



TECHNICAL SPECIFICATION OF GYPSUM DEWATERING SYSTEM
NTPC DADRI 2X490MW TPS

DADRI:FGD:GDS:R00

S.No	Description
8.2	VACUUM BELT FILTERS
a.	The vacuum belt filter shall be proven design in operation for similar capacities. The filter cloth shall be polyester or polypropylene as per the proven design of the supplier and shall be guaranteed for a minimum life of not less than 7000 hrs.
b.	The complete frame of the filter and all parts in contact with gypsum shall be made of corrosion resistant material or shall be provided with corrosion resistant liners of proven design.
c.	In case, the contractor offers a design with an underlying belt for carrying the filter cloth, the same shall be endless, factory vulcanized rubber belts. The belt shrouds and the sealing belts shall provide a leak tight arrangement to prevent overflow of gypsum slurry. The sealing belt shall have minimum life of not less than 7000 hrs.
d.	The vacuum box shall ensure tight sealing with the belt/cloth and shall be of proven design.
e.	The belt filter shall have an automatic cloth tracking mechanism and shall be provided with all required instrumentation as per the supplier's proven practice. The belt filter shall have an automatic cloth tensioning mechanism.
f.	The filter shall be provided with minimum 2 stages of cake washing for removing impurities in the gypsum. For cake washing only clarified water shall be used. For this purpose, 2x100% cake washing pumps for each Vacuum Belt Filter. One stage of cloth washing arrangement shall also be provided along with 2x100% cloth washing pumps for each Vacuum Belt Filter.
g.	The filtrate from gypsum slurry and from cake washing shall be taken to vacuum receiver tank(s) as per the proven practice of the supplier. Each belt filter shall have an independent vacuum pump.
h.	Gypsum cake from each belt filter shall be discharged through a hopper onto belt conveyor being provided by the Employer.
i.	Local control panel shall have display on the front panel and necessary electrical parts.
j.	The service factor of the gear unit (if any) shall be minimum 1.5.
k.	Piping and wiring within the skid should be in the vendor's scope.
l.	Nozzles and connections The suction and discharge pipes will be flanged and will have the same nominal test procedure as the body of the pump. Threaded connections are not admitted in these pipes.



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m.	The flanges shall comply with the following standards: - Steel flanges as per ANSI B16.5 (raised face type, at least class 150) - Cast iron flanges as per ANSI 16.1 (flat face type, at least class 125) - The pipe shall be designed according to API676 with regards to the force.
8.3	VACUUM SYSTEM
a.	The filtrate from each belt filter, cake washing & cloth washing shall be taken to receiver tank(s) as per the supplier's proven practice.
b.	Each belt filter shall be provided with an independent vacuum pump sized to meet the requirements of the belt filter operating at its maximum capacity. An additional margin of 10% (min.) over the above capacity shall be provided for each vacuum pump.
8.3.1	VACUUM PUMP
a.	The vacuum pump shall be of low speed liquid ring type of proven design. The design of the vacuum pumps shall avoid cavitations under all operating conditions. The seals shall be of proven design.
b.	Silencers shall be provided, if required, to limit the noise level to values stipulated elsewhere in this specification.
c.	The vacuum receiver and pump internals shall be suitably lined to protect against the corrosive environment. The material selected for vacuum pumps & vacuum receivers shall be proven for similar application.
d.	Each vacuum receiver tank(s) shall be provided with slide plate type pneumatic vacuum breaker. The plate shall be stainless steel with a min. thickness of 3 mm.
e.	Pump Casing Pumps shall be Radial Split Casing, Close/Semi-open, Over-hang, End Suction type Back Pull-out design, Vertical Discharge type for Horizontal Centrifugal Pump. The casing shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature. Pump casing shall be provided with a vent connection and piping with fittings & valves. Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pressure gauge as standard feature. It shall be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimum radial load at part load operation.
f.	Impeller Impeller shall be closed, semi-closed or open type as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled. The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft, impellers shall be secured to the shaft by a lockout or cap screw which tightness in the direction of normal rotation.



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g.	Impeller/Casing Wearing Rings Replaceable type wearing rings shall be provided at suitable locations of pumps. Suitable method of locking the wearing ring shall be used. Wearing rings shall be provided in pump casing and/or impeller as per manufacturer's standard practice.
h.	Shaft The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed. The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.
i.	Shaft Sleeves Renewable type fine finished shaft sleeves shall be provided at mechanical seals. Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.
j.	Bearings Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished. The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard type, if provided, shall be selected for a minimum life 20,000 hrs. of continuous operation at maximum axial and radial loads and rated speed. Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly. Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing.
k.	Mechanical Seals
i.	Mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.
ii.	The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with complete piping fittings and valves as required shall form integral part of pump supply.



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I.	Pump Shaft Motor Shaft Coupling The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.
m.	Base Plate A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the piping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided.
n.	Drive Motor (Prime Mover) The kW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified.
8.4	GYPSUM DISCHARGE CHUTE
a.	The minimum valley angle of chutes shall be 60 degrees at the feeding point to guide the material in the direction of belt travel. Transfer chutes shall be adequately sized and sloped to ensure smooth flow of Gypsum without any accumulation anywhere.
b.	Chutes shall be made of minimum 20 mm thick TISCRA / SAILHARD/ LSLAS07 or equivalent material. All chutes should have one inspection door at every floor and for the ones in between the floors (more than 1.5 meter above the operating floor level) suitable access for trouble free maintenance shall be provided. For sealing of inspection doors labyrinth type arrangement to be provided.
c.	Complete chute work in the region of flap gates shall be fabricated from 20 thk TISCRA or equivalent. In case of vertical chute (valley angle more than 80 degree) complete chute, work shall be of 20 mm thick TISCRA or equivalent material. While finalizing the chute work inside the building, arrangement for shifting and replacing chute legs, proper handling arrangement/wall openings, trolleys, hoists shall also be provided. While fabricating the chute, no welds in between shall be allowed.
8.4.1	CHUTE BLOCKAGE SWITCHES
a.	One no. chute blockage switch of proven type (subject to approval of the employer) shall be provided



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b.	Chute blockage switch shall trip the feeding conveyor in case of Chute blockage and protect the feeding conveyor equipment.						
8.5	PIPING / VALVES						
a.	All the pipes handling slurry shall be provided with replaceable rubber lining of proven quality. The slurry pipes shall be lined with replaceable wear resistant natural rubber lining of minimum 6 mm thickness. Additional thickness of 2 mm in rubber lining shall be provided at bends. The Supplier can provide slurry pipes of size lower than 3" made up of FRP material. <table><tr><th>Piping</th><th>MOC</th></tr><tr><td>Water line</td><td>Carbon steel</td></tr><tr><td>Slurry line</td><td>Carbon steel with rubber lining</td></tr></table>	Piping	MOC	Water line	Carbon steel	Slurry line	Carbon steel with rubber lining
Piping	MOC						
Water line	Carbon steel						
Slurry line	Carbon steel with rubber lining						
b.	The isolation valves provided in all the slurry lines shall be of knife gate type/butterfly type. Motorized actuators shall be provided for valves requiring frequent operation as indicated in the relevant scheme.						
c.	The valves shall be of proven type and the supplier shall submit a detailed valve schedule for employer's approval. Reference list for previous installations for similar application shall also be furnished to the employer						
d.	The isolation valves shall be of knife gate type with rubber seats designed to prevent accumulation of solids on the valve seat.						
e.	Supplier shall provide all necessary arrangements for purging & flushing of all the process pipelines, equipment's etc.						
8.6	SECONDARY HYDRO-CYCLONE						
a.	Each set of secondary hydro-cyclone shall be provided with 10% spare hydro-cyclones.						
b.	The hydro-cyclone shall be of proven design. Hydro-cyclones shall be of modular construction. The secondary hydro-cyclone shall be made up of polyurethane or urethane materials. It shall be possible to remove and replace individual hydro-cyclone with the set in service. Individual isolation valve shall be provided for each hydro-cyclone for this purpose.						
c.	The feed chamber shall be provided with a minimum rubber lining thickness of 12mm. The liners shall have a minimum wear life of not less than 7000 hrs.						



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8.7 Motor

8.7.1 General

This specification generally covers the requirement for motors involved in gypsum dewatering system package.

8.7.2 Voltage level:

The voltage level for motors shall be as follows:

S.No	Rating	Voltage	Freq and voltage variation
1	Upto 0.2 kw	Single phase 240V AC / Three phase 415V AC	1. 50 Hz- +3% & -5 % 2. 10% combined variation of voltage & frequency.
2	Above 0.2 and up to 200 kw	Three phase 415V AC	

8.7.3 Starting voltage requirement

Up to 85% of rated voltage for ratings below 110 KW

Up to 80% of rated voltage for ratings from 110 KW to 200 KW

- Voltage rating for special purpose motors viz, VFD shall be as per manufacturer's standard.

8.7.4 Degree of protection:

S.NO	Item	Indoor	Outdoor
1	Motors	IP 54	IP 55
2	Cable box	IP 54	IP 55

8.7.5 Efficiency class:

Premium efficiency IE3 (For Continuous duty motors up to 200 kw) as per IS 12615,IEC:60034-30

8.7.6 General requirements:

S.No	Parameters	To be confirmed by vendor	Vendors confirmation
1	Direction of rotation	Suitable for both directions	
2	Class of Insulation	Thermal class 155 (F) insulation	
3	Winding Insulation	The winding insulation process shall be Global Vacuum Pressure Impregnated i.e. resin poor method	
4	Starting	1. Less than or equal to 600 % full load current	



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	Current	subject to tolerance as per IS (Normal motor) 2. Less than or equal to 700 % full load current subject to tolerance as per IS (Normal motor)	
5	Starting Voltage	1. Up to 85% of rated voltage for ratings below 110 KW 2. Up to 80% of rated voltage for ratings from 110 KW to 200 KW	
6	Torque requirement	1. Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. 2. Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.	
7	Type of enclosure	1. Motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tubeventilated (TETV) or Closed air circuit air cooled (CACA) type. 2. VFD driven motors to be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor.	
8	Dimensions of Terminal box for LV motors	Motor MCR	Distance between centre of stud & gland plate (In mm)
		a. Upto 3 Kw b. Above 3 kw to7 kw c. Above 7 kw to13 kw d. Above 13 kw to 24kw e. Above 24 kw to 37kw f. Above 37 kw to 55kw g. Above 55 kw to 90kw	As per manufacturer's practise 85 115 167 196 249 277
9	Cable glands & Lugs	Double compression type Nickel plated brass cable gland & insulated tinned copper crimping lugs to suit the cable sizes	
10	Paint shade	RAL 5012 (Blue)	
11	Space heaters	Suitable single phase space heaters shall be provided on motors rated 30KW and above. Separate terminal box for space heaters shall be provided	

8.7.7 Locked rotor withstand time

S.No	Starting time at min permissible voltage	Locked rotor withstand time
1	Upto 20 secs	Under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time
2	More than 20 sec & less than 45 sec	Under hot condition at highest voltage limit shall be at least 5 secs. more than starting time
3	More than 45 sec's	under hot condition at highest voltage



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limit shall be more than starting time by at least 10% of the starting time

8.7.8 Special Requirement:

Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.

8.7.9 Torque Requirements

- Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

8.8 JUNCTION BOX

8.8.1 GENERAL

This specification generally covers the requirement for Junction boxes involved in gypsum dewatering system package. The requirements are only indicative. If , any additional facility to be provided for satisfactory operation same shall be brought out.

8.8.2 DESIGN AND CONSTRUCTIONAL FEATURES

8.8.2.1 JUNCTION BOX:

- JB shall be of Thermoplastic or thermosetting or FRP type.
- The box shall be provided with the terminal blocks, mounting bracket and screws etc.
- The cable entry shall be through galvanized steel conduits of suitable diameter.
- The JB shall be suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures.
- The JB shall be of grey colour RAL 7035. All the metal parts shall be corrosion protected.
- JB's will be provided with captive screws so that screws don't fall off when cover is opened



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- JB's mounting brackets should be of powder coated MS.
- Class of protection shall be IP 55.

8.8.2.2 TERMINAL BLOCK

- Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade
- The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs.
- All terminal blocks shall be suitable for terminating on each side the required cables/wire size.
- All internal wiring shall be of cu. Conductor PVC wire.

8.9 INSTRUMENTS

8.9.1 General:

This section covers the specification for instruments involved in gypsum dewatering system.

Instruments as per attached list (Section 8.9.7) shall be minimum. Instruments that are required for satisfactory operation of the system though not indicated in the list shall also be supplied.

8.9.2 INSTRUMENTS:

8.9.2.1 General:

All transmitters, sensors, switches and gauges for parameters like pressure, level, flow etc. as required for the safe and efficient operation and maintenance of equipment in the system under the scope of specification shall be provided on as required basis.

8.9.2.2 Instrumentation valves:

The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis.

8.9.2.3

The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The necessary cables, flexible



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conduits, junction boxes and accessories for the above purpose shall also be supplied. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.

8.9.3 SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS

Minimum technical requirements shall be as follows: -

- 8.9.3.1 Microprocessor based 2 wire loop powered electronic transmitter with 4-20 mA DC HART output signal shall be provided.
- 8.9.3.2 For calibration ranges greater than or equal to 400mmwc, accuracy of transmitter shall be ± 0.060 % of calibrated range(min), stability 0.25 % of calibrated range for 10 years and 50:1 turn down. For calibration ranges less than 400mmwc accuracy shall be ± 0.10 % of calibrated range (min) and 20:1 turndown.
- 8.9.3.3 Overpressure rating of transmitter shall be 150% of maximum operating pressure.
- 8.9.3.4 Transmitter shall have weather proof IP-67 metallic housing with durable corrosion resistant coating, integral digital display with self-indicating diagnostics, plug and socket type electrical connection, calibration using HART calibrator, 2/3/5 Valve non integral manifold and rack with canopy.

8.9.4 ULTRASONIC TYPE LEVEL TRANSMITTER, RADAR TYPE LEVEL TRANSMITTER

Minimum technical requirements shall be as follows: -

- 8.9.4.1 Microprocessor based 2 wire type, HART protocol compatible, output signal 4-20mA along with superimposed digital signal (based on HART protocol)
- 8.9.4.2 Accuracy $\pm 0.5\%$ of calibrated span or minimum 5 mm, Load impedance 500 Ohm (minimum)
- 8.9.4.3 Weather proof IP-65 metallic housing with durable corrosion resistant coating
- 8.9.4.4 Plug in socket type electrical connection, zero & span adjustment- temper proof remote as well as local from instrument, integral digital display and self-indicating type diagnostic features



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- 8.9.4.5 Power supply 24V DC $\pm$ 10%, calibration using hand held HART calibrator, temperature compensation built in the instrument (applicable for ultrasonic type only),
- 8.9.4.6 It should be possible to calibrate the instrument without any level in the tank/sump etc. All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations.
- 8.9.4.7 In case of Guided wave radar (GWR) type level transmitters coaxial probe of SS316L shall be provided. However, Rod probe, cable probe of SS316L can be used for applications wherever coaxial probe is not suitable.
- 8.9.4.8 External cage and other mounting accessories shall be provided where ever side mounting is required. Where ever top mounting is required, all mounting accessories, stilling well (as required) etc., shall be provided by the contractor.
- 8.9.4.9 Four wire type transmitters can be provided for applications where 2- wire transmitter has some technical limitations. However, in such cases isolated 4-20 mA DC (analog) output shall be provided.
- 8.9.4.10 Power supply required for such transmitters shall be 24V DC.
- For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It shall be possible to mount the electronic unit at accessible location.
- 8.9.4.11 Sonic frequency based transmitters can also be provided under “ultrasonic transmitters” category for powdery medium

8.9.5 SPECIFICATION FOR CORIOLIS FLOW TRANSMITTER

Minimum technical requirements shall be as follows: -

- 8.9.5.1 Microprocessor based, HART protocol compatible, output signal 4-20mA along with superimposed digital signal (based on HART protocol), accuracy $\pm$ 0.2% of rate, repeatability $\pm$ 0.1% of rate, material of wetted parts SS316, material of housing SS304L, weather proof.
- 8.9.5.2 Degree of protection shall be IP-65, Load impedance 500 Ohm (minimum), zero & span adjustment- temper proof remote as well as local from



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instrument, integral digital display, calibration using hand held HART calibrator.

8.9.6 LOCAL INSTRUMENT ENCLOSURE & LOCAL INSTRUMENT RACK:

All transmitters, switches, etc. for Gypsum dewatering system and other system being provided under the contract shall be suitably grouped together and mounted inside (i) local instruments enclosures in case of open areas of the plant and (ii) In local instrument racks in case of covered areas.

8.9.7 LIST OF INSTRUMENTS:

8.9.7.1 Level Transmitter – For cake thickness sensor

8.9.7.2 Flow meter

- Process water to belt, cloth and cake washing
- Process water for belt lube water
- Seal water for vacuum Pump

8.9.7.3 Pressure gauge

- Washing water
- instrument air
- Vacuum receiver

8.9.7.4 Pressure switch

- Lubricating oil to mill bearing
- Vacuum receiver

8.9.7.5 Limit switch

- Cloth sway
- Pull code

8.9.7.6 Pressure Transmitter

- Process water



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8.10 CONTROL CABLE

1.1 KV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I).

Cable selection & Sizing :

Control cables shall be sized based on the following considerations:

- (a) The minimum conductor cross-section shall be 1.5 sq.mm.
- (b) The minimum number of spare cores in control cables shall be as follows:

No of cores in cable	Min No of spare cores
2C,3C	NIL
5C	1
7C, 12C	2
14C	3

8.11 INSTRUMENTATION CABLE

General:

This section covers the specification for instrumentation cables involved in gypsum dewatering system.

Instrumentation cable required for the gypsum dewatering system shall be supplied till the terminal of the local junction box. Termination of the cables in junction box shall also be in vendor's scope.



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SPECIFICATION OF INSTRUMENTATION CABLE

Common Requirements

S. No.	Property	Requirement
1	Operating Voltage	225 V (peak value)
2.	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IEC 60584, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.
3.	Continuous operation suitability	At 205 Deg C for Type-C cables & heat resistant cables, at 70 Deg C for all other type of cables.
4.	Marking :-	a. <i>Progressive automatic on-line sequential marking of length in meters to be provided at every one meter on outer sheath.</i> b. Marking to read 'FRLS' to be provided at every 5 meters on outer sheath except for Type-C cable c. Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided on outer sheath.
5.	Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the declared value in data sheet
6.	Variation in diameter	Not more than 1.0 mm throughout the length of cable.
7.	Ovality at any cross-section	Not more than 1.0 mm
8.	Color	The outer sheath shall be of blue color except for KX & SX extension cables. For KX & SX extension cables color of outer sheath shall be as per ANSI MC 96.1/ IEC 60584.
9.	Others	Repaired cables shall not be acceptable.



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Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	
A. CONDUCTORS				
Cross section area	0.5 sq. mm			
Conductor material	Type KX as per ANSI MC 96.1/ IEC 60584	Type SX as per ANSI MC 96.1/ IEC 60584	Annealed bare copper	
Colour code	As per ANSI MC 96.1/ IEC 60584	As per ANSI MC 96.1/ IEC 60584	As per VDE-815	
Conductor Grade	As per ANSI MC 96.1 / IEC 60584		Electrolytic	
No & dia of strands	7x0.3 mm (nom)			
No. of Pairs	2	2	2/4/8/12/16/24/48	
Max. conductor loop resistance per Km (in ohm) at 20 deg. C	As per ANSI MC 96.1		73.4	
Reference Standard	As per ANSI MC 96.1/ IEC 60584		VDE : 0815	
B. INSULATION				
Material	Extruded PVC type YI 3			
Thickness in mm (Min/Max)	0.25/0.35			
Volume Resistivity (Min) in ohm-cm	1 x 10 ¹⁴ at 20 deg. C & 1x10 ¹¹ at 70 deg. C.			
C. PAIRING & TWISTING				
Max. lay of pairs (mm)	50			
Single layer of binder tape on each pair provided	Each core printed with number or Numbered binder tape to be provided on each pair		Yes	
Bunch (Unit Formation) for more than 4P	N.A		To be provided	
Conductor /pair identification as per	N.A.		To be provided	



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Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	
VDE0815				
D. SHIELDING				
Type of shielding	Al-Mylar tape			
Individual pair shielding	No		To be provided for F-type cable	
Minimum thickness of Individual pair shielding	No		0.028mm (28 micron)	
Overall cable assembly shielding	To be provided			
Minimum thickness of Overall cable assembly shielding	0.055 mm (55 micron)			
Coverage / Overlapping	100% / 20%			
Drain wire provided for individual shield	N.A.		Yes (for F-type) Size- 0.5 sqmm No of strands-7 Dia of strands- 0.3mm Annealed Tin coated copper	
Drain wire provided for overall shield	Yes, Size- 0.5 sqmm, No of strands-7, Dia of strands- 0.3mm, Annealed Tin coated copper			
E. FILLERS (if applicable)				
Non-hygroscopic, flame retardant	To be provided			
F. OUTER SHEATH				
Material	Extruded PVC compound YM1 with FRLS properties			
Minimum Thickness at any point	1.8 mm			
Nominal Thickness at any point	>1.8 mm			
Resistant to water, fungus, termite & rodent attack	Required			



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Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	
Minimum Oxygen index as per ASTMD-2863	29 %			
Minimum Temperature index as per ASTMD-2863	250 deg.C			
Maximum Acid gas generation by weight as per IEC-60754-1	20%			
Maximum Smoke Density Rating as per ASTMD-2843	60% (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTMD-2843)			
Reference standard	VDE207 Part 5,VDE-816			
G. Electrical Parameters				
Mutual Capacitance Between Conductors At 0.8 Khz (Max.)	200 nF/km		120 nF/km for F type and 100 nF/km for G-type	
Insulation Resistance (Min.)	100 M Ohm/Km			
Cross Talk Figure (Min.) At 0.8 Khz	60 dB		60 dB	
Characteristic Impedance (Max) At 1 Khz	N.A.		320 OHM FOR F-TYPE 340 OHM FOR G-TYPE	
Attenuation Figure At 1 Khz (Max)	N.A.		1.2 db/km	
H. COMPLETE CABLE				
Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.			



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9.0 PACKING AND FORWARDING

1.	Proper packing to be ensured. Indigenous Supply: GDS & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the GDS internals during storage in the outer yard of power plant. Imported Supply: All imported supply should be packed as per Sea worthy packing standards Annexure - VI. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.
2.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
3.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
4.	Crates and packing material used for shipping will become the property of owner (NTPC)
5.	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.
6.	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.
7.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number



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	c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
8.	Each package or shipping units shall be clearly marked or stenciled on at least two sides as follows. NTPC NATIONAL CAPITAL THERMAL POWER PROJECTS STAGE – II DADRI, 2 X 490 MW. UTTAR PRADESH INDIA EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED, INDIA" In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.
9.	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.
10.	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.
11.	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.
12.	Wherever necessary besides usual inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care", "Keep Dry" etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks)
13.	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling
14.	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification



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	mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
15.	The packing slip shall contain the following information:- Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of GDS & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.
16.	Prior to transport from manufacturer's work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.
17.	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as "very severe" during final finishing/shipping.
18.	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering. Also, complete billing break-up with above mentioned details shall be submitted within 10days of LOI.
19.	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).
20.	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.
10.0	SUPERVISION OF ERECTION AND COMMISSIONING
1.	The erection of Gypsum Dewatering System (GDS) will be done by owner as per Erection Manual and check List. However, the bidder shall make one visit per GDS for the supervision of erection, pre-commissioning & post- commissioning check-up, start-up, testing and trial runs of all the items covered under the scope of supply.
2.	There will be one visit per GDS and totally there will be 2 visits for 2 GDS. The bidder will be informed well in advance for the visit. Bidder shall include 15 working days per visit in the offer with minimum 2 visits.
3.	TA/DA, boarding and lodging shall be borne by the bidder and shall be inclusive in