PROJECT: TURBO BLOWER STATION (Package-010A)

CUSTOMER: M/s NMDC LIMITED, 3.0MTPY INTEGRATED STEEL PLANT, NAGARNAR, CHHATTISHGARH

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TECHNICAL SPECIFICATION FOR INTELLIGENT MCC (IMCC)

This document is to be followed with concurrence to Main Technical Specification for LT Switchgear Package PY-55127 Rev-00

1.0 INTELLIGENT MOTOR CONTROL CENTRE (IMCC):

1.1 Constructional features:

Intelligent fully draw-out type with modules having service, test and isolated positions. Floor mounting, free standing with ISMC 75 high for fixing on the inserts on the floor. MCC shall be single front, totally enclosed dust and vermin proof.

MCC shall be Modular type, fully compartmentalized with metal/insulating material partition. All the module of the MCCs shall be spacious to facilitate maintenance of equipment inside modules. The design of modules shall be such as to provide interchangeability of similar unit.

Pollution degree applicable shall be pollution degree 3 as per IS 13947 (Part 1) : 1993. Enclosure shall have min. IP-54 degree of protection.

Paint shade shall be Light Grey RAL-7035.

1.2 Incomer and bus coupler panels:

Incomers and bus coupler shall be electrically & mechanically through castle key interlock to prevent parallel operation. However, a definite delay defeat Interlock switch shall be provided to facilitate momentarily parallel operation. Auto changeover facility shall also be provided between the two incomers & bus coupler.

Incomers shall be provided with MFM (Multi-Function Meter) with communication facility with DCS through Intelligent Controller Communication Network.

1.3 Feeder modules:

Feeders shall be single front, fully draw-out type. MCC shall consist of MPCB/MCCB, contactor and intelligent controllers (for DOL feeders only) with communication features as main power components to ensure type 2 coordination. The short circuit release of MPCB/MCCBs shall be selected such as to avoid tripping during starting of devices.
MPCB/MCCBs outgoing feeders shall be provided with Microprocessor based adjustable O/C, S/C, E/F releases. MCCB <160A rating need not be adjustable type.

RDOL feeders shall be provided with MPCB/MCCBs, contactors and thermal overload protection.

Intelligent Module for RDOL feeders is not applicable.

1.4 Busbars and terminations:

Busbars and connection shall be of high conductivity –Al/Al Alloy E-91E of suitable hardness and purity complying with as per IS-5082-1981. Busbars shall be insulated by heat shrinkable PVC Sleeves.

Temperature rise of bus bars shall not be more than 40 deg.C above ambient of 50 deg.C at rated load condition and during short circuit condition upto 200 deg.C.

Busbars shall be rated for the nominal current rating of incoming breaker and for the full short-circuit rating. Earth bus shall run throughout the length of MCC at bottom.

Control bus shall be provided in the bus bar chamber isolated with main bus in all the MCCs. Similarly power and control terminations shall be in separate chambers in the MCCs. Cable allay shall have sufficient space for maintenance and minimum width of cable allay shall be 300 mm. Shrouding/isolation shall be provided for outgoing power terminations in the cable allays. Modules of MCCs shall be spacious for easy maintenance of the various equipment sides.

1.5 Short circuit strength:

Rated short time withstand current shall not be less than 50 KA for 1 second. Rated peak withstand current not less than 2.1 times the specified short circuit level.

1.6 Intelligent Controllers:

The intelligent controllers shall be of modular type and must perform the basic functions.

- Protection
- Control
- Metering
- Annunciations

Contacts from components (breakers, contactors) shall be hardwired to I/O terminal block of the controller. All the potential transformer PT's, protection CT's (phase CT and neutral CT) shall be hard wired directly to the controller or the controller module shall have built-in CT and PT for protection & metering purpose.

Separate power source (240 V AC) from UPS for controllers is provided. The same shall be provided to each controller through MCB (for controller only). To achieve the same, a separate bus for UPS supply shall be provided in MCC.

Two redundant 240V AC UPS power supplies will be provided at each MCC by Purchaser. Automatic changeover and manual changeover of UPS buses in MCC shall be provided along with selector switches by bidder.

The controller shall have following inputs and outputs:-

i. Minimum 12 digital and 2 analog inputs (for increasing the number of I/O's extended module can be added).
ii. One thermistor/RTD input shall also be available as per requirement.
iii. Minimum 4 relay outputs (240 V AC, 10A) shall be provided.
iv. One Analogue output.
For increasing/achieving the desired no. of I/Os extended modules can be added.
v. Refer drive control philosophy (refer Annexure-05) and DCS I/O list (refer Annexure-04) for number of DI, DO, AI requirements.

The controller shall have following led indications:

- Controller healthy
- Controller fault
- Controller power supply healthy

Any Intelligent controller unit shall communicate on the communication bus (Device-net /Modbus/Profibus).

The controller shall have fault memory to store faults on FIFO sequence.

Control shall be done:-

- From 16 character keypad and backlit LCD alphanumeric display provided on the controller. The keypad shall have facility to start and stop the motor through a separate key (touch screen type) or separate PBs are to be provided for the same on the front of the module.

- From HMI (located in control room).

Communication to DCS:

I. Single Trunk line configuration to each module, however suitable conversion of the media for achieving the redundancy in the communication along with complete accessories shall be provided at the beginning of MCC from where communication to DCS shall be on redundant communication bus. Also, Converter at DCS end including all the termination accessories are included in the scope of switchgear vendor.

II. Bidder to note that Master controller as part of DCS is on MODBUS RTU protocol through 1 no. RS-485 port (Terminal). Accordingly, bidder shall consider all the communicating devices including converter & accessories to suit the MODBUS RTU protocol (RS-485 terminal) at DCS end.

Incase bidder is not having Modbus RTU protocol at device level, Bidder may offer other protocol (Profibus/Device net.). However, Bidder shall provide necessary protocol converter to meet Modbus RTU protocol (RS-485 terminal) at DCS end.

III. Redundant communication between IMCC and DCS. Converter shall convert single trunk configuration to redundant configuration & vice versa along with protocol converter if applicable.

IV. Maximum 15 No. of devices shall be connected in each (MOSBUS/Profius/Devicenet) communication network at device level. Accordingly, Bidder shall select no. of converters, Communication cables and other accessories.

V. Maximum distance between IMCC and DCS shall be 100 mtrs.

VI. Communication cabling within IMCC upto converter at IMCC & DCS in the scope of switchgear vendor.

VII. All the configuration and monitoring shall be done through inbuilt software. All the required software required for operation and communication shall be provided with latest version available.

VIII. Bidder shall submit the system architecture.

1.7 Working Philosophy:

Provision of Parameterization of the intelligent controllers from DCS shall be provided. Necessary software and hardware shall be provided. DCS shall be able to monitor, control, metering and annunciations for O/G feeders and shall be able to monitor metering and annunciations of I/Cs & B/C.

All the necessary inputs for metering, status /indication and annunciation for I/C, B/C and out going feeders shall be hooked up to DCS through redundant communication bus as mentioned for Intelligent Controller. Necessary software and hardware shall be provided. Commands for O/G feeders from DCS shall be directly hardwired to the respective controllers.

DCS located in control room shall be able to monitor, control, metering and annunciations for O/G feeders and shall be able to monitor metering and annunciations of I/Cs & B/C. Please refer I/O list & Drive control philosophy for Signal Interface.

1.8 Motor protection moulded case circuit breaker (MPCB)

The characteristic shall match the motor duty application. Rated ultimate short circuit breaking capacity (Icu) shall be 50 KA. Ratings shall be at least 125% of the full load current of the motor. For small rating drives such as valves. Utilization category shall be A.

1.9 Magnetic contactors

Pick shall be positively at voltage between 85% and 110% of rated value. For frequently reversing drives, AC 3 rating selected shall be 50% higher than full load current of the motor at the specified duty cycle shall be provided .For reversible drives, mechanically as well as electrically interlocked contactors shall be used.

1.10 Motor controller

The motor controller should offer the following protections:

- Thermal overload
- Adjustable overload pre-alarm
- Earth fault
- Stalling
- Unbalance
- Short circuit
- Single phase prevention
- Under current
- Too many starts
- Under voltage
- Under voltage lockout
- Breaker or contactor failure alarm
- Trip failure alarm
- Over temperature
- Winding and bearing temperature (if applicable for motor)

The motor controller should offer the following display and indications:

- Voltage
- Frequency
- Power factors
- Power consumption, KW
- Thermal capacity
- Temperature
- Phase and average Amp.
- Earth fault current
- % motor load
- % unbalance
- Peak current during starting
- Starting time
- Pre trip values

The motor controller should offer the following Fault /alarm history descriptions:

- No. of trips
- No. of operations (Forward/Reverse)
- Hours run
- Hours run last start
- Kilowatt hours
- Kilowatt peak demand
- Alarm / trip history (with date and time)

- Alarm /trip description
- Reference start curve (in graphics)
- Start curve (in graphics)
- Time to trip /reset

1.11 Push Buttons / Indicating lamps /Indicating instruments

Push buttons shall be spring return, push to actuate type and their contacts shall be suitable to carry and break 240 V AC, 10 A and 220 V DC, 1 A. Indicating lamps shall be LED LVGP (Low Voltage Glow protection) type. Standard colours shall be applicable for push buttons and for indicating lamps. Indicating instruments shall be flush mounting, square dial with 90 deg. scale with zero adjusting device for external operation. Accuracy shall be 1.0 or better. KWh meter shall also be provided with incomers.

1.12 Current transformers

The thermal and dynamic stability current for CTs and CT ratio shall be as per requirement. Protection and measuring current transformer shall be bar type primaries with 5A (max) secondary with thermal and dynamic ratings corresponding to the units with which they are used.

Accuracy Class : Metering CTs accuracy class 1.0
Protective CTs accuracy class 5 P 20.

1.13 Control transformer

Control transformers shall be cast resin, dry type 415V/240V, primary taps at +-2.5%, +-5% and shall be mounted in draw-out trolley. Control supply shall have supervision facility, alarm shall be provided for non availability of any one of the control supply. Automatic /manual changeover facility shall also be provided. Auto-changeover shall be blocked if power supply to respective section is not available.

For capacity consideration of control transformers, each shall be capable to meet 100% load including spare feeders and 10% cushion for future and 15 VA for each module for remote aux. relays indication lamps.

i. 415/240V Control Transformer for Motor Control Supply.
ii. 415/240V for Space heater (derived from upstream).

1.14 Internal Control Wiring and External Terminations

Internal control wiring shall be by 1100V grade PVC insulated, single core stranded copper conductor of minimum cross section 2.5 mm square for CTs and space heater circuits and 1.5 mm square for other circuits. For external terminations, 1100V grade multi-way terminal blocks of non-tracking moulded plastic shall be used complete with insulated barriers, stud type terminals, washers, nuts and lock nuts and identification strips. Power and control terminals segregated.

2.0 INTELLIGENT TYPE MCC :-

A.	**General**	
1.0	Type	Metal clad. cubicle construction Draw-out type.
2.0	Construction	Modular construction. Fully compartmentalized with metal / insulating material partition.
3.0	Enclosure class	IP 54 degree of protection.
4.0	Type of execution	Single front.

5.0	Mounting	Floor mounting. Free standing with ISMC 75. Incomer, Bus coupler in single tier and Outgoing in multi tier.
6.0	Installation	Indoor.
B.	**Constructional Features :-**	
1.0	Sheet steel	
	Thickness	2.0 mm for load bearing members. 1.6 mm for non load bearing members.
	Material	CRCA
2.0	Cable entry	Incomer :- Bottom cable entry. Outgoing :- Bottom cable entry.
3.0	Design	• Separate cable alley. • Extendable at both ends. • Rear access through removable rear hinged cover door. • All the components shall be accessible from front. • Motor controller shall be flush mounted on the respective door. • Interchangeable facility of same type of feeder modules. • Each module to have covering at the bottom.
4.0	Interlocking & protection	Module door interlocked with main power isolating devices. Power circuit isolation device to have pad locking in the OFF position with door closed.
5.0	Operating height	Minimum :- 300mm Maximum :- 2000 mm.
6.0	Gland plate	Undrilled removable bottom gland plates (3 mm thick)
7.0	Miscellaneous	Neoprene rubber gasket shall be provided for all the doors , removable covers & between adjacent covers Lifting hooks for all the shipping sections Doors shall have concealed hinges.
8.0	Labelling	Clear legible identification labels (anodized aluminum with white letters engraved on black background) with letter sizes of :- 25-50 mm for MCC panel in front and back side of the panel. 5 mm for components and module name plates. Danger board on front and rear sides in English, Hindi & regional Language.
9.0	Earthing	Two separate earthing terminals shall be provided. Bolted joints with tooth spring washers for good earth continuity. Earth bus to run in all cable alley of the panel.
10.0	Shipping length	To be limited to 2.4 M.

11.0	Limiting dimensions	Width of MCC :- 800 mm Width of Module :- 500 mm Width of Cable alley :- 275 mm Height of module :- 400 mm (min) Depth of MCC :- 600 mm , maximum However depth of incoming ACB panel will be 1200 mm (minimum).
12.0	Paint shade	Light Grey RAL 7035.
13.0	Panel space heater	In each panel with thermostat, fuse, switch.
C.	**Bus-bars**	
(i)	**Main horizontal & vertical busbars**	
1.0	Arrangement	Three phase & neutral.
2.0	Material	High conductivity electrolytic Aluminum alloy confirming to grade E91E as per IS-5082 -1981.
3.0	Phase Bus-bar Rating	Shall be able to carry continuously the connected load (considering diversity factor) plus a 25% margin Max. current density shall be :- 1.0 A/sq.mm for Aluminum 1.5 A/sq.mm for Copper.
4.0	Neutral Busbar Rating	50 % of phase busbar rating
5.0	Short circuit rating	50 kA for 1 sec.
6.0	Busbar configuration	Red-yellow-blue from front to back or top to bottom or left to right as viewed from front.
7.0	Busbar insulation	Heat shrinkable PVC R,Y,B coloured sleeves for phases. Black for neutral.
8.0	Busbar supporting insulators	Non-hygroscopic Flame retarded Track resistant High strength Sheet moulded compound or equivalent polyster fibre glass moulded type.
9.0	Max. temp. rise of bus	Not to exceed 40 deg. C. above ambient of 50 deg.C.
10.	Air clearance for bare busbar	Phase to phase :- 25.4 mm (minimum) Phase to earth :- 19.0 mm (minimum)
11.0	Joints and tap off points	Busbar joints and tap off points shall be shrouded and bolted (with cadmium-coated bolts with plain and spring washers and locknuts). Bimetallic connectors for connection between dissimilar metals. Anti-oxide grease for all bus connections.

12.0	Neutral bus isolation	Through disconnecting link.
13.0	Vertical busbar	Rear side
14.0	Creepage distance	As per IS: 13947 (1993), Part-1.
(ii)	**Earth bus**	
1.0	Material	GI.
2.0	Size	Minimum 50 x 6 mm with extension at both ends.
(iii)	**Control bus**	
1.0	Material	Copper.
2.0	Size	Minimum 25 x 3 mm.
3.0	Segment	Control bus shall be sectionalized and each bus shall be fed from control trafo of respective section, however selector switch in one module shall be available to select the feed of both sections of control bus from either of control trafo also.
4.0	Selector switch	4 position (Trafo -1, Trafo -2, Individual, OFF) and as described above for all Control Transformers.
(iv)	**Power supply bus for Intelligent motor controller (from UPS)**	
1.0	Voltage	240 V AC , 50 Hz.
2.0	Material	Copper.
3.0	Size	Minimum 25 x 3 mm.
D.	**Insulation level**	
1.0	Rated insulation voltage	1100 V
2.0	Impulse withstand voltage	4 kV as per IS-13947 (Part I) 1993
3.0	One minute power frequency withstand voltage	2.5 kV for power circuit & 500 V for control circuit
E.	**Pollution Degree**	
1.0	Pollution Degree	Pollution Degree 3 As per IS-13947 (Part-1) : 1993 ; unless otherwise stated
F. NIL.		
G.	**Feeder arrangement**	
	Incomers and Bus-coupler	
1.0	Isolating Equipment	3 pole MCCB with adjustable O/C, S/C , E/F protection with inbuilt microprocessor based releases.
2.0	Quantity	Two incomer

3.0	Bus coupler	Required.
4.0	Interlocking	Required.
5.0	Interlocking Type	Electrically. Mechanical (through Castle Key)
6.0	Indication Lamps	LED cluster type indicating lamps for :- MCCB - ON/OFF/TRIP. Incoming Power ON : R / Y / B.
7.0	Meters and selector switches	144 sq.mm size voltmeter with 7 position selector switches 144 sq.mm size ammeter with 4 position selector switches
8.0	Current transformer	As per SLD.
9.0	Potential transformer	As per SLD.
H.	**Outgoing feeder arrangements**	
(i)	**Motor Starter feeders**	
1.0	Circuit breaker	Three pole MCCB (or MPCB upto 45kW) Three pole ACB (for rating above 630 A).
2.0	Power contactor	AC3/AC4 as per requirement. 3 pole. Minimum 32 A at AC-3 duty. Contactor coil rating for 240 V AC. 2NO + 2NC auxiliary contacts. Mechanically interlocked for reversible drives.
3.0	Auxiliary contactors	Required nos. as per scheme.
4.0	Control supply isolation device	MCB
5.0	Test PB	Inside module for testing of power contactor when the module incoming power breaker is OFF
6.0	Space heater power provision	For motor feeders of 45 KW and above :- Through separate MCB and interlock with main power contactor.
7.0	Ammeter in LCS	Interposing CT (middle phase) shall be provided in the feeder module for motor rating 45 KW and above.
I	**NIL**	
J	**Power supply feeders**	
1.0	Circuit breaker	Three pole MCCB (or MPCB upto 45kW) Three pole ACB (for rating above 630 A).
2.0	Indications	ON/OFF/TRIP indication lamp.
3.0	Earth fault protection required	Yes
K.	**Panel wiring**	
1.0	Power / current transformer circuit	1.1kV grade single core, black colour PVC insulated, stranded copper conductor of minimum size 2.5 sq.mm. For feeder rating 100A and above all the power

		circuit shall be through rigid busbar.
2.0	Control and potential circuit	1.1kV grade single core Black colour PVC insulated Stranded copper conductor of minimum size 1.5 sq.mm.
3.0	Ferrules	Numbered plastic/ceramic ferrules. Self locking type.
4.0	Marking	Wiring will be properly marked as per relevant IS.
5.0	Spare contacts	All spare contacts of relays selector switches & contactors will be wired upto the terminal block. Each component shall have at least one potential free spare contact.
6.0	Terminals	- Power & control terminals shall be segregated by insulating material like hylam/bakelite sheet. - Power terminals will be stud type. - Control terminals will be ELMEX type suitable for connecting two cores of 2.5 sq.mm wires. - Minimum 20 % spare terminals will be provided. - The minimum rating of control terminal shall be 10 Amps. - Colour coded wires, TB's of different voltage rating to be provided. - Uniform color-coding to be followed for cabling, TB, etc.
7.0	Cable glands	Double compression Nickel plated brass cable glands for receiving external power and control cables
8.0	Cable Lugs	Tinned copper heavy duty lugs for receiving external power and control cables
L.	**Control Supply**	
1.0	Control transformer	1 nos. of 415V/240V control transformer of minimum 2.5 KVA in each section. Secondary unearthed.
2.0	Input and output side isolation device	Input side :- MCCB/MPCB Output side :- MCB
3.0	Control supply changeover system	Control supply auto and manual changeover through contactor logic and through selector switch respectively (Sel.sw. shall have a contact rating of 25 A at 240 V AC)

3.0 Void.

4.0 Specifications of major components

01. MOULDED CASE CIRCUIT BREAKER (MCCB)

1.0	Reference standard	IS : 13947 (Part-2) : 1993
2.0	Rated Current	As per the load ratings.

3.0	MCCB for motor feeders	MCCBs for motor feeders shall be motor protection type confirming to type-2 co-ordination with short-circuit release only & Isc>12In.
4.0	Short circuit rating	50 kA (Minimum) (Ics =Icu). Ics = Service short circuit breaking capacity. Icu = Rated ultimate short circuit breaking capacity.
5.0	Service Short circuit breaking capacity (Ics)	100% of rated ultimate short circuit breaking capacity (Icu)
6.0	Operating handle	Yes
7.0	Safety Door interlock	Door interlock, Padlocking in ON/OFF position.
8.0	Withstand capability	Rated short time with-stand current (Icw) will be 12 times maximum rated operational current for 1 sec.
9.0	Utilisation category	AC23B
10.0	Electrical features	- S/C, O/C, Over load (Thermal magnetic release), E/F protection for power supply feeders & crane trolley line feeder MCCB's. - Features to minimise the let-through energy (I2t) in the event of short circuit on load side. - Complete with continuous electronic / microprocessor based adjustable thermal and magnetic releases. Adjustable type for feeders less than 160A not required. - MCCB's for motor feeders shall be of motor duty class with magnetic trip only.
11.0	Auxiliary contacts	1 NO + 1 NC. (Spares shall be provided apart from Scheme requirements). Alarm contacts.
12.0	Miscellaneous	Can be used in load side or line side vice versa. Shunt trip coil.

02. AC CONTACTORS

1.0	Service	Indoor within steel cubicle for maximum system voltage, starting of motors and miscellaneous loads.
2.0	Standard	Shall confirm to IS/IPSS.
3.0	No. poles	3 pole air break.
4.0	Operating type	Magnetic coil operated at 240 V AC. No economy resistors. Insulation for coils shall be class 'E' or better
5.0	Rating	25A (Minimum) , Rated generally for 150% of full load motor rated current.

6.0	Interrupting capacity	Ten times the rated current for rated size upto 100A and eight times the rated current for larger sizes.
7.0	Duty	According to IEC 158-1 - AC 1 duty: - Non-inductive or slightly inductive loads. - AC 2 duty :- Slip ring motors : starting , plugging - AC 3 duty :- Squirrel cage motors : starting , switching off motors during running - AC4 duty: - Squirrel cage motors: Plugging, inching. Derated AC4 ratings shall be selected for inching and plugging operation of the drive (crane duty).
8.0	Utilisation category	AC23A for unidirectional motors AC24A for bi-directional motors
9.0	Aux. contact requirement	- Minimum 4 NO +4 NC contacts with minimum rating of - 10A , 415 V for rated duty AC-11. - 2A , 220 V for rated duty DC-11. - Shall have the facility of adding add-on contact blocks.
10.0	Closing (pick-up)	85% to 110%
11.0	Dropout	65% to 45%
12.0	Miscellaneous	For RDOL feeders the power contactors shall be mechanically interlocked.

03. Current transformers:

1.0	Type	Bar type primaries and 5A (max) secondary with thermal and dynamic ratings corresponding to the units with which they are used. Resin Cast, window type.
2.0	Accuracy class	- Measuring CT accuracy class 1.0. - Protective CT accuracy class 10 P10 or better.

04. Control transformers:

1.0	Type	Dry type, cast resin, class-B or better.
2.0	Voltage	415V/240V
3.0	Primary taps	+2.5 %, +5 %

05. Indicating instruments:

1.0	Basic details	- Shall not damage by passage of fault current or existence of over voltage for the maximum permitted duration of fault conditions. - Ammeters for drives above 45 kW shall be CT

		operated. - Voltmeters protected by fuses placed as close to the bus-bar as possible. - Maximum reading 700% of IFL for motor feeders .
2.0	Mounting	Flush mounting, square dial with zero adjusting device for external operation.
3.0	Accuracy class	1.5
4.0	Size	- Size of voltmeter and ammeter for incomer 144 x 144 mm for incoming feeders. - Size of ammeter for motor feeders 96 x 96 mm.

06. Thermal Overload Relays.

1.0	Standard	IEC:292-1
2.0	Basic details	- Triple pole - Ambient temperature compensated. - Inverse time lag. - Hand reset type. - Bimetallic with adjustable setting and built in single phase protection. - Reset PB shall be operable from outside. - Shall be able to withstand prospective short circuit current without damage or injurious heating till the motor protection MCCB/MPCB clears the fault. - Auto tripping shall be indicated on MCC.
3.0	Contacts	1 NO + 1 NC contacts with minimum rating of - 10A, 415 V for rated duty AC-11. - 2A, 220 V for rated duty DC-11.

07. Magnetic Overload Relays.

1.0	Standard	IEC:292-1
2.0	Basic details	- Triple pole - Ambient temperature compensated. - Adjustable time lag feature or of instantaneous type. - Provided with a latch and hand reset feature or auto reset with flag indication. - Adjustable current setting and time delay calibrated between nominal current and twice nominal current rating
3.0	Contacts	1 NO + 1 NC contacts with minimum rating of - 10A , 415 V for rated duty AC-11. - 2A , 220 V for rated duty DC-11.

08. Push Buttons

1.0	Basic details	- All push button switches including illuminated push buttons shall be of sturdy design.

		- Shrouded actuator for "START" application and "STOP" application shall be provided. - Mushroom Head actuator for "EMERGENCY STOP" application shall be latched type with turn to release. - Press to latch in operated position and turn-to-release in unactuated position. - Key "STOP" application for "LOCK-OUT" application shall be provided. - Double break parallel contact design or other suitable design feature enhancing contact reliability required in circuits with electronic interfaces involving low voltages and small currents shall be adopted.
2.0	Size	- 22.4 mm diameter
3.0	Contact rating	- Minimum 2 NO + 2NC contacts (or 4NC Contacts for Emg. Stop PB) with following current ratings . • Continuous - 10 A • AC 11 - 1.5 amps at 240V • DC 11 - 0.5 amps at 110 V DC, L / R - 40 ms - All contact faces of contacts shall be of silver or silver alloy. - Facility of adding add-on contact blocks to be provided
4.0	Colour	• Accept - Blue • Test - Yellow • Reset - Black

09. Indicating Lamps

1.0	Type	- LED Cluster type
2.0	Basic details	- Sufficient number of lamp grips shall be provided for easy replacement of lamps.
3.0	Size	- 22.4 mm diameter
4.0	Voltage level	- Suitable for any of the following voltages as per the system requirement : • 415V AC / 230V AC / 240V AC / 24V DC / 220V DC - All indicating lamps shall be suitable for continuous operation at 90 to 100 percent of their rated voltage.
5.0	Colour	- For motor `ON', valve/damper/gate 'OPEN', supply `ON', breaker `CLOSE' : Red - For motor `OFF', valve/damper/gate 'CLOSE', supply `OFF', breaker `OPEN' : Green - Fault indication, over load, alarm condition, 'SERVICE & TEST POSITION' indication. : Amber - General purpose indication, motor `AUTO TRIP'. : White

		Other colours may be adopted depending upon particular application as approved by the Purchaser.
6.0	Layout of indication lamps on boards / panels	• Indicating lamps shall be located just above the associated push-button / control switches. • Red lamps shall invariably be located to the right of green lamps. • In case a white lamp is also provided, it shall be placed between red and green lamps along the centre line of control switch/ push button pair. • Blue and Amber should normally be located above the Red and Green lamps. • When associated with push buttons, red lamps shall be directly above the green push button and green lamp shall be directly above the red push button.
7.0	Legend plates	Anodised aluminium

10. Miniature Circuit Breakers (MCB)

1.0	Type	Heat resistant plastic moulded type
2.0	Ref . Standard	IS: 8828 –1978
3.0	Protections	MCB's shall be provided with • quick break trip-free mechanism • direct acting thermal overload • short circuit trip elements.
4.0	Short circuit capacity	Not less than 9kA at 0.8pf
5.0	Mounting	• DIN Channel mounting. • Single phase MCBs mounted adjacent to each other and connected to different phases will be provided with adequate insulated phase barriers.
6.0	Current Rating	• The MCBs shall be selected from standard current ratings.(As per SLD) • Motor duty MCBs will be provided, if specified. • MCB shall be of C curve .

11. Selector Switches

1.0	Basic details	- All control selector switches shall be of sturdy design. - Shall have modular construction with number of switching contacts for each position operated by a single shaft. - Inscription for each position shall be provided. - Stay-put or spring return arrangement shall be provided as per the circuit and control/operational requirement. - The contacts shall be designed for higher contact reliability and electronics compatibility involving low voltage and small value of currents. - The operating handle shall be robust and strong. - One number of potential free switching contact for each position shall be provided as spare. - Control switches for circuit breaker ON/OFF

		control 3 position spring return to neutral with lost motion device and pistol grip handle. - Other control and selector switches - stay put type with wing type knobs.
2.0	Contacts	2 NO + 2 NC contacts with minimum rating of - All the selector switches shall be of 10 A rating - 25A for sturdy applications . - 1 NO & 1 NC contact / poles shall be potential free for PLC inputs .