

ESP-001- 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION			Std. / Doc. Number
					Annexure-2
					Rev. No. 00

COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.	Annexure-2 DATA SHEETS FOR DIESEL ENGINE & DG SET
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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Rajeev Jain	Girish Prasad Palo	Siva Prasad Babu	09.06.2018

1	GENERAL			
2	Project:		Job No.:	
3	Owner:		Site:	
4	Purchaser:		Unit:	Unit No.:
5	Item No.:		Service:	
6	No. Reqd.:	Working:	Standby:	Driven Equipment Item no.:
7	Applicable to: ☒ Proposals ☐ Purchase ☐ As built			
8	Note: ☒ Scope option / information specified by Purchaser ☐ information required from / options left to vendor. Vendor to cross ☒ the selected option.			
9	SITE / INSTALLATION DATA			
10	Site Conditions		Location:	
11	Barom. Pressure(kg/cm ² a): ☐ Highest: ☐ Lowest: ☐ Avg.:		☒ Indoor ☐ Outdoor ☒ Grade	
12	Height above Mean Sea Level (m):		☐ Heated ☐ Unheated	
13	Ambient Air Temp.(°C): ☐ Max.: ☐ Min.:		☐ Under-roof ☐ Partial Sides	
14	Ambt. Air Temp. around the Engine(°C): ☐ Highest ☐ Lowest		☐ Closed Room With Air Ventilation System.	
15	Relative Air Humidity at the Max. Ambient Air Temp.(%):		Electrical Area classification(Refer Electrical part)	
16	Water Vapour Pressure at the Max. Ambient Air Temp.(kg/cm ² A):		Class Group Division	
17	Wet Bulb Temp. (°C):		Dry Bulb Temp. (°C):	
18	Cooling Water Supply Temp. (°C):			
19	UTILITY DATA			
20	Cooling Water:			
21	Cooling Water Temp(°C)	Supply(Design/Max/Nor/Min):	Return(Max):	
22	Cooling Water Press(kg/cm ² g)	Supply(Design/Max/Nor/Min):	Return(Min):	
23	Cooling Water Characteristics:		DM Water Consumption:	
24	Instrument Air:			
25	Supply Pressure(Design/Max/Nor/Min)(kg/cm ² g):			
26	Supply Temp.(Design/Max/Nor/Min)(°C):		Dew pt.(°C)	
27	Electric Power (Refer Electrical Specification)			
28	Electric Supply:		Volts Hz	
29	Available during Engine ☐ Starting ☐ Operations ☐ Shut-down			
30	Fuel Oil:			
31	Type of Fuel Oil:		Lower Calorific Value(kJ/kg):	
32	Fuel Oil Characteristics:			
33	APPLICABLE CODES & STANDARDS			
34	☒ EIL Standard spec. no. 6-43-0040 ☒ ISO 3046/ BS 5514 ☒ ISO: 8528 ☒ Others: Job Specification			
35	Noise specification: ☐ Applicable to m/c			
36	☒ Acoustic Housing: ☐ Yes ☐ No (As per Central & State Pollution Control Board guidelines)			
37	Exhaust Gas Emission - Statutory requirement (if any): Refer Job Spec & EIL Std. Spec. 6-43-0040			
38	☐ Listing/Approval of Engine Required From: ☐ UL/FM ☐ TAC			
39	☒ Air Receiver for Starting Air System ASME SEC- VIII DIV 1		☒ Air Compressor for Starting Air System Manufacturer's Std.	
40	☒ Shell and Tube type Exchangers: Manufacturer's Std.		☒ Auxiliary Pumps: Manufacturer's Std.	
41	☒ Air Cooled Heat Exchangers/Radiator: Manufacturer's Std.		☒ Other Tanks and Vessels: Manufacturer's Std.	
42	DRIVEN EQUIPMENT			
43	Driven Equipment: ☒ Elect. Generator ☐ Pump ☐ Other:			
44	Duty: ☐ Emergency ☐ Intermittent ☒ continuous			
45	Probable Period For Continuous Running:			
46	Duration of Max. Load:		Duration of Min. Load:	
47	☐ Minimum BKW of the driven eqpt. kW:		@ RPM:	
48	☐ Rated BKW of the driven eqpt. kW:		@ RPM:	
49	☐ Maximum BKW of the driven eqpt. kW:		@ RPM:	
50	☐ For Mech. Drive Applications: Minimum site rating of the engine required		kW @ RPM	
51	(With 10 % Overload provision for One Hour within a period of 12 Hours of Operation).			
52	☒ For DG set application: The Net Power available at Alternator Terminals shall be _____ kW @ _____ KV with rated			
53	P.F. of _____ after accounting for Engine Deration for Site conditions & Alternator Efficiency with Engine Driving its all auxiliaries			
54	and power consumed by essential independent auxiliaries. (PRP Rating/ COP Rating as per ISO 8528-1)			
55	Direction of Rotation of driven equipment viewed from Coupling End: ☐ CW ☐ CCW			
56	Method of Drive: ☐ Thru universal joint ☒ Direct thru Flexible Coupling ☐ V-Belts ☐ Gear Drive			
57	CONSTRUCTION FEATURES			
58	Manufacturer:		Engine Model:	
59	Type of Engine: ☐ Two-Stroke ☒ Four-Stroke		Engine Cooling: ☐ Air Cooled ☒ Water Cooled	
60	☐ Mech. Pressure-charged ☒ Turbo-Charged: ☒ With Charge Air Cooler ☐ Normally Aspirated			
61	☐ No. of Cylinders: ☐ Cylinder Arrangement:			

62	☐ Bore/Stroke(mm/mm):		☐ Compression Ratio:	
63	☒ Speed (rpm):		☐ Mean Piston Speed (m/sec.):	
64	PERFORMANCE			
65	☒ Rated Engine Power at Standard operating conditions as per ISO 3046/ BS 5514 (ISO Std. Power):		kW @	RPM
66	(Using only the essential dependent Auxiliaries and with 10% Overload provision for One Hour within a period of 12 Hours of Operation).			
67	☒ Rated engine Power at Site conditions (Service Std. Power) (Guaranteed, No Negative Tolerance):		kW @	RPM
68	(Using only the essential dependent Auxiliaries and with 10% Overload provision for One Hour within a period of 12 Hours of Operation).			
69	☐ Min. Engine site power at which Engine can be Operated Continuously.		kW @	RPM
70	☐ Min. Engine Speed & corresponding site Power at which Engine can be Operated Continuously		RPM @	kW
71	☐ Starting time required for full load operation (Seconds):			
72	☐ Direction of Rotation of Engine viewed from Coupling End		☐ CW	☐ CCW
73	Air Flow Required for Operation of the Engine for:		☐ Combustion & Scavenging ☐ Cooling & Ventilation	
74	Essential dependent Auxiliaries are:			
75	☐ Engine Shaft Driven Radiator Fan	kW	☐ Engine Shaft Main LO Pump	kW
76	☐ Engine Shaft Driven CW Pump	kW	☐ Engine Shaft Driven Fuel Oil Pump	kW
77	Independent Auxiliaries are:			
78	☐ Electric Motor Driven Auxiliary LO Pump.	kW	☐ Electric Motor Driven Fuel Oil Transfer Pump.	kW
79	☐ Electric Motor Driven CW Pump.	kW	☐ Electric Motor Driven Starting Air Compressor.	kW
80	☐ Electric Motor Driven Radiator Fan	kW	☐ Electric Motor Driven Exhaust Fan	KW
81	☐ Electric Motor Driven Fresh Air Fan	KW		
82	Specific Fuel Consumption:			
83	Description	Fuel Consumption, gm/kW-hr @ reference conditions *		
84		ISO 3046 *	Manufr's. Std. *	Site *
85	(a) Guaranteed Engine Rated Power			
86	(100 % Rating)			
87	(b) 75 % of (a)			
88	(c) 50 % of (a)			
89	(d) 110 % of (a)			
90	* Standard Reference Conditions:			
91	-- Total Barometric Pressure, p_r , kg/cm ² A	(100 kPa)		
92	-- Atmospheric Temp., t_r , °C	25 (298°K)		
93	-- Relative Humidity, ϕ_r , %	30		
94	-- Charge Air Coolant Temp., t_{cr} , °C	25 (298°K)		
95	SPEED GOVERNING SYSTEM			
96	Type:	☐ Single Speed ☐ Multiple Speed ☐ All Speed (Variable Speed)		
97	Class of Accuracy:	☐ A ₀ ☐ A ₁ ☐ A ₂ ☐ B ₁ ☐ B ₂		
98	Governor Type:	☐ Electronic ☐ Electro Hydraulic ☐ Mechanical		
99	Make: Woodward or Equivalent	Model:		
100	Governor Control Mechanism:	☐ Manual ☐ Remote/ Auto		
101	STARTING SYSTEM			
102	Method of Starting	☐ Manual ☐ Automatic (through AMF)		
103	Method of Stopping	☐ Manual (Push button) ☐ Automatic		
104	Type of Cold Starting Aid:			
105	Type of Starting System:			
106	☐ Hand Starting with Starting Handle	☐ Battery Starting	☐ Air Starting through Pneumatic Motor	
107	☐ Air Starting through Air Injection into Cylinders	☐ Hydraulic Motor		
108	Battery Starting System:			
109	Battery Bank:	☐ Number:	Voltage	AH Capacity Make:
110	Cells per Bank	☐ Number	Voltage	AH Capacity
111	☐ Starter Make/Rating:	☐ Dynamo Make/Rating:		
112	☐ Regulator and Cut-out:			
113	☐ Battery charging equipment including transformer, Static Rectifier, D.C. Ammeter, D.C. Voltmeter, Charge Rate selector switch and Charging Meter.			
114				
115	☐ Inter connecting cable leads between battery charger & battery			
116	☐ Inter connecting cable leads between battery & engine Starter			
117				
118				
119				
120				

121	Starting Air System:			
122	☐ Air Compressor Type: ☐ Reciprocating ☐ Screw			
123	Rated Capacity(m ³ /hr at Inlet Conditions):		Discharge Pressure (Kg/cm ² g):	BKW: RPM:
124	☐ Air Compressor Driven by: ☐ Working by Electric Motor ☐ Standby by Diesel Engine			
125	Driver Rating kW:	RPM:	Volts/N/Hz.:	
126	☐ Air Receiver with Pressure Gauge, Relief Valve & Manual as well as Automatic (with Timer) Drain Valve:			
127	☐ Start-Stop Switch for Compressor ☐ Manual ☐ Automatic (Through Pressure switch on air receiver) with Selector switch			
128	No. of Air Receiver:	☐ One ☐ Two	Capacity of Each Air Receiver(M ³):	
129	Note: Total Capacity of each air Receiver shall be suitable for atleast Six (6) consecutive starts.			
130	Other starting systems:			
131				
132	COOLING SYSTEM (As per Manufacturer's Standard)			
133	Type: ☐ Open Circuit Cooling with Engine driven water circulating Pump.			
134	☐ Closed circuit cooling including:			
135	☐ Water Pump driven by:		☐ Driver Rating/Speed (KW/RPM):	
136	☐ Primary (Soft) circuit Piping with Temp. Control & Make-up tank.			
137	☐ Heat Exchanger with Anchor/Foundation Bolts			
138	☐ Secondary(Raw Water) circuit Piping with		☐ Strainers	☐ Pressure Regulating Valve
139	☐ By-Pass Valve:		☐ Check Valve:	
140	Heat Exchanger Temp(EC) (Primary Circuit):		Inlet:	Outlet:
141	Heat Exchanger Temp(EC) (Secondary Circuit):		Inlet:	Outlet:
142	Water Pressure(Secondary circuit) Kg/cm ² (g):		Heat Exchanger Testing Pressure Kg/cm ² (g):	
143	☒ Radiator Cooling including Interconnecting Piping and:			
144	☒ Radiator with Temp. Control Valve		☒ Expansion/Make-Up water Tank	
145	☒ Fan Driven By: Electric motor		Rating/Speed (KW/RPM):	
146	☒ Engine/Motor Driven Water circulating Pumps: No.:		Rating/Speed (KW/RPM):	
147	☒ Engine Water Inlet/Outlet Temp(deg C):			
148	FRAME LUBRICATION SYSTEM (As per Manufacturer's Standard)			
149	Type:			
150	☐ Splash Lubrication			
151	☒ Force Feed Lubrication including Valves, oil Pump, Piping &:			
152	☒ Oil cooler type: (As per manufacturer standards)			
153	☒ Oil Filters ☐ Self Cleaning ☐ Duplex ☐ Paper Cartridge ☐ Simplex Filter self cleaning type (As per manufacturer standards)			
154	☒ Pre-lube Oil Pump driven by:			
155	Pre-lubrication ☒ Manual ☒ Automatic at intervals of ____ hours. (Vendor to recommend)			
156	☐ Type/Grade of Lube Oil: ☒ Auto pre-lubrication pump shall be powered from mains.			
157	☐ Oil Sump capacity (litres):		☐ Oil consumption (Lph):	
158	☐ Oil Cooler testing Pressure (Kg/cm ² g):			
159	☐ Explosion Relief Valve for Crankcase			
160	FUEL SYSTEM			
161	Type: ☐ Gravity Feed System ☒ Fuel Lift Pump including			
162	☒ Fuel Filters ☐ Paper cartridge ☐ Duplex			
163	☒ Fuel Injection Pump		Make:	Model:
164	☒ Daily Service Fuel Tank: ☐ Engine Mounted ☐ Wall Mounted ☐ at elevation of ____ m			
165	☒ Capacity of Daily Service Tank(litres) ☐ Two Nos. of 990 litres each ☐ For 6 hrs of continuous operation @ full load			
166	☐ For 12 hrs continuous operation @ full load ☐ For 24 hrs continuous operation @ full load			
167	☐ Fuel Float Tank Ground Mounting with Base Plate			
168	☐ Motor Driven Fuel Transfer Pump (For unloading fuel from fuel tanker to daily service tank)			
169	☒ Fuel Piping and Fittings:			
170	☐ Fuel Piping from Transfer Pumps to Daily Tank		☒ Fuel Piping from Daily Tank to Engine	
171	☒ Overflow Pipes		☒ Vent Connection for Fuel Tank with Flame Arrester	
172	☒ Drain Valve for Fuel Tank		☒ Inspection and cleaning Hole for Fuel Tank (min 150 mm dia.)	
173	☒ Fill connection for Fuel Tank		☒ Level Switch in Fuel tank (For Low Alarm)	
174	☒ Shielded Level Gauge for fuel tank		☒ Float valve in fill connection	☒ Strainers
175	AIR INLET SYSTEM			
176	☒ Suction Air Filter		☒ Air Inlet Ducting / Piping / Manifolds	☒ Inlet Silencer
177	☒ Expansion Bellows		☒ All supports / Hangers	
178	ENGINE EXHAUST SYSTEM			
179	☒ Exhaust Manifolds / Ducting / Piping		☒ Exhaust Silencer (Residential Type)	
180	☒ Expansion Bellows		☒ Exhaust Stack/Chimney	☒ All supports/Hangers ☒ Thermal Insulation for complete Exhaust Piping
181				

182	CONTROLS & INSTRUMENTATION						
183	Hazardous Electrical Area Classification	NEC:	Class	Div.	Group (Refer Elec. Spec.)		
184		ISO:	Zone	Gas Group			
185							
186	Electric Supply: Refer Electrical Specification						
187	Lamps	: ±	24V; AC/DC; φ; ±	Hz.			
188	Alarm Circuit	: ±	24V; AC/DC; φ; ±	Hz.			
189	Trip Circuit	: ±	24V; AC/DC; φ; ±	Hz.			
190	Control Circuit	: ±	24V; AC/DC; φ; ±	Hz.			
191	Solenoid Valves	: ±	24V; AC/DC; φ; ±	Hz.			
192							
193							
194	Notes						
195	1. Pre-Alarms to precede Trips.						
196	2. Instruments to be connected to junction boxes on skid and consoles.						
197	3. All Tubings, pipings, wiring between instruments and junction boxes, local gauge boards and local panels to be supplied by vendor.						
198	4. Instruments, safety and control devices specified herein are minimum required by customer. In case, in the opinion of vendor,						
199	additional devices are required, vendor shall specifically state so and include the same in his scope of supply.						
200	5. Vendor shall also refer to P&ID's enclosed and any additional instruments required as per P&ID's shall be included						
201	by vendor in his scope of supply.						
202	6. All switching devices (hardware/software) for prealarms, trips, trip alarm, and interlocking shall be in the vendor's scope.						
203							
204	Nomenclature		Location				
Loose Supply			Locally Mtd.	LGB Mtd.	LCP Mtd.	UCP	DCS
205							
206							
207							
208	■ AC Power On/Off Switch With Indication Lamp				■		
209	■ Control Power On/Off Switch With Indication Lamp				■		
210	■ Selector Switch A/M Station For L/O Pump Motor				■		
211	□ Selector Switch A/M Station For CW Pump Motor				□		
212	■ Start/Stop Push Button for L/O Pump Motor				■		
213	■ Start/stop Push Button for DG set				■		
214	■ Emergency Stop Push Button				■		
215	■ Lamp Test Push Button				■		
216	■ Alarm/Trip Acknowledge /Reset Push Button				■		
217	■ Lubricating Oil Heater 'ON' Indicating lamp				■		
218	■ Motor Interlock Against Start Without Pre-lubrication				■		
219							
220							
221	NOTE:						
222							
223	Legend:	LM: Local Mounted:	■ By Vendor	□ Others			
224		LGB: Local Gauge Board:	■ By Vendor	□ Others			
225		LCP: Local Control Panel:	■ By Vendor	□ Others			
226		UCP: Unit Control Panel:	□ By Vendor	□ Others			
227		PLC: Programmable Logic Control:	□ By Vendor	□ Others			
228		DCS: Distributed Control System:	□ By Vendor	□ Others			
229							
230	■ Items under LGB to be housed in the Engine Mounted Gauge Board						
231	■ Items under LCP to be housed in free standing type Local Engine Control Panel						
232	■ Electric Switches for Alarm and shutdowns to have Enclosures (Refer Electrical Specification)						
233	■ Temp. gauges shall be Bimetallic Dial Type						
234	■ All wiring piping between Engine - Gauge Board - Control Panel in Vendor's Scope						
235							
236							
237							
238							
239							
240							

CONTROLS AND INSTRUMENTATION																
S.No.	DESCRIPTION	REQUIRED	Indication					A/V Annun. & Pre-Alarm					Trip & A/V Alarm Annun.			
			Gauge- Local Mounted	Gauge- LGB	Indicator -LP	Indicator – UCP	Repeat Signal to DCS/MP	Low - LP	Low - UCP	High - LP	High - UCP	Repeat Signal to PLC/DCS/MP	Low Low - LP	Low Low - UCP	High High - LP	High High- UCP
241	LUBRICATION SYSTEM															
242	- Reservoir Oil Level	■	■													
243	- Reservoir Temp.	□	□													
244	- Main/Std by L/O Pump Disch. Pr.	■	■													
245	- L/O Filter Diff. Pr.	■	■													
246	- L/O Supply Header Pressure	■		■			■					■				
247	- L/O Supply Header Temp.	■		■					■							
248	- Oil cooler Oil Outlet Temp.	□	□													
249	- Stand by Pump Start	■			■											
250	-															
251																
252	COOLING SYSTEM															
253	- Oil Cooler CW outlet temp.	■	■													
254	- CW Supply header flow	□	□													
255	- Sight Flow CW return each Cooler & Header	□														
256	- Local mount TSV on each isolatable circuit	□														
257	- Water level in make up water tank / Radiator	■	■													
258	- Engine Jacket C.W. Supply Temp. (Outlet of Radiator)	□														
259	- Engine Jacket C.W Return Temp. (Inlet of Radiator)	■							■					■		
260	For Closed Circuit Cooling (as applicable):															
261	- Coolant main/standby pump disch. Pr.															
262	- Coolant stand by pump start															
263	- Coolant supply header Pr.															
264	- Coolant supply header temp															
265	- Coolant cooler Outlet Temp.															
266	- Coolant reservoir Level (Make up water tank)															
267																
268																
269	STARTING SYSTEM (if applicable)															
270	- Air Receiver Pressure	■	■					■								
271																
272																
273	FUEL SYSTEM															
274	- Fuel Oil level in fuel tank	■	■					■								
275																
276	INLET AIR SYSTEM															
277	- Inlet Air filter - differential pressure	■	■													
278	- Boost Air (Turbo Charger) Disch. Pr. (if reqd.)	□	□													
279	-Charge Air Cooler Outlet - Air Temp. (if reqd.)	□	□													
280																
281	MISCELLANEOUS															
282	- Engine Vibrations	□								□						
283	- Engine Speed	■	■		■											
284	- Key Switch - Start & Push Button Stop	■			■											
285	- Engine Over-speed	■							■						■	
286	- Engine fails to start	■						■				■				
287	- Tacho-hour Meter	■			■											
288	-Engine running	■			■											
289																
290	Note: Instrumentations specified as minimum required. vendor shall include any other instruments if required for smooth, safe															
291	and Trouble free operation of the DG sets.															

292	MATERIAL		
293	Charge Air Cooler	Shell:	Tubes:
294	Water Cooler	Shell:	Tubes:
295	Air Cooler	Shell:	Tubes:
296	Air Receiver		
297	Fuel Tank: MS		
298	INSPECTION AND TESTING		
299		Witness	Observe
300	☐ Stage Inspection during Manufacture	☐	☐
301	☒ Full Load Test at Engine Manufacturer's Shop (Refer EIL spec 6-43-0040)	☒	☐
302	☒ Fuel consumption & Governing Test at Engine Manufacturer's Shop (Refer EIL spec 6-43-0040)	☒	☐
303	☒ Control Panel Functional Test at panel vendor's shop.	☒	☐
304	☒ Full Load Test for 4 hours & 10% overload test for 1 hour of Engine Generator set at Packager's shop	☒	☐
305	☐ No load Mechanical Run test at Packager's/Driven Eqpt. Mfr. Shop	☐	☐
306	☒ Site Testing of the DG Set (Refer Remark- 1)	☒	☐
307	Inspection/Testing Witnessed By: ☐ Others	☒ Owner/ Purchaser/ Representative	
308	WEIGHTS		
309	Net Weight of Engine with Mounted Ancillaries (kg):		
310	Heaviest part to be handled during erection and its weight (kg):		
311	Heaviest part to be handled during normal maintenance and its weight (kg):		
312	Recommended Crane capacity (Tons):	Crane Hook Height (m):	
313	MAINTENANCE DATA		
314	Expected Period of Running Between Top Overhauls:	Hours	
315	Expected Period of Running Between Main Overhauls:	Hours	
316	The Type and Grade of Lubricating Oil Recommended		
317	Lube Oil Consumption (kg/hr)/ (Litres/hr)		
318	Change of Lubricating Oil After:	Hours	
319	ACCESSORIES		
320	☒ Flywheel with Barring Device		
321	☒ Guards for Moving Parts		
322	☒ Common Base Plate for Engine - Driven equipment		
323	☒ Foundation/ Anchor Bolts, grouting material		
324	☐ Acoustic enclosure with ventilation system		
325	☒ Anti Vibration Pads (if required)		
326	☐ First Fill of Lubricating Oil		
327	☒ Torsional analysis report on Engine & Generator		
328	☒ Quotation for 2 years spares parts for Normal Operation and Maintenance along with unit prices		
329	☐ Separate Quotation for Two Years Annual Maintenance Contract		
330	☐ Site Storage, Erection & commissioning of DG Set		
331	☐ Purchaser's Training		
332			
333	REMARKS		
334	1) DG Set shall be tested at site based on the available load so as to demonstrate power and voltage build- up at the alternator terminals.		
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05/02/14	A	AY	AM
Date	Rev	Job Engineer	Rev. & Approved By

 ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)		EMERGENCY GENERATOR PACKAGE		Document No. B016-606-16-50-DS-1025 Rev. No. A Page 1 of 6	
Project Project Management Consultancy (PMC) Services for execution of VRMP		Client M/s HPCL			
Unit CPP PACKAGE	Location Vizag	Job No. B016	Unit No. 606		
PURCHASER'S DATA					
A. Site Conditions					
1.	Maximum Ambient Temperature	°C	45		
2.	Minimum Ambient Temperature	°C	12.5		
3.	Design Ambient Temperature	°C	45		
4.	Relative Humidity	%	95		
5.	Altitude Above MSL	m	Less than 5.56		
6.	Environment	HUMID & HIGHLY CORROSIVE			
VENDOR'S SCOPE					
S. No	Description	Supply	Installation	Testing & Commissioning	
1.	Emergency generator complete with brushless excitation system, AVR system, & lubrication system	☒	☒	☒	
2.	Generator control panel with AMF system, auto transfering and auxiliary equipment	☒	☒	☒	
3.	Line cubicle for CT/PT	☒	☒	☒	
4.	Neutral cubicle for CTs	☒	☒	☒	
5.	Line side breaker in cubicle	☒	☒	☒	
6.	Synchronising equipment	☒	☒	☒	
7.	Power and control cabling within package	☒	☒	☒	
8.	Earthing within battery limits & connection to main earth grid	☒	☒	☒	
9.	Battery & battery charger for control power requirement of complete DG set	☒	☒	☒	
10.	Fabricated GI cable trays/racks within battery limits	☒	☒	☒	
Special tools, commissioning spares and spares required for two years of operation and maintenance shall be supplied by the vendor.					
B. Power Supply System					
1.	Main Supply for Auxiliaries	415V ± 10% TPN			
	Fault Level				
	Neutral Earthing	Solidly earthed			
2.	Frequency	50			
3.	DC Supply for Controls	110 V ± 10% DC			
C. Power Supplies Available from Owner's System					
1.	415V Normal Supply	N/A			
2.	DC Supply	N/A			
D. Utilisation Voltage					
1.	Motors Rated < 0.18 kW	as per design basis			
2.	Motors Rated 0.18 to 160 kW	as per design basis			
3.	Battery Charger				
	DC output < 1000 W	as per design basis			
	DC output > 1000 W	as per design basis			
4.	Anticondensation Heaters	240V AC			
E. Ref Ambient Temp. for Equipment Design (IS:9676)		45°C			
D. Technical Particulars					
1.	Item no.				
A	18-MAY-2017	ISSUED WITH TENDER	GAURAV KATYAL	ACHUTUNI SAI	GUPTA PARAG
Rev. No.	Date	Purpose	Prepared By	Reviewed By	Approved By

Project	Project Management Consultancy (PMC) Services for execution of VRMP				Client	M/s HPCL	
Unit	CPP PACKAGE	Location	Vizag	Job No.	B016	Unit No.	606
2.	Duty	Emergency					
3.	No. of Units						
4.	Type of Driver	Diesel engine					
5.	Painting	Epoxy					
6.	Colour Shade	RAL 7032					
7.	Rated Output						
8.	Rated Terminal Voltage	11 kV					
9.	Rated p.f	0.8					
10.	Rated Frequency	50					
11.	System Fault Level	Included					
12.	Gen. neutral earthing	Solidly earthed					
13.	Degree of Protection	as per spec					
14.	Insulation Class	Class F					
15.	Temperature Rise Limit	Class B					
16.	Max. Transient Reactance						
17.	Excitation System						
18.	Excitation by PMG	Required					
19.	Type of Cooling	Air cooled					
20.	Parallel Operation	with state grid and generator					
	Short Time	Required					
	Continuous	Required					
21.	Permissible Volt Drop						
22.	Black Start Facility	Required					
23.	Gen. Start up Time	< 30 seconds					
24.	Termination Details						
	Line Side	Cable					
	Cable Size/Type						
	Neutral Side	Cable					
	Cable Size/Type						
25.	Generator Breaker	Required					
	Rating						
	Breaking Capacity						
	Making Capacity						
26.	CTs & PTs						
	Current Transformer for Protection				CT/PT for AVR		
		P-CT	D-CT	R-CT	N-CT	P-CT	P-CT
	Requirement						
	Ratio						
	Class						
	Burden						
	Function						
	Vk/Rct						
	P-CT : CT for overcurrent and short circuit protection, to be located just before the star point						
	D-CT : CT for differential protection to be located just before the star point						
	R-CT : CT for restricted earth fault protection to be located between star point and the neutral tee-off point						
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Unit CPP PACKAGE	Location Vizag	Job No. B016	Unit No. 606		
N-CT : CT for earth fault protection to be located between star point and the neutral tee-off point					
27. Protection Relays & Metering					
	Type	Required	Type	Required	
	Voltage restrained O/C relay		Synchroscope & Cut-off switch		
	O/V relay with time delay		Ammeter with selector switch		
	Standby earth fault relay		Voltmeter with selector switch		
	Lockout Relay		KWH meter		
	Control Supply Failure Relay		KW meter		
	Check synchronising relay		PF meter		
	Reverse power relay		Frequency meter		
	Thermal overload relay		Hour Run Counter		
	Under voltage relay		Winding RTD		
	Generator Differential Relay		Bearing RTD		
	PT fuse failure relay		Trip circuit Supervision relay		
	Negative phase sequence		Exciter o/c relay		
	Under frequency failure		Generator field failure		
	Auxiliary relay		Timers		
28. Control Requirements					
	Control function/Element	Local control panel	Remote control panel		
	Generator start/stop				
	Frequency increase/decrease pushbutton				
	Voltage increase/decrease				
	Generator circuit breaker control switch				
	Synchronising equipment				
	Auto/Manual selector switch for starting				
	Auto/Manual selector switch for regulation				
	Local/Remote switches				
	Annunciation windows Annunciation accept/reset pushbutton				
Frequency increase/decrease from remote control panel shall be achievable by changeover of contacts (pushbutton type). Vendor to ensure governor suitability for this type of control.					
29. Indication & Alarm					
	Function	Local control panel	Remote control panel		
	Loads on mains/generator				
	Generator circuit breaker open/close/trip				
	Control supply failure				
	Winding temperature high				
	Bearing temperature high				
	Start failure				
	PT fuse failure				
Unless otherwise specified, remote control panel shall be in Purchaser's scope of supply. Emergency generator vendor shall provide necessary facility enabling the above mentioned control/monitoring functions to be transferred to the remote control panel by cables.					
30. Testing at works					
Witness of generator control panel functional requirements by simulation					
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DATA SHEET					
Project Project Management Consultancy (PMC) Services for execution of VRMP		Client M/s HPCL			
Unit CPP PACKAGE		Location Vizag		Job No. B016	
		Unit No. 606			
Witness of routine tests as per IS.4722, wave form test, vibration test of generator					
Transient voltage performance with job AVR and shop driver					
i. By 100% load rejection at unity pf					
ii. By 100% load application at 0.2 pf					
31. Applicable standards					
Standard specification for emergency generator set (6-51-40)					
Standard specification for engine starting battery & charger (6-51-30)					
MANUFACTURER'S DATA					
A. Rating & Performance details					
1.	Make				
2.	Temp. inside enclosure				
3.	Frame designation				
4.	Rated output				
5.	Terminal voltage				
6.	Enclosure				
7.	Rated pf				
8.	No. of phases				
9.	Connection				
10.	No. of terminals				
11.	Full load current				
12.	Speed				
13.	Rated Frequency				
14.	Cooling System				
15.	Maximum Permissible Inductive Loading				
16.	Steady state 3 phase short circuit current				
	Short circuit withstand time				
Type of voltage regulator					
17.	Insulation Class				
18.	Maximum Permissible Impact Load				
19.	Temperature rise at full load				
20.	Efficiency at rated pf				
	at 25% load				
	at 50% load				
	at 75% load				
	at 100% load				
21.	Efficiency at unity pf				
	at 25% load				
23.	at 50% load				
24.	at 75% load				
	at 100% load				
B. Reactance's					
1.	Direct axis transient reactance				
2.	Direct axis subtransient reactance				
3.	Synchronous reactance				
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Unit	CPP PACKAGE	Location	Vizag	Job No.	B016
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4.	Zero sequence reactance				
5.	Negative sequence reactance				
C.	Resistance time constants				
1.	Armature resistance (25°C)				
2.	Armature resistance (100°C)				
3.	Synchronous reactance				
4.	Zero sequence reactance				
D.	Local control panel				
1.	Make				
2.	Dimension				
3.	Type				
4.	Degree of protection				
5.	Weight				
6.	Colour shade				
E.	Remote control panel				
1.	Dimension				
2.	Weight				
3.	Degree of protection				
F.	Mechanical data				
1.	Generator dimension				
2.	Stator weight				
3.	Rotor weight				
4.	Total weight				
5.	Coupling				
G.	Auxiliary motors				
1.	Make				
2.	Voltage/Frequency				
3.	Enclosure protection				
4.	Insulation class				
5.	Starting				
H.	Battery				
1.	Make				
2.	Model				
3.	Type				
4.	No. of cells				
5.	Nominal voltage				
6.	Nominal capacity				
7.	Dimension of rack				
8.	Cell arrangement				
I.	Battery charger				
1.	Make				
2.	Model				
3.	Input voltage				
4.	Float voltage range				
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Client M/s HPCL

Unit CPP PACKAGE

Location Vizag

Job No. B016

Unit No. 606

5. Boost voltage range

6. Float charge current

7. Boost charge current

8. Overall dimension

Eil Notes

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Project Project Management Consultancy (PMC) Services for execution of VRMP

Client HPCL

Unit CAPTIVE POWER PLANT (CPP)

Location VIZAG

Job No. B016

Unit No. 606

PURCHASER'S DATA

A. Site Conditions			
1.	Maximum Ambient Temperature	°C	45
2.	Minimum Ambient Temperature	°C	12.5
3.	Design Ambient Temperature	°C	45
4.	Relative Humidity	%	95
5.	Altitude Above MSL	m	< 5.56
6.	Environment	Humid & highly corrosive	
B. RELAY SELECTION			
1. RELAY FUNCTION			
a	Only Protection	☐	
b	Protection and metering	☐	
c	Protection and metering and control	☒	
d	Ethernet communication	☒	
e	Password protection		
	a. For write	☐	
	b. For both read and write	☒	
2. CONSTRUCTION FEATURE			
a	Enclosure type	IP5X	
b	Terminal size-sqmm for external wires	2.5 for control, 4 for CT/PT	
c	Mounting	flush	
d	Drawout feature	as per 6-51-0055	
e	Display type	Alpha Numeric LCD + LED indication	
3. SPECIAL REQUIREMENT IF ANY			
a	Applicable standards	IEC	
b	Distance for cable capacitance for application where field contacts are directly wired to relay e.g. Motor start/ stop, intertrip	m	1000
4. INPUT POWER SUPPLY			
a	Site selectable feature	☒	
b	Input supply	v	110 DC
5. CT/PT INPUT TO RELAY			
a	Current operated relays	☐	
	a1 Main CT input		
	a2 CT for sensitive EF or back up EF		
b	Voltage operated relays	☐	
	b1 PT input		
c	Comprehensive relay	☒	
	c1 Main CT input	3 CTs, 4 wire	
	c2 PT input	3 Phase, 4 Wire	
	c3 CT for sensitive EF or back up EF	1 CT, 2 wire input (Yes for I/C & TR fdr)	
d	CT Secondary current	1	
C. RELAY PROTECTION/ METERING FUNCTIONS			
1. CURRENT OPERATED RELAYS			
a	3 phase C/C current (50, 51)	* I> ☒	* I>> ☒
	Characteristics as per IEC		
	* Inverse (normal, very, extremely, long) and definite time for I> and I>>		

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Project	Project Management Consultancy (PMC) Services for execution of VRMP			Client	HPCL
Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG	Job No.	B016
				Unit No.	606

	* Definite time for I >>>				
b	E/F relay (50N, 51N, 51G)	* I>	☒	* I>>	☒
	Characteristics as per IEC				
	* Inverse (normal, very, extremely, long) and definite time for IO >, IO >>				
	* Definite time for IO>>>				
c	Metering/ event recording				
	3 phase/ line currents		☒		
	Disturbance record		☒		
	Breaker trip/ close status		☒		
	Relay faults		☒		
	Trip Values		☒		
2	VOLTAGE OPERATED RELAYS				
a	3 phase O/V element with time delay (59+2)	* OV>	☒	* OV>>	☒
b	3 phase U/V element with time delay (27+2)	* UV>	☒	* UV>>	☒
	Characteristics as per IEC				
	* Inverse (normal, very, extremely, long) and definite time for UV> ,UV>>				
c	Under/ Over Frequency element with time delay (81U/ 81O)				
	Settable under voltage restraint		☐		
	df/dt element		☐		
	Number of stages with u/f				
	Number of stages with df/dt				
d	Synchrocheck function		☒		
e	Metering/ event recording				
	3 phase/ line Voltages		☒		
	Disturbance record		☒		
	Breaker trip/ close status		☒		
	Relay faults		☒		
	Trip Values		☒		
3	MOTOR PROTECTION RELAY				
a	Protection elements				
	Thermal overload (49)		☒		
	OC protection with doubling feature (50)		☒		
	EF protection (50N)		☒		
	Locked Rotor protection		☒		
	Maximum start time		☒		
	Maximum number of starts		☒		
	Negative phase sequence		☒		
	Under voltage delayed trip		☒		
	EF Through CBCT		☐		
	Single phasing		☒		
b	Metering/ events				
	3 phase/ line current		☒		
	Hour run		☒		
	KW, KWH, pf		☒		
	Disturbance record		☒		
	Plot start characteristic		☒		

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Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG	Job No.	B016
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	Trip values	☒
	Start time	☒
	Start current	☒
c	Control	
	Breaker close in test mode	☒
	Reacceleration logic	☒
	Breaker trip	☒
	RTD/BTD input	☒
4	COMPREHENSIVE NUMERICAL RELAY	
a	Current elements (51, 50, 51N, 50N, 51G)	
b	Voltage elements (59, 27, 2, 81U, 81C)	
c	Control function	
	Breaker close/ trip from relay	
	Breaker close/ trip on serial	
	PLC logic function for control scheme	
	Digital I/P & Digital O/P:	
	Motor Feeder control function	
5	SPECIAL PROTECTION RELAYS (Refer Job Spec)	
	Part of main relay	☐
	Separate relay	☒
a	Differential relays	☒
	BUS	Applicable
	Feeder	Required
	Trafo	as per Engineering Design Basis
	Machine	as per Engineering Design Basis
b	Directional relays (67, 67N)	☒
c	Restricted EF (64R)	☒
d	Generator protection	☒
e	Distance protection	☒
f	Reverse power relay	☒
6	OTHER RELAY FEATURES	
a	Analog inputs 4-20mA	
	RTD/ BTD-GPR	Required
	WTI/ OTI-Trafo relay	Required
	WTI= Winding temperature indicator	
	CTI= Oil temperature indicator	
b	Out put relays	
	Number of relays	As per 6-51-055
	Contact rating	
	Reset	
	FUNCTIONS part of numerical relay	
c	Lock out function (86)	☒
d	Trip circuit supervision(95)	☒
e	Watch dog	☒
f.	Time stamp	☒
g	Modular construction for easy and quick replacement of faulty PCB/circuit	☒
D	ETHERNET COMMUNICATION AND RELAY INTEGRATION	

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Unit	CAPTIVE POWER PLANT (CPP)		Location	VIZAG	Job No.	B016	Unit No. 606

1	RELAY INTEGRATION						
a	Communication ports at Relay						
	Relay front		IS 15653: 2006/IS 15653-1: 2006				
	Relay back		IS 15653: 2006/IS 15653-2: 2006				
b	Protocol of relay LAN		IEC 61850				
c	Requirement of Integration						
	Integration with DC		☒				
	Directly to MMI		☐				
d	Topology		as per 6-51-0055				
e	Data concentrators		YES				
2	REDUNDANCY						
a	Relay LAN / serial		☒				
	Redundant (serial)		☒				
	Non redundant (star)		☒				
b.	From DC to MMI		☒				
	Redundant		☒				
	Non redundant		☐				
c	From DC to ECS-RTU		☒				
	Redundant		☒				
	Non redundant		☐				
3	REDUNDANCY REQUIREMENT FOR DC/ETHERNET SWITCH/MMI						
a	Ports at STAR coupler						
	For each relay		Applicable				
	For DC/Ethernet Switch		Applicable				
b	Data concentrator / Ethernet Switch						
	Power supply card		Applicable				
	Communication port for each relay LAN		Applicable				
	Communication Processor		Dual redundant				
4	SERIAL COMMUNICATION FROM DC/ETHERNET SWITCH ONWARDS						
a	DC/Ethernet Switch to MMI						
	Topology		as per 6-51-0055				
	Protocol		IEC 61850				
b	DC to DCS		YES				
c	DC/Ethernet Switch to ECS-RTU		YES				
d	Scan time		as per 6-51-0055				
5	OTHER REQUIREMENT						
a	Time synchronization		☒				
b	Remote relay parameterization		☒				
c	Annunciation at MMI		☒				
MANUFACTURER'S DATA							
1.	NUMERICAL RELAY TYPES						
	Relay Make/Model	Serial Ports	Analogue Inputs	No of DI/DO	Protocol	Any Other Data	Remarks
A	Incomer						
B	Buscoupler						
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Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG	Job No.	B016	Unit No.	606
C	Generator						
D	Transformer						
2 DATA CONCENTRATOR / ETHERNET SWITCH AND RELAY INTEGRATION							
a	Model no.						
	Make						
b	Input power supply						
	Voltage						
	Power reqt						
c	Redundancy						
	Power supply						
	Communication processor						
	Communication port						
	Relay LAN/ Serial communication						
	ECS-RTU interface						
	MMI interface						
d	Serial interface/ Relay LAN						
	Topology						
	Protocol						
	Nos of relay in each						
	Topology						
	Type of port						
	Cable type						
e	Serial interface- MMI						
	Topology						
	Protocol						
	Type of Port						
	Cable type						
f	Serial Interface -ECS-RTU						
	Topology						
	Protocol						
	Type of Port						
	Cable type						
g	Number of Digital Input/ Aanalogue Input (4-20mA)						
	DI for substation eqpt						
	Spare DI						
	AI as per project data sht						
	Spare AI						
h	Maximum Scan Time						
	Status						
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Project	Project Management Consultancy (PMC) Services for execution of VRMP			Client	HPCL		
Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG	Job No.	B016	Unit No.	606
PURCHASER'S DATA							
A.	Site Conditions						
1.	Maximum Ambient Temperature	°C	45				
2.	Minimum Ambient Temperature	°C	12.5				
3.	Design Ambient Temperature	°C	45				
4.	Relative Humidity	%	95				
5.	Altitude Above MSL	m	< 5.56				
6.	Environment	Humid & highly corrosive					
B.	RELAY SELECTION						
1.	RELAY FUNCTION						
a	Only Protection		☐				
b	Protection and metering		☐				
c	Protection and metering and control		☒				
d	Ethernet communication		☒				
e	Password protection						
	a. For write		☐				
	b. For both read and write		☒				
2	CONSTRUCTION FEATURE						
a	Enclosure type		IP5X				
b	Terminal size-sqmm for external wires		2.5 for control, 4 for CT/PT				
c	Mounting		flush				
d	Drawout feature		as per 6-51-0055				
e	Display type		Alpha Numeric LCD + LED indication				
3	SPECIAL REQUIREMENT IF ANY						
a	Applicable standards		IEC				
b	Distance for cable capacitance for application where field contacts are directly wired to relay e.g. Motor start/ stop, intertrip	m	1000				
4	INPUT POWER SUPPLY						
a	Site selectable feature		☒				
b	Input supply	v	110 DC				
5	CT/ PT INPUT TO RELAY						
a	Current operated relays		☐				
	a1 Main CT input						
	a2 CT for sensitive EF or back up EF						
b	Voltage operated relays		☐				
	b1 PT input						
c	Comprehensive relay		☒				
	c1 Main CT input		3 CTs, 4 wire				
	c2 PT input		3 Phase, 4 Wire				
	c3 CT for sensitive EF or back up EF		1 CT, 2 wire input (Yes for I/C & TR fdr)				
d	CT Secondary current		1				
C	RELAY PROTECTION/ METERING FUNCTIONS						
1	CURRENT OPERATED RELAYS						
a	3 phase O/C element (50, 51)		* I> ☒	* I>> ☒	* I>>> ☒		
	Characteristics as per IEC						
	* Inverse (normal, very, extremely, long) and definite time for I > and I >>						
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Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG	Job No.	B016
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	* Definite time for I >>>				
b	E/F relay (50N, 51N, 51G)	* I>	☒	* I>>	☒
	Characteristics as per IEC				
	* Inverse (normal, very, extremely, long) and definite time for IO >, IO >>				
	* Definite time for IO>>>				
c	Metering/ event recording				
	3 phase/ line currents		☒		
	Disturbance record		☒		
	Breaker trip/ close status		☒		
	Relay faults		☒		
	Trip Values		☒		
2	VOLTAGE OPERATED RELAYS				
a	3 phase O/V element with time delay (59+2)	* OV>	☒	* OV>>	☒
b	3 phase U/V element with time delay (27+2)	* UV>	☒	* UV>>	☒
	Characteristics as per IEC				
	* Inverse (normal, very, extremely, long) and definite time for UV>, UV>>				
c	Under/ Over Frequency element with time delay (81U/ 81O)				
	Settable under voltage restraint		☐		
	df/dt element		☐		
	Number of stages with u/f				
	Number of stages with df/dt				
d	Synchrocheck function		☒		
e	Metering/ event recording				
	3 phase/ line Voltages		☒		
	Disturbance record		☒		
	Breaker trip/ close status		☒		
	Relay faults		☒		
	Trip Values		☒		
3	MOTOR PROTECTION RELAY				
a	Protection elements				
	Thermal overload (49)		☒		
	OC protection with doubling feature (50)		☒		
	EF protection (50N)		☒		
	Locked Rotor protection		☒		
	Maximum start time		☒		
	Maximum number of starts		☒		
	Negative phase sequence		☒		
	Under voltage delayed trip		☒		
	EF Through CBCT		☐		
	Single phasing		☒		
b	Metering/ events				
	3 phase/ line current		☒		
	Hour run		☒		
	KW, KWH, pf		☒		
	Disturbance record		☒		
	Plot start characteristic		☒		

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Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG	Job No.	B016
				Unit No.	606

	Trip values	☒
	Start time	☒
	Start current	☒
c	Control	
	Breaker close in test mode	☒
	Reacceleration logic	☒
	Breaker trip	☒
	RTD/BTD input	☒
4	COMPREHENSIVE NUMERICAL RELAY	
a	Current op elements (51, 50, 51N, 50N, 51G)	
b	Voltage op elements (59, 27, 2, 81 U, 81O)	
c	Control function	
	Breaker close/ trip from relay	
	Breaker close/ trip on serial	
	PLC logic function for control scheme	
	Digital I/P & Digital O/P:	
	Motor Feeder control function	
5	SPECIAL PROTECTION RELAYS (Refer Job Spec)	
	Part of main relay	☐
	Separate relay	☒
a	Differential relays	☒
	BUS	Applicable
	Feeder	Required
	Trafo	as per Engineering Design Basis
	Machine	as per Engineering Design Basis
b	Directional relays (67, 67N)	☒
c	Restricted EF (64R)	☒
d	Generator protection	☒
e	Distance protection	☒
f	Reverse power relay	☒
6	OTHER RELAY FEATURES	
a	Analog inputs 4-20mA	
	RTD/ BTD-GPR	Required
	WTI/ OTI-Trafo relay	Required
	WTI= Winding temperature indicator	
	OTI= Oil temperature indicator	
b	Out put relays	
	Number of relays	As per 6-51-055
	Contact rating	
	Reset	
	FUNCTIONS part of numerical relay	
c	Lock out function (86)	☒
d	Trip circuit supervision(95)	☒
e	Watch dog	☒
f.	Time stamp	☒
g	Modular construction for easy and quick replacement of faulty PCB/circuit	☒
D	ETHERNET COMMUNICATION AND RELAY INTEGRATION	

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Project	Project Management Consultancy (PMC) Services for execution of VRMP	Client	HPCL
Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG
		Job No.	B016
		Unit No.	606

1	<u>RELAY INTEGRATION</u>	
a	Communication ports at Relay	
	Relay front	RS 232/ RJ45/USB
	Relay back	RJ45/FO
b	Protocol of relay LAN	IEC-61850 IEC-61850-HSR
c	Requirment of Integration	
	Integrator with DC	☒
	Directly to MMI	☐
d	Topology	as per 6-51-0055 IEC-61850-HSR
e	Data concentrators	YES
2	<u>REDUNDANCY</u>	
a	Relay LAN / serial	☒
	Redundant (serial)	☒
	Non redundant (star)	☒
b.	From DC to MMI	☒
	Redundant	☒
	Non redundant	☐
c	From DC to ECS-RTU	☒
	Redundant	☒
	Non redundant	☐
3	<u>REDUNDANCY REQUIREMENT FOR DC/ETHERNET SWITCH/MMI</u>	
a	Ports at STAR coupler	
	For each relay	Applicable
	For DC/Ethernet Switch	Applicable
b	Data concentrator / Ethernet Switch	
	Power supply card	Applicable
	Communication port for each relay LAN	Applicable
	Communication Processor	Dual redundant
4	<u>SERIAL COMMUNICATION FROM DC/ETHERNET SWITCH ONWARDS</u>	
a	DC/Ethernet Switch to MMI	
	Topology	as per 6-51-0055
	Protocol	IEC 61850
b	DC to DCS	YES
c	DC/Ethernet Switch to ECS-RTU	YES
d	Scan time	as per 6-51-0055
5	<u>OTHER REQUIREMENT</u>	
a	Time synchronization	☒
b	Remote relay parameterization	☒
c	Annunciation at MMI	☒
MANUFACTURER'S DATA		
1.	<u>NUMERICAL RELAY TYPES</u>	
	Relay Make/Model	Serial Ports
	Analogue Inputs	No of DI/DO
	Protocal	Any Other Data
A	Incomer	Remarks
B	Buscoupler	
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		ACHUTUNI SAI
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Rev. No.	Date	Purpose
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		Approved By

Project	Project Management Consultancy (PMC) Services for execution of VRMP			Client	HPCL	
Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG	Job No.	B016	Unit No. 606
C	Generator					
D	Transformer					
2 DATA CONCENTRATOR / ETHERNET SWITCH AND RELAY INTEGRATION						
a	Model no.					
	Make					
b	Input power supply					
	Voltage					
	Power reqt					
c	Redundancy					
	Power supply					
	Communication processor					
	Communication port					
	Relay LAN/ Serial communication					
	ECS-RTU interface					
	MMI interface					
d	Serial interface/ Relay LAN					
	Topology					
	Protocol					
	Nos of relay in each					
	Topology					
	Type of port					
	Cable type					
e	Serial interface- MMI					
	Topology					
	Protocol					
	Type of Port					
	Cable type					
f	Serial Interface -ECS-RTU					
	Topology					
	Protocol					
	Type of Port					
	Cable type					
g	Number of Digital Input/ Aanalogue Input (4-20mA)					
	DI for substation eqpt					
	Spare DI					
	AI as per project data sht					
	Spare AI					
h	Maximum Scan Time					
	Status					
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Project	Project Management Consultancy (PMC) Services for execution of VRMP			Client	HPCL
Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG	Job No.	B016
		Unit No.	606		
	events				
	Data acquisition (analog)				
	Disturbance record download time				
i	Other features				
	Spare capacity for additional devices for relay LAN				
	Time synchronization options				
	Power walk in time				
	Restoration time of communication of DC with NR & MMI				
3	STANDARD FEATURES OF RELAY / SYSTEM ARCHITECTURE				
Notes					
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		HV SWITCH BOARD DATA SHEET		Document No. B016-606-16-50-DS-1006 Rev. No. A Page 1 of 4	
Project Project Management Consultancy (PMC) Services for execution of VRMP		Client HPCL			
Unit CAPTIVE POWER PLANT (CPP)		Location VIZAG		Job No. B016 Unit No. 606	
PURCHASER'S DATA					
A. Site Conditions					
1.	Maximum Ambient Temperature	°C	45		
2.	Minimum Ambient Temperature	°C	12.5		
3.	Design Ambient Temperature	°C	45		
4.	Relative Humidity	%	95		
5.	Altitude Above MSL	mm	< 5.56		
6.	Environment	Humid & highly corrosive			
B. Operating Conditions					
1.	Voltage	kV	11 +/- 10 %		
2.	Frequency	Hz	50 +/- 3 %		
3.	No of phases	Three			
4.	System fault level	kA	40		
5.	System earthing	Resistance Earthing			
6.	Auxiliary supply				
	AC	V	240 +/- 10 %		
	DC	V	110 +/- 10% DC		
C. Electrical Data					
1.	Busbar current rating (inside panel at design temp.)				
2.	1 sec. Short Circuit withstand capacity	kA	40		
3.	System Breaking capacity	kA	40		
	% D.C. Component	As per IEC			
4.	System making capacity	kA(peak)	100		
5.	Type of Circuit Breaker	VCB			
	Shunt Trip Coil-1 :	V	110 DC		
	Shunt Trip Coil-2 : (see note-1)	V	110 AC UPS		
6.	Duty Cycle of C.B.	O-3min-CO-3min-CO			
7.	Suitability for Cap. Switching	YES			
8.	Surge supressor for Motor Feeder.	Yes			
9.	Provision of earthing				
	Earthing truck	Required			
	Earthing switch	Not Required			
D. Miscellaneous					
1.	Interface with ECS	Required			
2.	Incoming Power Entry	Cable/Bus Duct			
3.	Cable Entry				
4.	Separate bolted removable gland palte for cable entry	Reqd.(Gland Plate Drilled at site)			
5.	Cable glands and lugs for cable termination	Included			
6.	Paint shade	RAL-7032			
7.	Windows at the rear side of panels for thermography	Required			
MANUFACTURER'S DATA					
A. Switchboards					
1.	Make				
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Project	Project Management Consultancy (PMC) Services for execution of VRMP			Client	HPCL	
Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG	Job No.	B016	Unit No. 606
2.	Type designation					
3.	Degree of protection					
4.	Max. overall weight of C.B. panel		Kg			
5.	Overall dimensions of C.B. panel					
	Width		mm			
	Depth		mm			
	Height		mm			
6.	Overall dimensions of dummy /gland palte for cable entry					
	Width		mm			
	Depth		mm			
	Height		mm			
7.	Overall weight and dimensions of largest shipping section					
	Weight		Kg			
	Width		mm			
	Depth		mm			
	Height		mm			
8.	Overall dimensions of each swbd. including all dummy/adaptor/rear extension panels					
	Width		mm			
	Depth		mm			
	Height		mm			
9.	Recommended clearances					
	Front		mm			
	Rear		mm			
	Above		mm			
10.	Shock loading on foundation					
11.	Max. size/no. of cables that can be terminated inside the panel					
	without rear extension panel					
	with rear extension panel					
	size of rear extension panel					
12.	Clearance in air					
	Phase to Phase (min.)		mm			
	Phase to Earth (min.)		mm			
13.	Busbar current rating at design ambient temperature		A			
14.	Busbar (separately for each swbd)					
	(a).Horizontal main busbar size (No. of flats x size of each flat)					
	(b).Horizontal main busbar size as tested at CPRI for full short ckt					
	withstand as per specification requirement (No. of flats x size of each flat)					
	(c).Vertical dropper size (No. of flats x size of each flat)					
15.	Horizontal main busbar/Vertical busbar material					
16.	Insulating material (Busbar supports)					
17.	Earth busbar size					
18.	Earth busbar material					
19.	1 min. power frequency withstand voltage (rms)		kV			
	Over voltage factor for PTs					
20.	Impuse withsatnd voltage (peak)		kV			
A	18-MAY-2017	ISSUED WITH TENDER	GAURAV KATYAL	ACHUTUNI SAI	GUPTA PARAG	
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Project Project Management Consultancy (PMC) Services for execution of VRMP		Client HPCL	
Unit CAPTIVE POWER PLANT (CPP)	location VIZAG	Job No. B016	Unit No. 606
Wave shape of impulse voltage			
21.	1 sec. short ckt. Withstand capacity	kA	
22.	Peak dynamic withstand capacity	kA	
23.	Safety Features		
	(a).Heat shrinkable sleeves, rated to withstand the system line to line voltage for one min., provided on busbar		
	(b).Removable FRP shrouds for all busbar joints and tap-off connections provided		
	(c).Arc propagation barrier in busbar compartment provided		
	(d).Breaker service, test and drawn-out position provided		
	(e).Distinct overall lockable door for breaker compartment provided		
	(f).Automatic safety shutter provided		
	(g).Independent pressure release flaps provided for all HV compartments		
	(h).Wire mesh for all louvered openings provided		
	(i).Suitable interlocks to prevent faulty operation as per Cl. 4.4.10 of spec. 6-51-0001 provided		
B. Circuit Breaker			
1.	Type		
	2nd shunt trip coil for VFD feeders		
2.	Make		
3.	Type Designation		
4.	Circuit Breaker mounting in panel		
5.	No. of poles/phase		
6.	Current rating (in free air)	A	
7.	Current rating inside the panel at specified design temperature	A	
8.	Short time rating (1sec.)	kA	
9.	Symmetrical breaking capacity	kA	
9.1	% D.C. Component		
10.	Peak making current	kA	
11.	1 min. dry withstand voltage (power frequency)	kV	
12.	Duty Cycle		
13.	Total opening time	m sec.	
14.	Total closing time	m sec.	
15.	Power required for opening	W/VA	
16.	Power required for closing	W/VA	
17.	Power required for spring charging motor	W/VA	
18.	Breaker is trip free		
19.	Closing mechanism		
20.	Provision of manual spring charging provided		
21.	Mechanical Trip PB provided		
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			Reviewed By
			Approved By

Project	Project Management Consultancy (PMC) Services for execution of VRMP			Client	HPCL	
Unit	CAPTIVE POWER PLANT (CPP)	Location	VIZAG	Job No.	B016	Unit No. 606
22.	Mech. On/Off indicator provided					
23.	Operation counter provided					
24.	Time taken for spring charging		sec.			
25.	No. of aux. contacts and their current ratings					
26.	Interrupter					
	(a).Make					
	(b).Pressure switch for monitoring of SF6 gas pressure provided					
	(c).Re-filling arrangement of SF6					
27.	LOTO (Lock-Out Tag-Out) Provision for mechanical locking arrangement					
28.	Supressor					
	Type designation					
	Make					
27.	Derating reqd. for Cap. Switching					
29.	Earthing System					
30.	Copies of following test cerificates enclosed					
	For each type of offered circuit breaker panel with breake					
	(a).Short Circuit tests (Peak and 1 sec.withstand)					
	(b).Heat run test					
	(c).Internal arc test					
	(d).Impulse and power freq. withstand					
	For each type of offered circuit breaker (in panel)					
	(a).Short Circuit test duties					

Eil Notes

1 Shunt Trip Coil-2 shall be provided for VFD feeders.

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ESP-001- 2A Rev.00		PROJECT ENGINEERING & SYSTEMS DIVISION			Std. / Doc. Number
					Annexure-4
					Rev. No. 00

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Rajeev Jain	Girish Prasad Palo	Siva Prasad Babu	09.06.2018

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Bidder's reply/ confirmation as furnished in this annexure shall supersede the stipulations mentioned elsewhere in their bid.

Sl. NO.	DESCRIPTION	BIDDER'S Confirmation
1.	Bidder to confirm that the Scope of Supply shall be as per BHEL tender specification.	
2.	Bidder to confirm that Performance requirement, Design and construction, Engineering, Testing etc. of the DG Set & its various Auxiliaries/Accessories shall as per applicable standards as mentioned in Specification and EIL specifications.	
3.	Bidder to confirm that the 11 kV DG set of 6750 kVA at 0.8 PF Gross capacity selected. No negative tolerance shall be allowed on the engine rating specified by the Vendor in the equipment datasheet.	
4.	Bidder to confirm that gross capacity of DG Set 6750 KVA is ensured considering the derations specified under the latest edition of British Standard- 5514/ ISO 3046 and the power absorbed by the entire engine driven auxiliaries shall also be deducted. No negative tolerance shall be allowed on the engine rating specified by the Vendor in the equipment datasheet.	
5.	Bidder to confirm that the offered DG Sets/Systems cater to the operating philosophy mentioned in Cl. No. 4.6.0 of BHEL tender Specification (Doc. No. PY 51350).	
6.	Bidder to confirm that the offered DG sets are suitable for Black Start Condition. In case any additional equipment/accessory is required on account of the same, Bidder to include the same in their scope of supply.h	
7.	Bidder to confirm that the linear vibration values shall be in accordance with BS 5000/Part 3-1980 "Generators to be driven by reciprocating internal combustion engines".	
8.	Bidder to confirm that the torsional analysis of the dynamic system as specified in the latest edition of British Standard - 5514/ ISO 3046 shall be carried out and results in the form of a report shall be submitted during detail engg. stage.	
9.	Bidder to confirm that 5 feeders of 63 Amps each are provided through bidder's MCC for DG Room Air Conditioning, Ventilation System, Fire Protection System ,EOT Crane operation, Lighting etc.	
10.	Bidder to confirm that dedicated Auxiliaries System/Accessories is provided for Each DG set.	
11.	Bidder to confirm that the DG Set & its various Auxiliaries/Accessories is selected as per Site Data (Meteorological Data) mentioned in BHEL tender Specification.	
12.	Bidder to confirm that the diesel engine shall be four stroke water cooled, Naturally aspirated/turbo charged with charge air cooler, spark ignited type	
13.	Bidder to confirm that the speed of diesel engine shall be 1000 rpm (direct through flexible coupling) or lower.	



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14.	Bidder to confirm that the DG set is provided with Compressed air starting system. For compressed air starting system, two Air compressors (1 Motor Driven+1 Engine Driven) along with 1 No. of air receiver is considered. The Air Receiver shall be sized for 6 consecutive starts without charging. Bidder to Confirm.	
15.	Bidder to confirm that the height of the exhaust stack also should be in conformance to local regulation (Pollution board). The height of the exhaust stack shall be minimum of 30m from grade level.	
16.	Bidder to confirm that Battery and Battery Charger required for Diesel Engine (To Drive Air Compressor for Main DG Set Starting) is considered in scope of supply.	
17.	Bidder to confirm that the power rating category shall be Prime Power Rating (PRP) as per ISO 8528-1 provided the actual average power output of genset over 24 hrs of operation (Excluding Stop time) doesn't exceed 70% of the PRP or the permissible average power output confirmed by engine manufacturer, whichever is higher.	
18.	Bidder to confirm that the Common base plate for mounting the diesel engine and the driven alternator is considered. Non-skid decking is provided on the base plate and a base plate is of single fabricated unit.	
19.	Bidder to confirm that Speed governing system is of Woodward or equivalent make.	
20.	Bidder to confirm that all the Accessories required etc. for Exhaust Gas System is considered in Bidder's scope of supply.	
21.	Bidder to confirm that to meet the CPCB Norms, all the Accessories required for Noise attenuation System for DG Room including doors and Windows etc. is considered in Bidder's scope of supply.	
22.	Bidder to confirm that the insulation for Exhaust Gas System from Engine to stack (Upto a height of 3.0 m from ground Level) is included in Bidder's scope of supply.	
23.	Bidder to confirm that that DG Set & its various Auxiliaries/Accessories are accommodated within the designated space as mentioned in <u>Annexure-1C</u> .	
24.	Bidder to confirm that Mandatory Spares is quoted & included in scope of supply as per Price bid format (Annexure-3) of BHEL tender specification.	
25.	Bidder to confirm that instruments, control and safety devices required for trouble free and smooth running of DG Set and its various auxiliaries/accessories is in their scope of supply as specified in specification and additional requirement, if any, as per manufacturer	
26.	Bidder to confirm that the Complete Unit test shall be conducted inline with Cl. No. 4.0.13 of BHEL tender Specification (Doc. No. PY 51350).	
27.	Bidder to include commissioning spares in scope of supply & furnish a list of commissioning spares for BHEL review. (Refer Cl no 4.0.16) of BHEL tender Specification (Doc. No. PY 51350).	

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28.	Bidder to include Special Tools & Tackles in scope of supply & furnish a list of Special Tools & Tackles for BHEL review. (Refer Cl no 4.0.18) of BHEL tender Specification (Doc. No. PY 51350).	
29.	Bidder to confirm that software for PLC, if applicable for any of the equipment, in considered their scope of supply and soft copy & hard copy of the logics executed in PLC shall be provided during detail Engineering.	
30.	Bidder to furnish Reference list/Equipment Qualification criteria as per clause no 7.0.0 of BHEL tender specification PY51350. Bidder to furnish dully filled in proforma as per Annexure-7.	
31.	Bidder to confirm that all the Suitable reducers/expanders, Flanges & counter flanges along with gaskets & stud nuts at all the terminal point shall be in their scope.	
32.	Bidder to confirm that bidder has furnished list of 2 year recommended spares in their offer separately with optional price as per 6.0.0 of BHEL specification PY51350.	
33.	Bidder to highlight specific comments on the inspection requirements w.r.t scope of supply. (Refer Cl no 8.0.0 of BHEL specification PY51350)	
34.	Bidder to Confirm that all Inspection & acceptance, type Tests etc. as required for each equipment is as per specification and Codes applicable for the particular packages.	
35.	Bidder to highlight any deviation w.r.t the sub vendor list with proper justification. (Refer Cl. No. 11.0.0 of BHEL specification PY51350).	
36.	Bidder to Confirm that all rotating equipment shall be procured from the approved vendors listed in the bid package. However, in case vendor list for particular item could not be followed due to practical difficulties, the same shall be reviewed during detail engg stage. Sub vendor list furnished by the bidder will not be reviewed during bid evaluation stage.	
37.	Bidder to check the master document list and submit all the required documents as per the master document list (Annexure-5) without fail and take the approval of BHEL/EIL.	
38.	Bidders to furnish deviations [if any] only as per the format enclosed as annexure-10. Any deviations in the scope of supply, works and specifications if listed elsewhere shall be neither be reviewed nor accepted.	
39.	Bidder to quote as per BHEL price format (Annexure-3) only. Price quoted as per the price bid format, clearly indicating all the applicable items are quoted, and not applicable items are clearly highlighted. Bidder to quote individual price for each item mentioned in the seal priced bid. Bidder to confirm the same.	
40.	Bidder to confirm that All Piping & Fittings are supplied in prefabricated condition to the extent possible so as to minimize works activities at site during erection.	
41.	Bidder to confirm that Maintenance platform, Access Platform & Ladders for DG Set & Its various auxiliaries/Accessories is considered in scope of supply.	

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			Rev. No.	00
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42.	Bidder to confirm that supply of ladders & access platforms as applicable for subject DG (at inlet & exhaust duct) is included in bidder's scope of supply.	
43.	Bidder to confirm that Sea Worthy packing shall be followed in case of imported items as per Annexure-12 of BHEL tender Specification(Doc. No. PY 51350).	
44.	Bidder to confirm that Feedback signals as mentioned in Cl. No. 4.21.0 is included in bidder's scope.	

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					Annexure-5	
					Rev. No.	00

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Revisions: Refer to record of revisions	Prepared by :	Checked by :	Approved by :	Date :
	Rajeev Jain	Girish Prasad Palo	Siva Prasad Babu	09.06.2018

MASTER DOCUMENT LIST -DG SET[illegible]

MASTER DOCUMENT LIST -DG SET														
	Vendor Name:				PROJECT:									
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:				
	Vendor contact No.				Supplier's Job No.									
	SYSTEM/PACKAGE:	BFP				TODAY-DATE	20/Jun/18			Submission status to BHEL				
SLNo	DRG/DOC. NAME	DRG/DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0			Final Rev-(R)	REMARKS
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" /PV/PB /PC/AA	SD	AD	APP.CAT	Date	
Note: i) The Above mentioned list is brief & general in nature.During the kick off meeting(After PO Placement),the documentation shall be discussed & a detail list of Documents/Drawings specific to each system shall be prepared.Based on detail list, Bidder/ Vendor shall furnish the documents/Drawing for BHEL/HPCL/EIL review/Approval. *Various Auxiliaries Systems/Accessories indicates the packages/Items such as Fuel System,Lubricating Oil System,Cooling System(Water & Air),Compressed Air Satrting System,Combustion Air System,Exhaust Air System,Electrical System,Earthling System,Illumination System,Ventilation and Air Conditioning System,Noise Attenuation(Accoustic) System etc. **Details(Such as Data Sheet,GAD,CSD,Catalogue etc.) to be provided for all the items appliciable for the entire package.														
							TOTAL	0		*APP.CAT				
	A-Approval Category	PV-Commented and pending with vendor					TOTAL "PV"		0	A1-Approved				
	I-Information Category	PB- Pending with BHEL					TOTAL "PB"		0	A2-Mfg. Clearance given subject incorp				
		PC- Pending with Customer					TOTAL "PC"		0	A3-Commented.Revision & resubmission required.				
		AA- Approved					TOTAL "AA"		0	A4- Retained for info.				
		" " - Not yet Due.												
		OD - Over Due.					TOTAL "OD"		0					
Vendor documentation status														
Total No of Docs		Due as on Date	Submitted by vendor as on Dt.	Approved by BHEL as on Dt.	Commented by BHEL as on Dt.	Pending with BHEL/CUSTOMER as on date	%age of Dos Approved	%age of critical Dos Approved	Is Mfg. Clearance given?	Status/ Remarks				
(Nos)		(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	% age	% age	(Y/N)./(if Y) put Dt.					
0		0	0	0	0	0	#DIV/0!		Y					