1.0 Scope

This electrical design basis defines the design requirements agreed by owner/clients in addition to EIL standard design philosophy for electrical facilities specification no: 6-51-0099 Rev-6.

In case of any conflict between statutory requirements, this design basis and standard design philosophy, the most stringent requirement shall govern.

2.0 Abbreviations, Codes & Standards / Publications

2.1 Abbreviations

Code	Description
AC	Alternating Current
ACB	Air Circuit Breaker
ASB	Auxiliary Service Board
CBCT	Core Balance Current Transformer
CEA	Central Electricity Authority
CPWD	Central Public Works Deaprtment
CT	Current Transformer
DC	Direct Current
DCP	Data Concentrator Panel
DG	Diesel Generator
DOL	Direct On Line
ELCB	Earth Leakage Circuit Breaker
EPCC	Emergency Power Control Centre
EPMCC	Emergency Power cum Motor Control Centre
FRLS	Flame Retardant Low Smoke
GI	Galvanised Iron
HMI	Human Machine Interface
HV	High Voltage
IEC	International Electro-Technical Commission
LDB	Lighting Distribution Board
LV	Low Voltage
MCC	Motor Control Centre
MCCB	Moulded Case Circuit Breaker
MOV	Motor Operated Valve
MV	Medium Voltage
NA	Not Applicable
OCTC	Off Circuit Tap Changer
PCC	Power Control Centre
PLC	Programmable Logic Control
PMCC	Power Cum Motor Control Centre
PRP	Parallel Redundancy Protocol
PT	Potential Transformer
PVC	Poly Vinyl chloride
RCC	Reinforced Cement Concrete
RSTP	Rapid Spanning Tree Protocol
SFU	Switch Fuse Unit
SPN	Single Phase & Neutral
TP	Three Phase
TPN	Three Phase & Neutral
UPS	Uninterrupted Power Supply
VFD	Variable Frequency Drive
XLPE	Cross Linked poly Ethylene

2.2 Codes & Standards / Publications

The main codes and standards, considered as minimum requirements, as applicable, are as follows -

S. No.	Description	Standards / Codes	Edition
1	General requirements for silos for Grain storage, Part-I, Constructional Requirements	IS-5503-I	Latest
2	General requirements for silos for Grain storage, Part-II, : Grain Handling Equipment and Accessories	IS-5503-II	Latest
3	Outdoor Distribution Transformers of ratings up to & including 100KVA, for use on systems with nominal system voltages up to & including 11kV	IS-1180	Latest
4	Code of practice for the fire safety of buildings - Electrical Installations.	IS-1646	Latest
5	Code of practice for selection: installation and maintenance of automatic fire detection and alarm system.	IS-2189	Latest
6	Code for protection against lightning.	IS/IEC-62305	Latest
7	Code of practice for fire safety of industrial buildings - Electrical generating and distributing stations.	IS-3034	Latest
8	Code of practice for Earthing.	IS-3043	Latest
9.	Code of practice for Interior Illumination.	IS-3646	Latest
10	Application guide for Insulation Coordination.	IS-3716	Latest
11	Guide for safety procedures and practices in electrical work	IS-5216	Latest
12	Code of practice for Industrial Lighting.	IS-6665	Latest
13	Guide for Control of undesirable static electricity.	IS-7689	Latest
14	Guide for improvement of power factor - consumer's installations.	IS-7752	Latest
15	Energy Efficient Induction Motors – Three Phase Squirrel Cage	IS-12615	Latest
16	Reference ambient temperature for electrical equipment	IS-9676	Latest
17	Code of practice for selection, installation and maintenance of transformer.	IS-10028	Latest
18	Code of practice for selection, installation and maintenance for switchgear and control gear.	IS-10018	Latest
19	Application guide for Power Transformer.	IS-10561	Latest
20	Voltage bands for electrical installations including preferred voltages and frequencies.	IS-12360	Latest
21	Guide for short circuit calculations in three phase AC systems.	IS-13234	Latest
22	National Electrical Code (NEC) - BIS Publication.	SP-30	Latest
23	Electrical Apparatus for use in the presence of combustible dust	IS/IEC-61241	Latest

3.0 General/ Design Considerations

1)	LV - Low Voltage. The voltage which does not normally exceeds 250 V.
2)	MV - Medium Voltage. The voltage which normally exceeds 250 V and does not exceeds 650 V.
3)	HV - High Voltage. The voltage which normally exceeds 650 V but does not exceed 33 kV.

4.0 Site conditions

4.1 Equipment design temperature (IS-9676) :45°C

4.2 Minimum /Maximum Ambient Temperature :1.0°C/ 46.1°C

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

4.3	Relative Humidity	:85%
4.4	Soil Resistivity	: As per Soil investigation report or 20 Ohm-m(min) whichever is maximum
4.5	Minimum temperature for battery sizing	:10°C
4.6	Altitude above mean sea level	: Less than 1000m above mean sea level
4.7	Seismic Zone	:As per IS-1893

5.0 Power Source Details

5.1 **General**

Independent system or existing system : Independent/Existing system $

5.2 **Grid Supply**

5.2.1	Name of sub station	:	**$**
5.2.2	Number of feeders	:	1
5.2.3	Length of feeder	:	**$**
5.2.4	Type /size of conductor/ cable size	:	$ mm²
5.2.5	Voltage	:	11 kV ± $ %
5.2.6	Frequency	:	50 Hz ± 3 %
5.2.7	Maximum fault level	:	$ kA for $ sec
5.2.8	Minimum fault level	:	**$**
5.2.9	Design fault level	:	$ kA for $ sec
5.2.10	Basic Insulation Level	:	$ kV
5.2.11	System neutral Earthing	:	**$**
5.2.12	Minimum load power factor	:	$
5.2.13	Parallel operation of incomers	:	NA
5.2.14	PLCC requirement	:	~~Yes~~/No

5.3 **Emergency generator**

5.3.1	Number of emergency generators	: 1
5.3.2	Type of emergency generators	: Diesel
5.3.3	Generator rating/Voltage/Power factor	: @ KW/415V / 0.8
5.3.4	Parallel operation with other sources	:No, Except Momentary paralleling with grid power supply for transfer of power from emergency to normal
5.3.5	Type of starting	: Auto / ~~Manual~~
5.3.6	Centralised DG set	: Yes /~~No~~
5.3.7	Location of generator set	: 1 No. at Centralised location

Note: The rating of emergency DG set shall be finalized during detailed engineering. The emergency DG set shall cater to emergency loads of various utilities, emergency lighting etc.

6.0 Power Supply Distribution System

6.1 **Voltage and frequency variation**

6.1.1	AC System		
	Voltage	:	11 KV / 415 V ± 10%
	Frequency	:	50Hz ± 3%
6.1.2	DC System (at system output terminal)		

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

	Electrical protection and Control system.	:	110V ±10 %
	DC critical Lighting system	:	110V ±10 %
6.2	**Utilisation voltage**		
6.2.1	Primary HV distribution voltage	:	11kV
6.2.2	Secondary MV distribution voltage	:	415V
6.2.3	Primary HV distribution system neutral Earthing	:	$
6.2.4	Secondary MV distribution system neutral Earthing	:	Solidly earthed for 415V
6.2.5	HV motor voltage (KW more than 160KW)	:	NA
6.2.6	MV motor voltage (0.18≤KW ≤160)	:	415 V AC
6.2.7	AC Motors rated below 0.18 KW (except MOVs)	:	240V AC 1Ph/415V 3Ph
6.2.8	DC Motor	:	As per manufacturer standard design
6.2.9	Motor operated valves	:	415V AC, 3 Ph
6.2.10	Battery chargers incoming power supply	:	415V AC, 3 Ph
6.2.11	UPS System incoming power supply	:	415V AC, 3 Ph
6.2.12	AC Lighting/Power Panels	:	415V AC, 3 Ph
6.2.13	Auxiliary Boards incoming power supply	:	415V AC, 3 Ph
6.2.14	Welding Receptacles	:	415V AC, 3 Ph
6.2.15	Bulk loads like Process Heaters etc.	:	415V AC, 3 Ph
6.2.16	Normal Lighting/Emergency Lighting	:	240V AC, 1 Ph
6.2.17	Convenience outlets	:	240V AC, 1 Ph
6.2.18	LAN	:	240V AC, SPN, UPS
6.3	**Utilisation voltage for critical supplies**		
6.3.1	Switchgear protection control power supply	:	110V, DC
6.3.2	Critical lighting power supply	:	110V, DC
6.3.3	Input power supply for Public Address system	:	110VAC UPS
6.3.4	Input power supply for Fire alarm system	:	240VAC (with dedicated battery backup)
6.4	**Power factor improvement capacitors**	:	At 415V PMCC, Automatic Power Factor Correction
6.4.1	Minimum Power Factor To be maintained at Transformer primary	:	0.95

7.0 Control -Protection - Metering

7.1 Control Philosophy

7.1.1	Numerical Protection/Monitoring system for	
a	11kV Switchboard	:Yes / ~~No~~
b	415V PMCC/EPMCC	:Yes (For incomers & outgoing breaker feeders)
7.1.2	Control and logic through numerical relays	:Yes ~~/ No~~
7.1.3	Hard wired annunciation panel	: ~~Yes~~ / No
	Type of annunciation panel	:~~Hard wired/HMI/Part of SCAP~~
7.1.4	Method of motor starting	
a	MV Motors	:Direct on line/Soft Starter if required

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

7.2 **Type of power isolation for transformers**

7.2.1 Push button in transformer bay for tripping breaker : Yes

7.2.2 Local Isolating breaker panel with protection relay and metering : Yes

7.3 **Relay protection system**

7.3.1 Protection devices for power distribution system shall be as indicated below (Figure inside bracket refers to note below) √ Applicable

RELAY DESCRIPTION	RELAY NUMBER	HV TRANSFORMER FEEDER	OUTGOING BREAKER FEEDER	INCOMER	
		(SECONDARY WINDING VOLTAGE ≤ 0.433 KV)	MV PCC/ PMCC	HV	MV PCC /PMCC
IDMTL over-current relay	51	√	√	√ (1)	√
IDMTL earth-fault relay	51N	√	√	√ (1)	√
51G backup earth-fault relay (secondary neutral)	51G	√	-	√	-
Motor protection relay with (50, 50N,46, 49, 50L/R,86,95)	99	-	√ (3)	-	-
Instantaneous restricted earth-fault relay (secondary side)	64R	-	-	-	-
Instantaneous over-current relay	50	√	-	-	-
Instantaneous earth-fault relay	50N	√	-	-	-
Differential protection relay	87	-	-	-	-
High speed tripping relay	86	√(15)	√(15)	√(15)	√(15)
Trip circuit supervision relay	95	√ (5)	-	√ (5)	√(5)
Transformer auxiliary relay	63	√	-	-	-
Under-voltage relay with timer	27/2	-	-	√	√
Check synchronisation relay	25	-	-	√ (7)	√(7)

Notes:

1. In case of HV switchboards with continuous parallel operation of incomers, following additional relays shall be provided:
   a. One set of 87B (Bus differential) and 95 B (Bus wire supervision) for each bus section.
   b. 67 and 67N (Directional IDMTL over current and earth fault) relays for the incomers.
2. Instantaneous earth fault (50N) shall be provided only for transformer with delta primary.
3. For motor feeders rated above 55 kW.
4. For critical/long feeders and plant feeders connected to main power generation and distribution bus. A plant feeder implies outgoing feeders from one switchboard to another switchboard of same voltage level.
5. Trip circuit supervision relay 95 shall be provided as part of the numerical relay for feeders wherever numerical relays are provided.
6. Wherever auto-transfer feature is provided.

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

7. For switchgears where continuous or momentary paralleling of Incomers is envisaged, check synchronising relay shall be provided.
8. 51G and 64R relays shall not be provided for input transformer of VFD system.
9. MV capacitor bank feeders shall be provided with 51, 51N, 59 (over voltage) and 86 relays.
10. The following feeders shall be provided with timers for delayed tripping on bus under voltage while the under voltage relay shall be common for the bus
    a. MV capacitor feeders
    b. HV and MV breaker controlled motor feeders
    c. Contactor controlled motor feeders with DC control supply.

    Numerical relays where ever provided for motor and capacitor feeders shall use in built under voltage relay and timer for delayed tripping on bus under voltage.
11. One no. DC supply supervision relay (80) shall be provided for each incoming DC supply to the switchboard.
12. One set of bus differential relays (87B) and bus wire supervision relay (95 B) for each bus section shall be provided for HV switchboards connected directly to generation buses
13. In case of numerical relays, all relays shall be comprehensive units including all protection, metering and control unless otherwise specified.
14. Under voltage and over voltage along with associated timer shall be part of the numerical relays.
15. Auto changeover logic between Incomers and bus coupler shall be built in the numerical relay.
16. Master Trip relay (86) shall be Electro-Mechanical type
17. 2 Nos. of 86 relays shall be considered for MV motor rated more than 55KW.
18. Breaker control switch shall be hardwired type.
19. Stand by earth fault relay 51G shall be provided in the incomer of switchboard fed from transformers and transformer/switchboard located remotely from HV substation.
20. Relay 51V voltage controlled over current relay shall be provided on specific requirement considering the rating of the outgoing feeders with respect to the Incomer rating. Generally this relay shall be provided wherever CT primary current of outgoing feeders is exceeding 40% of the CT primary current of the Incomer.
21. DG set shall be provided with protection but not limited to 51V,51G,40,46,86,95,80 , 64R etc for generator rated above 500KVA and Generator rated less than 500KVA shall have 51V,51G,40,46,86,95,80 unless otherwise agreed with the owner. The protective relay shall be numerical type.

7.4 Metering

The metering devices in HV and MV switchboards shall be as below:

Type of metering : Analogue/As part of the Numerical relay

FEEDER TYPE	A	V	Hz	PF	MW	MWH	HM	MVAR	MVAH	MVA
HV Incomer	√	√	√	√	√(2)	√	-	√(2)	√(2)	√(1,2)
HV Bus Tie	√	-	-	-	-	-	-	-	-	-
HV Transformer	√	-	-	-	√	√	-	-	-	-
HV Bus P.T.	-	√	-	-	-	-	-	-	-	-
Capacitor	√	√						√		
PCC/PMCC Incomer	√	√	-	√	-	√ kWh	-	-	-	-
PCC/PMCC Bus Tie	√	-	-	-	-	-	-	-	-	-
PCC Bus P.T.	-	√	-	-	-	-	-	-	-	-
ACB Outgoing (Non motor)	√	-	-	-	-	√ kWh	-	-	-	-
MV Motor (≥55kW)	√	-	-	-	-	-	-	-	-	-

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

FEEDER TYPE	A	V	Hz	PF	MW	MWH	HM	MVAR	MVAH	MVA
ASB Incomer	√	√	-	-	-	-	-	-	-	-
MCCB/SFU O/G(250A)	√	-	-	-	-	√kWh	-	-	-	-
LDB Incomer	√	√	-	-	-	√kWh	-	-	-	-
DG Set	√	√	√	√	√kW	√kWh	√	√	-	-

Notes:

1. MVA meter in HV external power supply Incomers shall include maximum demand indication also.
2. MW, MVAR, MVA, MVAH meters shall be provided for HV external power supply Incomers only.
3. Field Ammeters are to be provided for all motors rated above 5.5kW.
4. All metering shall be part of numerical relay in case of electrical system is having numerical relays. Energy meters where provided separately shall be digital type.

8.0 Substation Design

8.1 Substation feature

	Description	MV	MCC/Electrical Room
8.1.1	Elevated with trays in cable cellar	~~Yes~~/No	~~Yes~~/No
8.1.2	Raised with internal trenches	Yes/~~No~~	Yes/~~No~~
8.1.3	Pressurisation against ingress of dust	Yes/~~No~~	~~Yes~~/No
8.1.4	Air-conditioned room for operator	Yes/~~No~~	~~Yes~~/No
8.1.5	Roof slab for Distribution transformer	~~Yes~~/No	NA

8.2 Specific Equipment Locations

8.2.1	Batteries in substation and control Rooms	:Separate room
8.2.2	Battery charger in substation	:~~Air conditioned~~ /non air conditioned room
8.2.3	Battery charger in control room	:Air conditioned ~~/non air conditioned room~~
8.2.4	Variable speed drive panels	:Air-conditioned room
8.2.5	Thyristor controlled panels	:Air-conditioned room
8.2.6	UPS System	:Air conditioned room in control room
8.2.7	Location of VRLA battery	: Air conditioned room

Notes:1. Battery room shall be preferably located in corner side at switchgear floor of the substation building
2. Heat detectors installed in battery room shall be of intrinsically safe type

9.0 Equipment Design

9.1 HV Switchboard

9.1.1	Execution	: Draw out for 11kV
9.1.2	Type of switchgear	: Air insulated for 11kV
9.1.3	Circuit breaker type	: Vacuum for 11 kV

9.2 Current Transformer (CT)/potential Transformer (PT)

9.2.1	CT Secondary	
a	General Protection	:1A
b	Special protection(51G etc)	:1A
c	Metering	:1A for conventional and remote metering

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

9.2.2	PT Secondary	:110 V AC

Note: CT for metering shall be separate from the protection CT and no interposing CT shall be provided in the protection CT secondary circuit for metering purpose

9.3 Transformers (distribution)

	Transformer	Voltage ratio	Vector group	Cooling	Tap changer
9.3.1	Dedicated (e.g. for VFD)	As required	As Reqd.	AN	Off-circuit
9.3.2	Distribution transformer (≤ 2000 KVA)	11/.433kV	Dyn 11	ONAN	OLTC +5%, -15%

Note : Soak pit shall be provided for oil filled transformers as per following condition:

a)	Oil qty< 2000 lit	:	Not Reqd
b)	2000lit<Oil qty<9000 lit	:	Soak pit

9.4 MV Switchboard

9.4.1	**Execution**	
9.4.1.1	PMCC/ EPMCC	
a	Breaker panels	:Draw out, Single front
b	Contactor feeders	:Draw out, ~~single front~~ / Double front
9.4.1.2	LDB	:Draw out /~~Fixed, single front~~/Double Front
9.4.1.3	Motors	
	PMCC / EPMCC	:Up to160 kW
9.4.1.4	Type of switchboard for small package (AC system, Pressurisation system ,Bagging plant etc)	:Compartmentalised and Fixed type / ~~Non Compartmentalised and Fixed type~~

9.5 Medium voltage Motor Starter Type

9.5.1	Contactor and switch fuse with overload relay	:Up to 22KW
9.5.2	Contactor, switch fuse and overload relay with CBCT for earth fault protection	:Above 22Kw up to 55 Kw
9.5.3	Air circuit breaker with motor protection relay	:Above 55 KW up to 160 KW

Note : 4 pole ACB for PMCC/EPMCC incomers, and DG circuit breaker shall be provided.

9.6 Medium voltage Outgoing feeder Type

9.6.1	Switch fuse	:Up to 100A
9.6.2	Switch fuse with Contactor and CBCT for earth fault protection	:More than 100A and up to 250A
9.6.3	Air Circuit Breaker with protection relay	: More than 250 A

Note: R-C Circuit across power contactor and low-burden auxiliary contactor for receiving start/stop command from field shall be provided in all DOL start feeders.

9.7 Motor Controls

: As per operating philosophy, process and inst. Design basis-

9.7.1	Auto / Manual switch	:~~Near motor/Switchgear~~/control room-@

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

9.7.2	Local/remote switch	:Near motor/~~Switchgear/control room~~ @
9.7.3	Process interlock	:DCS/PLC /~~switchgear~~

9.8	**Control supply voltage**	
9.8.1	Breaker control	: 110V DC
9.8.2	Breaker spring charging	: 110V DC
9.8.3	Contactor feeder	: 240V AC
9.8.4	Control supply for earth fault relay in contactor feeder	: 110V DC
9.8.5	Control supply for contactor motor starter	: Control transformer

9.9	**Motors**	**415 volts**
9.9.1	Enclosure	
	Indoor	IP65
	Outdoor	IP65
9.9.2	Insulation class	F (Temp. Rise limited to B)
9.9.3	Anti-condensation heater	30 kW and Above
9.9.4	Additional canopy (outdoor motors)	Yes
9.9.5	Design voltage variation	± 10 %
9.9.6	Design frequency variation	± 3 %
9.9.7	Combined voltage / frequency variation (Design)	± 10 %

Note:

1) All MV motors shall be energy efficient IE2 type as per IS-12615:2011
2) For enclosure protection for motors located in dust-laden atmospheres refer clause no. 14.8

9.10	**UPS System**	
9.10.1	Redundancy	:Single UPS with Bypass
9.10.2	Back-up time	:30 minutes
9.10.3	Bypass transfer control	:Auto / Manual
9.10.4	Separate fault diagnostic unit	:Yes/No (Note-2)
9.10.5	Battery type	:Lead acid (2 x 50% configuration)

Notes-

1. UPS for data communication system and CFAP of FA system shall be non-redundant single UPS with bypass type and with VRLA battery.
2. Separate FDU is not required in case UPS system is serial connected to HMI and fault diagnosis can be done from HMI

9.11	**Communication System**	
9.11.1	Public Address System	: Yes/~~No~~
9.11.2	Telephone System	: Yes/~~No~~
9.11.3	Telephone system and Public Address system	:Separate/~~Integrated~~
9.11.4	Telephone system and Data communication LAN system	:Separate/~~Integrated~~

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

9.11.5	No. of external lines	: $,@
9.11.6	No. of Intercom lines	: @
9.11.7	Interface of Communication system	
a	With fire alarm system	:Yes/~~No~~
b	With telephone system	:Yes/~~No~~

9.12 Fire Detection and Alarm System

9.12.1	Type	: Analogue addressable
9.12.2	Name of buildings to be provided with Detectors	: Sub-Stations, Control Rooms, office, canteen, laboratory etc.
9.12.3	Detection System	:Break Glass, multi sensor detector
9.12.4	Type of manual call point	:~~With~~/Without call back facility
9.12.5	Qty of Siren and location	: Adequate to cover the entire complex@
9.12.6	Power supply for Siren	: 415V AC
9.12.7	Siren range	: 5km (Diametrically)

9.13 DC System

9.13.1	Battery type	
a	Switchgear Protection Control and critical lighting	:Lead acid
b	Diesel Engine Starting	:Lead acid
c	DC Motors	:As per equipment supplier recommendation
d	Fire alarm system	:VRLA
e	Telephone system	:VRLA
f	Data communication LAN system	:VRLA
9.13.2	Battery backup time	
a	Switchgear Protection and Control	:120 minute
b	DC Critical lighting	:120 minute
c	Diesel Engine Starting	:10 starts (FW pumps) & 6 starts (others)
d	DC Motors	: As per equipment supplier recommendation
9.13.3	Battery Configuration	: 2 x 50%

9.14 Variable frequency drive

9.14.1	By pass feature required	:Yes

9.15 Cables

The power and control cables shall have the following minimum cross sectional areas:

9.15.1	Medium voltage power cable	: From 2.5 mm² up to 16 mm² -Copper, Above 16 mm² -Aluminium
9.15.2	Control cables	:1.5 mm² (Copper)
9.15.3	Lighting	:2.5 mm² (Copper)
9.15.4	Communication system	:0.9 mm dia (Copper)
9.15.5	Telephone system	:0.9 mm dia (Copper)
9.15.6	Fire alarm system	:1.5 mm² (Copper)

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

Notes:

1. For lighting inside the building, minimum 1.5 mm² copper conductor, PVC Insulated wire shall be used in conduit system (for circuit and point wiring), with proper colour coding.
2. Communication system, Telephone system and Fire alarm System cable sizes are indicative only and these shall be finalised as per the recommendations of equipment manufacturers. However minimum conductor size shall be as mentioned above.
3. Special cable type and size shall be decided on specific requirement.
4. Control cable shall be twisted pair overall shielded type.
5. All cables shall be with FRLS outer sheath.

10.0 Cabling System

10.1 Cable details

Design Criteria	High voltage	415 volts
Loads located beyond 1000 m	Cable	Cable
Loads beyond 1000A rating and located near the transformer.	NA	Bus duct /cable
Recommended limiting size of multi-core cable (mm²)	300 (for 3 core cable)	300 (for 3/3.5 core cable)
Short-circuit withstand time (seconds)	0.6 sec	Not Applicable
Insulation voltage grade	Unearthed for 11 kV	Earthed
Type of cable insulation	XLPE	PVC
Conductor	Al	As per cl. No. 9.16.1
No. of cores for motor cables	NA	3

10.2 Cable laying philosophy

10.2.1	Process area	:Above Ground cable tray /RCC trench
10.2.2	Offsite paved area	:Above Ground cable tray/RCC trench
10.2.3	Offsite unpaved area	: Above Ground cable tray/RCC trench.
10.2.4	Type of cable trays	:Galvanized prefabricated
10.2.5	Road Crossings for underground cables	:PVC Pipes /Cable culvert

Note: Plant communication, fire alarm and telephone cables shall be laid in overhead cable trays / instrumentation trenches as far possible. In case these are not available. Cable shall be laid along berm of the roads.

11.0 Earthing System

11.1	Earth electrode	:GI pipe
11.2	Main earth loop material	:GI strip
11.3	Substation earth loop	:GI strip

Note: For Electronic Earthing, copper plates shall be used as earth electrode. Electronic earthing shall not be interconnected with power equipment earthing.

12.0 Lighting System

12.1 Supply System

12.1.1	Centralised with Lighting distribution board-LDB	:Yes
12.1.2	LDB at substation	:Yes
12.1.3	Normal & Emergency Lighting transformer required	:Yes

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

12.1.4	Lighting transformer voltage ratio	:415/415V
12.2	**Control Philosophy**	
12.2.1	Outdoor yard	:Auto/Manual/centralised/Local
12.2.2	Street lighting	:Auto/Manual/centralised/Local
12.2.3	Outdoor process area	:Auto /Manual/Centralised /Local
12.2.4	Process building	:Auto/Manual/centralised/Local
12.2.5	Auto control	:Synchronous timer/photocell/
12.2.6	Lamp type for Outdoor General Lighting	:HPSV
12.2.7	Lamp wattage for High Mast Lighting fixture	: 2 x 400W SON-T
12.2.8	Lamp type for DC critical lighting	:LED
12.2.9	Lamp Type for Indoor area and Outdoor area Lighting	:LED
12.2.10	Switch ON/OFF push button at Sub-station Entry	: YES
12.2.11	ELCB for lighting circuits and lighting and Power Panels	:Yes-(in LDB /PMCC Outgoing feeders)
12.3	**AC Emergency Lighting**	
12.3.1	Name of process areas	:20-25% of normal lighting in all areas
12.3.2	Name of buildings	: 20-25% of normal lighting in all buildings (Control room, Substation, DG room, office, canteen, laboratory etc.)
12.3.3	Power supply source	:Diesel Generator
12.4	**DC Critical Lighting for Escape**	
12.4.1	Name of process units	: NA
12.4.2	Name of building	: Control room, Administration building/office, Substation, laboratory
12.4.3	Power supply	: 110V DC
12.4.4	DC lighting for remote buildings	: Lighting fixture with built in battery
12.5	**Wiring Type**	
12.5.1	Process area/ Process/Building / Shed	:Armoured cable
12.5.2	Large service building	:Surface conduit/Armoured cable
12.5.3	Buildings with false ceiling	:Surface conduit above false Ceiling, Concealed conduit below false ceiling
12.5.4	Substation (Switchgear Room)	:METSEC channel / Concealed conduit
12.5.6	Other buildings	: Concealed Conduits
12.6	**Specific Lighting Requirements**	
12.6.1	Aviation lighting	:Yes
12.6.2	Security lighting for peripheral road boundary wall	:Required
12.6.3	Type of control gear for HPMV/HPSV lamps	:Separate/~~Integral~~

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

12.6.4	Control gear box location	:Accessible level
12.6.5	Type of high mast flood light	:30 meters Telescopic tubular

NOTE:

1) For enclosure protection for Lighting equipment and wiring/cables located in dust-laden atmospheres refer clause no. 14.8

13.0 Statutory Approval

Statutory Authority for Electrical Installation: State Electrical Inspectorate / CEA

14.0 Specific requirements

14.1 Canopy shall be provided for all outdoor equipment except transformers.

14.2 No unarmoured cable shall be used.

14.3 All power cables in racks/trays shall be laid in single layer only. Further 20% spare space shall be provided in cable trays/trenches for future use.

14.4 Heat shrinkable type HV cable end termination kits shall be used.

14.5 All MV switchboards (i.e. PMCC, EPMCC, LDB etc.) in substation shall be of one make only.

14.6 Spare feeders in PMCC, EPMCC, LDB, UPS ACDB and DCDB shall be 10% for future use with minimum of 1 no. of each rating.

14.7 External hardware of lighting fixtures, CG boxes, junction boxes, welding receptacles, 230V receptacle, LCS, lighting panel, local control panel shall be of stainless steel (SS-304).

14.8 In line with clause no. 4.11.2 of IS-5503: 1969 (Part-II) "All Electrical wirings, fittings, fixtures and electric drive motors installed in dust-laden atmosphere, except in the open and in offices and similar locations so occupied and segregated as to be reasonably free from dust, shall be flame-proof."

$-data to be provided /confirmed by client.
@-Details to be finalised during detail engineering

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)	DATA SHEET HV SWITCHBOARD	Datasheet No. A951-000-16-50-DS-01 Rev : 0 [redacted]

PURCHASER'S DATA

A	**Site conditions**				
1	Maximum ambient temperature:	46.1 Deg c	3	System Breaking capacity	40 kA
2	Minimum ambient temperature:	1Deg C	3.1	% D.C. Component	As per IEC
3	Design ambient temperature:	45 Deg c	4	System making capacity	100 kA (peak)
4	Relative humidity:	85%	5	Type of Circuit Breaker	VCB/~~SF_6~~
				Shunt Trip Coil-1 :	110/~~220V~~ DC
				Shunt Trip Coil-2 :	110V UPS AC
					(See Note-1)
5	Altitude above MSL:	<1000M	6	Duty Cycle of C.B.	O-3min-CO-3 min-CO
6	Environment:	Humid & Corrosive	7	Suitability for Cap. Switching	Reqd. for VCB
B	**Operating conditions**		8	Surge supressor for Motor Feeder	
1	Voltage	11kV ± 10%		& other outgoing feeders	Reqd. for VCB
2	Frequency	50Hz ± 3%	9	Provision of earthing	
3	Number of Phases	THREE		Earthing truck	Required
4	System Fault Level	40 kA		Earthing switch	Not Required
5	System Earthing	Resistance Earthed	D	**Miscellaneous**	
6	Auxiliary Supply		1	Interface with ECS	Not Required
a.	AC	240V ± 10% SPN	2	Incoming Power Entry	Cable
b.	DC	110V ± 10%	3	Cable Entry	Bottom
C	**Electrical Data**		4	Separate bolted removable	Reqd.(Gland plate
1	Busbar current rating (inside			gland palte for cable entry	drilled at site)
	panel at design temp.)	*	5	Cable glands and lugs for	
2	1 sec. Short Circuit withstand	40 kA		cable termination	Required
	capacity		6	Painting/Paint shade	RAL 7032
			7	Applicable spec	CPWD

Note:

*** To be decided by contractor in line with Engineering Design Basis/Bid document.**

1) For all HV circuit breakers feeding HV VFDs, second shunt trip coil operating on different control supply shall be provided

MANUFACTURER'S DATA

A	**Switchboards**		9	Recommended clearances	
1	Make			Front	mm
2	Type designation			Rear	mm
3	Degree of protection			Above	mm
4	Max. overall weight of C.B. panel	Kg	10	Shock loading on foundation	
5	Overall dimensions of C.B. panel		11	Max. size/no. of cables that can be	
a	Width	mm		terminated inside the panel	
b	Depth	mm	a.	without rear extension panel	
c	Height	mm	b.	with rear extension panel	
6	Overall dimensions of dummy /		c.	size of rear extension panel	
	adaptor panel of each type		12	Clearance in air	
a	Width	mm	a.	Phase to Phase (min.)	mm
b	Depth	mm	b.	Phase to Earth (min.)	mm
c	Height	mm	13	Busbar current rating at design	
7	Overall weight and dimensions of			ambient temperature	A
	largest shipping section		14	Busbar (separately for each swbd)	
a	Weight	Kg	14.1	Horizontal main busbar size	
b	Width	mm		(No. of flats x size of each flat)	
c	Depth	mm	14.2	Horizontal main busbar size as	
d	Height	mm		tested at CPRI for full short ckt.	
8	Overall dimensions of each swbd.			withstand as per specification	
	including all dummy/adaptor/rear			requirement (No. of flats x size	
	extension panels			of each flat)	
	Width		14.3	Vertical dropper size	
	Depth			(No. of flats x size of each flat)	
	Height		14.4	vertical drop per bus bar size	

Note: Vendor shall furnish the dimensins of various types/ratings of swbds., CB panels and dummy/adaptor panels separately.

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15	Horizontal main busbar/Vertical busbar material	Al/Cu	b	Removable FRP shrouds for all busbar joints and tap-off connections provided	Yes/No
16	Insulating material (Busbar supports)		c	Arc propagation barrier in busbar compartment provided	Yes/No
17	Earth busbar size	mm^2	d	Breaker service, test and drawn-out position provided	Yes/No
18	Earth busbar material	Copper	e	Distinct overall lockable door for breaker compartment provided	Yes/No
19	1 min. power frequency withstand voltage (rms)	kV	f	Automatic safety shutter provided	Yes/No
19.1	Over voltage factor for PTs	1.9 for 30 sec.	g	Independent pressure release flaps provided for all HV compartments	Yes/No
20	Impuse withsatnd voltage (peak)	kV	h	Wire mesh for all louvered openings provided	Yes/No
20.1	Wave shape of impulse voiltage		i	Suitable intrlocks to prevent faulty operation as per Cl. 5.1.11 of spec. 6-51-0001 provided	Yes/No
21	1 sec. short ckt. Withstand capacity	kA			
22	Peak dynamic withsatnd capacity	kA			
23	Windows at the rear side of panels for thermography	Not Required			
24	**Safety Features**				
a	Heat shrinkable sleeves, rated to withstand the system line to line voltage for one min., provided on busbar	Yes/No			
B	**Circuit Breaker**				
1	Type	VCB/SF_6	16	Power required for closing	W/VA
	2nd shunt trip coil for VFD feeders	Yes			
2	Make		17	Power required for spring charging motor	W/VA
3	Type Designation		18	Breaker is trip free	Yes/No
4	Circuit Breaker mounting in panel	Truck/cassette @	19	Closing mechanism	
5	No. of poles/phase		20	Provision of manual spring charging provided	Yes/No
6	Current rating (in free air)	A at °C	21	Mechanical Trip PB provided	Yes/No
7	Current rating inside the panel at specified design tempeature	A	22	Mech. On/Off indicator provided	Yes/No
8	Short time rating (1sec.)	kA	23	Operation counter provided	Yes/No
9	Symmetrical breaking capapcity	kA	24	Time taken for spring charging	sec.
9.1	% D.C. Component		25	No. of aux. contacts and their current ratings	NO + NC ,
10	Peak making current	kA	26	Interrupter	
11	1 min. dry withstand voltage (power frequency)	kV	a	Make	
12	Duty Cycle		b	Pressure switch for monitoring of SF_6 gas pressure provided	Yes/No
13	Total openeing time	m sec.	c	Re-filling arrangement of SF_6	
14	Total closing time	m sec.	27	LOTO (Lock-Out Tag-Out) Provision for mechanical locking arrangement	Required
15	Power required for opening	W/VA			

@ Lifting truck shall be provided for cassette type circuit breaker.

27	**Supressor**			
a	Type designation			
b	Make			
28	Derating reqd. for Cap. Switching	%		
29	Earthing System	Integral earthing/		
		Separate earthing		
		carriage		
30	**Copies of following test cerificates**			
	enclosed :	Yes/~~No~~ *		
30.1	*For each type of offered circuit*			
	breaker panel with breaker			
a.	Short Circuit tests (Peak and 1 sec.			
	withstand)			
b	Heat run test			
c	Internal arc test			
d	Impulse and power freq. withstand			
30.2	*For each type of offered circuit*			
	breaker (in panel)			
a.	Short Circuit test duties			

* **Switchboard offered shall be of proven design and shll havbe been successfully type tested. Type test certificates for an exactly identical design of offered switchboard shall be furnished by bidders. These test reports shall not be more than 5 years old, as on the final bid opening date. In case these type tests have not been conducted during the last 5 years, bidder shall conduct these type tests on the offered design of switchboard before despatch without any cost and delievery impact.**

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

DATA SHEET FOR MV SWITCHBOARD

Datasheet No. A951-000-16-50-DS-02 Rev. 0

PURCHASER'S DATA

A	**Site conditions**				
1	Maximum ambient temperature:	46.1 Deg c	4	Relative humidity:	85%
2	Minimum ambient temperature:	1 Deg C	5	Altitude above MSL:	<1000M
3	Design ambient temperature:	45Deg c	6	Environment:	Humid & Corrosive
B	**Operating Conditions**				
1	Voltage	415V ± 10%	6	Auxiliary supply	
2	Frequency	50Hz ± 3%		AC	240V ± 10% SPN
3	No of phases	Three & Neutral		DC	110V ± 10%
4	System fault level	50kA for 1 second	7	Power supply for spring	110V DC ± 10%
5	System earthing	Solidly earthed		charging motor	
C	**Electrical Data**				
1	Short circuit withstand capacity	50kA	7	Incoming power entry	
	for 1 sec.		8	Cable entry (I/C & O/G)	Bottom
2	Busbar current rating inside panel		9	Bus duct entry	Top
	panel at specified ambient	*	10	Cable gland/lugs	Included
3	Busbars	Heat shrunk PVC	11	Colour shade Exterior	RAL 7032
		sleeved	12	Feeder arrangement	Single/Double front
4	System breaking capacity	50 kA	13	Minimum motor starter	240mm
5	System making capacity	105 kA (peak)		module size	
6	Circuit breaker		14	Minimum MCCB module	200mm
	Type	ACB		size	
	Duty cycle	O-3min-CO-3 min-CO	15	Floor fixing	Integral base frame & tack
	Rating				welding to the floor channel
			16	Applicable Specifications	CPWD

Note:

*** To be decided by contractor in line with Engineering Design Basis/Bid document.**

MANUFACTURER'S DATA

A	**Switchboard**		15	Clearance in air	
1	Tag no.			Phase to Phase	mm
2	Make			Phase to Earth	mm
3	Type designation		16	Max. size/no. of cables that	
4	Degree of protection			can be terminated	
5	CB panel			with rear extension	
	Overall weight			without rear extension	
	Incomer	kg	17	Size of rear extension panel	
	Outgoing	kg	18	Main horizontal bus bar	
	Overall dimensions			Bus bar current rating at	A
	Length*Depth*Height	mm		design ambient temp.	
6	Overall dimensions of MCC/			Main bus bar size	
	contactor controlled feeder panel:			Main bus bar material	Al / Cu
	Length*Depth*Height	mm		Main bus bar location	Top/ Bottom
7	Overall dimensions of each PCC		19	Vertical bus bars	
	Length*Depth*Height	mm		Bus bar current rating at	
8	Overall dimensions of each PMCC			design ambient temp.	A
	Length*Depth*Height	mm		Bus bar size	
9	Overall dimensions of each MCC			Bus bar material	
	Length*Depth*Height	mm		Bus bar location	
10	Overall dimensions of each ASB		20	Insulating material	
	Length*Depth*Height	mm	21	Earth bus bar size	mm²
11	Overall dimensions of each LDB			Material	Al / Cu
	Length*Depth*Height	mm	22	1min power freq voltage	kV
12	Shock loading on foundation		23	Short circuit	
13	Largest shipping section:			1 second	kA
	Max. overall weight	kg		Peak dynamic	
	Length*Depth*Height	mm	24	Whether adaptor panel required	Yes/No
14	Recommended clearances for SWBD			between PCC/MCC panel	
	Front*Rear*Above	mm		If Yes, furnish dimensions	

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B	**Circuit breaker**						
1	Type designation			16	Power requirement		
2	Make				Opening		W/VA
3	Mounting				Closing		W/VA
4	No. of poles/phases				Spring charge motor		W/VA
5	Current rating (in air)	A at °C		17	Breaker is trip free	Yes	
6	Current rating (inside panel	A		18	Closing mechanism		
	at design temperature)			19	Provision of manual spring	Yes	
7	Short time rating (1 sec)				charging		
8	Sym breaking capacity	kA		20	Tripping mechanism		
	% DC component			21	Mechanical trip PB provided	Yes	
9	Peak making capacity	kA (peak)		22	Mechanical ON/OFF indicator	Yes	
10	Power frequency withstand				provided		
11	Impulse withstand voltage			23	Operation counter provided	Yes/ No	
12	Duty cycle			24	Time taken for spring charging		sec
13	Total opening time	m sec		25	No. of auxiliary contacts	NO+	NC
14	Total closing time	m sec		26	Derating required for capacitor		%
15	Time for spring charging				switching		
C	**CONTACTOR**						
1	Type designation			9	Life		
2	Make				Electrical		
3	Rated Voltage				Mechanical		
4	Rated current			10	Coil consumption - Pick up		
	AC-3 Duty			11	Coil consumption - Hold on		
	AC-4 Duty			12	Closing time		
5	Thermal rating			13	Opening time		
6	Making capacity			14	No of aux. contacts	NO+	NC
7	Breaking capacity			15	Maxi. permitted back up MCCB rating		
8	Switching frequency						
D	**SWITCH**						
1	Rated voltage			6	Rated short circuit withstand		
2	Rated current				current with max. permissible		
3	AC 23 rating				rated fuses		
4	Rated making capacity			7	Mechanical life		
5	Rated breaking capacity			8	Maximum permitted back		
					up fuse rating		
E	**THERMAL OVERLOAD RELAY**						
1	Make			5	Type of operation	Direct / CT operated	
2	Type			6	Maximum permitted back		
3	Setting range				up MCCB rating		
4	Single phasing preventer	Integral / Separate					
F	**MCCB/MCB**						
1	Make			9	Rated Breaking Capacity at		
2	Type				Service Voltage		
3	Rated Voltage			10	No of operations at full fault		
4	Rated Frequency			11	No of operations at partial fault		
5	Rated Current			12	No of guaranteed mech. operations		
6	No of Poles			13	1 min dry p.f. withstand voltage		
7	Derating factor for operation			14	Shunt trip feature (for MCCB only)		
	under site conditions			15	Operating voltage range for MCCB		
8	Rated 10 Sec Short time rating				shunt trip		

Notes :

1. **Vendor shall furnish dimensions of various switchboards, CB Panels and dummy/adaptor panels separately.**
2. **Vendor shall furnish technical particulars of various switchboards separately.**
3. **Switchboard offered shall be of proven design and shall have been successfully type tested. Type test certificates for an exactly identical design of offered switchboard shall be furnished by bidders. These test reports shall be not more than 5 yeas old, as on the final bid due date. In case these type tests have not been conducted during the last 5 years, bidder shall conduct these type tests on the offered design of switchboard before despatch without any extra cost and delivery impact.**

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)	DATA SHEET DISTRIBUTION TRANSFORMER	Datasheet No. A951-000-16-50-DS-03 Rev : 1 [redacted]

PURCHASER'S DATA

A	**Site conditions**				
1	Maximum ambient temperature:	46.1 Deg c	4	Relative humidity:	85%
2	Minimum ambient temperature:	1 Deg C	5	Altitude above MSL:	<1000M
3	Design ambient temperature:	45 Deg c	6	Environment:	HUMID & CORROSIVE
B	**Technical particulars**				
1	Tag no.:		27	Explosion protection	PRV
2	Duty:	Continuous	28	Terminal location:	
3	No. of windings:	Two		HV side	Smaller Side
4	Type of cooling:	ONAN		LV w.r.t HV	90°
5	Rated MVA	*	29	Terminal connection	
6	Rated voltage			HV side	Cable Box
	HV winding	11 kV		LV side	Cable/busduct
	LV winding	0.433 kV	30	Cable size	
7	System earthing:			HV side	*
	HV side	*		LV side	NA
	LV side	Solidly Earthed	31	Neutral CT specification:	
8	Rated frequency:	50 Hz ± 3%		51G (Standby E/F)	
9	No. of phases:	Three		64R (REF)	
10	Fault level on HV side:	40 kA for 1 Sec.		V_k	
11	Connection			I_m at $V_k/2$	
	HV side	Delta		R_{CT}	
	LV side	Star	32	Installation	Outdoor
12	Vector group:	Dyn11	33	Painting & colour	RAL 7031
13	Impedance at max MVA:		34	AC Auxiliary voltage	415V ± 10%
14	Insulation class:	A	35	DC Auxiliary voltage	110V ± 10%
15	Insulation level:		36	Bidirectional roller type	Flat
	P. f withstand		37	¢ distance of flat rollers	1000 mm
	HV winding	As per IS & CBIP	38	Applicable specifications	CPWD
	LV winding	As per IS & CBIP	39	Loss Capitalization	Not applicable
16	Impulse withstand		a	Rate for copper loss Rs./kW:	-
	HV winding	As per IS & CBIP	b	Rate for iron loss Rs./kW:	-
	LV winding	As per IS & CBIP			
17	Oil type	Mineral (as per IS 335)	40	Accessories requirement	
18	Winding insulation type:	Uniform	a	Sampling valve	Yes
19	Clearance:		b	Conservator drain valve	Yes
	Ph to Ph	As per IS & CBIP	c	Top oil filter valve	Yes
	Ph to N	As per IS & CBIP	d	Explosion vent/PRV	Yes
20	Tap changer		e	Air bag for conservator	Yes
	Location	HV Side	f	Dial type thermometer	Yes
	Type	On Load Tap Changer		& contacts for OTI, WTI	
	Range	.+5% -15%	g	Drain valve	Yes
	No. of steps	8 (9 positions)	h	Marshalling box	Yes
21	Normal load:	70-80%	i	Double float Buchholz	Yes
22	Temp. rise at extreme tap		j	Channels, towing lugs	Yes
	having max. losses:		k	Rollers	Yes
	oil	45 °C	l	Neutral bushing	Yes
	winding	50 °C		outside terminal box	
23	Minimum Guaranteed efficiency	see note-3		with connector assembly	
	at 0.8 p.f at 80% of ONAN rating:		m	Inspection cover	Yes
24	Load at which max eff. occurs:	KVA	n	Disconnecting chamber	Yes
25	Power flow:	Unidirectional	o	WTI & OTI	Yes
26	HV/LV phase sequence	UVW/To suit switchgear	p	Busduct flange on Sec.	Yes
			q	Lugs and cable glands	Yes

* To be decided by contractor in line with Engineering Design Basis/Bid document.

Rev. No.	Date	Purpose	Prepared by	Checked by	Approved by
1	14.12.16	REVISED AND REISSUED FOR TENDER	GK	VK	PG
0	21.11.16	ISSUED FOR TENDER	GK	VK	PG

41	Tests requirements		43	Creepage Distance	31 mm/ kV
	Impulse test:	Not Reqd.		Total	As per CBIP & IS
	Heat run test:	Not Reqd.		Protected	As per CBIP & IS
	Vacuum test on tank:	Required			
	Pressure test on tank:	Required			
	Short circuit test:	Not Reqd.			
42	ECS Interface	Not Required			

MANUFACTURER'S DATA

A	**Make:**		C	**Constructional Features**	
B	**Performance:**		1	Location of terminals	
1	No load loss at			Primary	
	100% Voltage;	kW		Secondary	
	110% Voltage:	kW	2	Location of Neutral CT	
2	Full load copper loss at 75°C:	kW	3	Explosion Protection	Explosion Vent/ PRV
3	Auxilliary Losses	kW			
4	No load current at		D	**Mechanical data**	
	100% Voltage:	A	1	Core & winding weight:	Kgs.
	110% Voltage:	A	2	Tank & fitting weight:	Kgs.
5	Efficiency at full load at 75°C		3	Radiator without oil weight:	Kgs.
	at 0.8 p.f:	%	4	Total weight:	Kgs.
	at 1.0 p.f:	%	5	Total quantity of oil:	ltrs.
6	Eff. at 50% load at 75°C		6	Quantity of oil in radiators:	ltrs.
	at 0.8 p.f;	%	7	Overall dimensions:	ltrs.
	at 1.0 p.f:	%		Length	mm
7	Maximum efficiency:	%		Breadth	mm
8	Load at which max eff. Occurs:	MVA		Height	mm
9	Regulation at 75°C				
	at 0.8 p.f:	%			
	at 1.0 p.f:	%			
10	X1/R1 Ratio				
11	X0/R0 Ratio				
12	Zero sequence impedence, Z0				

Note

1 Losses shall be inclusive of positive tolerance and shall be at nominal tap.

2 Transducers for providing 4-20mA signal for OTI & WTI for owner's interface shall be provided.

3 Minimum Guaranteed efficiency for transformers at 0.8 p.f & at 80% of ONAN rating shall be as below:

Transformer rating	Maximum efficiency
<1000kVA	>=99 %
>1000 kVA upto 1250 kVA	>=99.1 %
>1250 kVA upto 2500 kVA	>=99.3 %

इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)	DATASHEET FOR MV BUS DUCT	Datasheet No. A591-000-16-50-DS-04 Rev.No. 0 [redacted]

PURCHASER'S DATA

A	**Site conditions**				
1	Maximum ambient temperature:	46.1 Deg c	4	Relative humidity:	85%
2	Minimum ambient temperature:	1 Deg C	5	Altitude above MSL:	< 1000m
3	Design ambient temperature:	45Deg c	6	Environment:	Humid & Corrosive
B	**Operating Conditions**				
1	Voltage	415 V ± 6% For MV	4	System fault level	50kA for 1 sec for MV
2	Frequency	50Hz ± 3%	5	System earthing	Solidly Earthed for MV
3	No of phases	Three			
C	**Busduct Details**		6	Auxiliary supply (AC)	240V ± 10% SPN
1	Rated Voltage	415 V ± 6% For MV	7	Wall frame assembly with seal	Required
				off bushings and bus conductors	
2	Current Rating	*	8	Paint Shade of enclosure	RAL 7032for indoor and
3	Short Circuit rating	50kA for 1 sec for MV			RAL 7031 for outdoor
			9	Supporting structure for bus duct	Required
4	Type	TPN for MV	10	Space heater and bearther with	Required
				silica gel in bus duct	
5	Phase segregation	No for MV			
			11	Applicable Specification	6-51-0054 Rev 4
6	Location	Outdoor / Indoor			

MANUFACTURER'S DATA

1	Make		7.6	Flexibles (Size x Quantity)	x mm^2 / No
2	Current rating		7.7	Earth bus material / size	/ x
3	Short circuit rating		7.8	Heat shrinkable sleeves rated to	Yes / No
4	Phase segregation	Yes / No		withstand the system line to line	
5	Degree of protection			voltage for 1 min provided	
6	Canopy for outdoor busduct	Yes / No	7.9	Removable FRP shrouds for all	Yes / No
7	Busbar details			busbars joints provided	
7.1	Busbar material	Al / Cu	8	Cross sectional dimensions of	mm x mm
7.2	Busbar size (W x D)	x mm^2		each busduct	
7.3	Busbar insulator		9	Space heater provided	Yes / No
	a Type		10	Overall dimensions(LxBxH)	mm x mm x mm
	b Tracking index		11	Weight of each section of busduct	
7.4	Busbar size as tested at CPRI	x mm^2	12	Type test certificates enclosed	Yes / No #
	for full short ckt withstand			a Short ckt	
	(No. of flats x size of each flat)			(Peak & 1s withstand)	
7.5	Clearance			b Temperature rise	
	a Phase to phase	mm		c Voltage withstandability	1 min. power freq.
	b Phase to earth	mm			Impulse (for HV)
			13	Enclosure material	Sheet steel / aluminium

\# **Bus duct offered shall be proven design and shall have been successfully type tested.Type test certificates for an exactly identical design of offered bus duct shall be furnished by bidders. Type test reports shall not be more than 5 years old, as on the final bid opeining date. In case these type testsbidder shall conduct the type tests have not been conducted during the last 5 years, bidder shall conduct these type tests on the offered design of switchboard before despatch without any cost and delievery impact.**

Note

* To be decided by contractor in line with Engineering Design Basis/Bid document.

0	21.11.16	ISSUED FOR TENDER	GK	VK	PG
Rev.	**Date**	**Purpose**	**Prepared**	**Checked**	**Approved**

PURCHASER'S DATA

A	**Site conditions**					
1	Maximum ambient temperature:	46.1 Deg c	4	Relative humidity:	85%	
2	Min. amb temp for battery sizing	1 Deg C	5	Altitude above MSL:	<1000 m	
3	Design ambient temperature:	45Deg c	6	Environment:	Humid & Corrosive	
B	**Technical particulars**					
1	Battery					
a	Type	Lead Acid	b	Plate construction	Tubular Positive	
c	Discharge duty requirements					

Item no.	Nominal DC voltage	Duty cycle			No. of cells	End cell voltage
		First 1 min.	Next 118 min.	Last 1 min.	Lead Acid	Lead Acid
						1.85 V

d	Boost charging time	10 Hours	h	Accessories (Per battery set)	
e	Electrolyte liquid in containers	Required	i	Hydrometer (syringe type) *	
f	Battery stand formation		ii	Thermometer *	
g	Cable details between		iii	Cell testing voltmeter (3V-0-3V)	1 no.
	battery & charger		iv	Rubber gloves	4 pairs
	Item no.	Cable size	v	Spanner	1 no.
			vi	Acid resistant jugs & funnels *	
			vii	Wall mounting teakwood holder *	
2	**Battery charger**				
a	System voltage	415 V±10% AC, TPN	i	Earth Bus	25X6 mm2 Cu (Min)
b	System frequency	50 Hz ± 3%	j	Separate bolted removable	Required(Gland Plate
c	System neutral earthing	Solidly earthed		undrilled gland plate for cable	shall be drilled at site)
d	System fault level	50 kA		entry	
e	Charger voltage range		k	Cable glands and lugs	
	Float charging voltage range/cell	Lead Acid - 2.25 V	l	Painting	RAL 7032
	Boost charging voltage range/cell	Lead Acid- 2.70 V	m	Incoming cable details for	
f	Cable entry	Bottom		battery charger	
g	Mounting	Free Standing,		Item no.	Cable size
		Floor Mounted			
h	Access	Front			
3	**DC distribution board**				
a	Type	Compartmentalized			
b	Feeder requirements				

Item no. as per MR/PR	Feeder type	Feeder rating	No. of feeders	Max. cable size	Rating of DC contactor for lighting
	incomer				
	Outgoing fdr				

4	**ECS Interface**				
a	Indication-Charger failure	not required	c	Indication-Battery discharged	not required
b	Indication-Inverter failure	not required	d	Indication-Battery isolated	not required

Notes

1

2 End cell voltage shall confirm to the values specified.

3 * Asterisk marked items are not applicable for Ni-Cd and VRLA batteries.

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MANUFACTURER'S DATA

A	**Battery**		
1	Item no. As per MR/PR	19	Short ckt current of battery bank
2	Tag. No.	20	Short circuit withstand time
3	Manufacturer's name	21	Max. allowable termp.of electrolyte
4	Type & Catalogue no. of cell		the cells can withstand without
5	Ampere hour capacity		injurious effects
6	No. of cells		Continuously
7	Nominal cell voltage		Short period
8	Cell voltage at the end of full	22	Type of positive plate
	discharge at 10 hrs/ 5 hrs rate	23	Type of negative plate
9	Specific gravity of electrolyte at the	24	No. of positive plates/cell
	end of full charging at °C	25	No. of negative plates/cell
10	Specific gravity of electrolyte at the	26	Material & thickness of separators
	end of full discharge at 10 hrs/	27	Ampere hour capacity at min. amb.
	5 hrs rate at °C		10 hrs rate to end cell voltage
11	Quantity of electrolyte per cell		specified at s.no. 8 above
12	Weight of cell with electrolyte		5 hrs rate to end cell voltage
13	Quick charging current		specified at s.no. 8 above
	Max. safe quick charging rate		2 hrs rate to end cell voltage
	Permissible ripple content		specified at s.no. 8 above
14	Suggested quick charging rate		1 hr rate to end cell voltage
15	Quick charging voltage		specified at s.no. 8 above
	Max. quick charging voltage/cell		30 min. rate to end cell voltage
	Quick charging voltage/cell for		specified at s.no. 8 above
	constant voltage finish charging	28	Dimensions of each battery rack
16	Float charging voltage/cell		Width
17	Float charging current		Depth
	Float charging current range		Height
	Permissible ripple content	29	No. of battery racks
18	AH efficiency at 10 hrs/5 hrs rate		
B	**Battery charger**		
1	Item no. As per MR/PR	11	Max. RMS ripple voltage at
2	Tag. No.		rated load
3	Manufacturer's name		with battery connected
4	Rating		without battery
	Charger rating	12	Method of volatege control
	Output voltage		Float charging mode
	Output current		Quick charging mode
5	Nominal voltage	13	Method of current control
	Float charging		Float charging mode
	Quck charging		Quick charging mode
6	Float charging voltage range	14	Safety factor for component
7	Quick charging voltage range		selection
8	Min. efficiency of charger	15	Charger dimensions
	at light load (40%)		Width
	at rated load		Depth
9	p.f. at rated voltage & load		Height
10	Degree of protection	16	Max. heat loss in watts
C	**DCDB**		
1	Item no. As per MR/PR	5	DCDB dimensions
2	Tag. No.		Width
3	Manufacturer's name		Depth
4	Degree of protection		Height
D	**Cell booster**		
1	Item no. As per MR/PR	6	Dimensions
2	Tag. No.		Width
3	Manufacturer's name		Depth
4	Current rating		Height
5	Voltage range	5	Voltage range

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DATA SHEET HV/MV CABLE

Datasheet No.
A951-000-16-50-DS-08
Rev.No. 0
Page 1 of 4

PURCHASER'S DATA

A	**Site conditions**						
1	Maximum ambient temperature:		46.1 Deg c	4	Relative humidity:		85%
2	Minimum ambient temperature:		1 Deg C	5	Altitude		<1000m
3	Ground temperature:		45Deg c	6	Environment:		Humid & Corrosive
B	**Technical particulars**						
1	System voltage			3	Conductor material		
	Nominal	Highest	Voltage grade		HV Power cable		Copper & Al.
	415 V	500 V	650/1100V ☑		MV Power cable		Copper & Al.
	3.3kV(E)	3.6 kV	1.9/3.3kV ☐		MV control cable		Copper & Al
	3.3kV(UE)	3.6 kV	3.3/3.3kV ☐		(See Note-4)		
	6.6kV(E)	7.2 kV	3.8/6.6kV ☐	4	Installation under DGMS jurisdiction		No
	6.6kV(UE)	7.2 kV	6.6/6.6kV ☐		(See Note-2)		
	11kV(E)	12 kV	6.35/11kV ☐	5	Applicable spec.		6-51-0051rev 7
	11kV(UE)	12 kV	11/11kV ☑				
	22kV(E)	24 kV	12.7/22kV ☐				
	33kV(E)	36 kV	19/33kV ☐				
2	Frequency		50± 3% Hz				

MANUFACTURER'S DATA

1	Name of manufacturer		9	Inner sheath	
2	MR/PR item no.			Type of compound	
3	Cable type/ code			Thickness	mm
4	Conductor material		10	Nominal dia under armour	mm
5	Conductor semiconducting screen (HV cables)		11	Calculated dia under armour	mm
	Material		12	Armour	
	Thickness	mm		Material	
6	Insulation			Type	
	Type of compound			Size	
	Thickness	mm	13	Nominal dia under outersheath	mm
7	Insulation semiconducting screen (HV cables)		14	Calculated dia under outersheath	mm
	Material		15	Outersheath	
	Thickness	mm		Type of compound	
8	Copper tape			Thickness	mm
	Thickness	mm	16	Nominal outer dia of cable	mm
			17	Tolerance on outer dia	%
			18	Weight of cable per km	kg
			19	Maximum drum length	mtr.

Notes

1 E- Earthed system
UE-Un Earthed system
2 Where the installation falls under the jurisdiction of Directorate General of Mines Safety, cables shall comply
3 Copper upto 16Sqmm and Aluminium above 16Sqmm.
4 Conductor size for control cables shall be 2.5 sq mm.control cable shall be twisted pair overall shielded type.
5 Single line to ground fault current (applicable for HV cables) for sizing of insulation screening shall be 300A for 11kV cables.

Rev. No.	Date	Purpose	Prepared by	Checked by	Approved by
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NUMERICAL RELAY AND DATA CONCENTRATOR

Datasheet No.
A951-000-16-50-DS-09
Rev.No. 0

Rev.	Date	Purpose	Prepared	Checked	Approved
0	21.11.16	ISSUED FOR TENDER	GK	VK	PG

PURCHASER'S DATA

A PROJECT DATA ☑ TICK FOR SELECTION

1 Project details

a	Project	:	DEVELOPMENT OF SILOS
b	Client	:	CWC
c	Location	:	Nabha, Punjab
d	Unit	:	Common

2 SITE CONDITIONS

a	Ambient tempeature		
b	MIN 1 MAX 46.1 °C Design 45 °C		
c	Humidity	:	>90
d	Altitude	:	< 1000 m
e	Atmospheric condtion	:	Highly corrosive
f	Installation	:	Indoor inside pnl

B RELAY SELECTION ☑ TICK FOR SELECTION

1 RELAY FUNCTIONS

a	Only Protection	☐
b	Protection and metering	☐
c	Protection and metering and control	☑
d	Serial commuication	☐
e	Password protection	
	a. For write	☑
	b. For both read and write	☑

2 CONSTRUCTION FEATURE

a	Enclosure type	:	IP5X
b	Terminal size- sqmm	:	2.5 for control
	for external wires	:	4 for CT/ PT
c	Mounting	:	Flush
d	Drawout feature	:	as per 6-51-0055
e	Display type	:	Graphic LCD + LED Indication + Backlit Display

3 SPECIAL REQUIREMENT IF ANY

a	Applicable standards: IEC	
b	Distance for cable capacitance for application where field contacts are directly wired to relay e.g. Motor start/ stop	up to 1000 m

4 INPUT POWER SUPPLY

a	Site selectable feature		☑
b	Input supply	:	110V DC
		:	
		:	

5 CT/ PT INPUT TO RELAY

a	Current operated relays		☑
	a1 Main CT input	:	
	a2 CT for sensitive EF or back up EF	:	
b	Voltage operated relays		☑
	b1 PT input	:	
			☑
c	Comprehensive relay		
	c1 Main CT input	:	3 CTs, 4wire
	c2 PT input	:	3phase, 4wire
	c3 CT for sensitive EF or back up EF	:	1 CT, 2 wire input (Yes for IC& TR FDR)
d	CT Secondary current	:	5A for Protection CT 1A for Differential CT

C RELAY PROTECTION/ METERING FUNCTIONS ☑ TICK FOR SELECTION

(where no check box is shown, the requirement is minimum but not limited. Refer SWBD data sht for fdr wise protection)

1 Curernt operated relays

a. 3 phase O/C element (50, 51)
- * I > * I >> * I>>>

Characteristics as per IEC
- * *Inverse (normal, very, extremely, long) and definite time for I > and I >>*
- * *Definite time for I >>>*

b. E/F relay (50N, 51N, 51G)
- * I_o > * I_o >> * I_o >>>

Characteristics as per IEC
- * *Inverse (normal, very, extremely, long) and definite time for I_o >, I_o >>*
- * *Definite time for I_o >>>*

c. Metering/ event recording
- * 3 phase/ line currents ☑
- * Disturbance record ☑
- * Breaker trip/ close status ☑
- * Relay faults ☑
- * Trip Values

2 Voltage operated relays

a. 3 phase O/V element with time delay (59+2)
- * OV> * OV>>

b. 3 phase U/V element with time delay (27+2)
- * UV> * UV>>

Characteristics as per IEC
- * *Inverse (normal, very, extremely, long) and definite time for UV > , UV>>*

c. Under/ Over Frequency element with time delay (81U/ 81O) ☐
- * Settable under voltage restraint ☐
- * df/dt element ☐
- * Number of stages with u/f
- * Number of stages with df/dt

d. Synchrocheck function ☑

d. Metering/ event recording
- * 3 phase/ line Voltages ☑
- * Disturbance record ☑
- * Breaker trip/ close status ☑
- * Relay faults ☑
- * Trip Values

ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

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Datasheet No.
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C RELAY PROTECTION/ METERING FUNCTIONS

☑ TICK FOR SELECTION

(where no check box is shown, the requirement is minimum but not limited. Refer SWBD data sht for fdr wise protection)

3 Motor Protection relay

a. Protection elements
- * Thermal overload (49)
- * OC protection with doubling feature (50)
- * EF protection (50N)
- * Locked Rotor protection
- * Maximum start time
- * Maximum number of starts
- * Negative phase sequence
- * Under voltage delayed trip ☑
- * EF Through CBCT ☑
- * Single phasing

b. Metering/ events
- * 3 phase/ line current
- * Hour run
- * KW, KWH, pf ☑
- * Disturbance record ☑
- * Plot start characteristic ☐
- * Trip values
- * Start time
- * Start current

c. Control
- * Breaker close in test mode ☑
- * Reacceleartion logic ☐
- * Breaker trip ☑
- * RTD/BTD input

4 Comprehensive numerical relay

a. Current op elements (51, 50, 51N, 50N, 51G)

b. Voltage op elements (59, 27, 2, 81U, 81O)

c. Control function
- * Breaker close/ trip from relay
- * Breaker close/ trip on serial
- * PLC logic function for control scheme
- * Digital I/P Min4nos.for I/C& plant fdr
  Min12no.for mtr &trf. Fdr.
- * Motor Feeder control function

5 Special protection relays
- * Part of main relay ☐
- * Separate relay ☑

a. Differential relays
- * BUS High/Low Imp, vendor to select
- * Feeder High/Low Imp, vendor to select
- * Trafo With harmonic restraint
- * Machine Biased differential

b. Distance relays (67, 67N)

c. Restricted EF (64R)

d. Generator protection

e. Distance protection

f. Reverse power relay

6 Other relay Features

a. Analog inputs 4-20mA
- * RTD/ BTD-MPR AS REQD
- * WTI/ OTI-Trafo relay AS REQD

WTI= Winding temperature indicator
OTI= Oil temperature indicator

b. Out put relays
- * Number of relays 4NOS
- * Contact rating 2A, 220V DC
- * Reset Hand reset

FUNCTIONS part of numerical relay

c. Lock out function (86) ☑
d. Trip circuit supervision(95) ☑
e. Watch dog ☑
f. Time stamp ☑
g. Modular construction for easy and quick replacement of faulty PCB/circuit ☑

D SERIAL COMMUNICATION AND RELAY INTEGRATION

☐ TICK FOR SELECTION

1 Relay integration ☑

a Communication ports at Relay
- * Relay front : RS 232
- * Relay back : RS485

b Protocol of relay LAN : Vendor to decide

c Requirment of data concentrator (DC)
- * Integraton through DC ☐
- * Directly to MMI ☐

d Topology NA

e Data concentrators NA

2 Redundancy

a Relay LAN /serial
- * Redundant (serial) ☐
- * Non redundant (star) ☐

b From DC to MMI
- * Redundant ☐
- * Non redundant ☐

c From DC to ECS-RTU
- * Redundant ☐
- * Non redundant ☐

3 Redundancy requirement for DC/MMI

a Ports at STAR coupler
- * For each relay Non Redundant
- * For DC Dual Redundant

b Data concentrator (DC)
- * Power supply card Dual Redundant
- * Communication port for each relay LAN Dual Redundant
- * Communication Processor Dual Redundant

4 Serial communication from DC to MMI/ ECS RTU

a DC to MMI
- * Topology Vendor to decide
- * Protocol Vendor to decide

b DC to ECS-RTU MODBUS (As per ECS Spec)

c Scan time As per 6-51-0055

5 Other requirement

a Time synchronization ☑ Detail during engg
b Remote relay parameterization ☐
c Annunciation at MMI ☑

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NUMERICAL RELAY AND DATA CONCENTRATOR

Datasheet No.
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MANUFACTURER'S DATA

1 NUMERICAL RELAYS TYPES

	Feeder type	INCOMER	BUS PT	BUS TIE	MOTOR	TRANSFORMER	MOTOR
Relay selection	**Main relay** **Indicate equivalent NEMA no. of element offered inMainRelay* ** lockout feature 86* ** trip ckt sup 95* ** relay model & extra element for syn mot* **Differential relay** CT circuit supervision **REF relay** **Direction relay** **Reverse Power** **Impedance relay** ** 86 with all special protection relays*						
Nos of Serial Port	RS232 RS485 RS422 FO						
Analog input	RTD -PT100 BTD- PT100 WTI input OTI input						
Nos of DI	* DI used by MFR * DI avaialble for customer interlock * DI for auto C/O logic						
Protocol	* Main relay * Special relays * Protocol for relay setting from remote						
Any other data							
REMARKS							

2 DATA CONCENTRATOR AND RELAY INTEGRATION

a Model no.

Make

b Input power supply

* Voltage
* Power reqt

c Redundancy

* Power supply
* Communication processor
* Communication port
* Relay LAN /Serial communi
* ECS-RTU interface
* MMI interface

d Serial interface/ Relay LAN

* Topology
* Protocol
* Nos (*
* Topology
* Type of port
* Cable type

f Serial interface- MMI

* Topology
* Protocol
* Type of Port
* Cable type

g Serial Interface -ECS-RTU

* Topology
* Protocol
* Type of Port
* Cable type

h Number of Digital Input/ Aanalog Input (4-20mA)

* DI for substation eqpt
* Spare DI
* AI as per project data sht
* Spare AI

I Maximum Scan Time

* Status
* events
* Data acqusition (analog)
* Disturbance record download time

j Other features

* Spare capacity for additional devices for relay LAN
* Time synchronization options
* Power walk in time
* Restoration time of communication of DC with NR & MMI
  - *After detecting break in serial loop
  - *After switchover of supply from normal to reduandant
  - *After failure of normal & reduandant supply&restoratic of same
  - *Time required for synchronisation with external clock

3 Standard features of relay/ system architecture

Vendor to provide data as applicable for the product offered

OPTIONS

SITE CONDITIONS

AMB TEMP	MIN	MAX	DESIGN
	1 °C	46.1 °C	45 °C

HUMIDITY	MIN	MAX	DESIGN
			40
			60
			>90
			100
			0.8

ALTITUDE	MIN	MAX	DESIGN
			100 m
			200 m
			< 1000 m
			> 1000 m

ATMOSPHERIC CONDTION

INSTALLATION

DISPLAY TYPE	SELECT
	AlphaNumeric LCD
	Graphic LCD
	+ LED Indication

INPUT POWER SUPPLY

CT-PT INPUT

MAIN CT	CBCT	PT	CTSECOND/
3 CTs 3wire	(Yes for IC& T	3phase, 4wire	1A
3 CTs, 4wire	1 CT, 2 wire ii	3phase, 3 wir	5A
		1phase	5A-Main, 1A Other
			1A/5A site selectable
			Refer swbd data sht

CONSTRUCTION FEATURES

ENCL	TML SIZE	MTNG
IP5X	2.5	Flush
IP41	4.0	Surface
IP23	2.5 for control	
IP55	4 for CT/ PT	

PROTECTION FUNCTIONS

FREQUENCY RELAY	SELECTION
UNDER FREQUENCY	2
df/dt	4
	5
	6

DIGITAL INPUTS FOR INTERLOCKS/ SC

DIFFERENTIAL PROTECTION	SELECTION
	Low Imp with checK diff
	High Imp with check diff
	High Impedance
	Low Impedance
	Pilot wire
	Biased low Impedance
	With harmonic restraint
	High/Low Imp, vendor to select
	Biased differential

ANALOG INPUT/ OP RELAYS

4-20mA

FIXTURE TYPE	DESCRIPTION	WATTAGE	MANUFACTURER TYPE DESIGNATION
LED FIXTURES			
LEDIND1	Mounting rail type fixture suitable for 1x18/22 W LED lamp made of stove enamel finish MS sheet steel housing.	1 x 18/22 W	Philips-Master-LED-tube Surya-SLE TL
LEDIND2	Same as INDLED1 but suitable for 2`x18/22 W LED lamp	2 x 18/22 W	Philips-Master-LED-tube Surya-SLE TL
LEDIND3	Industrial type fixture suitable for 1x18/22W fluorescent lamp made of stove enamel finish MS sheet steel housing and vitreous enameled white reflector.	1 x 18/22 W	Philips-Master-LED-tube Surya-SLE TL
LEDIND4	Same as INDLED3 but suitable for 2x18/22 W LED lamp	2 x 18/22 W	Philips-Master-LED-tube Surya-SLE TL
LED 1	Decorative circular (200 mm dia approx.) down lighter, recess mounted type with LED light source having high glossy mirror, matt reflector including suitable integrated independent driver box	28/30W	Philips- BBS498 Crompton-LCDLH-30CDL
LED 2	Recess type square (600 mm x 600 mm approx) fixture 50 W with LED light source having high efficiency low glare optics with integrated independent driver box	50/55 W	Philips-QUADRA II Crompton-LCTLR-50-FO-CDL
LED3	Recess type square (300 mm x 300 mm approx) fixture 18 W with LED light source having high efficiency low glare optics with integrated independent driver box	18 W	Crompton-LCDRP81
LED4	Under water lighting fixture 7 W with LED light source with all controllers, drivers as required.	7 W	Crompton-AQUA(LUWH2-07-T)
LED5	Similar to LED2, but with 36 W LED Fixture complete with LED Lamp, driver, including other materials as applicable for installation.	36 W	Crompton-LCTLR-36-CDL or equivalent
LED6	Similar to LED2, but SURFACE type with 36 W LED Fixture complete LED Lamp, driver, including other materials as applicable for installation.	36 W	Crompton-LCTLS-36-CDL or equivalent

FIXTURE TYPE	DESCRIPTION	WATTAGE	MANUFACTURER TYPE DESIGNATION
LED7	Bollard type fixture, 10 W with LED light source having high efficiency soft glare free light with LED Lamp, driver, including other materials as applicable for installation.	10 W	Philips BR840 Crompton LBLS1-10-CDL, LBLS3-10-T or equivalent
LED8	LED Fixture TUBE Type complete with LED Lamp, driver, including other materials as applicable for installation.	18 W	Crompton IPFC111LT8-16 or equivalent
LED9	Similar to LED 8 above but Weatherproof (min. IP-65) suitable for conduit / pipe/ surface mounting with LED Lamp, driver, including other materials as applicable for installation.	42W	Philips WT550C LED355 CW PSU S1 PC or equivalent
LED10	Decorative circular down lighter, surface/ wall mounted type, Weatherproof (min. IP-65) with LED Lamp, driver, including other materials as applicable for installation.	18W/24W	Philips WL120V Round or equivalent
LED-11	Decorative circular (200 mm dia approx.) dowlighter, surface mounted type with LED Module, aluminium satin finished reflector, polycarbonate lenses including suitable integrated independent driver box.	1x9W	Crompton LCD SLW-10C or equivalent
LED-12	Decorative circular (200 mm dia approx.) dowlighter, recess mounted type with LED Module, aluminium satin finished reflector, polycarbonate lenses including suitable integrated independent driver box.	1x9W	Crompton LCD RLW-15C or equivalent
LED13	LED Fixture suitable for DC Voltage complete with LED Lamp, driver, including other materials as applicable for installation.	18 W	Crompton LCDV-18-CDL or equivalent
LED14	LED Chemical resistance Fixtures complete with LED Lamp, driver, including other materials as applicable for installation.	Upto 50W	Philips WT461C or equivalent
LED15	LED Low Bay Fixtures complete with LED Lamp, driver, including other materials as applicable for installation.	Upto 90W	Philips Crompton LHBV-40-CDL or equivalent
LED16	LED Medium Bay Fixtures complete with LED Lamp, driver, including other materials as applicable for installation.	Upto 125W	Philips Crompton LHBB-90-CDL-MB or equivalent
LED17	LED High Bay Fixtures complete with LED Lamp, driver, including other materials as applicable for installation.	Upto 250W	Philips BY460P (2-pod version) Crompton LHBBx-150-CDL or equivalent

FIXTURE TYPE	DESCRIPTION	WATTAGE	MANUFACTURER TYPE DESIGNATION
LED18	LED High Bay Fixtures complete with LED Lamp, driver, including other materials as applicable for installation.	Upto 400W	Philips BY461P (4-pod version) Crompton LHBBx-180-CDL or equivalent or equivalent
	OUTDOOR TYPE FIXTURES		
LEDFD1	LED Flood Light Fixtures complete with LED Lamp, driver, including other materials as applicable for installation.	90W	Crompton LFBx11-90-CDL or equivalent
LEDFD2	LED Flood Light Fixtures complete with LED Lamp, driver, including other materials as applicable for installation.	150W	Crompton LFBxK-150-CDL or equivalent
LEDFD3	LED Flood Light Fixtures complete with LED Lamp, driver, including other materials as applicable for installation.	180W	Crompton LFBxK-180-CDL or equivalent
LEDST1	Street lighting but with LED fixtures with LED Lamp, driver, including other materials as applicable for installation.	30W	Philips BRP320 Crompton LSTO-30-CDL or EQUIVALENT
LEDST2	Street lighting but with LED fixtures with LED Lamp, driver, including other materials as applicable for installation.	45W	Crompton LSTO-45-CDL or EQUIVALENT
LEDST3	Street lighting but with LED fixtures with LED Lamp, driver, including other materials as applicable for installation.	60W	Philips BY200P LED 27S CW PSU SI PC Crompton LSTO-60-60/CDL or EQUIVALENT
LEDBK1	Weatherproof (min. IP-65) lighting fixture (ceiling mounted and wall mounted) for use in safe areas with LED Lamp, driver, including other materials as applicable for installation.	1x10 W	Philips WT202W LED6S CW PSU S1 PC or equivalent
LEDBK2	Weatherproof (min. IP-65) well glass lighting fixture for use in safe areas with LED Lamp, driver, including other materials as applicable for installation.	60W	SUDHIR WG/182 or equivalent
LEDBK3	Bulk head fitting with cast aluminum alloy body having stove enameled finish (silver grey outside, white inside) and complete with prismatic front glass, wire guard, tropicalised gasket and BC lamp holder suitable for 100W GLS lamp.	1x100 W	Crompton IBH-1110BC Bajaj BJDB-100 Philips FXC 101 or equivalent
LEDBK4	Similar to LEDBK1 but with pressed aluminum body, finished stove enameled grey outside white inside with frosted front glass fitted with tropicalised gasket and without wire guard.	1x100 W	Philips-FXC-101 Crompton IBH-1110BC or equivalent

FIXTURE TYPE	DESCRIPTION	WATTAGE	MANUFACTURER TYPE DESIGNATION
FD9	Flood lighting fixture suitable for 2x400W SON tubular lamp comprising of anodised aluminum housing and reflector with adjustable lamp holder, heat resistant front glass cover fixed to reflector by aluminum ring and rubber gasket. (IP-54 enclosure).	2x400 W	Philips SNT-001 / 400 Bajaj BJEF-22CA/BGENF 22 Crompton FHD-1524

FLAMEPROOF/DIV. 2 LIGHTING FIXTURE

LEDFLP-1	Flameproof well glass/linear LED lighting fixture suitable for use in dust-laden atmosphere complete with LED lamp, LED driver, reflectors, mounting hardwares, clamps & brackets etc. **(Light Output i.e. LUMENS of fixture 4000 to 4500 LM and min. 100 LM/Watt.)**	Upto 30 W or 40-45 W	BALIGA 22W-FLPW-1245, 30W-FLPW-1245 KAYSONS KWL-A20, or equivalent
LEDFLP-4	Same as FLP-1 **(Light Output i.e. LUMENS equivalent to 125W HPMV lamp)**	Upto 65 W or 40-45W	
LEDFLP-4A- WG	Flameproof well glass LED lighting fixture suitable for use in dust-laden atmosphere complete with LED lamp, LED driver, reflectors, mounting hardwares, clamps & brackets etc. **(Light Output i.e. LUMENS of fixture 4000 to 4500 LM and min. 100 LM/Watt.)**	Upto 50 W	BALIGA 36W-FLPW-1245 FEPL FLP-WF-13 FLEXPRO MFWLED/3001 KAYSONS KWL-A21 or equivalent
LEDFLP-4A-LNR	Flameproof linear LED lighting fixture suitable for use in dust-laden atmosphere complete with LED lamp, LED driver, reflectors, mounting hardwares, clamps & brackets etc. **(Light Output i.e. LUMENS of fixture 4000 to 4500 LM and min. 100 LM/Watt.)**	Upto 50 W	
LEDFLP-5a	Flameproof well glass LED lighting fixture suitable for use in dust-laden atmosphere complete with LED lamp, LED driver, reflectors, mounting hardwares, clamps & brackets etc. **(Light Output i.e. LUMENS of fixture 15000 to 16000 LM and min. 100 LM/Watt.)**	120 to 250 W	BALIGA 72W-FLPW-1095 FLEXPRO MFWLED/3001 KAYSONS KWL-A22 or equivalent
LEDFLP-5b	Flameproof & WP Well glass lighting	60 W to 150	BALIGA 100W-FLPW-

	fixture suitable for use in dust-laden atmosphere classified areas with 60W to 150W LED Lamp, driver, including other materials as applicable for installation. **(Light Output i.e. LUMENS equivalent to 400W HPMV lamp)**	W	2595L FLEXPRO MFWLED/3001 KAYSONS KWL-A23 or equivalent
LEDFLP-7	Flameproof flood light LED lighting fixture suitable for use in dust-laden atmosphere complete with LED lamp, LED driver, reflectors, mounting hardwares, clamps & brackets etc. **(Light Output i.e. LUMENS of fixture 15000 to 16000 LM and min. 100 LM/Watt.)**	Upto 160 W	FEPL FLP-RH-IL-01 FLEXPRO MFFLED/4001 or equivalent
LEDFLP-9	Flameproof and weatherproof flood lighting fixture with 120W to 250W LED Lamp, driver, including other materials as applicable for installation.. **(Light Output i.e. LUMENS equivalent to 400W HPMV lamp)**	120 W to 250 W	FEPL FLP-RH-IL-02 FLEXPRO MFFLED/4001 or equivalent
FLP-12	Flameproof and weatherproof LED cluster based aviation obstruction light suitable for use in dust-laden atmosphere complete with LEDs (Twin type) with LED Lamp, driver, including other materials as applicable for installation.	Upto 60 W (Medium Intensity)	
LEDExn'R'-1	Weatherproof well glass non sparking restricted breathing type lighting fixture for use in in dust-laden atmosphere with LED lamp with LED driver. **(Light Output i.e. LUMENS equivalent to 100/200W incandescent lamp)**	Upto 30 W Or 40-45 W	
LEDExn'R'-4	Weatherproof well glass non sparking restricted breathing type lighting fixture for use in dust-laden atmosphere but with LED lamp with LED driverand separate control gear. **(Light Output i.e. LUMENS equivalent to 125W HPMV lamp)**	Upto 65 W Or 40-45 W	
LEDExn'R'-5	Same as Exn'R-1but with separate control gear. **(Light Output i.e. LUMENS equivalent to 250W HPMV lamp)**	Upto 100 W Or 60-100 W	
LEDExn'R'-6	Non sparking restricted breathing & WP Well glass lighting fixture for use in dust-laden atmosphere with 60W to 100W LED lamp with LED driver. **(Light Output i.e. LUMENS equivalent to 400W HPMV lamp)**	60 W to 100W	BALIGA 100W-FLPW-2595L KAYSONS KWL-A23 or equivalent
LEDExn'R'-7	Non sparking restricted breathing & WP lighting fixture with LED lamp with LED driver suitable for use in dust-laden	Upto 72 W	BALIGA 72W-FLPW-1095 KAYSONS KWL-A22

	atmosphere. **(Light Output i.e. LUMENS equivalent to 250W HPMV lamp)**		or equivalent

NOTES:

1. LED Lamp Efficacy shall be minimum 100 Lumens/ watt.
2. All LED fixtures including driver shall be provided with 5 years warranty.
3. Color rendering Index (CRI) for LED lamps shall be greater than 80.
4. Color temperature for LED lamps shall be 6500K.
5. Life of lamps including drivers shall be minimum 35,000 burning hours.
6. For LED fixture, integral junction box shall be provided with 2 nos. cable entries for loop-in, loop-out and associated wiring to fixture.
7. All fixtures shall be complete with lamps.
8. All fixtures shall be high power factor (Min. 0.9) type.
9. All mirror optics luminaries should be epoxy powder coated.
10. Make of fixtures shall be embossed on the body of the lighting fixtures.
11. 2 nos cable entrie shall be provided for loop in & loop out with internal wiring for driver & lamp for all LED FLP/Exn'R' fixtures.
12. LED lamps shall be provided with highly translucent diffusers with advance optical system with high internal reflectivity material of excellent and smooth output for glare free light and no visibility of LED to eyes

ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

DATA SHEET
UPS SYSTEM

Datasheet No.
A951-000-16-50-DS-013
Rev.No. 0

PURCHASER'S DATA

A Site conditions

1	Ambient temperature,		3	Altitude :	<1000m
	- Maximum :	46 °C	4	Atmospheric condition :	Humid & corrosive
	- Minimum :	1 °C	5	Location :	Indoor- in airconditioned room
	- Design :	45 °C	6	Applicable EIL specification	6-51-0017
2	Design temperature for battery sizing	10 °C			

B Input power supply

1	Voltage :	415V ±6%	3	Phase :	◉ TPN ○ SPN
2	Frequency :	50Hz ±3%	4	System fault level :	50kA

C System requirements

1	Equipment tag no.:		11	Type of battery :	Ni-Cd
2	Type of inverter:	IGBT	12	Battery backup time :	mins.
3	Rating :	* kVA(0.8 P.F.)			
4	Phase :	◉ TPN ○ SPN			
5	Output voltage :	110V ±1%			
6	Output frequency :	50Hz ±1%			
7	Mode of operation :	Select			
8	Load power factor,		13	Battery rack information :	
	- Rated :	0.8 (lag)	14	Ingress protection of enclosure :	
	- Variation :	0.6-1.0 (lag)	15	Cable entry :	
9	Fault diagnostic unit :	○ Required ◉ Not required	16	Colour shade :	631 as per IS5
10	Cell booster	◉ Required ○ Not required			

Description	kVA	Backup time (mins.)
Instrumentation		
Telecom		
PA system		

D AC distribution board (Outgoing feeder details)

1	Item no. as per MR	Incomer rating (Amp.)	No. of outgoing feeders	kVA rating of feeders	Switch rating (Amp.)	Fuse rating (Amp.)

2	Mounting of ACDB :	Floor mounted	3	Type of ACDB	Compartmentalised (drawout)

E Specific requirements

a) All interconnecting cables between all panels of UPS system are included in vendor's scope.

b) ECS Interface

Normally Open (NO) potential free contacts shall be wired upto terminal strip for connection by purchaser to ECS interface, for the following conditions:

- Charger Failure
- Inverter Failure
- Battery Discharged
- Battery Isolated

Note:

*** To be decided by contractor in line with Engineering Design Basis/Bid document.**

Rev.	Date	Purpose	Prepared	Checked	Approved
0	18.11.16	ISSUED AS TENDER INPUT	GK	VK	PG

MANUFACTURER'S DATA

A UPS system

1	Make :		
2	Type designation :		
3	Rating :	kVA at 0.8 p.f.	
4	Mode of operation :		
5	Output voltage distortion under the following conditions,		
	- For 50% step load :	V±	%
	- For 100% step load :	V±	%
	- For 100% step unload :	V±	%
	- Power supply interruption and restoration :	V±	%
	- Load transferred to bypass line :	V±	%
	- When one inverter gets faulty and load transferred to healthy inverter :	V±	%
6	Phase angle distortion under the following conditions, (for three phase inverter only)		
	- For 50% step load :	120°±	%
	- For 100% step load :	120°±	%
	- For 100% step unload :	120°±	%
	- Power supply interruption and restoration :	120°±	%
	- Load transferred to bypass line :	120°±	%
	- When one inverter gets faulty and load transferred to healthy inverter :	120°±	%
7	Maximum recovery time to reach steady state after above disturbances (clause nos. 5 & 6) :	milli sec.	
8	Redundancy of cooling system :		

B Inverter

1	Rating :	kVA	
2	No. of phase(s) :		
3	Steady state output voltage,		
	- Nominal :	V	
	- Variation :	V	
4	Output voltage adjustment range at rated load :		
5	Input DC voltage,		
	- Nominal :	V	
	- Range :	V	
6	Frequency variation limit for inverter when phase locked with mains :		
7	Allowable unbalance between phases : (for 3 phase only)		
8	Harmonic distortion at inverter output at rated load,		
	- For linear load:		
	- For non linear load:		
9	Overload capacity & duration :		
	- For 110% load:	min.	
	- For 125% load:	min.	
	- For 150% load:	sec.	

C Static switches

1	No. of static switches in the UPS system :		
2	Current rating at specified ambient,		
	- Continuous :	A	
	- Short time :	A	

D Battery charger

1	Current rating :	A	
2	Type of charger :		

9	Noise level :		
10	Guaranteed overall dimensions of UPS system except ACDB and battery,		
	- Length:	mm	
	- Depth:	mm	
	- Height:	mm	
11	Efficiency of each rectifier and inverter module including input and output transformer		
	- At 100% load :	%	
	- At 75% load :	%	
	- At 50% load :	%	
	- At no load :	%	
12	Efficiency of bypass stabiliser including input transformer,		
	- At 100% load :	%	
	- At 75% load :	%	
	- At 50% load :	%	
	- At no load :	%	
13	Heat loss for the total system :	kW	
14	Overall efficiency of UPS system (ratio of output load to input power drawn from mains when all charger and inverters are on and synchronised with bypass, operating at no load),		
	- At 100% load :	%	
	- At 75% load :	%	
	- At 50% load :	%	
	- At no load :	%	
10	Short circuit capacity & duration :		
11	Output voltage/phase angles (for 3 phase only),		
	- For 30% unbalance load :	V/	deg.
	- For 40% unbalance load :	V/	deg.
	- For 50% unbalance load :	V/	deg.
	- For 100% unbalance load :	V/	deg.
12	Type of control circuit :		
13	Max. allowable rating of outgoing feeders for fault clearance of feeder fault by UPS with mains bypass supply back up,		
	- With fast acting semiconducting fuses :	amps.	
	- With normal HRC fuses :	amps.	
14	Max. allowable rating of outgoing feeders for fault clearance of feeder fault by UPS without mains bypass supply back up,		
	- With fast acting semiconducting fuses :	amps.	
	- With normal HRC fuses :	amps.	
15	Load Crest factor		

3	Type of static switch :		
4	Transfer time,		
	- Synchronised mode :	milli sec.	
	- Unsynchronised mode :	milli sec.	

3	Output voltage range under,		
	- Float charging condition :	V	
	- Boost charging condition :	V	

4	Output voltage accuracy under specified input		6	Maximum harmonic content in input current :	
5	Maximum ripple content on DC side with battery,		7	Input transformer rating :	kVA
	- Connected :				
	- Disconnected :				
E	**Manual transfer devices**				
1	Make :		3	Rating,	
2	Type designation :			- Continuous :	
				- Short time :	
F	**Battery**				
1	Make :		11	Overall rack dimension	
2	Type designation :			- Length :	mm
3	Type :			- Depth :	mm
4	AH rating :			- Height :	mm
5	End cell voltage :		12	Battery charging requirements,	
6	Nominal Voltage :			- Nominal voltage/cell :	V
7	Boost charging time :	hrs.		- Float voltage/cell :	V
8	No. of cells in each bank :			- Boost charging voltage/cell :	V
9	No. of battery banks :		13	Container type :	
10	No. of racks :		14	No. of recommended air changes/hour for battery room :	m^3
G	**Stepdown bypass transformer with solid state voltage stabiliser**				
1	Make :		5	Accuracy of stabiliser :	%
2	Type designation :		6	Type of control :	
3	Rating :	kVA	7	Type of cooling :	
4	Voltage ratio :	V	8	Type of stabiliser :	
H	**AC distribution board**				
1	Make :		5	Overall dimensions,	
2	Type designation :			- Length	mm
3	Rating :	A		- Depth	mm
4	Degree of protection			- Height	mm
5	No. of outgoing Feeder / rating of each			(Including max. & min operating Height)	
I	**Cell booster**				
1	Make :		5	Overall dimensions,	
2	Type designation :			- Length	mm
3	Voltage range :			- Depth	mm
4	Current range :			- Height	mm
J	**Reliability**				
1	Safety factor used for selecting the components,		2	MTBF/MTTR :	
	- Electronic devices :		3	Availability factor :	
	- Electrical devices :				

DATA SHEET FOR DRY TYPE TRANSFORMER

PART - I (TO BE FURNISHED BY PURCHASER)

1.0	**SITE CONDITIONS**			
1.1	Maximum ambient temp		:	46.1 °C
1.2	Minimum ambient temp		:	1°C
1.3	Design Ambient temp.		:	45°C
1.4	Relative humidity		:	Max 89 %
1.5	Altitude		:	< 1000 m above sea level
1.6	Environment		:	Tropical, dusty & corrosive as found in Refineries
2.0	**OPERATING CONDITIONS**			
2.1	Primary voltage		:	415V
2.2	Fault level		:	50 kA
2.3	Earthing system			
		Primary	:	Solidly earthed
		Secondary	:	Solidly earthed
3.0	**GENERAL DATA**			
3.1	Service		:	Lighting
3.2	Duty		:	Continuous
3.3	Type of cooling		:	ANAN
3.4	Installation		:	Within substation
3.5	Painting		:	Epoxy
	Colour		:	RAL 7032
4.0	**ELECTRICAL DATA**			
4.1	No. of windings		:	Two
4.2	Phase		:	3
4.3	Frequency		:	50 Hz±3%
4.4	Insulation class		:	B (Upto 100kVA)
			:	H (Above 100kVA)
4.5	Winding insulation		:	Uniform

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1	14.12.16	REVISED AND REISSUED FOR TENDER	GK	VK	PG
0	21.11.16	ISSUED FOR TENDER	GK	VK	PG

4.6	Neutral earthing	:	Solidly earthed
4.7	Prim. phase sequence		
4.8	Sec. phase sequence	:	* (To suit switchgear/As per IS:8623)

5.0 SPECIFIC REQUIREMENTS

5.1	Transformer Tag nos.	: Later	
5.2	Rated KVA	: *	
5.3	Voltage ratio	: 415/ 415V	
5.4	Vector group	: Dyn 1	
5.5	% Impedance	: 4 % minimum	
5.6	Off load tap changer	: ± 7.5%,each step of 2.5%	
5.7	Neutral C.T.	: N.A.	
5.8	Terminal details		
	Terminal location	Primary : * Secondary :*	
5.9	Primary	: Cable box	
	Cable size/Type	: Later	
	Secondary	: Cable box	
	Cable size/Type	: Later	

6.0 ACCESSORIES

6.1	Two temp. Sensing devices in each limb	: Yes
6.2	Temperature sensing relay	: Yes
6.3	Rollers (Distance between rollers 1000 mm)	: Yes (Required for Transformer rated above 100 kVA)
6.4	Indicating platinum resistance type Thermometer with contacts	: Yes (Required for Transformer rated above 100 kVA)
6.5	Marshalling box (IP-55)	: Yes
6.6	Cross channels with towing lugs	: Yes
6.7	Separate neutral bushing outside terminal box with connector assembly	: Yes
6.8	Busduct flange on LV side	: No
6.9	Lugs and cable glands	: Yes

7.0 TESTS REQUIRED

7.1	Heat Run Test	: Yes (Type test certificates on 1 set of each rating)

PART-II (TO BE FILLED BY VENDOR)

1.0	Rating of transformer	:
2.0	**PERFORMANCE**	
	Losses shall be inclusive of positive tolerance at nominal tap	:
2.1	No load loss	
	At 100%V	:
	At 110%V	:
2.2	F.L. Copper losses at 75°C	
2.3	No load current	
	At 100%V	:
	At 110%V	:
2.4	Efficiency at full load at 75°C	:
	At 0.8 p.f.	:
	At 1.0 p.f.	:
2.5	Efficiency at 1/2 load at 75°C	
	At 0.8 p.f.	:
	At 1.0 p.f.	:
2.6	Load at which max. efficiency occurs	:
2.7	Maximum efficiency	:
2.8	Percentage regulation at 75°C	
	At 1.0 PF	:
	At 0.8 PF	:
3.0	**CONSTRUCTIONAL FEATURES**	
3.1	Location of terminals	:
3.1.1	Primary	:
3.1.2	Secondary	:
3.2	Location of Neutral CT	:
4.0	**MECHANICAL DATA**	
4.1	Core & Winding wt.	:
4.2	Total wt.	:
4.3	Overall dimensions LXBXH (mm)	

PURCHASER'S DATA

A	**Site conditions**				
1	Ambient temperature,		2	Relative humidity	85 %
	- Maximum :	46.1 °C	3	Altitude <1000	m above mean sea level
	- Minimum :	1 °C	4	Atmosphere	Humid & Corrosive
	- Design :	45 °C			
B	**Area classification**				
1	Buildings	Safe			
2	Plant units	As per area classification			
C	**General data**				
1	Type of fire alarm panels	Microprocessor based			
2	Area to be covered by FA system	As per block diagram			
D	**Power supply**				
1	Input power (Voltage/Frequency)	See Note-1	4	Temperature for battery sizing	10 °C
2	Battery type	VRLA	5	Ageing factor	0.8
3	Duration for battery sizing (Refer clause 5.2.3 of spec.6-51-0076)				
E	**Type of fire alarm system**				
1	Conventional	Not Required			
2	Microprocessor based analogue addressable	Required			
F	**Specific requirements of the fire alarm system**				
1	Status signals, alarms & shutdown signal requirements	Refer Cl. 9 of 6-51-0076			
a	Automatic signal for clean agent/ CO_2 release	Required	g	Fire water pump running indications	Required
b	Selector switches for clean agent/ CO_2 supply	Not Required	h	Fire water pump start push buttons	Not Required
			I	Control for sirens	Required
c	Manual push button for discharge of clean agent/CO2	Not Required	j	Controls & signals to various control rooms	Required
			k	Repeat alarm signal to mimic panel	Not Required
d	Clean agent/CO_2 discharge inhibit push-buttons	Not Required	l	Repeat alarm signal to repeat alarm panel	Required
e	Deluge valve activation/test push-buttons and activated status lamps	Not Required	m	Status of battery condition	Required
f	Shutdown signals (potential free contacts for air handling units)	Required			
2	Cable entries for manual call points	2 Nos.from bottom			

Notes:

1. **Following power supplies shall be provided by purchaser:**
   415V 3 Ph AC supply for Siren
   240V AC for each DGFAP, CFAP and Repeater Panel

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0	21.11.16	Issued For Tender	GK	VK	PG

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MANUFACTURER'S DATA

PART-2 (to be filled by the vendor)

A	**Make, type and model no. of following items**				
			Make	**Type/Model No.**	**Dimensions**
1	**Multisensor Detectors**				
a	Safe area				
b	Hazardous area				
2	**Ionisation type smoke detectors**	**NA**			
a	Safe area				
b	Hazardous area				
3	**Photoelectric type detectors**	**NA**			
a	Safe area				
b	Hazardous area				
4	**Linear beam smoke detectors**				
a	Safe area				
5	**Manual break glass boxes**				
a	Safe area				
b	Hazardous area				
6	**Ultra-violet flame detectors**	**NA**			
7	**I/R detectors**	**NA**			
8	**Heat sensing cables**	**NA**			
a	Detector unit for heat sensing cables				
9	**Wired telephone handset**	**NA**			
10	**Response indicators**	**NA**			
11	**Exit signs**				
12	**Hooters**				
a	Hooter acknowledge boxes				
13	**Blinking lights**				
14	**Halon/CO2 release/Inhibit switches**				
15	**Siren**				
16	**Detectors where radioactive**	**NA**			
	materials are used				
a	Strength of radioactive material				Less than 1 microcurie
B	**Conventional fire alarm system**	**NA**			
1	Central fire alarm panel				
a	Make & model no.			e	Dimensions (LXDXH)mm
b	No. of zones			f	Mimic
c	Operating voltage & power			g	LED size
	consumption			h	LEDs arrangement
d	Ingress protection			I	LEDs arrangement basis
2	**Siren**				
a	Siren				
b	Output	KW/	db at 1 meter		
c	Voltage		V		
	Phase		Phase		
	Frequency		Hz		
d	Starter for siren (IP-55)				
3	**Mimic panel (if non-integral)**				
a	Make & model no.			c	Mounting
b	Operating voltage			d	Dimensions (LXWXH)mm
4	**Zonal fire alarm panel**				
a	Make & model no.			d	Dimensions (LXDXH)mm
b	Operating voltage & power			e	Max.& Min.no.of zones
	consumption			f	No. of devices per loop(max.)
c	Mounting				

5	**Repeat alarm panel**				
a	Make & model no.		d	Dimensions (LXDXH)mm	
b	Operating voltage& power consumption		e	LEDs arranged in a matrix	
			f	LEDs arranged on graphic mimic	
c	Mounting				
C	**Computer aided fire alarm system**				
1	**Central fire alarm panel (CFAP)**				
a	Make & model no.		h	Processor redundancy (Refer clause5.3.1.28 of spec.6-51-76)	
b	Memory capacity				
c	No.of inputs				
d	No.of programable outputs		l	Ingress protection	
e	Scanning speed		j	Dimensions (LXDXH)	
f	Operating voltage & power consumption				
g	Software used				
2	**Video display unit (VDU)**				
a	Make & model no.				
b	Locations				
c	VDU screen size				
d	VDU type/Colour				
e	Dimensions (LXDXH)mm				
3	**Printer**				
a	Make & model no.		d	Speed & size	
b	Quantity		e	Dimensions (LXDXH)mm	
c	Locations				
4	**Data gathering cum fire alarm panel (DGFAP)**				
a	Make & model no.		f	Number of programmable outputs	
b	Type of panel		g	Scan frequency for devices	
c	Max.and min.number of loops		h	Operating voltage & power consumption	
d	Max number of devices in each analogue loop				
			l	Communication protocol	
e	Event history storage processing		j	Ingress protection	
5	**Repeat alarm panel**				
a	Make & model no.		c	Display	
b	Operating voltage & power consumption		d	Ingress protection	
			e	Dimensions (LXDXH)mm	
D	**Battery bank & charger details**				
1	**Battery**	**DGFAP**		**CFAP**	**Zonal panel**
a	Make				
b	Type/modelno.				
c	AH Rating				
d	No. of cells				
e	Voltage per cell				
f	End cell voltage				
g	Dimensions (LXDXH)mm				
2	**Charger/UPS**	**Charger**		**UPS**	
a	Make				
b	Type/modelno.				
c	Rating	Amp			
d	Dimensions (LXDXH)mm				
E	**Power requirements**				
a	DGFAP (Watts)				
b	Zonal fire alarm panel (Watts)				
c	Total fire alarm system (Watts)				

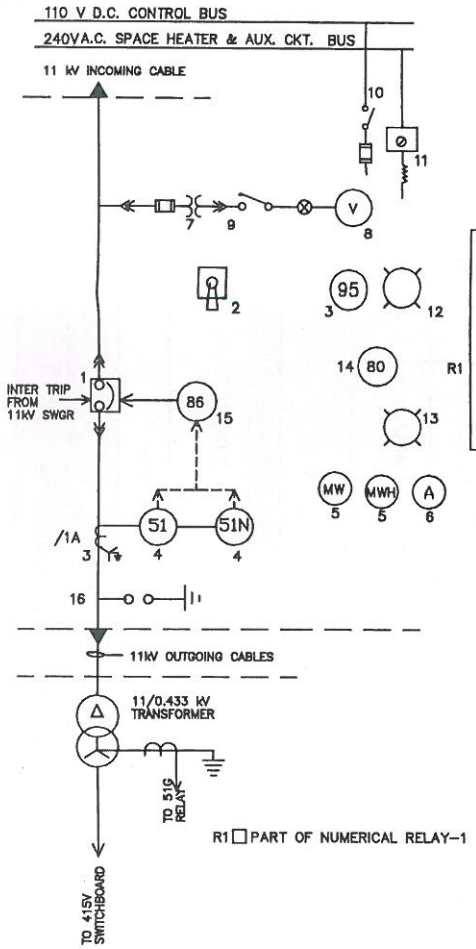
F	**Cables**
1	**Recommended cable/wire size & type**
a	Between DGFAP & detectors, manual call points
b	Between Zonal panel & detectors manual call points
2	**Recommended cable size & type**
a	Between CFAP & DGFAP
b	Between CFAP & Zonal panel
c	Between CFAP & repeat alarm panel
d	Between DGFAP & repeat alarm panel
e	Between zonal panel & repeat alarm panel
3	**Cable resistance (Max.per loop)**
4	**Cable capacitance (Max.per loop)**
G	**Details of equipment certification/approval for hazardous area application**

Equipment	MCP	Multisensor Detector	Linear Beam Detectors	Others	
MR item no.					
Explosion protection class (as applicable)					
Type reference no.					
Reference no.& date of CMRI/ other test					
certificates of recognised test authority					
Reference no.& date of CCE approval certificate					
BIS License no. & date					

PROJECT: DEVELOPMENT OF SILOS FOR STORAGE OF WHEAT

CLIENT: M/s CWC

REV.	DATE	PURPOSE	BY	CHKD	APPD.
1	14.12.16	REVISED AND REISSUED FOR TENDER	GK	VK	PG
0	21.11.16	ISSUED FOR TENDER	GK	VK	PG
A	04.11.16	ISSUED FOR CLIENT COMMENTS	GK	VK	PG



EQUIPMENT DATA

ITEM NO.	NEMA NO.	QTY.	DESCRIPTION
1	52	1	CIRCUIT BREAKER VCB
2	52 C/S	1	BKR. CONTROL SW. CLOSE-NEUTRAL-TRIP (LOCKABLE WITH SPRING RETURN TO NEUTRAL)
3	95	1	TRIP CKT. SUPERVISION RELAY 'ALSTOM' TYPE VAX 31 OR EQUIVALENT
4	51	2	IDMTL O/C RELAY (50-200%)
4	51N	1	IDMTL E/F RELAY (10-40%) WITH STABILISING RESISTOR
5	–	1	MW & MWH METER
6	–	1	AMMETER(3 PHASE)
7	–	3	Y_n/Y_n CONNECTED 50VA, Cl.-1, P.T. WITH $\frac{110V}{\sqrt{3}}$ SECONDARY
8	–	1	VOLTMETER WITH SELECTOR SW. 3-WAY AND OFF
9	–	1	4 POLE MCB 10A
10	–	1	D.P. SWITCH 10A WITH FUSE FOR D.C. CONTROL SUPPLY
11	–	1	PANEL SPACE HEATER WITH SWITCH, FUSE AND THERMOSTAT.
12	–	AS REQD.	INDICATING LAMPS -LED TYPE
13	–	AS REQD.	INDICATING LAMPS-LED TYPE (TRANSFORMER TROUBLE)
14	80	1	CONTROL SUPPLY SUPERVISION RELAY 'ALSTOM' TYPE VAA 11 OR EQUIVALENT
15	86	1	TRIPPING RELAY 'ALSTOM' TYPE VAJH 23 OR EQUIVALENT
16	–	1SET	METAL OXIDE TYPE SURGE SUPPRESSOR

NOTES:

1. ANTIPUMPING RELAY USED, IF ANY, SHALL BE CONSIDERED AS PART OF BREAKER MECHANISM.
2. THE ONE LINE DIAGRAM SHOWN ABOVE IS ONLY INDICATIVE. ALL THE ITEMS SPECIFIED UNDER 'EQUIPMENT DATA' AND IN CPWD SPECIFICATION SHALL BE INCLUDED IN VENDOR'S SCOPE.
3. ALL PROTECTION RELAY SHALL BE NUMERICAL TYPE (EXCEPT TRIPPING RELAY, 86 WHICH IS ELECTROMECHANICAL TYPE)
4. VA BURDEN OF CT SHALL BE DECIDED BY VENDOR

ENGINEERS INDIA LIMITED NEW DELHI	H.V. SW. BD. DATA SHEET 11kV ISOLATION BREAKER PANEL	DATA SHEET A951-000-16-50-DS-0021 SHT 1 OF 1	REV 1