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				SIZE:	
	DESCRIPTION		SPECIFICATION REQUIREMENT		VENDOR'S CONFIRMATION/INFORMATION
A	**APPLICABLE SPECIFICATION & STANDARD**				
1	SPECIFICATION		999-ELE-SPC-0005		
			Specification for Variable Frequency Drive(VFD)		
2	MANUFACTURING STANDARD		999-ELE-SPC-0005 2.1		YES
3	QUANTITY		SEE NOTE 15		SEE NOTE 15
4	TYPE OF DRIVEN EQUIPMENT		SEE NOTE 15		SEE NOTE 15
B	**SERVICE / SITE CONDITION**				
1	DESIGN AMBIENT TEMP. (MAXIMUM/ MINIMUM)		55°C / -5°C(40°C FOR THE AIRCONDITIONED ROOM)		55°C / -5°C(40°C FOR THE AIRCONDITIONED ROOM)
2	MECHANICAL DESIGN TEMPERATURE		80°C		80°C
3	ALTITUDE ABOVE M.S.L.		LESS THAN 100M		LESS THAN 100M
4	MIN-MAX RELATIVE HUMIDITY		25% - 87%		25% - 87%
5	SEISMIC ZONE		2A		2A
6	LOCATION (INDOOR / OUTDOOR)		VFD IN AIRCONDITIONED ROOM		VFD IN AIRCONDITIONED ROOM
7	ZONE OF HAZARD , GAS GROUP , TEMP CLASS		SAFE AREA		SAFE AREA
C	**INPUT SUPPLY**				
1	NO. OF PHASES		3		3
2	VOLTAGE		11kV ± 10%		11kV ± 10%
3	FREQUENCY		50HZ ± 10%		50HZ ± 10%
4	SYSTEM EARTHING		NEUTRAL EARTHING RESISTOR 6.36kV / 100A		NEUTRAL EARTHING RESISTOR 6.36kV / 100A
5	MINIMUM SHORT CIRCUIT CURRENT AT 11kV		25 kA		25 kA
6	MAXIMUM SHORT CIRCUIT CURRENT AT 11kV		31.5 kA/3s		31.5 kA/3s
7	HARMONICS AT THE LINE SIDE		TO BE LIMITED IN COMPLIANCE WITH IEEE 519		TO BE LIMITED IN COMPLIANCE WITH IEEE 519
8	DESIGN SHORT CIRCUIT FOR WITHSTAND		31.5 kA FOR 3 SEC		31.5 kA FOR 3 SEC
D	**BASIC REQUIREMENTS**				
1	RUNNING TEMP.				
1.1	VFD PANEL ROOM		40°C		40°C
	MAXIMUM AMBIENT TEMPERATURE		55°C, (CAPABLE of WORKING for 2 HOURS		55°C, (CAPABLE of WORKING for 2 HOURSWITHOUT HVAC)
1.2	VFD TRANSFORMER ROOM		ONLY VENTILATION REQUIRED		ONLY VENTILATION REQUIRED
2	TYPE OF VFD INVERTER (LCI/VSI)		VSI		VSI
3	VFD BYPASS TRANSFER SWITCH		YES		YES
4	NUMBER OF PULSES - SUPPLY SIDE/MOTOR SIDE		36 PULSE / 36 PULSE		54 PULSE / 54 PULSE
5	COMMUNICATION WITH DCS (YES / NO)		YES (hardwired contacts)		YES (hardwired contacts)
6	COMMUNICATION WITH EICS (YES / NO)		YES (SERIAL LINK MODBUS RTU PROTOCOL)		YES (SERIAL LINK MODBUS RTU PROTOCOL)
7	DRIVE TRANSFORMER TYPE		DRY TYPE		DRY TYPE
8	INPUT POWER FACTOR AT VFD		0.85		0.85
9	VFD CONTROL PARAMETER (SPEED/TORQUE/POWER OR COMBINATION) REQUIRED (YES / NO)		YES		YES
10	SPEED RANGE		30%~100%		1%~150%
11	LINE INPUT BREAKER (YES / NO)		NO (BY SWITCHGEAR VENDOR)		NO (BY SWITCHGEAR VENDOR)
12	IP RATING		IP20 (DOOR OPENED)		IP20 (DOOR OPENED)
13	NOISE LEVEL		<85 DB at 1m		<85 DB at 1m
14	"FLYING RESTART" POSSIBLE (YES / NO)		YES		Meet the Need
E	**OTHER REQUIREMENTS**				
1	ANTICONDENSATION HEATERS (YES / NO)		YES		COMPLY
2	PREFERRED COOLING SYSTEM FOR VFD (AIR / DM WATER CLOSED LOOP)		AIR		COMPLY
3	CABLE ENTRIES (BELOW / ABOVE)		BELOW (WITH GLAND PLATE)		COMPLY
4	POWER CABLE LENGTH FROM VFD PANEL TO MOTOR		(Note-15)		COMPLY
5	PAINTING TYPE AND SHADE		RAL7032		COMPLY
6	HARMONIC STUDY (OVERALL / LIMITED TO EACH DRIVE)		LIMITED TO EACH DRIVE (BY VENDOR)		COMPLY
7	OTHER STUDIES/ANALYSIS		RESONANCE STUDY TO BE CONDUCTED		COMPLY
			CONSIDERING LV PF IMPROVEMENT (BY VENDOR)		see attached
	CAPACITANCE WITH SERIES INDUCTANCE (BY VENDOR)				Provides avoidance of 3 resonance point frequencies
8	CONTROL SUPPLY		230V AC (OR 110V DC)		230V AC
9	AUX. AC POWER SUPPLY		230V, 1PH, 50Hz ((FOR INTERNAL LIGHTING & SPACE HEATER)		COMPLY

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DESCRIPTION	SPECIFICATION REQUIREMENT	VENDOR'S CONFIRMATION/INFORMATION
F REMOTE INDICATIONS AND CONTROLS	ALL SIGNALS FROM/TO UCP ARE THROUGH HARDWIRE (VOLTAGE FREE CONTACTS).	
1 MOTOR 'ON' SIGNAL TO UCP	YES	COMPLY
2 MOTOR 'OFF' SIGNAL TO UCP	YES	COMPLY
3 MOTOR 'AVAILABLE' SIGNAL TO UCP	YES	COMPLY
4 MOTOR 'FAULT' SIGNAL TO UCP	YES	COMPLY
5 INPUT SIGNALS FROM REMOTE TO VFD:	YES	COMPLY
6 LOCAL / REMOTE (POTENTIAL FREE CONTACT) FROM UCP	YES	COMPLY
7 START SIGNAL (POTENTIAL FREE CONTACT) FROM UCP	YES	COMPLY
8 STOP SIGNAL (POTENTIAL FREE CONTACT) FROM UCP	YES	COMPLY
9 EMERGENCY STOP(POTENTIAL FREE CONTACT) FROM UCP	YES	COMPLY
G TESTING		
1 ROUTINE TESTS		
INSULATION	YES	COMPLY
LIGHT LOAD AND OPERATION	YES	COMPLY
CHECKING OF AUXILIARY DEVICES	YES	COMPLY
CHECKING THE PROPERTIES OF THE CONTROL EQUIPMENT	YES	COMPLY
CHECKING THE PROTECTIVE DEVICES	YES	COMPLY
CONTINUITY TEST FOR WIRING	YES	COMPLY
OPERATION/FUNCTIONAL TESTS	YES	COMPLY
CHECKING OF INTERLOCKS	YES	COMPLY
IR/HV TEST ON POWER/CONTROL CIRCUIT	YES	COMPLY
2 TYPE TEST		
INSULATION	YES	COMPLY
LIGHT LOAD AND OPERATION	YES	COMPLY
RATED CURRENT/OUTPUT	YES	COMPLY
CURRENT SHARING	YES	COMPLY
VOLTAGE DIVISION	YES	COMPLY
POWER LOSS DETERMINATION	YES	COMPLY
TEMPERATURE RISE	YES	COMPLY
CHECKING OF AUXILIARY DEVICES	YES	COMPLY
CHECKING THE PROPERTIES OF THE CONTROL EQUIPMENT	YES	COMPLY
CHECKING THE PROTECTIVE DEVICES	YES	COMPLY
ON LOAD TEST	YES	COMPLY
H ADDITIONAL REQUIREMENTS		
1 LOAD STARTING TIME	SEE MECHANICAL EQUIPMENT VENDOR DATA (TBA)	COMPLY
2 GD^2 VALUE (LOAD + MOTOR)	AS PER MECHANICAL EQUIPMENT VENDOR DATA (TBA)	COMPLY
3 MOTOR AND LOAD TORQUE - SPEED CURVES	AS PER MECHANICAL EQUIPMENT VENDOR DATA (TBA)	COMPLY

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1	MANUFACTURER:		SERVICE:		EQUIPMENT NO.:		QTY:
2					SIZE:		
3			**INFORMATION BY VENDOR**				
4	**A**	**GENERAL**					
5	1	MAIN VFD SOFT STARTER SYSTEM VENDOR	LS ELECTRIC(DALIAN)CO.,LTD				
6	2	MODEL NO. FOR VFD SOFT STARTER	LSMV-M1000Z 100F100-1600，LSMV-M1000Z 100F100-2800				
7	3	APPLICABLE CODE / STANDARDS	IEC61800				
8	4	INPUT POWER SUPPLY RATING:					
9		a) VOLTAGE	11KV	V	±	10	%
10		b) FREQUENCY	50	Hz	±	10	%
11	5	COMPONENT MAKE AND COUNTRY OF ORIGIN:					
12		- CONVERTER	China				
13		- MOTOR	(*)	Note-14	NO MOTOR INFORMATION		
14		- REACTOR / FILTERS	(*)		NO REACTOR / FILTERS IN VFD		
15		- DRIVE TRANSFORMER	(*)		NO DRIVE TRANSFORMER IN VFD		
16	6	HEAT LOSS AT MAXIMUM LOAD FOR HVAC DESIGN		50 KW(1250kW)	90 KW(2200kW)		
17	7	NEAREST SERVICE LOCATION					
18							
19	**B**	**BASIC DATA FOR DRIVE SYSTEM**					
20	1	OPERATIONAL SPEED RANGE & SPEED CONTROL ACCURACY	0.1%~150%	NOT APPLICABLE			
21	2	DRIVE RATING (AT DESIGN AMBIENT)	84A	146.9AA			
22	3	BEARING INSULATION REQUIRED FOR MOTOR (YES / NO)	NO				
23	4	HARMONIC FILTER REQUIRED (YES / NO)	NO				
24	5	SEPARATELY MOUNTED REACTOR REQUIRED (YES / NO)	NO				
25	6	COOLING SYSTEM FOR DRIVE	Air Cooling				
26	7	POWER FOR ACCELERATION OF LOAD TO RATED SPEED	related to load	kW			
27	8	VSDS CONTROL PARAMETER (SPEED / TORQUE / POWER)	Speed				
28	9	CRITICAL SPEED:					
29		- FIRST CRITICAL SPEED	Can be set	RPM	Skip frequency band set in parameter		
30		- SECOND CRITICAL SPEED	Can be set	RPM	Skip frequency band set in parameter		
31	10	RUNNING UP TIME MOTOR	0-3200S (adjustable)	sec (Note-14)			
32	11	TOTAL RUNNING-UP TIME FOR VFD	Can be set	sec	continuous operation		
33	12	MAX SOUND PRESSURE LEVEL CONVERTER	85dB	dBA			
34	13	"FLYING RESTART" POSSIBLE (YES / NO)	YES				
35	14	MTBF OF THE VSD SYSTEM	100000				
36	15	MTTR OF THE VSD SYSTEM	60 minutes				
37	16	AVAILABILITY OF THE VFD SYSTEM	98%				
38	17	EXPECTED LIFETIME OF ELECTRONIC COMPONENTS	15	YEARS			
39	18	EXPECTED LIFETIME OF COOLING SYSTEM	10	YEARS			
40	19	OVERALL DIMENSION OF DRIVE PANELS (L X D X H) IN MM	11334*1700*2895(mm)				
41	20	WEIGHT OF EACH VERTICAL PANEL	21000	kg			
42	21	AUXILIARY SUPPLIES REQUIRED WITH POWER CONSUMPTION					
43		(VENDOR TO SPECIFY):	(*)	W	100KVA/set		
44		- NORMAL 230V AC 1-Ph 50Hz	(*)	W	50KVA/set		
45		- NORMAL 400V AC 3-Ph 50Hz (FOR AUXILIARIES)	50kva	V	50KVA/set		
46		- ANY UPS SUPPLY (110V DC)	(*)	kW/….. SECS.			
47	22	COOLING PERIOD FOR DRIVE BEFORE NEXT START	1min				
48	23	DEGREE OF PROTECTION	IP42				
49	24	OVERLOAD CAPABILITY/ NO. OF STARTS PER HOUR	120% 1min				
50							
51	**C**	**INPUT DRIVE TRANSFORMER**					
52	1	MAKE/ TYPE	Dry Type				
53	2	kVA RATING	1600kVA	2800kVA			
54	3	VOLTAGE RATIO	15.9				
55	4	NOS. OF WINDING	27				
56	5	VECTOR GROUP	9				
57	6	IMPEDANCE	8%				
58	7	TAP RANGE (IF ANY)	5%, 0, -5%				
59	8	IMPULSE WITHSTAND LEVEL	75kV(full wave peak)				
60							

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INFORMATION BY VENDOR

C	**INPUT DRIVE TRANSFORMER**	
9	POWER FREQUENCY WITHSTAND LEVEL	28kV
10	NOISE LEVEL	80dB
11	TRANSFORMER ACCESSORIES	NO
12	APPLICABLE CODES / STANDARDS	IEC61378-1
13	OVERALL DIMENSION (L X W X H)	Install in the inverter Panel
14	TOTAL WEIGHT	4.1KG/5.2KG
15	CLEARANCE FROM ALL SIDES IN MM	120mm
D	**AC-DC CONVERTER DETAILS**	
1	SEMICONDUCTOR DEVICES (DIODE / THYRISTOR / IGBT / IGCT / ANY OTHER)	IGBT
2	CONVERTER CONFIGURATION (3-PH UNCONTROLLED / 3-PH SEMI CONTROLLED / 3-PH FULLY CONTROLLED) WITH NO. OF SEMICONDUCTORS PER BRANCH	3-PH UNCONTROLLED 36
3	NO. OF PULSE	54
4	INPUT PERFORMANCE:	
	VENDOR SHALL FURNISH THE PERFORMANCE FIGURE FOR INDIVIDUAL DRIVE AS FOLLOWS:	

PERFORMANCE PARAMETER	100% LOAD	75% LOAD	50% LOAD	25% LOAD
TOTAL INPUT RMS CURRENT (I_S)	577	433	288	145
% CURRENT THD	0.03	0.035	0.05	0.07
% CURRENT TDD				
FUNDAMENTAL POWER FACTOR (DPF)	0.92	0.92	0.92	0.9
CONVERTER EFFICIENCY	0.96	0.96	0.955	0.95

CURRENT HARMONIC PROFILE (Note-10)

	100% load		75% load		50% load		25% load	
	AMPS	ANGLE (DEG)	AMPS	ANGLE (DEG)	AMPS	ANGLE (DEG)	AMPS	ANGLE (DEG)
5	2.2	100%						
7	1.06	100%						
11	1.42	100%						
13	1.36	100%						
17	0.11	100%						
19	0.07	100%						
23	0.03	100%						
25	0.03	100%						
29								
31								
35								
37								
41								
43								
47								
49								

5	DC LINK VOLTAGE	1800V
6	MAX. DC LINK CURRENT	380A
7	INPUT REACTOR (IF ANY)	NO
8	DC LINK REACTOR (REACTOR/CAPACITOR)	NO
9	CONVERTER EFFICIENCY	@ 75% LOAD % , @ 100% LOAD %

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INFORMATION BY VENDOR

E	**DC - AC INVERTER DETAILS**		
1	SEMICONDUCTOR DEVICES (THYRISTOR / IGBT / IGCT / ANY OTHER)	IGBT	
2	INVERTER CONFIGURATION WITH NO. OF SEMICONDUCTORS PER BRANCH	36	
3	TYPE OF INVERTER	VSI	
4	TYPE OF CONTROL	FOC	
5	SWITCHING FREQUENCY RANGE	800Hz~2000Hz	
6	MAX. OUTPUT VOLTAGE (AT MIN. -10%)	5%	
7	MAX OUTPUT CURRENT (AT MIN. -10%)	5%	
8	OUTPUT FREQUENCY RANGE	0~120Hz	
9	ACCURACY OUTPUT FREQUENCY	1%	
10	VOLTAGE THD	3%	
11	CURRENT THD	3%	
12	VFD OUTPUT VOLTAGE SURGE (dv/dt) AT MOTOR TERMINAL		
	a) PH-PH	1kV(peak)/sec。	
	b) PH-GND	0.6kV ((peak)/sec。	
13	OUTPUT REACTOR	NO	
14	INVERTER EFFICIENCY	@75%load% , @100%load%	
15	OVERLOAD CAPABILITY OF DRIVE:		
	a) 125% IN FOR:	1 min	
	b) 150% IN FOR	0.1 min	
	c) INRUSH CURRENT 250% IN FOR	3s	
16	OVERALL EFFICIENCY OF DRIVE (EXCL. MOTOR) AT:		
	a) 100% LOAD	96%	
	b) 75% LOAD	96%	
	c) 50% LOAD	96%	
	d) 25% LOAD	95%	
17	OVERALL POWER FACTOR OF DRIVE AT:		
	a) 100% LOAD	0.92	
	b) 75% LOAD	0.93	
	c) 50% LOAD	0.94	
	d) 25% LOAD	0.95	
18	TRANSIENT TORQUE	200%	
19	TORQUE BOOST AVAILABLE	130%	
20	MAX TRANSIENT TORQUE / DURATION	1s	
21	OUTPUT SHORT CKT. CAPABILITY AND DURATION	7us	
H	**RECOMMENDED TYPE, VOLTAGE GRADE AND SIZE OF CABLES**		
1	11kV SWITCHBOARD TO SHIFT TRANSFORMER	by EPC	
2	INPUTSHIFT TRANSFORMER TO VFD CABINET	by EPC	
3	VFD SWGR OR TRANSFORMER TO MOTOR	by EPC	
4	CONTROL CABLES	by EPC	
5	SIGNAL CABLES	by EPC	
6	MISC. AUXILIARY POWER SUPPLY CABLES	by EPC	
I	**ADDITIONAL DOCS TO BE SUBMITTED WITH BID**		
1	REFERENCE LIST OF PROJECTS SUBMITTED	YES	
2	SPARES LIST AS REQUESTED IN MR SUBMITTED (YES/NO)	YES	
3	VENDOR'S VFD SOFT STARTER INSPECTION TEST PLAN OFFERED	YES	
	FOR THIS PROJECT SUBMITTED.		
4	PRELIMINARY CALCULATION & CONFIRMATION REGARDING	No need	
	REQUIREMENT OF HARMONIC RESONANCE FILTERS SUBMITTED (YES/NO)		
5	LIST OF DEVIATIONS WITH JUSTIFICATION SUBMITTED (YES/NO)	YES	
	FOR ALL MRQ ATTACHMENTS		
6	SLD OF VFDS INCL. ALL EQUIPMENT (YES/NO)	YES	

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NOTES :

1. VFD VENDOR to furnish data marked as * with the Technical Bid Submission as a Minimum requirement. Also refer to Technical. Bid Tabulation (attached to MR) to be filled in by VENDOR and submitted with Bid.
2. "HOLD" is a tentative value. If there is any change later, this value will be corrected. Follow this value before receiving the correction,
3. VFD VENDOR to include Cable sizing calculation for all cables within his battery limit and provide the cables information. EPC CONTRACTOR will supply and install the cables as per VENDOR's design.
4. VFD VENDOR to include any series compensation devices if required due to the motor power cable length specified in this data sheet (Note 15).
5. An interlocks feature to prevent access to live parts in VFD panel to be provided.
6. All protection and alarm (refer to "999-ELE-SPC-0005 Specification for Variable Frequency Drive(VFD)") equipment for VFDS shall be advised by VFD VEBDOR.
7. Spares supply shall be as per MR.
8. Earthing facility for power cables to be provided in the VFD panels.
9. Language on equipment and on documentation shall be English.
10. Type of Cooling for the VFD (Air) shall be decided by Manufacturer. Cooling system shall be redundant.
11. Current Harmonic profile upto order 50 shall be furnished for the VFD by the VFD VENDOR at drive transformer primary which is the Point of Common Coupling (PCC) for VFD.
12. VFD VENDOR to confirm if torsional vibration study and any precaution to reduce pulsating torques is recommended for starting applications.
13. VFD VENDOR shall interface with EPC Contractor/ Power Study Consultant regarding carrying out the Harmonic Measurements at Site VFD VENDOR shall include this activity under his scope.
14. The fault diagnostic and monitoring logic shall be equipped with a memory function to retain information regarding the cause of tripping of the VFDS Vendor shall offer the standard retention period for
15. Application of VFD shall be as per following table :
16. Rating shown are indicative. Final rating shall be selected based on driven equipment requirements.

TAG NO.	DRIVEN EQUIPMENT	RATING (KW) (Note-16)	STARTING/SPEED ADJUSTMENT	ESTIMATED 11kV POWER CABLE LENGTH(FROM VFD TO MOTOR)	REMARKS
SS02-VFD-01	KM-02A	1200	SPEED ADJUSTMENT	360m	
SS02-VFD-02	KM-02B	1200	SPEED ADJUSTMENT	360m	
SS02-VFD-03	KM-02C	1200	SPEED ADJUSTMENT	360m	
SS02-VFD-04	PM-04A	2200	SPEED ADJUSTMENT	470m	
SS02-VFD-05	PM-04B	2200	SPEED ADJUSTMENT	470m	