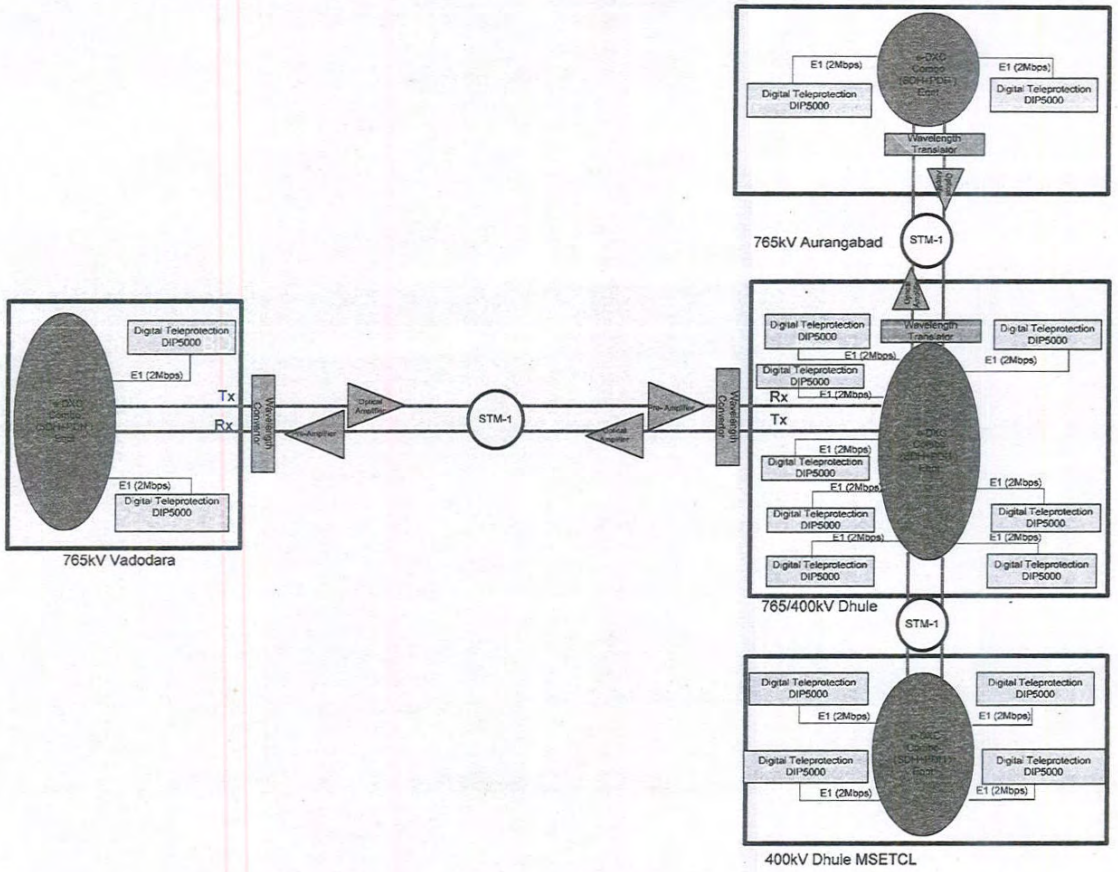



**Figure 1 DHULE Fibre Optic Network Diagram**

As shown in Figure 1 one eDXC Eqipment of 765kV/400kV Dhule and one e-DXC equipments at 4000kV Dhule MSETCL ,765kV Aurangabad & 765kV Vadodara will be used to establish a STM-1 (155Mbps) Optical link between these through OPGW. 765kV/ 400kV Dhule e-DXC equipment will be connected e-DXC equipments of 400kV Dhule MSETCL, 765kV Aurangabad & 765kV Vadodara through STM-1 optical interface.

eDXC Equipment at 765kV/400kV Dhule, 400kV Dhule MSETCL ,765kV Aurangabad & 765kV Vadodara will provide the 2Mbps interface for DIP and 4W E&M interface for existing PABX interfacing at 765kV/400kV Dhule & Dhule MSETCL (if any). FXS Card will be used for providing inter- station Hotline communication.

Total 16 Nos. of ALSTOM DIP Teleprotection Equipments - 4 Commands with 2Mbps Interface are used to achieve the protection system between the following links:-

765kV/400kV Dhule – Dhule MSETCL – 4 Nos. Teleprotection are used to facilitate two dedicated channels for Protection signalling on D/C line.

765kV/400kV Dhule – 765kV Aurangabad – 2 Nos. Teleprotection are used to facilitate two dedicated channels for Protection signalling on S/C line.

765kV/400kV Dhule – 765kV Vadodara – 2 Nos. Teleprotection are used to facilitate two dedicated channels for Protection signalling on S/C line.

2Mbps Port of DIP Equipment at 765kV/400kV Dhule is connected to 2Mbps port of DIP at Dhule MSETCL through eDXC 2Mbps interface available at 765kV/400kV Dhule & Dhule MSETCL S/s.

2Mbps Port of DIP Equipment at 765kV/400kV Dhule is connected to 2Mbps port of DIP at 765kV Aurangabad through eDXC 2Mbps interface available at 765kV/400kV Dhule & 765kV Aurangabad S/s.

2Mbps Port of DIP Equipment at 765kV/400kV Dhule is connected to 2Mbps port of DIP at 765kV Vadodara through eDXC 2Mbps interface available at 765kV/400kV Dhule & 765kV Vadodara.

In total 12 Nos. of FXS Interface will be available between 765kV/400kV Dhule & Dhule MSETCL, 765kV Aurangabad & 765kV Vadodara S/s for two dedicated channels for speech communication between the substation and respective terminal substations.

In total 8 Nos. of RS-232 Interfaces will be available between 765kV/400kV Dhule & PGCIL Vadodara for providing two dedicated channels for transferring "real time data" , to respective RLDC.

8 Port Ethernet interface card will be provided at Dhule & Dhule MSETCL S/s for Data transmission to RSCC from Dhule . Dhule MSETCL site is assumed for data transmission to RSCC from Dhule. If Data transmission from Dhule direction is changed to Vadodara or Aurangabad then Ethernet interface card will used at that site instead of Dhule MSETCL site.

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# 4 DETAILS OF FO LINKS

DHULE FIBRE OPTIC LINKS

| Station A | Equipment A | Eqt A interface card | Eqt A slot | Eqt A connector | Station B | Equipment B | Eqt B interface card | Eqt B slot | Eqt B connector |
|---|---|---|---|---|---|---|---|---|---|
| 765kV DHULE | N°E-105-AD-001 | XCU1 P1 (S1.1,LC) | XCU | Port 1 Tx | 400kV Dhule MSETCL | N°E-106-AD-001 | XCU1 P1 (S1.1,LC) | XCU | Port 1 Rx |
| 765kV DHULE | N°E-105-AD-001 | XCU1 P1(S1.1,LC) | XCU | Port 1 Rx | 400kV Dhule MSETCL | N°E-106-AD-001 | XCU1 P1 (S1.1, LC) | XCU | Port 1 Tx |
| 765kV DHULE | N°E-105-AD-001 | XCU1 P2 (S1.1, LC) | XCU | Port 2 Tx | 765kV Aurangabad | N°E-107-AD-001 | XCU1 P1 (S1.1, LC) | XCU | Port 1 Rx |
| 765kV DHULE | N°E-105-AD-001 | XCU1 P2 (S1.1, LC) | XCU | Port 2 Rx | 765kV Aurangabad | N°E-107-AD-001 | XCU1 P1 (S1.1, LC) | XCU | Port 1 Tx |
| 765kV DHULE | N°E-105-AD-001 | XCU2 P1 (S1.1,LC) | XCU | Port 1 Tx | 765kV Vadodara | N°E-108-AD-001 | XCU2 P1 (S1.1,LC) | XCU | Port 1 Rx |
| 765kV DHULE | N°E-105-AD-001 | XCU2 P1 (S1.1, LC) | XCU | Port 1 Rx | 765kV Vadodara | N°E-108-AD-001 | XCU2 P1 (S1.1, LC) | XCU | Port 1 Tx |

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# 5 OPTICAL BUDGET CALCULATIONS

| *Optical Link Budget: Dhule To Dhule MSETCL* | | |
|---|---|---|
| **Design Parameters** | **Unit** | **Values** |
| Transmission rate | | STM-1 |
| Fiber type | | SMF |
| Distance between A - B | Km | 18 |
| Source nominal wavelength | nm | 1310 |
| Cable loss | dB/Km | 0.35 |
| Chromatic dispersion at 1310 nm | ps/nm/km | 3.5 |
| Optical fiber loss | dB | 6.3 |
| Splice loss (0.1 dB per splice - 1 splice per 3.0km) | dB | 0.60 |
| Optical path penalty | dB | 1 |
| Repair & Aging margin & connectors | dB | 3 |
| ***Total Cable Attenuation*** | ***dB*** | ***10.90*** |
| **SDH Equipment Parameters** | | |
| Equipment | eDXC | |
| Optical Interface | S1.1 | |
| Transmitter power (at point S of CCITT) : | Min | -15 |
| Transmitter power (at point S of CCITT) : | Max | -8 |
| Receiver sensitivity with BER=E-10 (at point R of CCITT) : | | -34 |
| Receiver overload | | -8 |
| Maximum acceptable chromatic dispersion : | ps/nm | NA |
| **Optical Amplification System Parameters** | **Unit** | **Values** |
| Power Amplifier Budget (1RU-P21) | dBm | NA |
| Pre- Amplifier Budget (1RU-P35) | dBm | NA |
| Wavelength Convertor Chromatic Dispersion (1RU-WC1) | ps/nm | NA |
| | | |
| Total System Gain at EOL | | 19 |
| **Calculated Values** | | |
| Additional margin | db | 8.10 |
| Total Chromatic Dispersion | ps/nm | NA |
| Chromatic dispersion margin | ps/nm | NA |

25/04/2013

| Optical Link Budget: Dhule To Aurangabad | | |
|---|---|---|
| **Design Parameters** | **Unit** | **Values** |
| Transmission rate | | STM-1 |
| Fiber type | | SMF |
| Distance between A - B | Km | 192 |
| Source nominal wavelength | nm | 1550 |
| Cable loss | dB/Km | 0.21 |
| Chromatic dispersion at 1550 nm | ps/nm/km | 18 |
| Optical fiber loss | dB | 40.32 |
| Splice loss (0.1 dB per splice - 1 splice per 3.0km) | dB | 6.40 |
| Optical path penalty | dB | 1 |
| Repair & Aging margin & connectors | dB | 3 |
| ***Total Cable Attenuation*** | ***dB*** | ***50.72*** |
| **SDH Equipment Parameters** | | |
| Equipment | eDXC | |
| Optical Interface | S1.1 | |
| Transmitter power (at point S of CCITT) : | Min | -15 |
| Transmitter power (at point S of CCITT) : | Max | -8 |
| Receiver sensitivity with BER=E-10 (at point R of CCITT) : | | -34 |
| Receiver overload | | -8 |
| Maximum acceptable chromatic dispersion : | ps/nm | NA |
| **Optical Amplification System Parameters** | **Unit** | **Values** |
| Power Amplifier Budget (1RU-P15) | dBm | 15 |
| Pre- Amplifier Budget (1RU-P35) | dBm | NA |
| Wavelength Translator (1RU-WT1) | dBm | -42 |
| Wavelength Convertor Chromatic Dispersion (1RU-WT1) | ps/nm | 25600 |
| | | |
| Total System Gain at EOL | | 57 |
| **Calculated Values** | | |
| Additional margin | dB | 6.28 |
| Total Chromatic Dispersion | ps/nm | 3456.00 |
| Chromatic dispersion margin | ps/nm | 22144.00 |

25/04/2013

| Optical Link Budget: Dhule To Vadodara | | |
|---|---|---|
| **Design Parameters** | **Unit** | **Values** |
| Transmission rate | | STM-1 |
| Fiber type | | SMF |
| Distance between A - B | Km | 264 |
| Source nominal wavelength | nm | 1550 |
| Cable loss | dB/Km | 0.21 |
| Chromatic dispersion at 1550 nm | ps/nm/km | 18 |
| Optical fiber loss | dB | 55.44 |
| Splice loss (0.1 dB per splice - 1 splice per 3.0km) | dB | 8.80 |
| Optical path penalty | dB | 1 |
| Repair & Aging margin & connectors | dB | 3 |
| ***Total Cable Attenuation*** | ***dB*** | ***68.24*** |
| **SDH Equipment Parameters** | | |
| Equipment | eDXC | |
| Optical Interface | S1.1 | |
| Transmitter power (at point S of CCITT) : | Min | -15 |
| Transmitter power (at point S of CCITT) : | Max | -8 |
| Receiver sensitivity with BER=E-10 (at point R of CCITT) : | | -34 |
| Receiver overload | | -8 |
| Maximum acceptable chromatic dispersion : | ps/nm | NA |
| **Optical Amplification System Parameters** | **Unit** | **Values** |
| Power Amplifier Budget (1RU-P24) | dBm | 22 |
| Pre- Amplifier Budget (1RU-P35) | dBm | 49 |
| Wavelength Convertor Chromatic Dispersion (1RU-WC1) | ps/nm | 51200 |
| | | |
| Total System Gain at EOL | | 71 |
| **Calculated Values** | | |
| Additional margin | db | 2.76 |
| Total Chromatic Dispersion | ps/nm | 4752.00 |
| Chromatic dispersion margin | ps/nm | 46448.00 |

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# 6 SYNCHRONIZATION

eDXC equipment at 765kV Bhopal will be driven by its own internal clock and it will also act as the master node. eDXC equipment at 400kV Bhopal, 765kV Indore & 765kV Jabalpur equipment will consider the STM-1 stream coming from the master node as their first clock source.

The table below gives the clock priority of each of the eDXC equipments.

Synchronisation of Dhule Optical Network

| SDH SYNCHRONIZATION | | | | | |
|---|---|---|---|---|---|
| **Station** | **Eqt type** | **Eqt ID** | **Slot** | **Port** | **Clock Priority** |
| 765kV Dhule | eDXC | N°E-105-AD-001 | XCU1 | INTERNAL CLOCK | P-1 |
| 400kV Dhule MSETCL | eDXC | N°E-106-AD-001 | XCU1 | 1 | P-1 |
| 765kV Aurangabad | eDXC | N°E-107-AD-001 | XCU1 | 1 | P-1 |
| 765kV Vadodara | eDXC | N°E-108-AD-001 | XCU1 | 1 | P-1 |

# 7 STATION WISE EQUIPMENT CONFIGURATIONS

## 7.1 eDXC

**eDXC - Dhule - N°E-105-AD-001**

| FAN | | | | | | | | Connector | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48Vdc | 48Vdc | 16 E1 120 Ω | Ethernet L2 | | | O O XCU | O O XCU | 12 x FXS | 8 x RS232 Data | | | | |

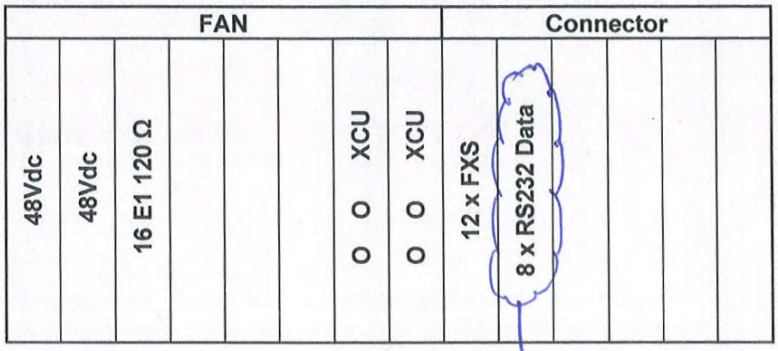
**eDXC – Dhule MSETCL - N°E-106-AD-001**

| FAN | | | | | | | | Connector | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48Vdc | 48Vdc | 16 E1 120 Ω | Ethernet L2 | | | O O XCU | O O XCU | 12 x FXS | | | | | |

**eDXC – Aurangabad - N°E-107-AD-001**

| FAN | | | | | | | | Connector | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48Vdc | 48Vdc | 16 E1 120 Ω | | | | O O XCU | O O XCU | 12 x FXS | | | | | |

25/09/2013




May Required to be shifted to Dhule MSETCL Substation eDXC.

25/04/2013

### 7.1.1 48VDC

This unit contains a DC/DC converter which power feeds the boards of the subrack.
DC input voltage: from –36 to -72 V DC (-48 V nominal, positive grounding).

### 7.1.2 XCU

This unit forms the interface between the different slots of the equipment (2Mbit/s, PDH interfaces, SDH optical interfaces). It fulfills the common functions of the Multiplexer:

- Management
- 64k matrix, VC12/VC-3/VC4 non-blocking matrix
- Integrated E1 Mapper & Framer
- Main processing of voice/data and signaling information
- Interface with central alarm system
- Synchronization processing: Internal, Line, External (2Mbit/s/ 2MHz/ 75/120:). (2MHz is "receive" only. It cannot be transmitted from *e*-DXC.
- Housekeeping processing (Access on Connector board)

This unit includes two STM1 interfaces using SFP modules.

### 7.1.3 Connector Board

The unit provides accesses for the following functions:

- DB9 console port for VT-100 local monitor connection
- 4 Alarms Input
- 4 Alarms Output related to the status of the equipment (Critical, Major, Minor, Informative)
- Two External Clock Input/Output accesses in 2MHz or 2Mbps, 75/120:. (2Mhz is only "receive")
- Connection for EOW analog telephone set

### 7.1.4 16E1 120Ω

This unit offers Sixteen 2Mbit/s G.703 interfaces with 120 Ohm (with RJ48c connectors)

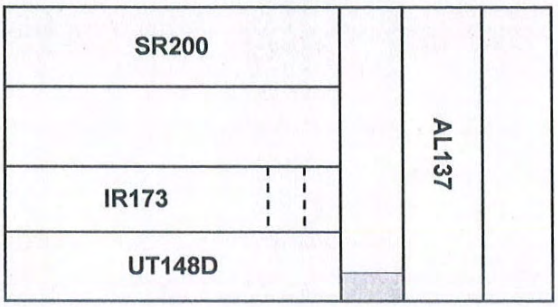
### 7.1.5 12 x FXS

The FXS unit forms the interface between the controller and 12 POTS (Plain Ordinary Telephone Subscriber) lines.

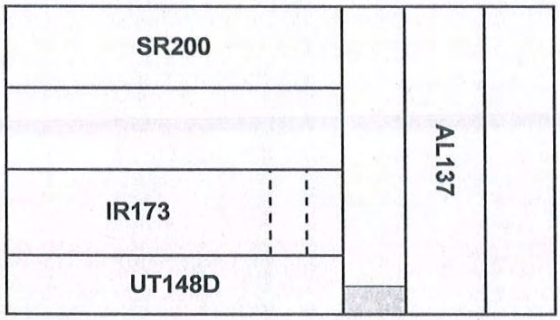
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## 7.2 DIP

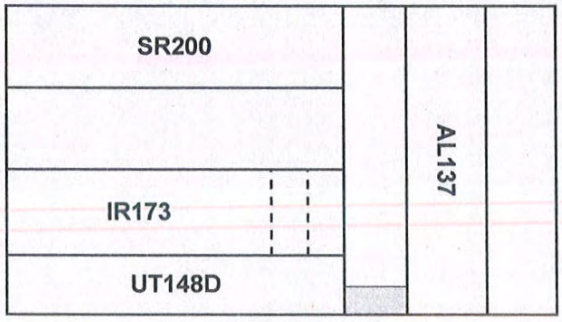
**DIP - Dhule- N°E-105-TP-001 - N°E-105-TP-008**




**DIP – Dhule MSETCL- N°E-106-TP-001 - N°E-106-TP-004**

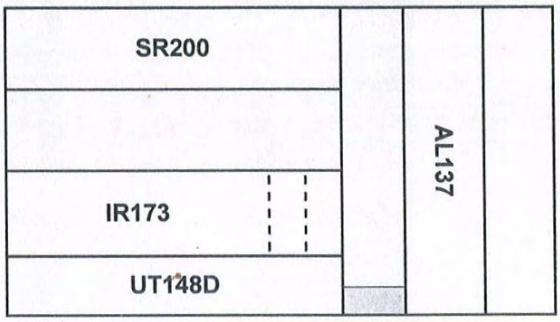



**DIP – Aurangabad- N°E-107-TP-001 – N°E-107-TP-002**




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DIP – Vadodara- N°E-108-TP-001 – N°E-108-TP-002




**DIP Modules**

- **SR200** -Voltage Acquisition Command Module 24 to 250 Volt DC for 4 Commands.
- **IR173** -G.703-6 (2Mbps) 120 ohms Interface Module.
- **AL137** -Power Supply Module 48 to 60 Volt DC.
- **UT148D**-CPU Module with Communication Port.

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## 8 BILL OF QUANTITY FOR EACH STATION (FOR INFORMATION)

| Item | Description | Unit | Site Name | | | | Total Qty. |
|---|---|---|---|---|---|---|---|
| | | | DHULE | DHULE (MSETCL) | AURANGABAD | VADODARA | |
| A | **FOTE Equipment** | | | | | | |
| 1 | **ALSTOM e-DXC SDH/PDH Combo Multiplexer** | | | | | | |
| 1.1 | Sub Rack with Fan Unit | Nos. | 1 | 1 | 1 | 1 | 4 |
| 1.2 | 48VDC Power Supply Board | Nos. | 2 | 2 | 2 | 2 | 8 |
| 1.3 | Controller/Matrix board (XCU/Cross-Connect Unit) | Nos. | 2 | 2 | 2 | 2 | 8 |
| 1.4 | Connector Board | Nos. | 1 | 1 | 1 | 1 | 4 |
| 1.5 | 16E1 Board | Nos. | 1 | 1 | 1 | 1 | 4 |
| 1.6 | Ethernet Interface Board | Nos. | 1 | 1 | 0 | 0 | 2 |
| 1.7 | 12-Port FXS Board | Nos. | 1 | 1 | 1 | 1 | 4 |
| 1.8 | 8-Port RS-232 Async Board | Nos. | 1 | 0 | 0 | 1 | 2 |
| 1.9 | Patch Cords | | | | | | |
| 1.9.1 | Patch Cords LC/PC-FC/PC SM | Nos. | 6 | 2 | 2 | 2 | 12 |
| 1.9.2 | Patch Cords FC/PC-FC/PC SM | Nos. | 6 | 0 | 2 | 4 | 12 |
| 2 | **Optical SFP & Optical Amplification System** | | | | | | |
| 2.1 | ALSTOM SFP | | | | | | |
| 2.1.1 | S1.1 SFP | Nos. | 3 | 1 | 1 | 1 | 6 |
| 2.2 | Optical Amplifier | | | | | | |
| 2.2.1 | 1RU-P15 | Nos. | 1 | 0 | 1 | 0 | 2 |
| 2.2.2 | 1RU-P24 | Nos. | 1 | 0 | 0 | 1 | 2 |
| 2.3 | Pre- Amplifier 1 RU-P35 | Nos. | 1 | 0 | 0 | 1 | 2 |
| 2.4 | Wavelength Convertor | | | | | | |
| 2.4.1 | Wavelength Convertor 1RU-WC1 | Nos. | 1 | 0 | 0 | 1 | 2 |
| 2.4.2 | Wavelength Translator 1RU-WT1 | Nos. | 1 | 0 | 1 | 0 | 2 |
| 3 | **Teleprotection Signaling Equipment** | | | | | | |
| 3.1 | Sub Rack | Nos. | 8 | 4 | 2 | 2 | 16 |
| 3.2 | 48VDC Power Supply Board | Nos. | 8 | 4 | 2 | 2 | 16 |
| 3.3 | 4 Commands I/O Board | Nos. | 8 | 4 | 2 | 2 | 16 |
| 3.4 | G.703 2Mbps Interface Board | Nos. | 8 | 4 | 2 | 2 | 16 |
| 4 | **Analogue Telephone Set Beetel B11** | Nos. | 6 | 2 | 2 | 2 | 12 |
| 5 | **19" Cubicle, IP31, Exterior/Interior Colour** : RAL7032 | Nos. | 3 | 1 | 1 | 1 | 6 |
| B | **Miscellaneous** | | | | | | |
| 1 | **Ancillaries** | | | | | | |
| 1.1 | FODP 19" Rack Mountable 24 Fiber | Nos. | 0 | 1 | 1 | 1 | 3 |
| 1.2 | FODP 19" Rack Mountable 72 Fiber | Nos. | 1 | 0 | 0 | 0 | 1 |
| 1.3 | Joint Box 24 Fiber | Nos. | 3 | 1 | 1 | 1 | 6 |
| 1.4 | Fiber Optic Approach Cable 24 Fiber | Km | 0.5 | 0.5 | 0.5 | 0.5 | 2 |
| 1.5 | Craft Terminal Laptop | Nos. | 1 | 0 | 0 | 0 | 1 |



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## 9 CHANNEL ROUTING

| STATION-A | | | | | | | | STATION-B | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | eDXC SDH/PDH EQUIPMENT | | | | | | | eDXC SDH/PDH EQUIPMENT | | | | | |
| STATION-A | SERVICES | EQUIPMENT-ID | SLOT No. | PORT No. | EQUIPMENT-ID | SLOT No. | PORT No. | STATION-B | EQUIPMENT-ID | SLOT No. | PORT No. | EQUIPMENT-ID | SLOT No. | PORT No. |
| Dhule | TELEPROTECTION 2Mbps | N°E-105-TP-001 | 1 | 1 | N°E-105-AD-001 | XCU1 | P1 | Dhule MSETCL | N°E-106-AD-001 | XCU1 | P1 | N°E-106-TP-001 | 1 | 1 |
| Dhule | TELEPROTECTION 2Mbps | N°E-105-TP-002 | 1 | 2 | N°E-105-AD-001 | XCU1 | P1 | Dhule MSETCL | N°E-106-AD-001 | XCU1 | P1 | N°E-106-TP-002 | 1 | 2 |
| Dhule | TELEPROTECTION 2Mbps | N°E-105-TP-003 | 1 | 3 | N°E-105-AD-001 | XCU1 | P1 | Dhule MSETCL | N°E-106-AD-001 | XCU1 | P1 | N°E-106-TP-003 | 1 | 3 |
| Dhule | TELEPROTECTION 2Mbps | N°E-105-TP-004 | 1 | 4 | N°E-105-AD-001 | XCU1 | P1 | Dhule MSETCL | N°E-106-AD-001 | XCU1 | P1 | N°E-106-TP-004 | 1 | 4 |
| Dhule | TELEPROTECTION 2Mbps | N°E-105-TP-005 | 1 | 5 | N°E-105-AD-001 | XCU1 | P2 | Aurangabad | N°E-107-AD-001 | XCU1 | P1 | N°E-107-TP-001 | 1 | 1 |
| Dhule | TELEPROTECTION 2Mbps | N°E-105-TP-006 | 1 | 6 | N°E-105-AD-001 | XCU1 | P2 | Aurangabad | N°E-107-AD-001 | XCU1 | P1 | N°E-107-TP-002 | 1 | 2 |
| Dhule | TELEPROTECTION 2Mbps | N°E-105-TP-007 | 1 | 7 | N°E-105-AD-001 | XCU2 | P1 | Vadodara | N°E-108-AD-001 | XCU1 | P1 | N°E-108-TP-001 | 1 | 1 |
| Dhule | TELEPROTECTION 2Mbps | N°E-105-TP-008 | 1 | 8 | N°E-105-AD-001 | XCU2 | P1 | Vadodara | N°E-108-AD-001 | XCU1 | P1 | N°E-108-TP-002 | 1 | 2 |
| Dhule | HOTLINE | N°E-105-AD-001 | 11 | 1 | N°E-105-AD-001 | XCU1 | P1 | Dhule MSETCL | N°E-106-AD-001 | XCU1 | P1 | N°E-106-AD-001 | 11 | 1 |
| Dhule | HOTLINE | N°E-105-AD-001 | 11 | 2 | N°E-105-AD-001 | XCU1 | P2 | Aurangabad | N°E-106-AD-001 | XCU1 | P1 | N°E-106-AD-001 | 11 | 2 |
| Dhule | HOTLINE | N°E-105-AD-001 | 11 | 3 | N°E-105-AD-001 | XCU2 | P1 | Vadodara | N°E-107-AD-001 | XCU1 | P1 | N°E-107-AD-001 | 11 | 1 |
| Dhule MSETCL | HOTLINE | N°E-106-AD-001 | 11 | 2 | N°E-106-AD-001 | XCU1 | P1 | Aurangabad | N°E-107-AD-001 | XCU1 | P1 | N°E-107-AD-001 | 11 | 2 |
| Dhule MSETCL | HOTLINE | N°E-106-AD-001 | 11 | 3 | N°E-106-AD-001 | XCU1 | P1 | Vadodara | N°E-108-AD-001 | XCU1 | P1 | N°E-108-AD-001 | 11 | 2 |
| Aurangabad | HOTLINE | N°E-107-AD-001 | 11 | 3 | N°E-107-AD-001 | XCU1 | P1 | Vadodara | N°E-108-AD-001 | XCU1 | P1 | N°E-108-AD-001 | 11 | 3 |
| Dhule | Data | N°E-105-AD-001 | 12 | 1 | N°E-105-AD-001 | XCU1 | P1 | Vadodara | N°E-108-AD-001 | XCU1 | P1 | N°E-108-AD-001 | 12 | 1 |
| Dhule | Data | N°E-105-AD-002 | 12 | 2 | N°E-105-AD-001 | XCU1 | P1 | Vadodara | N°E-108-AD-001 | XCU1 | P1 | N°E-108-AD-002 | 12 | 2 |

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| 2 | FA | 16-04-13 | REVISED AS PER CUSTOMER COMMENTS | ATP | RVA | RRY |
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| 0 | AC | 06-02-2012 | Original Issue | ATP | RVA | BPR |
| **REV** | **STATUS** | **DATE** | **MODIFICATIONS** | **Estab.** | **Check** | **Appr.** |

**Project** :

Supply of OPGW Communication System for 765/400kV Switchyard Package at Bhopal & Dhule for Bhopal Dhule Transmission Project .

**Client** :

Sterlite

**BHOPAL DHULE TRANSMISSION COMPANY LIMITED.**
**(A Wholly Owned Subsidiary of STERLITE TECHNOLOGIES LTD)**

**Contractor:** **ALSTOM T&D**

ALSTOM

**ALSTOM T & D India Ltd. , NOIDA**

**Drawing No.** 5429PS060-BPL-E-SYD-GAD-3502

Vendor Drawing number :

**BDTCL-ALTD-DES-TEL-01A**

Document Title :
**Telecom Network Design Document- Bhopal Network**

| Original signed by | DATE | NAME | SIGN |
|---|---|---|---|
| Established | 16-04-2013 | Amit Pandey | |
| Checked | 16-04-2013 | Rajesh Verma | |
| Approved | 16-04-2013 | Rajasekhar Reddy | |

| SCALE : / | | STANDARD : | IEC |
|---|---|---|---|

| Size : | Rev.: | Sheet N°: | Qty of Sheets: |
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| **A4** | **2** | **1** | 19 |

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☐ MANUFACTURING ☐ INDENT
☐ RECORD ☐ EXECUTION
22 APR 2013 ALSTOM T&D
Dt. AUTH. SIG.

# Telecom Network Design Document

## REVISION HISTORY RECORDS

| REV | DATE | CREATE / UPDATING |
|---|---|---|
| 0 | 06-02-2012 | ORIGINAL ISSUE |
| 1 | 03-04-2013 | REVISED AS PER CUSTOMER COMMENTS |
| 2 | 16-04-2013 | REVISED AS PER CUSTOMER COMMENTS |

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# 1 REFERENCES

1. BDTCL Tender No. BDTCL/04/001
2. BDTCL/04/001/17 dated 18.05.2011 Calrifications on Technical specifications
3. BDTCL LOA BDTCL/2011-12/LOA-Substations/004 dated 28-07-2011.

# 2 INTRODUCTION

The aim of this document is to present the Telecom Network Design & Fibre Optic Communication Network for BHOPAL under Supply of OPGW Communication System for 765/400kV Switchyard Package for Bhopal Dhule Transmission Project.

# 3 TELECOM EQUIPMENTS OVERVIEW

The ALSTOM e-DXC (Enhanced-DXC) is an SDH/PDH access and transmission multiplexer designed to provide integrated accesses to STM-1/4 optical lines through either a non-blocking VC12/VC3/VC4 crossconnect with High Speed modules or through an additional non-blocking DS0 64K cross-connect with Low Speed modules.

e-DXC belongs to the family of Integrated Multi-Services Access Platform combining functions of first order PDH multiplexer and NG-SDH ADM.

The equipment can be used to accommodate mixed traffic of telephony, data or Ethernet, and to achieve special configurations like terminal, drop and insert or cross-connect application.

The ALSTOM DIP Teleprotection System is designed to transfer protection commands coming, in most cases, from distance protection relay contacts to one remote location through a Communication medium. Communication between Teleprotection equipment is a point to-point communication.

The logical schematic of the Telecom Network is shown on the next page.

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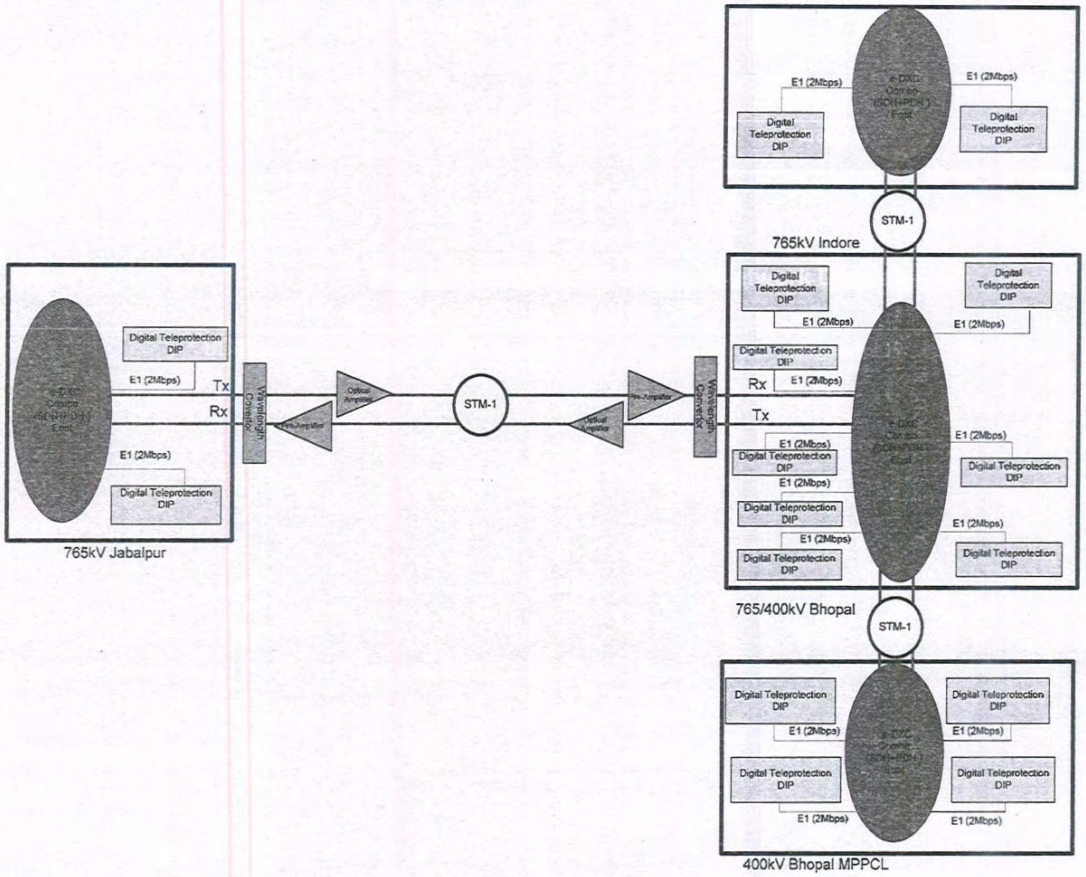



**Figure 1 BHOPAL Fibre Optic Network Diagram**

As shown in Figure 1 one eDXC Eqipment of 765kV/400kV Bhopal and one e-DXC equipments at 4000kV Bhopal MPPCL ,765kV Indore & 765kV Jabalpur will be used to establish a STM-1 (155Mbps) Optical link between these through OPGW. 765kV/ 400kV Bhopal e-DXC equipment will be connected e-DXC equipments of 400kV Bhopal MPPCL, 765kV Indore & 765kV Jabalpur through STM-1 optical interface.

eDXC Equipment at 765kV/400kV Bhopal, 400kV Bhopal MPPCL ,765kV Indore & 765kV Jabalpur will provide the 2Mbps interface for DIP. FXS Card will be used for providing inter-station Hotline communication.

Total 16 Nos. of ALSTOM DIP Teleprotection Equipments - 4 Commands with 2Mbps Interface are used to achieve the protection system between the following links:-

765kV/400kV Bhopal – Bhopal MPPCL – 4 Nos. Teleprotection are used to facilitate two dedicated channels for Protection signalling on D/C line.

765kV/400kV Bhopal – 765kV Indore – 2 Nos. Teleprotection are used to facilitate two dedicated channels for Protection signalling on S/C line.

765kV/400kV Bhopal – 765kV Jabalpur – 2 Nos. Teleprotection are used to facilitate two dedicated channels for Protection signalling on S/C line.

2Mbps Port of DIP Equipment at 765kV/400kV Bhopal is connected to 2Mbps port of DIP at Bhopal MPPCL through eDXC 2Mbps interface available at 765kV/400kV Bhopal & Bhopal MPPCL S/s.

2Mbps Port of DIP Equipment at 765kV/400kV Bhopal is connected to 2Mbps port of DIP at 765kV Indore through eDXC 2Mbps interface available at 765kV/400kV Bhopal & 765kV Indore S/s.

2Mbps Port of DIP Equipment at 765kV/400kV Bhopal is connected to 2Mbps port of DIP at 765kV Jabalpur through eDXC 2Mbps interface available at 765kV/400kV Bhopal & 765kV Jabalpur.

In total 12 Nos. of FXS Interface will be available between 765kV/400kV Bhopal & Bhopal MPPCL, 765kV Indore & 765kV Jabalpur S/s for two dedicated channels for speech communication between the substation and respective terminal substations.

In total 8 Nos. of RS-232 Interfaces will be available between 765kV/400kV Bhopal & Jabalpur for providing two dedicated channels for transferring "real time data" , to respective RLDC.

8 Port Ethernet interface card will be provided at Bhopal & Bhopal MPPCL for Data transmission to RSCC from Bhopal . Bhopal MPPCL site is assumed for data transmission to RSCC from Bhopal. If Data transmission from Bhopal direction is changed to Jabalpur or Indore s/s then Ethernet interface card will used at that site instead of Bhopal MPPCL site.

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# 4 DETAILS OF FO LINKS

BHOPAL FIBRE OPTIC LINKS

| Station A | Equipment A | Eq A interface card | Eq A slot | Eq A connect or | Station B | Equipment B | Eq B interface card | Eq B slot | Eq B connector |
|---|---|---|---|---|---|---|---|---|---|
| 765kV BHOPAL | N°E-100-AD-001 | XCU1 P1 (S1.1,LC) | XCU | Port 1 Tx | 400kV Bhopal MPPCL | N°E-101-AD-001 | XCU1 P1 (S1.1,LC) | XCU | Port 1 Rx |
| 765kV BHOPAL | N°E-100-AD-001 | XCU1 P1(S1.1,LC) | XCU | Port 1 Rx | 400kV Bhopal MPPCL | N°E-101-AD-001 | XCU1 P1 (S1.1, LC) | XCU | Port 1 Tx |
| 765kV BHOPAL | N°E-100-AD-001 | XCU1 P2 (U1.2e, LC) | XCU | Port 2 Tx | 765kV Indore | N°E-102-AD-001 | XCU1 P1 ( U1.2e , LC) | XCU | Port 1 Rx |
| 765kV BHOPAL | N°E-100-AD-001 | XCU1 P2 ( U1.2e , LC) | XCU | Port 2 Rx | 765kV Indore | N°E-102-AD-001 | XCU1 P1 ( U1.2e , LC) | XCU | Port 1 Tx |
| 765kV BHOPAL | N°E-100-AD-001 | XCU2 P1 (S1.1,LC) | XCU | Port 1 Tx | 765kV Jabalpur | N°E-103-AD-001 | XCU1 P1 ( S1.1,LC) | XCU | Port 1 Rx |
| 765kV BHOPAL | N°E-100-AD-001 | XCU2 P1 ( S1.1, LC) | XCU | Port 1 Rx | 765kV Jabalpur | N°E-103-AD-001 | XCU1 P1 ( S1.1, LC) | XCU | Port 1 Tx |

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# 5 OPTICAL BUDGET CALCULATIONS

| Optical Link Budget: Bhopal To Bhopal MPPCL | | |
|---|---|---|
| **Design Parameters** | **Unit** | **Values** |
| Transmission rate | | STM-1 |
| Fiber type | | SMF |
| Distance between A - B | Km | 8 |
| Source nominal wavelength | nm | 1310 |
| Cable loss | dB/Km | 0.35 |
| Chromatic dispersion at 1310 nm | ps/nm/km | 3.5 |
| Optical fiber loss | dB | 2.8 |
| Splice loss (0.1 dB per splice - 1 splice per 3.0km) | dB | 0.27 |
| Optical path penalty | dB | 1 |
| Repair & Aging margin & connectors | dB | 3 |
| ***Total Cable Attenuation*** | ***dB*** | ***7.07*** |
| **SDH Equipment Parameters** | | |
| Equipment | eDXC | |
| Optical Interface | S1.1 | |
| Transmitter power (at point S of CCITT) : | Min | -15 |
| Transmitter power (at point S of CCITT) : | Max | -8 |
| Receiver sensitivity with BER=E-10 (at point R of CCITT) : | | -34 |
| Receiver overload | | -8 |
| Maximum acceptable chromatic dispersion : | ps/nm | NA |
| **Optical Amplification System Parameters** | **Unit** | **Values** |
| Power Amplifier Budget (1RU-P24) | dBm | NA |
| Pre- Amplifier Budget (1RU-P35) | dBm | NA |
| Raman Pump | dBm | NA |
| Wavelength Convertor Chromatic Dispersion (1RU-WC1) | ps/nm | NA |
| | | |
| Total System Gain at EOL | | 19 |
| **Calculated Values** | | |
| Additional margin | db | 11.93 |
| Total Chromatic Dispersion | ps/nm | NA |
| Chromatic dispersion margin | ps/nm | NA |

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| Optical Link Budget: Bhopal To Indore | | |
|---|---|---|
| **Design Parameters** | **Unit** | **Values** |
| Transmission rate | | STM-1 |
| Fiber type | | SMF |
| Distance between A - B | Km | 174 |
| Source nominal wavelength | nm | 1550 |
| Cable loss | dB/Km | 0.21 |
| Chromatic dispersion at 1550 nm | ps/nm/km | 18 |
| Optical fiber loss | dB | 36.54 |
| Splice loss (0.1 dB per splice - 1 splice per 3.0km) | dB | 5.80 |
| Optical path penalty | dB | 1 |
| Repair & Aging margin & connectors | dB | 3 |
| ***Total Cable Attenuation*** | ***dB*** | ***46.34*** |
| **SDH Equipment Parameters** | | |
| Equipment | eDXC | |
| Optical Interface | U1.2e | |
| Transmitter power (at point S of CCITT) : | Min | 5 |
| Transmitter power (at point S of CCITT) : | Max | 8 |
| Receiver sensitivity with BER=E-10 (at point R of CCITT) : | | -45 |
| Receiver overload | | -10 |
| Maximum acceptable chromatic dispersion : | ps/nm | 4800 |
| **Optical Amplification System Parameters** | **Unit** | **Values** |
| Power Amplifier Budget (1RU-P24) | dBm | NA |
| Pre- Amplifier Budget (1RU-P35) | dBm | NA |
| Raman Pump | dBm | NA |
| Wavelength Convertor Chromatic Dispersion (1RU-WC1) | ps/nm | NA |
| | | |
| Total System Gain at EOL | | 50 |
| **Calculated Values** | | |
| Additional margin | dB | 3.66 |
| Total Chromatic Dispersion | ps/nm | 3132.00 |
| Chromatic dispersion margin | ps/nm | 1668.00 |

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| Optical Link Budget: Bhopal To Jabalpur | | |
|---|---|---|
| **Design Parameters** | **Unit** | **Values** |
| Transmission rate | | STM-1 |
| Fiber type | | SMF |
| Distance between A - B | Km | 261 |
| Source nominal wavelength | nm | 1550 |
| Cable loss | dB/Km | 0.21 |
| Chromatic dispersion at 1550 nm | ps/nm/km | 18 |
| Optical fiber loss | dB | 54.81 |
| Splice loss (0.1 dB per splice - 1 splice per 3.0km) | dB | 8.70 |
| Optical path penalty | dB | 1 |
| Repair & Aging margin & connectors | dB | 3 |
| ***Total Cable Attenuation*** | ***dB*** | ***67.51*** |
| **SDH Equipment Parameters** | | |
| Equipment | eDXC | |
| Optical Interface | S1.1 | |
| Transmitter power (at point S of CCITT) : | Min | -15 |
| Transmitter power (at point S of CCITT) : | Max | -8 |
| Receiver sensitivity with BER=E-10 (at point R of CCITT) : | | -34 |
| Receiver overload | | -8 |
| Maximum acceptable chromatic dispersion : | ps/nm | NA |
| **Optical Amplification System Parameters** | **Unit** | **Values** |
| Power Amplifier Budget (1RU-P24) | dBm | 22 |
| Pre- Amplifier Budget (1RU-P35) | dBm | 49 |
| Wavelength Convertor Chromatic Dispersion (1RU-WC1) | ps/nm | 51200 |
| | | |
| Total System Gain at EOL | | 71 |
| **Calculated Values** | | |
| Additional margin | db | 3.49 |
| Total Chromatic Dispersion | ps/nm | 4698.00 |
| Chromatic dispersion margin | ps/nm | 46502.00 |

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# 6 SYNCHRONIZATION

eDXC equipment at 765kV Bhopal will be driven by its own internal clock and it will also act as the master node. eDXC equipment at 400kV Bhopal, 765kV Indore & 765kV Jabalpur equipment will consider the STM-1 stream coming from the master node as their first clock source.

The table below gives the clock priority of each of the eDXC equipments.

Synchronisation of Bhopal Optical Network

| SDH SYNCHRONIZATION | | | | | |
|---|---|---|---|---|---|
| **Station** | **Eqt type** | **Eqt ID** | **Slot** | **Port** | **Clock Priority** |
| 765kV Bhopal | eDXC | N°E-100-AD-001 | XCU1 | INTERNAL CLOCK | P-1 |
| 400kV Bhopal MPPCL | eDXC | N°E-101-AD-001 | XCU1 | 1 | P-1 |
| 765kV Indore | eDXC | N°E-102-AD-001 | XCU1 | 1 | P-1 |
| 765kV Jabalpur | eDXC | N°E-103-AD-001 | XCU1 | 1 | P-1 |

# 7 STATION WISE EQUIPMENT CONFIGURATIONS

## 7.1 eDXC

**eDXC - Bhopal - N°E-100-AD-001**

| FAN | | | | | | | | Connector | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48Vdc | 48Vdc | 16 E1 120 Ω | L2 Ethernet | | | O O XCU | O O XCU | 12 x FXS | 8 x RS232 Data | | | | |

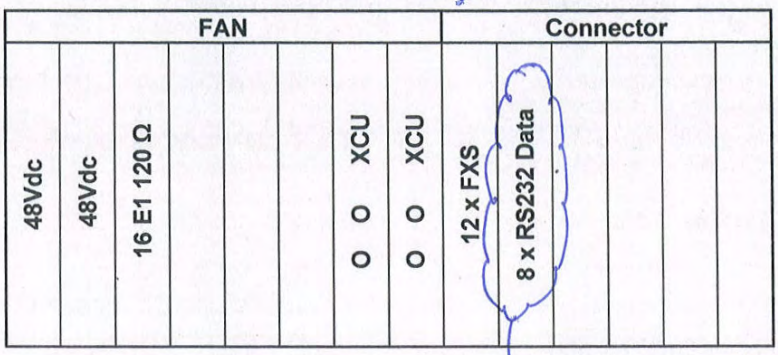
**eDXC – Bhopal MPPCL - N°E-101-AD-001**

| FAN | | | | | | | | Connector | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48Vdc | 48Vdc | 16 E1 120 Ω | L2 Ethernet | | | O O XCU | O O XCU | 12 x FXS | | | | | |

**eDXC – Indore - N°E-102-AD-001**

| FAN | | | | | | | | Connector | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48Vdc | 48Vdc | 16 E1 120 Ω | | | | O O XCU | O O XCU | 12 x FXS | | | | | |

25/04/2013




May Require to be Shifted to Bhopal MPPTCL & PGCIL Indore Substation eDXC.

25/04/2013

### 7.1.1 48VDC

This unit contains a DC/DC converter which power feeds the boards of the subrack.
DC input voltage: from –36 to -72 V DC (-48 V nominal, positive grounding).

### 7.1.2 XCU

This unit forms the interface between the different slots of the equipment (2Mbit/s, PDH interfaces, SDH optical interfaces). It fulfills the common functions of the Multiplexer:

- Management
- 64k matrix, VC12/VC-3/VC4 non-blocking matrix
- Integrated E1 Mapper & Framer
- Main processing of voice/data and signaling information
- Interface with central alarm system
- Synchronization processing: Internal, Line, External (2Mbit/s/ 2MHz/ 75/120:). (2MHz is "receive" only. It cannot be transmitted from *e*-DXC.
- Housekeeping processing (Access on Connector board)

This unit includes two STM1 interfaces using SFP modules.

### 7.1.3 Connector Board

The unit provides accesses for the following functions:

- DB9 console port for VT-100 local monitor connection
- 4 Alarms Input
- 4 Alarms Output related to the status of the equipment (Critical, Major, Minor, Informative)
- Two External Clock Input/Output accesses in 2MHz or 2Mbps, 75/120:. (2Mhz is only "receive")
- Connection for EOW analog telephone set

### 7.1.4 16E1 120Ω

This unit offers Sixteen 2Mbit/s G.703 interfaces with 120 Ohm (with RJ48c connectors)

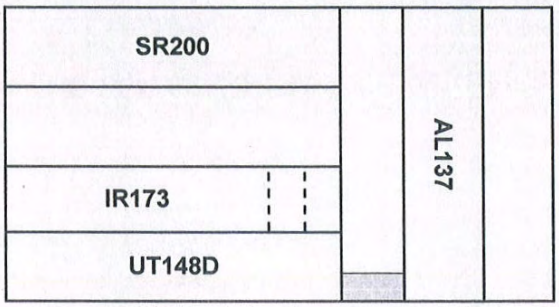
### 7.1.5 12 x FXS

The FXS unit forms the interface between the controller and 12 POTS (Plain Ordinary Telephone Subscriber) lines.

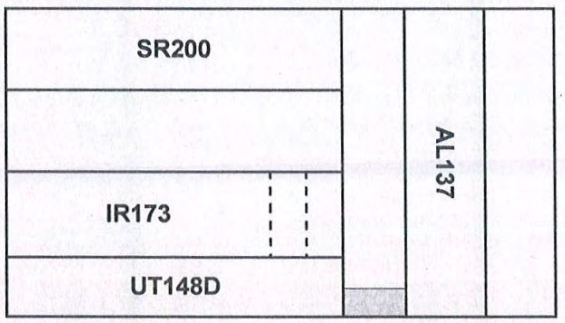
25/04/2013

## 7.2 DIP

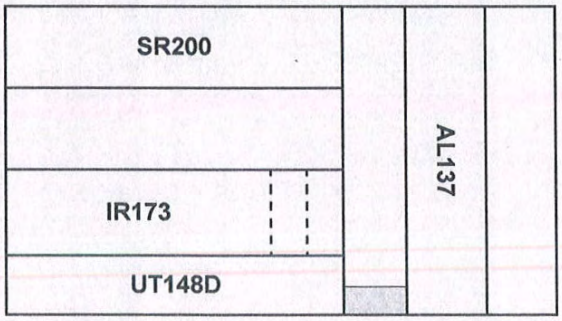
**DIP - Bhopal- N°E-100-TP-001 - N°E-100-TP-008**



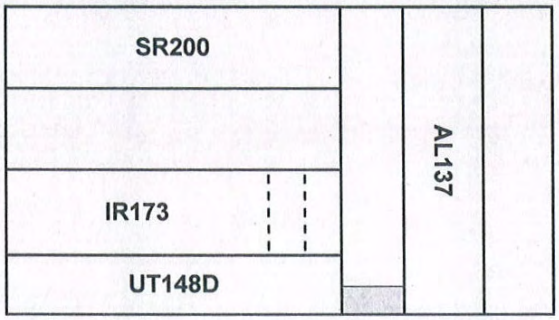

**DIP – Bhopal MPPCL- N°E-101-TP-001 - N°E-101-TP-004**




**DIP – Indore- N°E-102-TP-001 – N°E-102-TP-002**




25/04/2013




**DIP Modules**

- **SR200** -Voltage Acquisition Command Module 48 to 250 Volt DC for 4 Commands.
- **IR173** -G.703-6 (2Mbps) 120 ohms Interface Module.
- **AL137** -Power Supply Module 48 to 60 Volt DC.
- **UT148D**-CPU Module with Communication Port.

25/04/2013

## 8 BILL OF QUANTITY FOR EACH STATION (FOR INFORMATION)

| Item | Description | Unit | Site Name | | | | Total Qty. |
|---|---|---|---|---|---|---|---|
| | | | BHOPAL | BHOPAL (MPPCL) | INDORE | JABALPUR | |
| A | **FOTE Equipment** | | | | | | |
| **1** | **ALSTOM e-DXC SDH/PDH Combo Multiplexer** | | | | | | |
| 1.1 | Sub Rack with Fan Unit | Nos. | 1 | 1 | 1 | 1 | 4 |
| 1.2 | 48VDC Power Supply Board | Nos. | 2 | 2 | 2 | 2 | 8 |
| 1.3 | Controller/Matrix board (XCU/Cross-Connect Unit) | Nos. | 2 | 2 | 2 | 2 | 8 |
| 1.4 | Connector Board | Nos. | 1 | 1 | 1 | 1 | 4 |
| 1.5 | 16E1 Board | Nos. | 1 | 1 | 1 | 1 | 4 |
| 1.6 | Ethernet Interface Board | Nos. | 1 | 1 | 0 | 0 | 2 |
| 1.7 | 12-Port FXS Board | | 1 | 1 | 1 | 1 | 4 |
| 1.8 | 8-Port RS-232 Async Board | Nos. | 1 | 0 | 0 | 1 | 2 |
| 1.9 | Patch Cords | | | | | | |
| 1.9.1 | Patch Cords LC/PC-FC/PC SM | Nos. | 6 | 2 | 2 | 2 | 12 |
| 1.9.2 | Patch Cords FC/PC-FC/PC SM | Nos. | 4 | 0 | 0 | 4 | 8 |
| **2** | **Optical SFP & Optical Amplification System** | | | | | | |
| 2.1 | ALSTOM SFP | | | | | | |
| 2.1.1 | S1.1 SFP | Nos. | 2 | 1 | 0 | 1 | 4 |
| 2.1.2 | U1.2e | Nos. | 1 | 0 | 1 | 0 | 2 |
| 2.2 | Optical Amplifier 1RU-P24 | Nos. | 1 | 0 | 0 | 1 | 2 |
| 2.3 | Pre- Amplifier 1 RU-P35 | Nos. | 1 | 0 | 0 | 1 | 2 |
| 2.4 | Wavelength Convertor 1RU-WC1 | Nos. | 1 | 0 | 0 | 1 | 2 |
| **3** | **Teleprotection Signaling Equipment** | | | | | | |
| 3.1 | Sub Rack | Nos. | 8 | 4 | 2 | 2 | 16 |
| 3.2 | 48VDC Power Supply Board | Nos. | 8 | 4 | 2 | 2 | 16 |
| 3.3 | 4 Commands I/O Board | Nos. | 8 | 4 | 2 | 2 | 16 |
| 3.4 | G.703 2Mbps Interface Board | Nos. | 8 | 4 | 2 | 2 | 16 |
| **4** | **Analogue Telephone Set Beetel B11** | Nos. | 6 | 2 | 2 | 2 | 12 |
| **5** | **19" Cubicle, IP31, Exterior/Interior Colour** : RAL7032 | Nos. | 2 | 1 | 1 | 1 | 5 |
| **B** | **Miscellaneous** | | | | | | |
| **1** | **Ancillaries** | | | | | | |
| 1.1 | FODP 19" Rack Mountable 24 Fiber | Nos. | 0 | 1 | 1 | 1 | 3 |
| 1.2 | FODP 19" Rack Mountable 72 Fiber | Nos. | 1 | 0 | 0 | 0 | 1 |
| 1.3 | Joint Box 24F | Nos. | 3 | 1 | 1 | 1 | 6 |
| 1.4 | Fiber Optic Approach Cable 24 Fiber | Km | 0.5 | 0.5 | 0.5 | 0.5 | 2 |
| 1.5 | Craft Terminal Laptop | Nos. | 1 | 0 | 0 | 0 | 1 |



B.D.T.C.L.
CAT - I: INFORMATION PROVIDED HAVE BEEN NOTED.
Signed: .....
Date: 25/04/2013
This approval does not absolve the contractor/Supplier of his contractual responsibility to engineer an efficient design and successful performance of the Project/Equipment.

## 9 CHANNEL ROUTING

| STATION-A | | | | | | | | STATION-B | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | e-DXC SDH/PDH EQUIPMENT | | | | | | | e-DXC SDH/PDH EQUIPMENT | | | | | |
| STATION-A | SERVICES | EQUIPMENT-ID | SLOT No. | PORT No. | EQUIPMENT-ID | SLOT No. | PORT No. | STATION-B | EQUIPMENT-ID | SLOT No. | PORT No. | EQUIPMENT-ID | SLOT No. | PORT No. |
| Bhopal | TELEPROTECTION 2Mbps | N°E-100-TP-001 | 1 | 1 | N°E-100-AD-001 | XCU1 | P1 | Bhopal MPPCL | N°E-101-AD-001 | XCU1 | P1 | N°E-101-TP-001 | 1 | 1 |
| Bhopal | TELEPROTECTION 2Mbps | N°E-100-TP-002 | 1 | 2 | N°E-100-AD-001 | XCU1 | P1 | Bhopal MPPCL | N°E-101-AD-001 | XCU1 | P1 | N°E-101-TP-002 | 1 | 2 |
| Bhopal | TELEPROTECTION 2Mbps | N°E-100-TP-003 | 1 | 3 | N°E-100-AD-001 | XCU1 | P1 | Bhopal MPPCL | N°E-101-AD-001 | XCU1 | P1 | N°E-101-TP-003 | 1 | 3 |
| Bhopal | TELEPROTECTION 2Mbps | N°E-100-TP-004 | 1 | 4 | N°E-100-AD-001 | XCU1 | P1 | Bhopal MPPCL | N°E-101-AD-001 | XCU1 | P1 | N°E-101-TP-004 | 1 | 4 |
| Bhopal | TELEPROTECTION 2Mbps | N°E-100-TP-005 | 1 | 5 | N°E-100-AD-001 | XCU1 | P2 | Indore | N°E-102-AD-001 | XCU1 | P1 | N°E-102-TP-001 | 1 | 1 |
| Bhopal | TELEPROTECTION 2Mbps | N°E-100-TP-006 | 1 | 6 | N°E-100-AD-001 | XCU1 | P2 | Indore | N°E-102-AD-001 | XCU1 | P1 | N°E-102-TP-002 | 1 | 2 |
| Bhopal | TELEPROTECTION 2Mbps | N°E-100-TP-007 | 1 | 7 | N°E-100-AD-001 | XCU2 | P1 | Jabalpur | N°E-103-AD-001 | XCU1 | P1 | N°E-103-TP-001 | 1 | 1 |
| Bhopal | TELEPROTECTION 2Mbps | N°E-100-TP-008 | 1 | 8 | N°E-100-AD-001 | XCU2 | P1 | Jabalpur | N°E-103-AD-001 | XCU1 | P1 | N°E-103-TP-002 | 1 | 2 |
| Bhopal | HOTLINE | N°E-100-AD-001 | 11 | 1 | N°E-100-AD-001 | XCU1 | P1 | Bhopal MPPCL | N°E-101-AD-001 | XCU1 | P1 | N°E-101-AD-001 | 11 | 1 |
| Bhopal | HOTLINE | N°E-100-AD-001 | 11 | 2 | N°E-100-AD-001 | XCU1 | P2 | Indore | N°E-101-AD-001 | XCU1 | P1 | N°E-101-AD-001 | 11 | 2 |
| Bhopal | HOTLINE | N°E-100-AD-001 | 11 | 3 | N°E-100-AD-001 | XCU2 | P1 | Jabalpur | N°E-102-AD-001 | XCU1 | P1 | N°E-102-AD-001 | 11 | 1 |
| Bhopal MPPCL | HOTLINE | N°E-101-AD-001 | 11 | 2 | N°E-101-AD-001 | XCU1 | P1 | Indore | N°E-102-AD-001 | XCU1 | P1 | N°E-102-AD-001 | 11 | 2 |
| Bhopal MPPCL | HOTLINE | N°E-101-AD-001 | 11 | 3 | N°E-101-AD-001 | XCU1 | P1 | Jabalpur | N°E-103-AD-001 | XCU1 | P1 | N°E-103-AD-001 | 11 | 2 |
| Indore | HOTLINE | N°E-102-AD-001 | 11 | 3 | N°E-102-AD-001 | XCU1 | P1 | Jabalpur | N°E-103-AD-001 | XCU1 | P1 | N°E-103-AD-001 | 11 | 3 |
| Bhopal | Data | N°E-100-AD-001 | 12 | 1 | N°E-100-AD-001 | XCU1 | P1 | Jabalpur | N°E-103-AD-001 | XCU1 | P1 | N°E-103-AD-001 | 12 | 1 |
| Bhopal | Data | N°E-100-AD-001 | 12 | 2 | N°E-100-AD-001 | XCU1 | P1 | Jabalpur | N°E-103-AD-001 | XCU1 | P1 | N°E-103-AD-001 | 12 | 2 |

B.D.T.C.L.
CAT - I: INFORMATION PROVIDED HAVE BEEN NOTED.
Signed: .....
Date: 25/04/2013 .....
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DRAWING NO. : 5429PS060-BHO-E-SYD-CAB-0126 R0

6

Y = 750537000E
X = -2590609000N

Y= 750481881E
X= -2590517504N

Y= 750454634E
X= -2590417638N

Y= 750427923E
X= -2590522284N

Y= 750249221E
X= -2590365204N

Y= 750225210E
X= -2590469850N

Y= 750008942E
X= -2590359604N

Y= 749995986E
X= -2590401927N

Y= 749990661E
X= -2590342270N

Y= 749994457E
X= -2590388872N

EXCAVATION AREA

(3x80MVAR) L/R INDORE LINE

(3x80MVAR) L/R JABALPUR LINE

(3x80MVAR) BUS REACTOR

FUTURE LINE

MAIN BUS-I

MAIN BUS-II

ICT-I

ICT-II

ICT-III

SPARE ICT

COVERD STORE SHED

OPEN STORE AREA

BHOPAL LINE-1

BHOPAL LINE-2

FUTURE LINE-1

FUTURE LINE-2

RECEIPT BAY WIDTH 12M

3.75M WIDE ROAD

DETAIL-T

DETAIL-U

DETAIL-V

DETAIL-W

DETAIL-X

DETAIL-Y

DETAIL-Z

DETAIL-A

DETAIL-B

DETAIL-C

DETAIL-D

DETAIL-E

DETAIL-F

BMK-1

BMK-2

BMK-3

BMK-4

BMK-5

BMK-6

BMK-7

BMK-8

BMK-9

BMK-10

BMK-11

BMK-12

ACK-

LVL 109.5

LVL 110.2

LVL 111

LVL 111.25

LVL 112.8

LVL 113.5

LVL 115.3

LVL 117.8

LVL 120.3

LVL 122.8

LVL 125.3

LVL 127.8

LVL 130.3

LVL 132.8

LVL 135.3

LVL 137.8

LVL 140.3

LVL 142.8

LVL 145.3

LVL 147.8

LVL 150.3

LVL 152.8

LVL 155.3

LVL 157.8

LVL 160.3

LVL 162.8

LVL

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DRAWING NO. : 5429PS060-BHO-C-SYD-EAR-0202

DF009

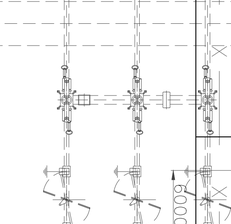



## 400kV LEGEND & BOQ OF EARTHMAT (TABLE NO-1)

| S.NO. | DESCRIPTION | UOM | TOTAL QTY |
|---|---|---|---|
| 1. | 32MM DIA MS ROD FOR MAIN EARTHMAT | mtrs | 3598 |
| 2. | 3m LONG ROD ELECTRODE OF 32MM DIA WITH UNTREATED EARTH PIT | NOS. | 44 |
| 3. | 3m LONG PIPE ELECTRODE OF 32MM DIA WITH TREATED EARTH PIT | NOS. | 02 |

## ROD ELECTRODE (TABLE NO-2)

| S.NO. | DESCRIPTION | UOM | TOTAL QTY |
|---|---|---|---|
| 1. | (LA) E67 TO E82 | NOS. | 16 |
| 2. | (CVT) E83 TO E94 | NOS. | 12 |
| 3. | (PEAK TOWER) E95 TO E110 | NOS. | 16 |




AUXILIARY EARTHMAT

## NOTES

1. THE EARTHMAT SHALL BE MADE WITH 32mm DIA MS ROD.
2. EARTHING CONDUCTORS SHALL BE BURIED 600mm BELOW FGL UNLESS OTHERWISE SPECIFIED.
3. WHEREVER EARTHING CONDUCTOR CROSS CABLE TRENCH UNDER GROUND SERVICES DUCTS PIPES, TUNNELS, RAILWAY TRACKS ETC. IT SHALL BE LAID ATLEAST 300mm BELOW THEM AND SHALL BE REROUTED IN CASE IT FOULS WITH EQUIPMENT/STRUCTURE FOUNDATION.
4. EARTHING CONDUCTORS CROSSING THE ROAD SHALL BE LAID AT 1m DEPTH FROM FGL.
5. ALL GROUND CONNECTIONS SHALL BE MADE BY ELECTRIC ARC WELDING. ALL WELDED JOINTS SHALL BE ALLOWED TO COOL DOWN GRADUALLY TO ATMOSPHERIC TEMPERATURE BEFORE PUTTING ANY LOAD ON IT. ARTIFICIAL COOLING SHALL NOT BE ALLOWED.
6. ALL EQUIPMENT & STRUCTURES SHALL BE GROUNDED AS PER EQUIPMENT EARTHING PHILOSOPHY ie : DOC NO 5429PS060-BHO-E-SYD-EAR-0203
7. THE LOCATION OF EARTHING CONDUCTOR, EARTHPITS AND GROUND RODS ARE INDICATIVE AND MAY BE MODIFIED TO SUIT SITE CONDITION.
8. EARTHING CONDUCTOR SHALL BE BURRIED 2000MM OUTSIDE THE SWITCHYARD FENCE. AND ALL THE GATES EVERY ALTERNATE POST OF FENCING SHALL BE CONNECTED TO MAIN EARTHING GRID.
9. FIRE FIGHTING PIPE LINE AND ANY OTHER PIPING SYSTEM RUNNING THROUGH THE 765kV YARD SHALL BE GROUNDED WITH 765kV YARD EARTHMAT.
10. EARTHING LAYOUT FOR SWITCHYARD BUILDINGS SHALL BE SUBMITTED SEPARATELY.
11. AUXILIARY EARTH MAT SHALL BE 1500X1500 SPACING OF 300MM
12. MINIMUM SPACE BETWEEN TWO EARTH ELECTRODES SHALL BE 6MTRS
13. @ICT TERTIARY, LT YARD DETAILED EARTHING LAYOUT TO BE SUBMITTED SEPARATELY
14. THE PIT NUMBERS SHALL BE WRITTEN BOLDLY ON THE EARTH PIT AS PER THE LAYOUT AND TABLE NO-2

AS-BUILT

ALL DIMENSIONS ARE IN MM

| REFR. DRG. NO. | DESCRIPTION |
|---|---|
| 5429PS060-BHO-C-SYD-ARR-1053 | 400kV FOUNDATION LAYOUT FOR BHOPAL SUBSTATION |
| 5429PS060-BHO-C-SYD-AAR-1000 | COMBINED ELECTRICAL LAYOUT PLAN FOR 765/400kV BHOPAL SUBSTATION. |
| 5429PS060-BHO-C-SYD-AAR-0001 | 765/400kV LAYOUT PLAN & SECTION FOR BHOPAL SUBSTATION |
| 5429PS060-BHO-C-SYD-ARR-1051 | 400kV STRUCTURAL LAYOUT FOR BHOPAL SUBSTATION. |

| REV. | DESCRIPTION | DRAWN | CHECKED | APPROVED | STATUS |
|---|---|---|---|---|---|
| R1 | REVISED AS PER CUSTOMER COMMENTS | KSV 14.03.13 | DPK 14.03.13 | PTK 14.03.13 | FOR APPROVAL |
| R0 | FIRST ISSUE | KSV 22.02.13 | DPK 22.02.13 | PTK 22.02.13 | FOR APPROVAL |

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

TITLE: 400kV EARTHMAT LAYOUT OF BHOPAL SUBSTATION

A0 | SCALE 1:275 | ALSTOM T&D INDIA LTD. (Formerly AREVA T&D INDIA LTD) A-7, SECTOR-65, NOIDA - 201301 UTTAR PRADESH (INDIA).

DRAWING NO.: 5429PS060-BHO-C-SYD-EAR-0202 | SHEET NO 002 | 002

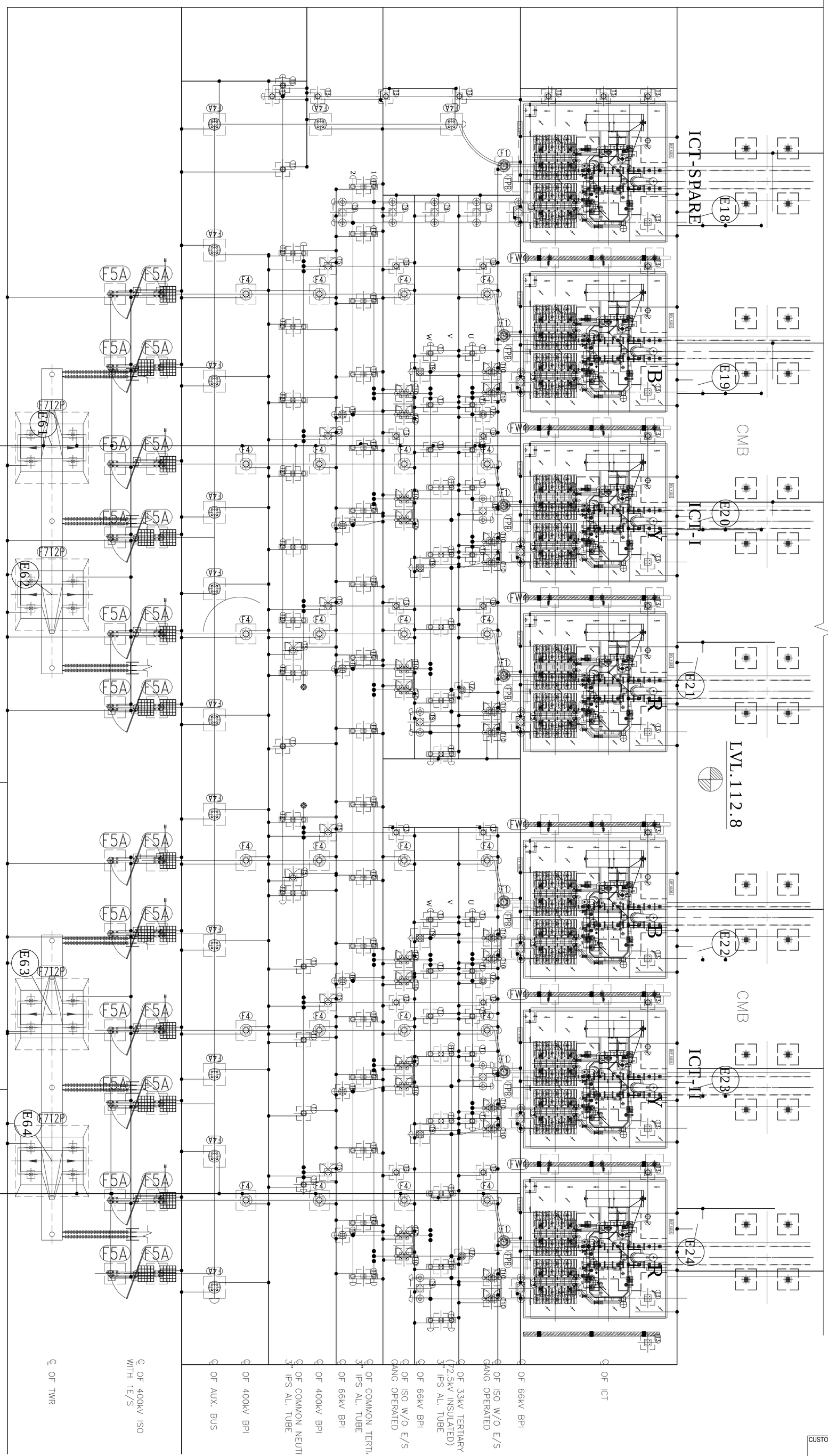
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DRAWING NO.:5429PS060-BHO-C-SYD-EAR-0204

DF009

℄ OF TWR
℄ OF 400kV ISO WITH 1E/S
℄ OF 400kV AUX. BUS
℄ OF 400kV BPI
℄ OF 400kV BPI
℄ OF 400kV BPI
℄ OF 400kV LA BPI
℄ OF TRAFO

8000 | 7500 | 3000 | 7000 | 8100 | 7900 | 1600 | 10000




1500 | 300 (TYP) | 1500

AUXILIARY EARTHMAT

℄ OF TWR
℄ OF 400kV ISO WITH 1E/S
℄ OF AUX. BUS
℄ OF 400kV BPI
℄ OF COMMON NEUTL 3" IPS AL. TUBE
℄ OF 400kV BPI
℄ OF 66kV BPI
℄ OF COMMON TERTL 3" IPS AL. TUBE
℄ OF ISO W/O E/S GANG OPERATED
℄ OF 66kV BPI
℄ OF 33kV TERTIARY (72.5kV INSULATED) 3" IPS AL. TUBE
℄ OF ISO W/O E/S GANG OPERATED
℄ OF 66kV BPI
℄ OF ICT

AS-BUILT

ALL DIMENSIONS ARE IN MM

| REFR. DRG. NO. | DESCRIPTION |
|---|---|
| 5429PS060-BHO-C-SYD-EAR-0202 | 765kV EARTHMAT LAYOUT OF BHOPAL (Sh-1) |
| 5429PS060-BHO-C-SYD-ARR-1053 | 765kV FOUNDATION LAYOUT FOR BHOPAL |
| 5429PS060-BHO-C-SYD-AAR-1000 | COMBINED LAYOUT PLAN FOR 765/400kV BHOPAL |
| 5429PS060-BHO-C-SYD-AAR-0001 | 765/400kV LAYOUT PLAN & SECTION FOR BHOPAL |

| REV. | DESCRIPTION | DRAWN | SIGN | CHECKED | SIGN | APPROVED | SIGN | STATUS |
|---|---|---|---|---|---|---|---|---|
| R0 | FIRST ISSUE | Name KSV Date 21.03.13 | | Name DPK Date 21.03.13 | | Name PTK Date 21.03.13 | | FOR APPROVAL |

CUSTOMER: BHOPAL DHULE TRANSMISSION COMPANY LTD

OWNER'S ENGINEER: KNR ENGINEERS (INDIA) PVT. LTD.

PROJECT: SYSTEM STRENGTHENING SCHEME OF WR.

CONTRACT: LOI NO. BDTCL/2011-12/LOA-SUBSTATIONS/004 DATED 28-07-2011

TITLE: TRANSFORMER YARD EARTHMAT LAYOUT OF BHOPAL SUBSTATION

A1 | SCALE 1:200

ALSTOM T&D INDIA LTD. (Formerly AREVA T&D INDIA LTD) A-7, SECTOR-65, NOIDA – 201301 UTTAR PRADESH (INDIA).

DRAWING NO.: 5429PS060-BHO-C-SYD-EAR-0204 | SHEET NO 001 | 001