CLAUSE NO.	TECHNICAL REQUIREMENTS
	(c) Above 200 KW & upto 1000KW : 10.0 (d) From 1001KW & upto 4000KW : 9.0 (e) Above 4000KW : 6 to 6.5
10.00.00	**TYPE TEST**
10.01.00	**HT MOTORS**
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII-(BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.
10.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
10.01.03	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the owner for waival of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.
10.01.04	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED"and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

CLAUSE NO.	TECHNICAL REQUIREMENTS
10.01.05	**LIST OF TYPE TESTS TO BE CONDUCTED** **The following type tests shall be conducted on each type and rating of HT motor** (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test(subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp.,coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.
10.01.06	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** The following type test reports shall be submitted for each type and rating of HT motor (a) Degree of protection test for the enclosure followed by IR, HV and no load run test. (b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15
10.02.00	**LT Motors**
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last *ten* years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

CLAUSE NO.	TECHNICAL REQUIREMENTS
10.02.02	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.
10.02.03	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** **The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only** 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip . 5. Temperature rise test . 6. Momentary excess torque test. 7. High voltage test . 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section) 10. Test for degree of protection and 11. Overspeed test. 12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1
10.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
10.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW of	**Minimum distance between centre stud and gland plate in mm**
UP to 3 KW	**As per manufacturer's practice.**
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW	**Clearance**
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

CLAUSE NO.	TECHNICAL REQUIREMENTS

LT CONTROL CABLES

1.00.00 CODES & STANDARDS

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes :

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wire and tapes for armouring of cables.
IS : 4905	Methods for random sampling.
IS : 5831	PVC insulation and sheath of electrical cables.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Test on gases evolved during combustion of electric cables.
IEC -332	Tests on Electric cables under fire conditions Part-3 : Tests on bunched wires or cables (category - B)

2.00.00 TECHNICAL REQUIREMENTS

2.01.00 The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground burried installation with chances of flooding by water.

CLAUSE NO.	TECHNICAL REQUIREMENTS

2.02.00 Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.

2.03.00 Conductor of control cables shall be made of stranded, plain annealed copper.

2.04.00 PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.

2.05.00 The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.

2.06.00 For multicore armoured cables, the armouring shall be of galvanised steel as follows :-

	Calculated nominal dia of cable under armour	**Size and Type of armour**
1)	Upto 13 mm	1.4mm dia GS wire
2)	Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
3)	Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
4)	Above 40 upto 55mm	1.4 mm thick GS formed wire/ 2.5mm dia GS wire
5)	Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
6)	Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

The gap between armour wire / formed wire shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface.

2.07.00 Outer sheath shall be of PVC as per IS: 5831 and grey in colour . In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.

	(a) Oxygen index of min. 29 (As per IS:10810 (part-58))
	(b) Acid gas emission of max. 20% (As per IEC-754-I).
	(c) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTMD-2843.
2.08.00	Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted. 1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black 5 core - Red, Yellow, Blue, Black and Grey
2.09.00	For cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu-Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed under neath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath : (a) Cable size and voltage grade - To be embossed (b) Word 'FRLS' at every 5 metre - To be embossed (c) Sequential marking of length of the cable in metres at every one metre. - To be embossed / printed. The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible. For EPR cables identification shall be printed on outer sheath.

2.11.00 All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part -3.

2.12.00 Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum over the declared value in the technical data sheets.

2.13.00 In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.

2.14.00 **Cable selection & sizing**

2.14.01 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 & above	3

2.14.03 Cable lengths shall be considered in such a way that straight through cable joints are avoided.

2.14.04 Cables shall be armoured type if laid in switchyard area or directly buried.

3.00.00 CONSTRUCTIONAL FEATURES

3.01.00 **1.1 KV Grade Control Cables**

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).

3.02.00 **Cable Drums**

(a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to

eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS : 10418.

(b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

4.00.00 TESTS

4.01.00 **GENERAL**

All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

4.02.00 **TYPE TESTS:**

4.02.01 The Type tests reports for the following shall be submitted for one size of LT control cable :

S. No.	Type Test	Remarks
a)	**For Conductor**	
1.	Resistance test	
b)	**For Armour Wires / Formed wires**	
2.	Measurement of Dimensions	
3.	Tensile Test	
4.	Elongation test	
5.	Torsion test	For round wire only
6.	Wrapping test	For aluminium wires / formed wires only
7.	Resistance test	
8(a).	Mass of zinc Coating test	For GS wires/formed wires only
8(b).	Uniformity of zinc coating	For GS wires/formed wires only
9.	Adhesion test	For GS wires/formed wires only
c)	**For PVC insulation & PVC Sheath**	
9.	Test for thickness	
10.	Tensile strength and elongation test before ageing and after ageing	
11.	Ageing in air oven	
12.	Loss of mass test	For PVC insulation and sheath only
13.	Hot deformation test	For PVC insulation and sheath only
14.	Heat shock test	For PVC insulation and sheath only
15.	Shrinkage test	

	16.	Thermal stability test	For PVC insulation and sheath only
	17.	Oxygen index test	For outer sheath only
	18.	Smoke density test	For outer sheath only
	19.	Acid gas generation test	For outer sheath only
	d)	**For completed cables**	
	20.	Insulation resistance test (Volume resistivity method)	
	21.	High voltage test	
	23.	Flammability test as per IEC - 332 Part-3 (Category-B)	
4.02.02	**Acceptance Tests** (as per QA table)		
4.03.00	**Routine Tests** (as per QA table)		

INSTRUMENTATION AND POWER SUPPLY CABLE

1.00.00 INSTRUMENTATION CABLE, POWER SUPPLY CABLE, INTERNAL WIRING AND ELECTRICAL FIELD CONSTRUCTION MATERIAL

1.01.00 **General Requirements**

1.01.01 All cables including special cables, internal wiring and electrical field construction material shall conform to this specification, Employer approved detail engineering drawings & documents and the latest edition of the relevant standards & guidelines. The Bidder shall furnish all material and services required for the completeness of the work identified in his scope as per this specification.

1.01.02 The Contractor shall supply, erect, terminate and test all instrumentation cables for control and instrumentation equipment/devices/systems included under Contractor's scope as illustrated in the enclosed Drg. No. 0000-110-POI-A-021 and ensuring completeness of the control system.

1.01.03 Any other application where it is felt that instrumentation cables are required due to system/operating condition requirements, are also to be provided by Contractor.

1.01.04 Other type of cables like fiber optic/co-axial cables for system bus, cables for connection of peripherals etc. (under Contractor's scope) are also to be furnished by the Contractor.

1.01.05 Contractor shall supply all cable erection and laying hardware from the main trunk routes like branch cable trays/sub-trays, supports, flexible conduits, cable glands, lugs, pull boxes etc. on as required basis for all the systems covered under this specification.

1.01.06 Wherever the quantity has been defined as on as required basis, the same are to be furnished by contractor on as required basis within his quoted lump sump price without any further cost implication to the Employer.

2.00.00 Specification of Instrumentation cable

2.01.00 Common Requirements

S. No.	Property	Requirement
1	Voltage grade	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, IS-8784, IS-

S. No.	Property	Requirement
		10810 (latest editions) and their amendments read along with this specification.
3.	Continuous operation suitability	At 70 deg. C for all types of cables, while 205 Deg C for Type-C cables.
4.	Progressive automatic on-line sequential marking of length in meters	To be provided at every one meter on outer sheath.
5.	Marking to read 'FRLS'	To be provided at every 5 meters on outer sheath except for Type-C cable.
6.	Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the declared value in data sheet
7.	Variation in diameter	Not more than 1.0 mm throughout the length of cable.
8	Ovality at any cross-section	Not more than 1.0 mm
9	Others	a) 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. b) Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground-buried installation c) Repaired cables shall not be acceptable.

2.02.00 Specific Requirements

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
A. Conductors				
Cross section area	0.5 sq. mm			
Conductor material	ANSI type KX	ANSI type SX	High conductivity Annealed bare copper	ANSI type KX
Colour code	Yellow-Red	Black-Red	As per VDE-815	Yellow-Red
Conductor Grade	As per ANSI MC 96.1		Electrolytic	As per ANSI MC 96.1
No & dia of strands	7x0.3 mm (nom)			
No. of Pairs	2	2	4,8,12,16,24,48	2
Max. conductor resistance per Km (in ohm) at 20 deg. C	As per ANSI MC 96.1		73.4 (loop)	As per ANSI MC 96.1
Reference Standard	As per ANSI MC 96.1		VDE 0815	As per ANSI MC 96.1
B. Insulation				
Material	PVC type YI 3			Teflon (i.e. extruded FEP)
Thickness in mm (Min/Nom/Max)	0.25/0.3/0.35			0.4/0.50
Volume Resistivity (Min) in ohm-cm	1×10^{14} at 20 deg. C & 1×10^{11} at 70 deg. C.			---

Voltage Rating	225 V peak operating voltage		
Reference Standard	VDE 0207 Part 4		VDE 0207 Part 6 & ASTMD 2116.
Core diameter above insulation	Suitable for cage clamp connector		
C. Pairing & Twisting			
Max. lay of pairs (mm)	50		
Single layer of Polyester tape on each pair provided	Numbered tape	Yes	N.A.
Unit formation of four pairs with printing of no. of Unit provided	N.A.	Yes	N.A.
Conductor /pair identification as per VDE0815	N.A.	To be provided (color coding attached).	N.A.
D. Shielding			
Type of shielding	Al-Mylar tape		
Individual pair shielding	No	To be provided for F-type cable	No
Minimum thickness of Individual pair shielding	No	28 micron	No
Overall cable assembly shielding	To be provided		
Minimum thickness of	55 micron		

Overall cable assembly shielding			
Shielding coverage	100% with at least 20% overlap		
Drain wire provided for individual shield	N.A.	Yes (for F-type) 7-strand 20 AWG (0.51 mm^2) annealed Tin coated copper	N.A.
Drain wire provided for overall shield	Yes. 7-strand 20 AWG (0.51 mm^2) annealed Tin coated copper		
E. FILLERS			
Non-hygroscopic, flame retardant	To be provided		
F. Outer Sheath			
Material	Extruded PVC compound YM1 with FRLS properties		Teflon (i.e. extruded FRP)
Minimum Thickness at any point	1.8 mm		0.4 mm
Nominal Thickness at any point	>1.8 mm		0.5 mm
Color	Blue		
Resistant to water, fungus, termite & rodent attack	Required		
Oxygen index as per ASTMD-2863	not less than 29%		N.A.

Temperature index as per ASTMD-2863	not less than 250 deg.C		N.A.
acid gas generation by weight as per IEC-60754-1	Maximum 20%		N.A.
Smoke Density Rating as per ASTMD-2843	Maximum 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)		N.A.
Reference standard	VDE207 Part 5		VDE207 Part 6 & ASTM D2116
G. Electrical Parameters			
MUTUAL CAPACITANCE BETWEEN CONDUCTORS AT 0.8 KHZ (MAX.)	200 nF/km	120 nF/km for F type 100 nF/km for G-type	200 nF/km
INSULATION RESISTANCE (MIN)	100 M Ohm/Km		
CROSS TALK FIGURE (MIN.) AT 0.8 KHZ	60 Db	60 dB	N.A.
CHARACTERISTIC IMPEDANCE (MAX) AT 1 KHZ	N.A.	320 ohm for F-type 340 ohm for G-type	N.A.
ATTENUATION	N.A.	1.2 db/km	N.A.

FIGURE AT 1 KHZ (MAX)				
H. Complete Cable				
Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.			N.A.
Flammability	Shall pass flammability as per IEEE-383 read in conjunction to this specification			N.A.
I. Accessories				
Cable accessories of flame retardant quality.	Yes. (Accessories such as harnessing components, markers, bedding, cable jointer, binding tape etc.)			
J. Tests				
Routine & Acceptance tests	Refer sub-section IIIE			
Type tests	Refer sub-section-CNI TYPE TEST			
K Cable Drum				
Type	Non-returnable wooden drum (wooden drum to be constructed from seasoned wood free from defects with wood preservative applied to the entire drum) or steel drum.			
Outermost layer covered with waterproof paper	Yes			
Painting	Entire surface to be painted			
Length	1000 m ± 5% for up to & including 12 pairs 500 m ± 5% for above12 pairs			

3.00.00 **SPECIFICATION OF OPTICAL FIBER CABLES (OFC)**

3.01.00 Optic Fiber cable shall be 4/8/12 core, galvanised corrugated steel taped armoured, fully water blocked with dielectric central member for outdoor/indoor application so as to prevent any physical damage. The cable shall have multiple single-mode or

B - 3

L.T. POWER CABLES

LT POWER CABLES

1.00.00 CODES & STANDARDS

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
IS : 5831	PVC insulation and sheath of electrical cables.
IS:7098 (Part -I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.
IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).

CLAUSE NO.	TECHNICAL REQUIREMENTS

2.00.00 TECHNICAL REQUIREMENTS

2.01.00 The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.

2.02.00 Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.

2.03.00 Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be stranded.

2.04.00 XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.

2.05.00 The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.

2.06.00 For single core armoured cables, armouring shall be of aluminium wires/ formed wires. For multicore armoured cables, armouring shall be of galvanised steel as follows :

Calculated nominal dia. of cable under armour	**Size and Type of armour**
Upto 13 mm	1.4mm dia GS wire
Above 13 & upto 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
Above 25 & upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
Above 40 & upto 55mm	1.4 mm thick GS formed wire /2.5mm dia GS wire
Above 55 & upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

2.06.01 The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm mm^2 per meter at 20 deg C. The sizes of aluminium armouring shall be same as indicated above for galvanized steel.

2.06.02 The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire /

CLAUSE NO.	TECHNICAL REQUIREMENTS
	formed wire. Zinc rich paint shall be applied on armour joint surface of G.S.wire/ formed wire.
2.07.00	Outer sheath shall be of PVC as per IS: 5831 & black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties. (a.) Oxygen index of min. 29 (as per IS 10810 Part-58). (b.) Acid gas emission of max. 20% (as per IEC-754-I). (c.) Smoke density rating shall not be more than 60 % (as per ASTMD-2843).
2.08.00	Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted: 1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black
2.09.00	For reduced neutral conductors, the core shall be black.
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath. (a.) Cable size and voltage grade - To be embossed (b.) Word 'FRLS' at every 5 metre - To be embossed (c.) Sequential marking of length of the cable in metres at every one metre -To be embossed / printed The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part-3.
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum, over the declared value in the technical data sheets.
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.
3.00.00	**Cable selection & sizing**
3.01.00	LT Power cables shall be sized based on the following considerations:

CLAUSE NO.	TECHNICAL REQUIREMENTS
	(a) Rated current of the equipment (b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage (c) Short circuit withstand capability This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let out energy of the fuse.For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time. (d) The minimum conductor size shall be 6 sqmm for aluminium conductor cables and 2.5 sqmm for copper conductor cables. The constructional details of copper conductor cables shall be same as indicated for copper control cable.
302.00	Derating Factors Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes: a) Variation in ambient temperature for cables laid in air b) Grouping of cables c) Variation in ground temperature and soil resistivity for buried cables.
3.03.00	Cable lengths shall be considered in such a way that straight through cable joints are avoided.
3.04.00	Cables shall be armoured type if laid in switchyard area or directly buried.
3.05.00	All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and preferable sizes are 1Cx150, 1Cx300, 1Cx630, 3Cx150 & 3Cx240 sq.mm.
4.00.00	**CONSTRUCTIONAL FEATURES** (a.) **1.1 KV grade XLPE power cables** shall have compacted aluminium conductor, XLPE insulated, PVC inner sheathed (as applicable), armoured/ unarmoured, FRLS PVC outer sheathed conforming to IS:7098. (Part-I). (b.) **1.1KV grade PVC power cables** shall have aluminium conductor (compacted type for sizes above 10 sq.mm), PVC Insulated, PVC inner sheathed, armoured/ unarmoured, FRLS PVC outer sheathed conforming to IS:1554 (Part-I).

CLAUSE NO.	TECHNICAL REQUIREMENTS
5.00.00	**CABLE DRUMS**
	(a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418. (b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.
5.00.00	**TYPE TESTS**
5.01.00	General All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval. All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price. The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.
5.02.00	**Type Tests**
5.02.01	The reports for the following type tests shall be submitted for one size each of LT XLPE and LT PVC Power cables. Size shall be decided by the employer during detailed engineering : **S.No.** **Type test** **Remarks**

		For Conductor	
	1.	Resistance test	
	2.	Tensile test	For circular non-compacted conductors only
	3.	Wrapping test	For circular non-compacted only
		For Armour Wires/ Formed Wires	
	4.	Measurement of Dimensions	
	5.	Tensile Test	
	6.	Elongation test	
	7.	Torsion test	For round wires only
	8.	Wrapping test	For aluminium wires / formed wires only.
	9.	Resistance test	
	10(a)	Mass of zinc coating test	For GS Formed wires/wires only
	10(b)	Uniformity of zinc coating	For GS Formed wires /wires only
	11.	Adhesion test	For GS Formed wires/wires only
		For PVC/XLPE insulation & PVC Sheath	
	12.	Test for thickness	
	13.	Tensile strength & elongation tests	before ageing and after ageing
	14.	Ageing in air oven	
	15.	Loss of mass test	For PVC insulation and sheath only
	16.	Hot deformation test	For PVC insulation and sheath only
	17.	Heat shock test	For PVC insulation and sheath only
	18.	Shrinkage test	
	19.	Thermal stability test	For PVC insulation and sheath only

CLAUSE NO.	TECHNICAL REQUIREMENTS

	20.	Hot set test	For XLPE insulation only
	21.	Water absorption test	For XLPE insulation only
	22.	Oxygen index test	For outer sheath only
	23.	Smoke density test	For outer sheath only
	24.	Acid gas generation test	For outer sheath only
		For completed cables	
	25.	Insulation resistance test (Volume resistivity method)	
	26.	High voltage test	
	27.	Flammability test as per IEC-332 Part-3 (Category-B)	

5.02.02 **Acceptance Tests** (as per QA table)

5.02.03 **Routine Tests** (as per QA table)

CLAUSE NO.	TECHNICAL REQUIREMENTS
	While crossing canals/river- to be laid in GI/rodent proof HDPE conduits within hume pipe.
9.02.00	Bidder shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.
9.03.00	Bidder shall furnish two completely new sets of cable termination kits like Crimping tools, etc., which are required for maintenance of the system as per the type of termination used.
9.04.00	Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.
9.05.00	No splices shall be made in conductors for instrument and control circuits except where required at connections to devices equipped with factory installed pigtails. Such splices shall be made only in approved splicing boxes of fitting with removable cover. The splices shall be made with sufficient slack left in the wires to permit withdrawal of the splice from the splicing box for ease of future disconnection of the splices. All exposed conductor or connector surfaces shall be covered with a minimum of three half-lapped layers of all weather vinyl plastic electrical tape. Taping shall extend a minimum of two cable diameters over the cable jacket and a similar distance over the other insulation or connections requiring insulation.
9.06.00	The Bidder shall be responsible for proper grounding of all equipment under C&I package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests. All the cables etc. required for grounding of all equipments supplied under this package are to be supplied by the Bidder.
9.07.00	The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.
10.00.00	**FIELD MOUNTED LOCAL JUNCTION BOXES** (i) No. of ways: 12/24/36/48/64/72/96/128 with 20% spares terminals. (ii) Material and Thickness: 4mm thick Fiberglass Reinforced Polyester (FRP).

	(iii)	Type	Door gasket shall be of synthetic rubber.
	(iv)	Mounting clamps and accessories	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass, included in Bidders scope of supply. Raceways shall be provided inside JBs for proper termination of cables.
	(v)	Type of terminal blocks	Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm^2. A M6 earthing stud shall be provided.
	(vi)	Protection Class	IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.
	(vii)	Grounding	To be provided.
	(viii)	Color	To be decided during detailed engineering & subject to Employer's approval.

11.00.00 CONDUITS

11.01.00 Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated steel, water leak, fire and rust proof. The temperature rating of flexible conduit shall be suitable for the following areas.

(i) Mills

(ii) Drum

(iii) Main steam, RH steam

(iv) Air heater

(v) Furnace, BFP DT's

And for remaining applications, water leak, fire & rust proof flexible G.I conduits shall be provided.

11.02.00 The Bidder shall install conduits according to the general routing as approved by Employer and shall coordinate conduit locations with other works.

11.03.00 All grounding bushings within all enclosures shall be wired together and connected internally to the enclosure grounding lug or grounding bus with 8 AWG bare copper

CLAUSE NO.	TECHNICAL REQUIREMENTS
22.00.00	**INTERNAL WIRING**
22.01.00	All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables. All inter-cubicle and inter-panel wiring all bus wiring for AC and DC supplies shall be provided by the Bidder.
22.02.00	All auxiliary wiring shall be carried out with 650V grade, single core stranded copper conductor, colour coded, PVC insulated wires. Conductor size shall be 1.5 mm^2 (min.) for control circuit wiring and 2.5 mm^2 (min) for CT and space heater circuits.
22.03.00	Extra flexible wires shall be used for wiring to devices mounted on moving parts such as hinged doors. The wire bunches from the panel inside to the doors shall be properly sleeved or taped.
22.04.00	All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminal blocks.
22.05.00	All internal wiring terminations shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor or an equally secure method. Similar lugs shall also be provided at both ends of component to component wiring. Insulating sleeves shall be provided over the exposed parts of lugs to the extent possible. Screw-less (spring loaded) / cage clamp type terminal shall also be provided with lugs.
22.06.00	Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit wiring.
22.07.00	Wiring for equipment, which are to be supplied by the Employer and for which the Contractor has to provide mounting arrangement in his panels, shall also be provided by the Contractor, upto the terminal blocks.
22.08.00	All connections from vertical busbars for individual modules above 100 A shall be by Copper / Aluminum links only. The cable connections for modules less than 100 A shall be selected in such a way that there will not be any melting / shorting in case of a short circuit inside the module and the cable shall have current rating to carry the let through energy of the corresponding fuses in case of a fault. The insulation of the cable and its cross section shall be decided considering the high ambient temperature within the module. For all modules where use of cable is envisaged by the Contractor specific approval from the Employer regarding cable details are to be taken. For power wiring colour coded wire insulation / tapes shall be provided.
23.00.00	**CONTROL TERMINAL BLOCKS**

CLAUSE NO.	TECHNICAL REQUIREMENTS
23.01.00	Terminal blocks shall be 650V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be either screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design.
23.02.00	Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing, isolation star / delta formation and earthing. Terminal blocks for CT secondary shall have the short circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only. All metal parts shall be of non-ferrous material.
23.03.00	In all circuit breaker panels and MCC modules at least 10% spare terminals for external connections shall be provided and these spare terminals shall be uniformly distributed on all terminal blocks.
23.04.00	All terminal blocks shall be suitable for terminating on each side two (2) nos. stranded copper conductors of size upto 2.5 sq. mm each, or alternatively, the terminal blocks shall have the possibility of double shorting space to facilitate looping. However for DDCMIS terminals shall be suitable for 1.5 sq. mm cable.
23.05.00	All terminals shall be numbered for identification and grouped according to the function. Engraved black-in-white labels shall be provided on the terminal blocks.
23.06.00	Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.
23.07.00	Terminal blocks shall be arranged with at least 100mm clearance between two sets of terminal blocks. The minimum clearance between the first row of terminal blocks and the associated cable gland plate shall be 250 mm.
24.00.00	**POWER CABLE TERMINATION**
24.01.00	Cable termination compartment and arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded aluminum conductor, PVC/ XLPE insulated, armoured / unarmoured and PVC sheathed cables. All necessary cable terminating accessories such as supporting clamps and brackets, hardware etc., shall be provided by the contractor.
24.02.00	All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS: 8309. All lugs shall be insulated/ sleeved.
25.00.00	**LOCAL PUSH BUTTON STATIONS**

CLAUSE NO.	TECHNICAL REQUIREMENTS

8.02.00 Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows:

From 11 kV/6.6 kV/3.3 kV tray system	-	914 mm
From 415V tray system	-	610 mm
From control cable tray system	-	305 mm

8.03.00 Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Fire proof sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Compression cable glands (double for armoured and single for other cables) shall be provided.

8.04.00 All cables shall be identified by tag. Nos. provided in Employer's approved format at both the ends as well as at an interval of 5 meters.

8.05.00 Line voltage drop due to high resistance splices, terminal contacts, insulation resistance at terminal block, very long transmission line etc. shall be reduced as far as practicable.

8.06.00 The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.

9.00.00 CABLE LAYING AND ACCESSORIES

9.01.00 **CABLE LAYING**

1 CABLES SHALL BE LAID STRICTLY IN LINE WITH CABLE SCHEDULE.

2 IDENTIFICATION TAGS FOR CABLES.

INDELIBLE TAGS TO BE PROVIDED AT ALL TERMINATIONS, ON BOTH SIDES OF WALL OR FLOOR CROSSING, ON EACH CONDUIT/DUCT/PIPE ENTRY/EXIT, AND AT EVERY 20 M IN CABLE TRENCH/TRAY.

3 CABLE TRAY NUMBERING AND MARKING.

TO BE PROVIDED AT EVERY 10M AND AT EACH END OF CABLE WAY & BRANCH CONNECTION.

4 JOINTS FOR LESS THAN 250 METERS RUN OF CABLE SHALL NOT BE

SPECIFIC ELECTRICAL REQUIREMENT FOR COMPRESSED AIR SYSTEM, SECTION C2

MOTOR DATASHEET A

SL.NO.	PARAMETERS	UNIT	REQUIREMENT
	MOTOR		
1	DESIGN AMBIENT TEMP	DEG. C	50
2	VOLTAGE SUPPLY AND VARIATION	VOLT	415V, ± 10%
3	FREQUENCY WITH VARIATION	Hz	50 (+) 3% to (-) 5%
4	COMBINED VOLTAGE & FREQUENCY VARIATION		10%
5	MAX ACCEPTABLE RATING OF MOTOR AT 415 V	KW	Above 200W and upto 200 kW
6	SYSTEM FAULT LEVEL AND ITS DUARTION	KA	45 KA, 1 Sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.25 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F and temp rise limited to Class-B
9	MIN. STARTING VOLTAGE		(a) 85% below 110 KW (b) 80% from 110 KW to 200 KW
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		Upto 200W
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	For LT motors of continuous duty (S1) type motors, starting current shall be as per IS: 12615.
12	ACCEPTABLE NOISE LEVEL	DB	85dB at 1.0m in line with IS 12065
13	TYPE OF STARTER PROVIDED IN MCC		DOL
14	DOP OF ENCLOSURE		Degree of protection for various enclosures as per IS:4691, IEC60034-05 shall be as follows :- i) Indoor motors - IP 54 ii) Outdoor motors - IP 55 iii) Cable box-indoor area - IP 54 iv) Cable box-Outdoor area - IP 55
15	SPACE HEATER REQUIREMENT		30KW & ABOVE
16	PAINT SHADE		RAL 5012 (Blue)
17	SPECIAL REQUIREMENT		(i) Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be **Premium Efficiency class-IE3**, conforming to IS 12615, or IEC:60034-30. (ii) For testing requirements, refer attached NTPC Spec of Motors.

CLAUSE NO.	BIDDERS'S NAME
DE-1B	**LT MOTORS**

A. GENERAL

1. Manufacturer & Country of origin. (Shall be as per approved QA make)
2. Equipment driven by motor
3. Motor type
4. Quantity

B. DESIGN AND PERFORMANCE DATA

1. Frame size
2. Type of duty
3. Type of enclosure /Method of cooling/Degree of protection
4. Applicable standard to which motor generally conforms
5. Efficiency class as per IS 12615
6. (a) Whether motor is flame proof Yes/No

   (b) If yes, the gas group to which it conforms as per IS:2148
7. Type of mounting
8. Direction of rotation as viewed from DE END_____
9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)
10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)
11. Maximum continuous load demand of driven equipment in KW
12. Rated Voltage (volts)
13. Permissible variation of :

    a. Voltage (Volts)

CLAUSE NO.	BIDDERS'S NAME

b. Frequency (Hz)

c. Combined voltage and frequency

14. Rated speed at rated voltage and frequency(RPM)

15. At rated Voltage and frequency:

a. Full load current

b. No load current

16. Power Factor at

a. 100% load

b. NO load

c. Starting.

17. Efficiency at rated voltage and frequrecy,

a. 100% load

b. 75% load

c. 50% load

18. Starting current (amps) at

a. 100 % voltage

b. 85% voltage

c. 80% voltage

19. Minimum permissible starting Voltage (Volts)

20. Starting time with minimum permissible voltage

a. Without driven equipment coupled

b. With driven equipment coupled

CLAUSE NO.	BIDDERS'S NAME

21. Safe stall time with 100% and 110% of rated voltage

    a. From hot condition

    b. From cold condition

22. Torques :

    a. Starting torque at min. permissible voltage(kg-mtr.)

    b. Pull up torque at rated voltage.

    c. Pull out torque

    d. Min accelerating torque (kg.m) available

    e. Rated torque (kg.m)

23. Stator winding resistance per phase (ohms at 20 Deg.C.)

24. GD^2 value of motors

25. No of permissible successive starts when motor is in hot condition

26. Locked Rotor KVA Input

27. Locked Rotor KVA/KW

28. Vibration limit :Velocity (mm/s)

29. Noise level limit (dBA)

C. CONSTRUCTIONAL FEATURES

1. Stator winding insulation

    a. Class & Type

    b. Winding Insulation Process

    c. Tropicalised (Yes/No)

CLAUSE NO.	BIDDERS'S NAME

d. Temperature rise over specified maximum ambient temperature of 50 deg C

e. Method of temperature measurement

f. Stator winding connection

2. Main Terminal Box

a. Type

b. Location (viewed from NDE side)

c. Entry of cables(bottom/side)

d. Recommended cable size (To be matched with cable size envisaged by owner)

e. Fault level (MVA), Fault level duration (sec)

f. Cable glands & lugs details (shall be suitable for power cable)

3. Type of DE/NDE Bearing

4. Motor Paint shade

5. Weight of

a. Motor stator (KG)

b. Motor Rotor (KG)

c. Total weight (KG)

D. List of accessories.

1. Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)

2. Terminal Box for Space Heater (Yes/No)

3. Speed switch (Yes/No) No of contacts and contact ratings of speed switch

CLAUSE NO.	BIDDERS'S NAME

4. Insulation of bearing (Yes/No)

5. Noise reducer(Yes/No)

6. Grounding pads

   i) No and size on motor body

   ii) Nos on terminal Box

7. Vibration pads

   i) Nos and size

   ii) Location

8. Any other fitments

E. List of curves.

1. Torque speed characteristic of the motor

2. Thermal withstand characteristic

3. Starting. current Vs. Time

4. Starting. current Vs speed

5. P.F. and Effi. Vs Load

F. Additional Data to be filled for each rating of DC Motor

1. Rated armature voltage (Volt)

2. Rated field excitation (Amp)

3. Permissible % variation in voltage

4. Minimum Permissible Starting voltage (volt)

5. At rated voltage

   i) Full load Armature current.(Amp)

   ii) Full load Field current (Amp)

CLAUSE NO.	BIDDERS'S NAME

iii) No load Armature current (Amp)

6. Full load Field current (Amp)

7. No load Aramature current (Amp)

8. Minimum permissible field current(Amp) to avoid overspeeding at

   i) Maximum permissible voltage

   ii) Rated voltage

   iii) Minimum Permissible Voltage

9. Resistance (indicative Values) in ohm

   i) Armature winding (Arm + IP + Series) at 25 deg.C

   ii) Field Winding at 25 deg. C

10. Inductance (indicative values)

    i) Armature winding

    ii) Field winding

11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at

    i) 220 V DC

    ii) 250 V DC

    iii) 187 V DC

12. Value of the external resistance (ohm) required to be connected in series with armature during starting only

13. Technical data sheet for external resistance box

14. GA drawing of motor

15. Starting time calculation

CLAUSE NO.	BIDDERS'S NAME
	16. Starter resistance design calculation 17. Electrical connection diagram of motor

CLAUSE NO.	BIDDERS'S NAME		
	POWER AND CONTROL CABLES (Use separate sheet for each type and size of cables)		
1.00.00	Make (Shall be as per approved QA make)	.....	.....
1.02.00	Country of Manufacturer	.....	.....
1.03.00	Type & designation	.....	.....
1.04.00	Applicable standard	.....	.....
1.05.00	Cable size & no. of cores	.....	.....
1.06.00	Rated voltage	.....	.....
1.07.00	Catalogue attached as Annexure No.	.....	.....
1.08.00	Continuous current rating for max. conductor temperature	.....	.....
	a) When laid in air at an ambient temperature of 50 deg. C	.....	.....
	b) When buried in soil having thermal resistivity of 150 deg.C cm/w at a depth of 1000 mm at ground ambient temperature of 40 deg. C	.....	.....
1.09.00	Short circuit withstand capacity and duration for	.....	.....
	a) Conductor	.....	.....
	b) Screen	.....	.....
	c) Armour	.....	.....
1.10.00	Conductor	.....	.....
	a) Material	.....	.....
	b) Nominal cross section area in sq. mm	.....	.....
	c) Shape of conductor	.....	.....
	d) DC resistance at 20°C (Maxm.)	.....	.....
1.11.00	Insulation		
	a) Material	.....	.....

CLAUSE NO.	BIDDERS'S NAME		
	b) Nominal thickness (in mm)	.....	.....
	c) Type of curing (for XLPE)	.....	.....
1.12.00	Metallic screen (wherever applicable)		
	a) Material	.....	.....
	b) Type	.....	.....
	c) Short Ckt. (KA) & Period (Sec.)		
1.13.00	Material & Type of Inner sheath	.....	.....
1.14.00	Armour material & shape	.....	.....
1.15.00	Outer sheath material & type	.....	.....
1.16.00	Over all dia of cable (in mm)	.....	.....
1.17.00	Guaranteed value of minimum oxygen index of outer sheath	.....	.....
1.18.00	Maximum acid-gas generation by weight (%) of outer sheath	.....	.....
1.19.00	Smoke Density rating of outer sheath	.....	.....

LIST OF TESTS FOR MOTOR.

SECTION C2

INDUCTION MOTOR & SYNCHRONOUS MACHINE

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydrualic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All tests as per IS-325/IS-4722 / 9283	Vibration	Over speed	Tan delta, shaft voltage & polarisation index test
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y					Y									
Shaft	Y	Y	Y	Y	Y	Y			Y									
Magnetic Material	Y	Y	Y	Y	Y		Y			Y		Y						
Rotor Copper/Aluminium	Y	Y	Y	Y		Y	Y		Y									
Stator copper	Y	Y	Y	Y			Y		Y			Y						
SC Ring	Y	Y	Y	Y	Y	Y	Y	Y	Y									
Insulating Material	Y		Y	Y			Y					Y						
Tubes for Cooler	Y	Y	Y	Y	Y				Y		Y							
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y							
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y										
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y										
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y				Y									
Wound stator	Y	Y					Y	Y										
Wound Exciter	Y	Y					Y	Y										
Rotor complete	Y	Y					Y						Y	Y				
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y											
Accessories, RTD, BTD,CT, Brushes, Diodes,Space heater, antifriction bearing, cable glands, lugs, gaskets etc.	Y	Y	Y															
Motor (IS 325 / 4722/ 9283)	Y	Y	Y												Y	Y	Y	Y1

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor up to 50KW.
2. Makes of all major bought out items will be subject to NTPC approval.
Y1 = for HT Motor / Machines only.

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 1 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION C2 VOLUME II B			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL