

Bidder's Data Sheet

Bidder's Name

2.9 ELECTRICAL

2.9.1 Generator and Excitation System

2.9.1.1 Gas Turbine Generator

Manufacturer * _____

Type * _____

Place of manufacture/Origin * _____

Numbers of years generators of same
type in service

 Inside the country of manufacture * _____

 Outside the country of manufacture * _____

 Type of rotor * _____

Noise Level (dB(A)) * _____

Quantity * _____

Rating * _____

 Maximum continuous rating (MW) * _____

 Rated power factor (lag) * _____

 Rated power factor (lead) * _____

 Rated terminal voltage (kV) * _____

Rated current	(kA)	*	_____
Rated frequency	(Hz)	*	_____
Number of Phases		*	_____
Number of Leads		*	_____
Method of generator neutral grounding		*	_____
Stator winding connection configuration		*	_____
Saturation factor		*	_____
Rated speed	(rpm)	*	_____
Rated power	(kVA)	*	_____
Rated field voltage	(V)	*	_____
Rated field current	(A)	*	_____
Short circuit ratio		*	_____
Inertia Constant:			
Generator	(kW · s/kVA)		_____
Generator and prime mover	(kW · s/kVA)		_____
Direction of rotation		*	_____
Type of stator winding cooling medium		*	_____

Type of stator core and rotor cooling medium		*	_____
Number of coolers		*	_____
Cooling water mineralization and PH requirements		*	_____
Monitoring of cooler leakproofness during operation		*	_____
Fluid control in generator casing during operation		*	_____
Availability of air dryers in generator casing		*	_____
Impulse withstand voltage of stator winding	(kV)		_____
Max pressure imposed of stator housing (pressure test)	(bar(g))		_____
Percentage continuous load with one cooler out of service (%)		*	_____
Over load operation time at 0.85 PF (lag)			
105%	(min)	*	_____
110%	(min)	*	_____
Insulation class for stator winding		*	_____
Insulation class for rotor winding		*	_____

Dielectric strength

Power frequency withstand
voltage of stator winding (kV) _____

Power frequency withstand
voltage of rotor winding (kV) _____

Impulse withstand peak voltage of
stator winding (kV) _____

Permissive long duration negative
phase sequence current (A) _____

Negative phase sequence
capability (I_2^2t) * _____

Influence of speed and
voltage variation:

Frequency (Speed)
variation (Hz/%) * _____ ± _____

Voltage variation (kV/%) * _____ ± _____

Voltage regulation (%) at 1.0pf _____ at 0.85pf (lag) _____

Noise level at 1.0m from
enclosure (dB(A)) _____

Mechanical strength

Over speed strength
(For one minute) (%) _____

Critical speed (rpm) _____

Waveform

Telephone influence factor

Balance (% or less) * _____

Residual (% or less) * _____

Waveform deviation at rated voltage
under no load conditions (%) _____

Temperature rise limit
(after 3 hours continuous running at
rated conditions)

		Temp. rise limit	Expected temp. rise
Stator windings	(°C)	* _____	_____
Rotor windings	(°C)	* _____	_____
Stator iron core in contact with insulated windings	(°C)	_____	_____
Stator iron core not in contact with insulated windings	(°C)	_____	_____
Rotor iron core in contact with insulated windings	(°C)	_____	_____
Collector ring	(°C)	_____	_____

Reactance and time constant
(The following per unit
values shall be of the rated capacity
and rated voltage base)

		Saturation	Non-saturation
Synchronous reactance	Xd	* _____	_____

Quadrature-axis reactance	X_q	*	_____	_____
Direct-axis transient reactance	X_d'	*	_____	_____
Direct-axis subtransient reactance	X_d''	*	_____	_____
Quadrature-axis transient reactance	X_q'		_____	_____
Quadrature-axis subtransient reactance	X_q''		_____	_____
Positive-phase-sequence reactance	X_1		_____	_____
Negative-phase-sequence reactance	X_2		_____	_____
Zero-phase-sequence reactance	X_0	*	_____	_____
Open-circuit time constant	$T_{do}'(s)$	*	_____	_____
Transient short-circuit time constant	$T_d'(s)$		_____	_____
Subtransient short-circuit time constant	$T_d''(s)$		_____	_____
Armature time constant	$T_a(s)$		_____	_____

Winding Resistance:

Stator winding resistance to ground at 25 °C
per phase (Ω) * _____

Field winding resistance at 25 °C (Ω) _____

Positive-phase-sequence resistance at 25 °C rated current per phase (Ω) _____

Negative-phase-sequence resistance at 25°C per phase (Ω) _____

Zero-phase-sequence resistance at 25°C per phase (Ω) _____

Windings capacitance to ground:

Three phase (F) _____

Stator (F) _____

Rotor (F) _____

Efficiency (At rated condition):

Load (%) 100 75 50

P.F 1.0 _____

P.F 0.9 lag _____

P.F 0.85 lag _____

Losses (At rated condition)

Iron loss	(kW)	_____		
Bearing friction loss	(kW)	_____		
Brush friction loss	(kW)	_____		
Windage loss	(kW)	_____		
Load	(%)	100	75	50
Resistance loss in the armature winding	(kW)	_____	_____	_____
Resistance loss in the field winding	(kW)	_____	_____	_____
Brush loss at the collector ring	(kW)	_____	_____	_____
Exciter loss	(kW)	_____	_____	_____
Stray load loss	(kW)	_____	_____	_____
Enclosure material		_____		
Enclosure IP classification		*	_____	
Generator bushing				
Type		*	_____	
Quantity		*	_____	
Insulation level, BIL	(kV)	*	_____	
Rated current	(A)	*	_____	

Resistance temperature
detector (RTD)

Quantity * _____

Brush

Type * _____

Size * _____

Quantity * _____

Bushing type current transformer

Metering relaying AVR

CT ratio * _____

Quantity * _____

Burden (VA) * _____

Accuracy class * _____

Short circuit current (at rated load, voltage
frequency and excitation):

Permanent three-phase short
circuit current (pu) _____

RMS value of transient
Short circuit current (AC component)

Neutral-phase (pu) _____

Phase-phase (pu) _____

Three-phase (pu) _____

RMS value of subtransient
short circuit current

Neutral-phase (pu) _____

Phase-phase (pu) _____

Three-phase (pu) _____

Short-circuit current, three phase initial
max. value (peak value with
DC component) (pu) _____

Rotor shaft vibration (peak to peak displacement)

Permissible vibration:

at over-speed (μm) * _____

at critical speed (μm) * _____

Alarm and Trip value :

Alarm (μm) _____

Trip (μm) _____

Maximum unbalance resistance
between any two phases (%) _____

No excitation residual voltage (V) _____

No-load excitation current (A) _____

No-load excitation voltage
(at 25 °C) (V) _____

Full-load excitation current (A) _____

No-load excitation voltage	(V)	_____
Shaft Voltage	(V)	_____
Method to prevent shaft current	*	_____
Insulation resistance of bearing insulation	(MΩ)	_____
Normal	(MΩ)	_____
Min required	(MΩ)	_____
Bearing oil		
Oil flow rate	(l/min)	_____
Oil outlet temperature	(°C)	_____
Viscosity at 38 °C	(N·s/m ²)	_____

At zero power factor:

Calculated max, under excitation power

100% rated voltage(kVA) _____

90% rated voltage(kVA) _____

80% rated voltage(kVA) _____

Calculated max, over-excitation power

105% rated voltage(kVA) _____

100% rated voltage(kVA) _____

85% rated voltage(kVA)	_____
Overall Generator Dimension (Approx.)	
Height (m)	* _____
Width (m)	* _____
Depth (m)	* _____
Minimum space to withdraw rotor	
Straight pull (m)	* _____
Askew (m)	* _____
Bearing:	
Type of bearing and bearing support insulation	* _____
Inside diameter of bearing (mm)	_____
Length of bearing (mm)	_____
Oil pressure of bearing(bar(g))	_____
Transportation Dimension	
Stator (mm)	* _____
Rotor(mm)	* _____
Transportation Weight	
Stator (kg)	* _____

Rotor (kg)		* _____
Stator Rotor Core		
Outer diameter	(m)	_____
Inside diameter	(m)	_____
Core length	(m)	_____
Stator Winding		
Number of slots		_____
Dimension of winding bar (top/bottom)(mm)		_____
Rotor		
Diameter(m)		_____
Length (m)		_____
Span of shaft (m)		_____
Length of air gap(mm)		_____
Total length	(m)	_____
Weight of generator		
Stator (kg)		_____
Rotor (kg)		_____
Total (kg)		_____

Transportation (kg) _____

2.9.1.2 Static Excitation System for Gas Turbine Generator

Thyristor

Manufacturer * _____

Type * _____

Place of manufacture/Origin * _____

Quantity * _____

Thyristor arrangement * _____

Rating

Output voltage (V) * _____

Output current (A) _____

Class of insulation _____

Excitation Transformer

Manufacturer * _____

Place of manufacture/Origin * _____

Type *

Rating

Frequency _____ (Hz)

Impedance _____

Winding connection Configuration _____

Short-time overload Capability _____

Impulse withstand peak voltage (kV) _____

Power frequency withstand Voltage _____ (kV)

Ratio of HV side CT _____

Input voltage(V) _____

Output voltage (V) _____

Quantity

Cooling method

Automatic Voltage Regulator (AVR)

Manufacturer * _____

Place of manufacture/Origin * _____

Quantity * _____

Type * _____

Rating

Sensitivity(%) * _____

Response ratio(s^{-1}) * _____

Range of voltage adjustment(%) * _____

Range of Manual control(%) * _____

Regulation for 20% change in
AVR power supply voltage (%)* _____

Ceiling voltage of
exciter (pu)* _____

Max voltage rise when throwing off
continuous max rated load at rated
power factor under actual service
conditions with speed control &
voltage control equipment in
operation(V) _____

Number of channels:
Automatic * _____

Manual * _____

Manual Control Range:

Percent of full load volts (%) _____

Percent of full load excitation (%) _____

Droop range (%) _____

Power Amplifier

Rectifying method * _____

Rated current (A) * _____

Rated Voltage (V) * _____

Time rating (s) _____

No. of power amplifier _____

Excitation cubicle

Manufacturer * _____

Type * _____

Thickness of steel plate (mm) _____

Dimension (Approx.)

Height (mm) _____

Width (mm) _____

Depth (mm) _____

Weight (Approx.) (kg) _____

Quantity * _____

Main exciter field breaker

Manufacturer * _____

Type * _____

Rating

Voltage (V) * _____

Current (A) * _____

Interrupting capacity (kA) _____

Control Voltage (DC) _____

Quantity * _____

Diagram of Control System
(Specified in Volume II
Section 10.3.2.1 4)) * _____

Reliability Indices

Availability factor, not less _____

Mean operating time between
failures, hours, not less _____

Overhaul scheduled life, years,
not less _____

2.9.1.3 Steam Turbine Generator

Manufacturer * _____

Type * _____

Place of manufacture/Origin * _____

Numbers of years generators of same
type in service

Inside the country of manufacture * _____

Outside the country of manufacture * _____

Type of rotor * _____

Noise Level at 1 m from enclosure (dB(A)) * _____

Quantity	*	_____
Rating	*	_____
Maximum continuous rating (MW)	*	_____
Rated power factor (lag)	*	_____
Rated power factor (lead)	*	_____
Rated terminal voltage (kV)	*	_____
Rated current (kA)	*	_____
Rated frequency (Hz)	*	_____
Number of Phases	*	_____
Number of Leads	*	_____
Method of generator neutral grounding	*	_____
Stator winding connection configuration	*	_____
Saturation factor	*	_____
Rated speed (rpm)	*	_____
Rated power (kVA)	*	_____
Rated field voltage (V)	*	_____
Rated field current (A)	*	_____
Short circuit ratio	*	_____

Inertia Constant:

Generator (kW.s/kVA)	_____
Generator and steam turbine (kW.s/kVA)	_____
Direction of rotation	* _____
Type of stator winding cooling medium	* _____
Type of stator core and rotor cooling medium	* _____
Number of coolers	* _____
Cooling water mineralization and PH requirements	* _____
Monitoring of cooler leakproofness during operation	* _____
Fluid control in generator casing during operation	* _____
Availability of air dryers in generator casing	* _____
Impulse withstand peakvoltage of stator winding (kV)	_____
Max pressure imposed on Stator Housing (Pressure test) (bar(g))	_____
Percentage continuous load with one cooler out of service (%)	* _____

Over load operation
time at 0.85 PF (lag)

105% (min) * _____

110% (min) * _____

Insulation class for stator winding * _____

Insulation class for rotor winding * _____

Dielectric strength

Power frequency withstand
voltage of stator winding (kV) _____

Power frequency withstand
voltage of rotor winding (kV) _____

Impulse withstand peak voltage of
stator winding (kV)

Permissive long duration negative
phase sequence current (A) _____

Negative phase sequence
capability (I_2^2t) * _____

Mechanical strength

Over speed strength
(For one minute) (%) _____

Critical speed (rpm)
1 st _____

2 nd _____

Waveform

Telephone influence factor

Balance (% or less) * _____

Residual (% or less) * _____

Waveform deviation at rated voltage
under no load conditions (%) _____

Temperature rise limit
(after 3 hours continuous running at
rated conditions)

Discription		Temp. rise limit	Expected temp. rise
Stator windings	(°C)	* _____	_____
Rotor windings	(°C)	* _____	_____
Stator iron core in contact with insulated windings	(°C)	_____	_____
Stator iron core not in contact with insulated windings	(°C)	_____	_____
Rotor iron core in contact with insulated windings	(°C)	_____	_____
Collector ring	(°C)	_____	_____

Reactance and time constant
(The following per unit
values shall be of the rated capacity
and rated voltage base)

Saturation Non-saturation

Synchronous reactance	X_d	*	_____	_____
Quadrature-axis reactance	X_q	*	_____	_____
Direct-axis transient reactance	X_d'	*	_____	_____
Direct-axis subtransient reactance	X_d''	*	_____	_____
Quadrature-axis transient reactance	X_q'		_____	_____
Quadrature-axis subtransient reactance	X_q''		_____	_____
Positive-phase-sequence reactance	X_1		_____	_____
Negative-phase-sequence reactance	X_2		_____	_____
Zero-phase-sequence reactance	X_0	*	_____	_____
Open-circuit time constant	$T_{do}'(s)$	*	_____	_____
Transient short-circuit time constant	$T_d'(s)$		_____	_____
Subtransient short-circuit time constant	$T_d''(s)$		_____	_____
Armature time constant	$T_a(s)$		_____	_____

Winding Resistance:

Stator winding resistance to ground at 25 °C per phase (Ω) * _____

Field winding resistance at 25°C (Ω) _____

Positive-phase-sequence resistance at 25 °C rated current per phase (Ω) _____

Negative-phase-sequence resistance at 25 °C per phase (Ω) _____

Zero-phase-sequence resistance at 25 °C per phase (Ω) _____

Windings capacitance to ground:

Three phase (F) _____

Stator (F) _____

Rotor (F) _____

Efficiency (At rated condition):

Load (%)	100	75	50
----------	-----	----	----

P.F	1.0	_____	_____	_____
-----	-----	-------	-------	-------

P.F	0.9 lag	_____	_____	_____
-----	---------	-------	-------	-------

P.F	0.85 lag	_____	_____	_____
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Losses (At rated condition)

Iron loss (kW)		_____		
Bearing friction loss (kW)		_____		
Brush friction loss (kW)		_____		
Windage loss (kW)		_____		
Load (%)		100	75	50
Resistance loss in the armature winding	(kW)	_____	_____	_____
Resistance loss in the field winding	(kW)	_____	_____	_____
Brush loss at the collector ring	(kW)	_____	_____	_____
Exciter loss	(kW)	_____	_____	_____
Stray load loss	(kW)	_____	_____	_____
Enclosure material		_____		
Enclosure IP classification		*	_____	
Generator bushing				
Type		*	_____	
Quantity		*	_____	
Insulation level, BIL	(kV)	*	_____	
Rated current	(A)	*	_____	

Resistance temperature
detector (RTD)

Quantity * _____

Brush

Type * _____

Size * _____

Quantity * _____

Bushing type current transformer

	Metering	relaying	AVR
--	----------	----------	-----

CT ratio * _____

Quantity * _____

Burden (VA) * _____

Accuracy class * _____

Short circuit current (at rated load, voltage
frequency and excitation):

Permanent three-phase short
circuit current (pu) _____

RMS value of transient
short circuit current (AC component)

Neutral-phase (pu) _____

Phase-phase (pu) _____

Three-phase (pu) _____

RMS value of subtransient short circuit current		
Neutral-phase	(pu)	_____
Phase-phase	(pu)	_____
Three-phase	(pu)	_____
Short-circuit current, three phase initial max. value (peak value with DC component)		
	(pu)	_____
Rotor shaft vibration (peak to peak displacement) (at rated speed)		
	(μ m)	_____
Permissible vibration:		
at over-speed	(μ m)	* _____
at critical speed	(μ m)	* _____
Alarm and Trip value:		
Alarm (rpm)	(μ m)	_____
Trip \leq rated speed	(μ m)	_____
Maximum unbalance resistance between any two phases		
	(%)	_____
No excitation residual voltage	(V)	_____
No-load excitation current	(A)	_____
No-load excitation voltage		

(at 25 °C)	(V)	_____
Full-load excitation current	(A)	_____
No-load excitation voltage	(V)	_____
Shaft Voltage	(V)	_____
Method to prevent shaft current	*	_____
Insulation resistance of bearing insulation	(M Ω)	_____
Normal	(M Ω)	_____
Min required	(M Ω)	_____
Bearing oil		
Oil flow rate	(l/min)	_____
Oil outlet temperature (°C)		_____
Viscosity at 38 °C	(N·s/m ²)	_____
At zero power factor:		
Calculated max, under excitation power		
100% rated voltage	(kVA)	_____
90% rated voltage	(kVA)	_____
80% rated voltage	(kVA)	_____
Calculated max, over-excitation power		

105% rated voltage (kVA) _____

100% rated voltage (kVA) _____

85% rated voltage (kVA) _____

Overall Generator Dimension (Approx.)

Height (m) * _____

Width (m) * _____

Depth (m) * _____

Minimum space to withdraw rotor

Straight pull (m) * _____

Askew (m) * _____

Bearing:

Type of bearing and bearing support installation * _____

Inside diameter of bearing (mm) _____

Length of bearing (mm) _____

Oil pressure of bearing (bar(g)) _____

Transportation Dimension

Stator (m) * _____

Rotor (m) * _____

Transportation Weight

Stator (kg) * _____

Rotor (kg) * _____

Stator Rotor Core

Outer diameter (mm) _____

Inside diameter (mm) _____

Core length (m) _____

Stator Winding

Number of slots _____

Dimension of winding bar
(top/bottom) (mm) _____

Rotor

Diameter (m) _____

Length (m) _____

Span of shaft (m) _____

Length of air gap (mm) _____

Total length (m) _____

Weight of generator

Stator (t) _____

Rotor	(t)	_____
Total	(t)	_____
Transportation	(t)	_____

2.9.1.4 Static Excitation System for Steam Turbine Generator

Thyristor

Manufacturer	*	_____
Type	*	_____
Place of manufacture/Origin	*	_____
Quantity	*	_____
Thyristor arrangement	*	_____

Rating

Output voltage	(V)	_____ *
Output current	(A)	_____
Class of insulation		_____

Excitation Transformer

Manufacturer	*	_____
Place of manufacturer/Origin	*	_____
	Rating	
Frequency	(Hz)	_____

Impedance	_____
Winding connection Configuration	_____
Short-time overload Capability	_____
Impulse withstand voltage	_____
Power frequency withstand Voltage (kV)	_____
Ratio of HV side CT	_____
Input voltage (V)	_____
Output voltage (V)	_____
Quantity	_____
Cooling method	_____
Automatic Voltage Regulator (AVR)	
Quantity	* _____
Manufacturer	* _____
Type	* _____
Place of manufacture/Origin	* _____
Rating	
Sensitivity	(%) _____ *

Response ratio (s⁻¹) _____ *

Range of voltage adjustment (%) _____ *

Range of Manual control(%) * _____

Regulation for 20% change in
AVR power supply voltage (%) _____

Ceiling voltage of
exciter (pu) _____ *

Max voltage rise when throwing off
continuous max rated load at rated
power factor under actual service
conditions with speed control &
voltage control equipment in
operation (V) _____

Number of channels:

Automatic * _____

Manual * _____

Manual Control Range:

Percent of full load volts (%) _____

Percent of full load excitation (%) _____

Droop range (%) _____

Power Amplifier

Rectifying method * _____

Rated current	(A)	*	_____
Rated Voltage	(V)	*	_____
Time rating	(s)		_____
No. of power amplifier			_____
Excitation cubicle			
Manufacturer		*	_____
Type		*	_____
Thickness of steel plate	(mm)		_____
Dimension (Approx.)			
Height	(mm)		_____
Width	(mm)		_____
Depth	(mm)		_____
Weight (Approx.)	(kg)		_____
Quantity		*	_____
Main exciter field breaker			
Manufacturer		*	_____
Type		*	_____
Rating			_____

Voltage (V) * _____

Current (A) _____

Interrupting capacity (kA) _____

Control Voltage (DC) _____

Quantity _____

Diagram of Control System
(Specified in Volume II
Section 10.3.2.1 4)) _____

Reliability Indices

Availability factor, not less _____

Mean operating time between
failures, hours, not less _____

Overhaul scheduled life, years,
not less _____

2.9.2 Generator Main Connections

2.9.2.1 Isolated Phase Bus Duct (IPB)

Manufacturer * _____

Country of Manufacturer * _____

Type * _____

Numbers of years IPB of same
type in service _____

Inside the country of manufacture		*	_____
Outside the country of manufacture		*	_____
Material of enclosure			_____
Number and size of silvered flexible connectors per phase/total (No/mm)		*	_____
Bus losses			
Total conductors	(w)	*	_____
Total enclosure	(w)	*	_____
Conductor			
Material		*	_____
Nominal cross section	(mm ²)		_____
Resistivity at 20°C	(Ω-m)	*	_____
Shape			_____
Rating			Main Bus Tee-Off
Rated voltage	(kV)		_____ _____
Rated current	(A)	*	_____ _____
3 sec short time withstand (Symm.)	(kA)	*	_____ _____
Basic Insulation level	(kV)	*	_____ _____
50Hz test Voltage	(kV)		_____ _____

Dry 50Hz withstand voltage(kV) _____

Impulse withstand voltage (kV) _____

Mechanical ratings:

Bus support: (material) _____

Insulator (Bending strength) (kg) _____

Mechanical force per support (kg) _____

Number of thermostats per phase/total * _____

Number of constantan thermocouples
phase/total _____

Allowable temp. rise at ambient temp 40 °C

*

Parts of IPB	Allowable temp. (°C)	Allowable temp. rise (°C)
Aluminum bus conductor		
Bolted connection joint		
Aluminum enclosure		

Voltage drop at continuous rated
current (mV) * _____

Heat loss per meter run of 3-phase circuit
when carrying CMR(continuous maximum rated) current

Total conductor (kW/m) _____

Total enclosure (kW/m) _____

Material used for clamps _____

Material of bolts and nuts for conductor _____

Minimum creepage distance (mm/kV) _____

Minimum live to earth clearance (mm) _____

Minimum phase to phase clearance(mm) _____

Type of flexible and expansion connectors _____

Enclosure/conductor diameter (m) _____

Insulators

Manufacturer * _____

Type * _____

Rated voltage (kV) * _____

Insulator BIL (kV) _____

Total creepage distance (mm) _____

Temperature rise

Enclosure (°C) * _____

Conductor (°C) * _____

Material of supporting structure _____

Enclosure material
wt per metre run 3 phase (kg) _____

Unitized sealed pressurized system

Type * _____

Pressure (bar) * _____

2.9.2.2 Generator Circuit Breaker

Circuit Breaker

Manufacturer * _____

Type/Model * _____

Class of insulation to IEC 60186 * _____

Operating voltage (kV) * _____

Maximum design voltage (kV) * _____

Frequency(Hz)/phase * _____

Quantity * _____

BIL withstand voltage (kV) * _____

Low frequency withstand voltage (kV) * _____

Continuous current rating (kA) * _____

Maximum symmetrical interrupting
Rating (kA) * _____

Operating method * _____

Operating/control voltage (V) * _____

Operating pressure (bar) * _____

Rated break time from initiation
of tripping (s) _____

Rated opening time (s) _____

Operating mechanism type: _____

Weight of circuit breaker (kg) _____

Dimensions of circuit breaker
Distance between poles (mm) _____

Height of line terminal above foundation
Incoming line terminal (mm) _____

Outgoing line terminal (mm) _____

Max insulation width of circuit breaker (mm) _____

Max insulation length of circuit breaker (mm) _____

Transportation dimension of the largest

part (CB pole)

Length x Width x Height (m) _____ x _____ x _____

Disconnecting Switch

Manufacturer * _____

Type/Model * _____

Class of insulation to IEC 60186 * _____

Operating voltage (kV) * _____

Maximum design voltage (kV) * _____

Frequency (Hz)/Phase * _____

Quantity * _____

BIL withstand voltage (kV) * _____

Low frequency withstand voltage (kV) * _____

Continuous current rating (kA) * _____

Momentary current rating (kA) * _____

Operating method * _____

Operating/control voltage (V) * _____

Operating pressure (bar(g)) * _____

2.9.2.3 PT Cubicle

Manufacturer * _____

Type/Model * _____

Class of insulation to IEC 60186 * _____

Temperature rise at 110% rated primary
voltage at rated burden
(ambient/rise) (°C/k) _____

Impulse withstand peak voltage (kV) _____

Total creepage distance over insulator externally	(mm)	_____	
Current limiting primary fuses continuous and interrupting current rating	(A) *	_____	
Current limiting resistor	(Ω)	_____	
Rating		metering	relaying
Transformation ratio	(kV/V)	_____ *	_____
Quantity		_____	_____
Accuracy class		_____	_____
Burden	(VA)	_____	_____
BIL	(kV)	_____	_____
Connection		_____	_____
Partial Discharge Level		_____	_____
Cubicle dimension			
Height	(mm)	_____	
Width	(mm)	_____	
Depth	(mm)	_____	
Total weight (Approx.)	(kg)	_____	
Space heater			

Capacity (VA) _____

Voltage (V) _____

2.9.2.4 Current Transformers

Manufacturer * _____

Type/Model * _____

Class of insulation to IEC 60185 * _____

Ratio Ip/Is * _____

Rated output (VA) * _____

Rated frequency (Hz) * _____

Rated impulse withstand peak voltage (kV) _____

Rated short-time current and rated time. (A/s) _____

Rating	metering	relaying
--------	----------	----------

Transformation ratio(A/A)	* _____	_____
---------------------------	---------	-------

Quantity	* _____	_____
----------	---------	-------

Accuracy class	* _____	_____
----------------	---------	-------

Burden	(VA) * _____	_____
--------	--------------	-------

BIL (kV) _____

2.9.2.5 Surge Arrester Cubicle

Manufacturer * _____

Type * _____

Quantity (No.) * _____

SA and Capacitor Rating _____

Rated voltage (kV) * _____

Rated current (kA) * _____

Residual voltage (kV) * _____

Cubicle dimension (Approx.)

Height (mm) _____

Width (mm) _____

Depth (mm) _____

Weight (Approx.) (kg) _____

Space heater

Capacity (VA) _____

Voltage (V) _____

2.9.2.6 Tee-Off Isolating Link

Manufacturer * _____

Type * _____

Method of opening link _____

Access arrangements to link _____

2.9.2.7 Short Circuit Bar

Whether short circuit bar be interlocked
to prevent inadvertent operation _____

Continuous rating of short circuit bar (kA) _____

Short time rating (3s) (kA) * _____

2.9.2.8 NGR Cubicle

Ground resistor

Manufacturer * _____

Type * _____

Rating

Resistance (Ω) * _____

Current (A) * _____

Class of rating (min) * _____

Disconnecting switch

Manufacturer * _____

Type * _____

Rating		*	_____
Voltage	(V)	*	_____
Current	(A)	*	_____
Cubicle (including grounding resistor and disconnecting switch)			
Dimension (Approx.)			
(Height x Width x Depth)	(mm)		_____
Weight (Approx.)	(kg)		_____
Space heater			
Capacity	(VA)		_____
Voltage	(V)		_____

2.9.3 Generator Transformers

2.9.3.1 Generator Transformer for Gas Turbine Generator

Manufacturer	_____
Country of Manufacture	_____
Type (Model) Reference	_____
Standard to which manufactured	_____
Number of years equipment of same type in commercial service:-	
In the country of manufacture	_____

Outside the country of manufacture		_____
Quantity		* _____
Rating		
OFAF rating (CMR) at maximum site ambient temperature	(MVA)	* _____
OFAN rating at maximum site ambient temperature	(MVA)	_____
Overload capability	(%)	* _____
Rating at self cooling basis	(MVA)	* _____
Voltage		
High tension side	(kV)	* _____
Low tension side	(kV)	* _____
Rated transformation ratio	(kV)	* _____
Frequency	(Hz)	* _____
Vector group		* _____
Full load Tap steps voltage range		* _____
Polarity Connection		
High tension side		* _____
Low tension side		* _____
High tension neutral		* _____
Impedance voltage at 75°C nominal ratio and CMR between HV-LV (%)	(%)	* _____

Insulation class		
High tension side		* _____
Low tension side		* _____
Basic Insulation level (BIL)		
High voltage side	(kV)	* _____
Low voltage side	(kV)	* _____
Power Frequency withstand voltage		
High voltage side	(kV)	* _____
Low voltage side	(kV)	* _____
Impulse withstand peak voltage		
Full wave	(kV)	* _____
Chopped wave	(kV)	* _____
Separate source withstand voltage for HV neutral	(kV)	_____
Normal operating pressure of tank	(bar(g))	_____
Pressure test of tank	(bar(g))	_____
Degree of vacuum (vacuum strength)	(kPa)	_____
Sound level at OFAF	(dB(A))	* _____
Maximum tank vibration at OFAF (peak to peak displacement)	(μm)	_____
Terminal Connection		
HV bushings		
Manufacturer		* _____

Type		* _____
Rated current	(A)	* _____
BIL	(kV)	* _____
Power frequency withstand level	(kV)	* _____
Impulse test voltage		_____
Full wave	(kV)	_____
Chopped wave	(kVp)	_____
Creepage length	(mm)	_____
 LV bushings		
Manufacturer		* _____
Type		* _____
Rated Current	(A)	* _____
BIL	(kV)	* _____
Power frequency withstand level	(kV)	* _____
Impulse test voltage		_____
Full wave	(kV)	_____
Chopped wave	(kV)	_____
Creepage length	(mm)	* _____
 HV Neutral Bushings		
Manufacturer		* _____
Type		* _____
Rated Current	(A)	* _____

BIL	(kV)	* _____
Power frequency withstand level	(kV)	* _____
Impulse test voltage		
Full wave	(kV)	_____
Chopped wave	(kV)	_____
Creepage length	(mm)	_____
Transformer dimension (approx.)		
Height	(m)	* _____
Width	(m)	* _____
Depth	(m)	* _____
Shipping dimensions		
Height	(m)	_____
Width	(m)	_____
Depth	(m)	_____
Weight (approx.)		
Total weight assembled with oil	(kg)	* _____
Weight of cores and coils	(kg)	* _____
Weight for transportation	(kg)	* _____
Weight of oil	(kg)	* _____
Insulating Oil		
Manufacturer		* _____
Type		* _____

Grade		_____
Quantity		* _____
Puncture voltage	(kV)	* _____
Electric loss at 100°C		_____
Moisture	(ppm)	_____
Flash point	(°C)	_____
Solidifying point	(°C)	_____
pH value		_____
Acidic value		_____
Efficiency		
at 100% load		
P.F. = 1		* _____
P.F. = 0.85		* _____
P.F. = 0.8		* _____
at 75% load		
P.F. = 1		_____
P.F. = 0.85		* _____
P.F. = 0.8		_____
at 50% load		
P.F. = 1		_____
P.F. = 0.85		* _____
P.F. = 0.8		_____
Losses		
at 100% rated load		

Copper loss	(kW)	* _____
Iron loss	(kW)	* _____
Other losses (coolant)	(kW)	* _____
Total Loss	(kW)	* _____
Operable cooler	(kW)	* _____

at 75% rated load

Copper loss	(kW)	_____
Iron loss	(kW)	_____
Other losses (coolant)	(kW)	_____
Total Loss	(kW)	* _____
Operable cooler	(kW)	_____

at 50% rated load

Copper loss	(kW)	_____
Iron loss	(kW)	_____
Other losses (coolant)	(kW)	_____
Total Loss	(kW)	* _____
Operable cooler	(kW)	_____

Voltage regulation (Other losses
excluded)

at 110% rated load

P. F. = 1.0	(%)	_____
P. F. = 0.95	(%)	_____

	P.F. = 0.90	(%)	_____
	P. F. = 0.85	(%)	* _____
	P.F. = 0.80	(%)	_____
at 100% rated load			
	P. F. = 1.0	(%)	* _____
	P. F. = 0.95	(%)	* _____
	P.F. = 0.90	(%)	* _____
	P. F. = 0.85	(%)	* _____
	P.F. = 0.80	(%)	* _____
at 80% rated load			
	P. F. = 1.0	(%)	_____
	P. F. = 0.95	(%)	_____
	P.F. = 0.90	(%)	_____
	P. F. = 0.85	(%)	* _____
	P.F. = 0.80	(%)	_____
at 60% rated load			
	P. F. = 1.0	(%)	_____
	P. F. = 0.95	(%)	_____
	P.F. = 0.90	(%)	_____
	P. F. = 0.85	(%)	* _____
	P.F. = 0.80	(%)	_____
at 50% rated load			
	P. F. = 1.0	(%)	_____
	P. F. = 0.95	(%)	_____

P.F. = 0.90	(%)	_____
P. F. = 0.85	(%)	* _____
P.F. = 0.80	(%)	_____
Magnetizing current at nominal voltage	(A)	_____
Maximum continuous overfluxing allowable	(kV/Hz)	* _____
Impedance voltage at 75°C and CMR		
at maximum tap	(%)	* _____
at minimum tap	(%)	* _____
Zero-phase sequence impedance voltage at site ambient and CMR	(%)	* _____
Impedance tolerance		* _____
Continuous time of operation at cooler shutdown		
at 100% rated load		
Time	(min)	* _____
Winding temperature	(°C)	* _____
Insulated oil temperature	(°C)	* _____
Continuous time of operation at one group of cooler shutdown		
at 100% rated load		
Time	(min)	* _____

Winding temperature	(°C)	* _____
Insulated oil temperature	(°C)	* _____
Temperature rise limit at maximum site ambient and CMR		
Winding	(°C)	* _____
Top Oil	(°C)	* _____
Bottom Oil	(°C)	* _____
Winding hottest spot temperature at maximum site ambient and CMR	(°C)	_____
Cooling equipment		
Number of cooler sets		* _____
Number of cooler per set		* _____
Cooling capacity of each cooler unit		* _____
Cooling Plant		
Type (tank mounted radiator/tubes or separate free standing)		* _____
Materials of cooler plates/tubes		_____
Maximum oil inlet temperature	(°C)	_____
Maximum oil outlet temperature	(°C)	_____

Motor

Fans

Number per cooler * _____

Number running at OFAF * _____

Rated capacity (kW) * _____

Rated voltage (V) * _____

Starting current (A) * _____

Pumps

Number per cooler * _____

Number running at OFAF * _____

Rated capacity (kW) * _____

Rated voltage (V) * _____

Starting current (A) * _____

Cooler control cubicle

Manufacturer * _____

Type * _____

Dimension (approx.)

Height (mm) _____

Width (mm) _____

Depth (mm) _____

Noise Level (dB(A) * _____)

Weight (kg) _____

Space heater

Capacity (VA) _____

Voltage (V) _____

Seismic strength

Horizontal component _____

Vertical component _____

Duration (s) _____

Short circuit current and surge
current stability _____

2.9.3.2 Generator Transformer for Steam Turbine Generator

Manufacturer * _____

Country of Manufacture * _____

Type (Model) Reference * _____

Standard to which
manufactured * _____

Number of years equipment of
same type in commercial
service:

In the country of _____
manufacture

Outside the country of _____
manufacture

Quantity * _____

Rating

OFAF rating (CMR) at

maximum site ambient	(MVA)	* _____
temperature		
OFAN rating at	(MVA)	
maximum site ambient		_____
temperature		
Overload capability	(%)	* _____
Rating at self cooling	(MVA)	* _____
basis		
Voltage		
High tension side	(kV)	* _____
Low tension side	(kV)	* _____
Rated transformation ratio	(kV)	* _____
Frequency	(Hz)	* _____
Vector group		* _____
Full load Tap steps voltage		* _____
range		
Polarity Connection		
High tension side		* _____
Low tension side		* _____
High tension neutral		* _____
Impedance voltage at 75°C	(%)	* _____
nominal ratio and CMR		
between HV-LV (%)		
Insulation class		
High tension side		* _____
Low tension side		* _____

Basic Insulation level (BIL)			
High voltage side	(kV)	*	_____
Low voltage side	(kV)	*	_____
Power Frequency withstand voltage			
High voltage side	(kV)	*	_____
Low voltage side	(kV)	*	_____
Impulse withstand peak voltage			
Full wave	(kV)	*	_____
Chopped wave	(kV)	*	_____
Separate source withstand voltage for HV neutral	(kV)		_____
Normal operating pressure of tank	(bar(g))		_____
Pressure test of tank	(bar(g))		_____
Degree of vacuum (vacuum strength)	(mmHg)		_____
Sound level at OFAF	(dB(A))	*	_____
Maximum tank vibration at OFAF	(mm)		_____
Terminal Connection			
HV bushings			
Manufacturer		*	_____
Type		*	_____
Rated current	(A)	*	_____
BIL	(kV)	*	_____

Power frequency	(kV)	* _____
withstand level		
Impulse test peak voltage		
Full wave	(kVp)	_____
Chopped wave	(kVp)	_____
Creepage length	(mm)	_____
LV bushings		
Manufacturer		* _____
Type		* _____
Rated Current	(A)	* _____
BIL	(kV)	* _____
Power frequency	(kV)	* _____
withstand level		
Impulse test peak voltage		
Full wave	(kV)	_____
Chopped wave	(kV)	_____
Creepage length	(mm)	* _____
HV Neutral Bushings		
Manufacturer		* _____
Type		* _____
Rated Current	(A)	* _____
BIL	(kV)	* _____
Power frequency	(kV)	* _____
withstand level		
Impulse test peak voltage		
Full wave	(kVp)	_____

Chopped wave	(kVp)	_____
Creepage length	(mm)	_____
Transformer dimension (approx.)		
Height	(m)	* _____
Width	(m)	* _____
Depth	(m)	* _____
Shipping dimensions		
Height	(m)	_____
Width	(m)	_____
Depth	(m)	_____
Weight (approx.)		
Total weight assembled with oil	(kg)	* _____
Weight of cores and coils	(kg)	* _____
Weight for transportation	(kg)	* _____
Weight of oil	(kg)	* _____
Insulating Oil		
Manufacturer		* _____
Type		* _____
Grade		_____
Quantity		* _____
Puncture voltage	(kV)	* _____
Electric loss at 100°C		_____
Moisture	(ppm)	_____
Flash point	(°C)	_____

Solidifying point	(°C)	_____
PH value		_____
Acidic value		_____
Efficiency		
at 100% load		
P.F. = 1	(%)	* _____
P.F. = 0.85	(%)	* _____
P.F. = 0.8	(%)	* _____
at 75% load		
P.F. = 1	(%)	_____
P.F. = 0.85	(%)	* _____
P.F. = 0.8	(%)	_____
at 50% load		
P.F. = 1	(%)	_____
P.F. = 0.85	(%)	* _____
P.F. = 0.8	(%)	_____
Losses		
at 100% rated load		
Copper loss	(kW)	* _____
Iron loss	(kW)	* _____
Other losses (coolant)	(kW)	* _____
Total Loss	(kW)	* _____
Operable cooler	(kW)	* _____
at 75% rated load		
Copper loss	(kW)	_____

Iron loss	(kW)	_____
Other losses (coolant)	(kW)	_____
Total Loss	(kW)	* _____
Operable cooler	(kW)	_____
at 50% rated load		
Copper loss	(kW)	_____
Iron loss	(kW)	_____
Other losses (coolant)	(kW)	_____
Total Loss	(kW)	* _____
Operable cooler	(kW)	_____
Voltage regulation (other losses excluded)		
at 100% rated load		
P. F. = 1.0	(%)	* _____
P. F. = 0.95	(%)	* _____
P.F. = 0.90	(%)	* _____
P. F. = 0.85	(%)	* _____
P.F. = 0.80	(%)	* _____
at 75% rated load		
P. F. = 1.0	(%)	_____
P. F. = 0.95	(%)	_____
P.F. = 0.90	(%)	_____
P. F. = 0.85	(%)	* _____
P.F. = 0.80	(%)	_____

at 50% rated load			
P. F. = 1.0	(%)		_____
P. F. = 0.95	(%)		_____
P.F. = 0.90	(%)		_____
P. F. = 0.85	(%)	*	_____
P.F. = 0.80	(%)		_____
Magnetizing current at nominal voltage	(A)		_____
Maximum continuous overfluxing allowable	(kV/Hz)	*	_____
Impedance voltage at 75°C and CMR			
at maximum tap	(%)	*	_____
at minimum tap	(%)	*	_____
Zero-phase sequence impedance voltage at site ambient and CMR	(%)	*	_____
Impedance tolerance		*	_____
Continuous time of operation (at cooler shutdown)			
at 100% rated load			
Time	(min)	*	_____
Winding temperature	(°C)	*	_____
Insulated oil temperature	(°C)	*	_____
Continuous time of operation (at one group of cooler)			

shutdown)

at 100% rated load

Time (min) * _____

Winding temperature (°C) * _____

temperature

Insulated oil temperature (°C) * _____

temperature

Overload rating (in minutes)

Note: The hottest temperature of the winding shall be lower than 140°C

at 120% rated current (min) * _____

at 130% rated current (min) * _____

at 145% rated current (min) * _____

at 160% rated current (min) * _____

at 175% rated current (min) * _____

at 200% rated current (min) * _____

Temperature rise limit at maximum site ambient and CMR

Winding (°C) * _____

Top Oil (°C) * _____

Bottom Oil (°C) * _____

Winding hottest spot temperature at maximum site ambient and CMR (°C) _____

Cooling equipment

Number of cooler sets * _____

Number of cooler per set * _____

Cooling capacity of each cooler unit * _____

cooler unit

Cooling Plant

Type (tank mounted radiator/tubes or separate free standing) * _____

Materials of cooler plates/tubes _____

Maximum oil inlet temperature (°C) _____

Maximum oil outlet temperature (°C) _____

Motor

Fans

Number per cooler * _____

Number running at OFAF * _____

Rated capacity (kW) * _____

Rated voltage (V) * _____

Starting current (A) * _____

Pumps

Number per cooler * _____

Number running at OFAF * _____

Rated capacity (kW) * _____

Rated voltage (V) * _____

Starting current (A) * _____

Cooler control cubicle

Manufacturer * _____

Type * _____

Dimension (approx.)

Height	(m)	_____
Width	(m)	_____
Depth	(m)	_____
Noise Level	(dB(A))	* _____
Weight	(kg)	_____
Space heater		
Capacity	(VA)	_____
Voltage	(V)	_____
Seismic strength		
Horizontal component		_____
Vertical component		_____
Duration	(ms)	_____
Short circuit current and surge current stability		_____

2.9.4 Generator Protection

2.9.4.1 Generator Differential Protection

Manufacturer		*	_____
Type Designation		*	_____
Rated Current (In)	(A)	*	_____
Rated Frequency	(Hz)	*	_____
Sensitivity (% of rated current)	(%)	*	_____
Setting range for stage 1 (Alarm)	(%Ir)		_____
Stage 1 Time delay setting/range	(s)	*	_____
Setting range for stage 2 (Trip)	(s)	*	_____
Relay burden at			
Rated current	(VA)	*	_____
Lowest setting	(VA)	*	_____
Highest setting	(VA)	*	_____
Voltage limiting non-linear resistors required and characteristic constant			_____
Method of stabilizing relay against maloperation due to DC component of fault current			_____
Operating time at twice minimum setting	(ms)	*	_____
Operating time at ten times rated current	(ms)	*	_____
Magnitude of external phase-phase and phase-earth fault current up to which protection is stable			_____
No. of serial ports	(nos.)	*	_____
Quantity	(nos.)	*	_____

2.9.4.2 Overall Differential Protection

Manufacturer		*	_____
Type Designation		*	_____

Basic operating principle of main element		*	_____
C.T. Burden at rated current	(VA)	*	_____
C.T. Burden at 5 x rated current	(VA)	*	_____
Required C.T. knee point voltage	(V)	*	_____
Setting range (or value of fixed setting)			
basic			_____
load bias			_____
second harmonic bias			_____
other harmonic bias			_____
Operating time for:			
current equal to 2 x setting			
current equal to 5 x setting	(ms)		_____
current equal to 10 x setting	(ms)		_____

			(ms) _____
No. of serial ports	(nos.)	*	_____
Quantity	(nos.)	*	_____

2.9.4.3 Stator Earth Fault Protection

Manufacturer		*	_____
Type Designation		*	_____
Percentage of Generator Winding Protected	(%)	*	_____
Basic Operating Principle			
Operating time of relay	(ms)	*	_____
Maximum duration of operating current equivalent to full generator earth fault current that relay can withstand without damage	(s)		_____

CT class	(VA)	*	_____
Required external components			_____
No. of serial ports	(nos.)	*	_____
Quantity	(nos.)	*	_____

2.9.4.4 Loss of Excitation Protection

Manufacturer		*	_____
Type Designation		*	_____
Setting range of offset characteristic		*	_____
Setting range of diameter of circular characteristic			_____
Setting range of time delay			_____
Relay burden CT	(VA)	*	_____
VT	(VA)	*	_____
No. of serial ports	(nos.)	*	_____
Quantity	(nos.)	*	_____

2.9.4.5 Generator/GSUT Overfluxing Protection

Manufacturer		*	_____
Type Designation		*	_____
Rated Setting Range	(V/Hz)	*	_____
Time Delay Relay Setting Range	(s)	*	_____
Relay Burden at			
Minimum setting	(VA)	*	_____
Maximum setting	(VA)	*	_____
No. of serial ports	(nos.)	*	_____

Quantity (nos.) * _____

2.9.4.6 Reverse Power Protection

Manufacturer * _____

Type Designation * _____

Rated Current (A) * _____

Rated Voltage (V) * _____

Basic Principle of Operation _____

Burden at rated current & voltage

Current Circuit (VA) * _____

Voltage Circuit (VA) * _____

Method of Polarizing _____

Minimum polarizing current & voltage for correct directional decision _____

Minimum polarizing current & voltage for definite operation _____

Setting range of principle element (% of rated power) (X pu) * _____

Setting range of time delay (s) * _____

No. of serial ports (nos.) * _____

Quantity (nos.) * _____

2.9.4.7 Negative Phase Sequence Protection

Manufacturer * _____

Type Designation * _____

Rated Current (In) (A) * _____

Rated Frequency (Hz) * _____

Stage 1 setting range (Alarm)	(% In)	* _____
Stage 1 time delay setting/range	(s)	* _____
Setting range for stage 2 (Trip)	(x In)	* _____
Stage 2 time delay setting range	(s)	* _____
Relay burden at rated current	(VA)	* _____
No. of serial ports	(nos.)	* _____
Quantity	(nos.)	* _____

2.9.4.8 Generator Backup Impedance Protection

Manufacturer		* _____
Type Designation		* _____
Rated Current	(A)	* _____
Rated Voltage	(V)	* _____
Stage 1 setting range	(A)	* _____
Stage 2 Setting range	(Ω/phase)	* _____
Relay Burden at		
Rated Current	(VA)	* _____
Rated voltage & max impedance setting	(VA)	* _____
Rated Voltage & min impedance setting	(VA)	* _____
Required CT knee point voltage	(V)	_____
CT class		
Stage 2 time delay range	(s)	_____
No. of serial ports	(nos.)	* _____

Quantity (nos.) * _____

2.9.4.9 Voltage Balance Protection

Manufacturer * _____

Type Designation * _____

Drop off voltage (one phase) as a % of nominal rating – other two phases at nominal voltage (V) _____

Pickup voltage as a % of nominal rating (V) _____

Burden (VA) * _____

2.9.4.10 Voltage Transformer Fuse Failure Supervision

Manufacture _____

Type Designation _____

Operating Time (ms) * _____

Method of detecting fuse failure _____

Burden (VA) * _____

No. of serial ports (nos.) * _____

Quantity (nos.) * _____

2.9.4.11 Rotor Earth Fault Protection

Principle of Operation _____

Additional slip rings required? * _____

Power supply required? * _____

Power supply voltage if required V * _____

Limits of rotor capacitance to Earth, if applicable (Mfd) _____

Minimum change of Insulation resistance which can be detected

Sensing relay manufacturer

* _____

Sensing relay type designation

* _____

No. of serial ports

(nos.)

* _____

Quantity

(nos.)

* _____

2.9.4.12 Pole Slip Protection

Manufacturer

* _____

Type Designation

* _____

Relay Setting Range

(V/Hz)

* _____

Time Delay relay setting range

(s)

* _____

Relay Burden at the Time of

a. Minimum setting

(VA)

* _____

b. Maximum setting

(VA)

* _____

No. of serial ports

(nos.)

* _____

Quantity

(nos.)

* _____

2.9.4.13 Over and Under Frequency Protection

Manufacturer

* _____

Type Designation

* _____

Rated Voltage

(V)

* _____

Rated Frequency

(Hz)

* _____

Frequency setting range

(Hz)

* _____

Setting range of time delay

(s)

* _____

Voltage setting range

(V)

* _____

Reset ratio

(%)

* _____

No. of serial ports	(nos.)	*	_____
Quantity	(nos.)	*	_____

2.9.4.14 Start-up Instantaneous Overcurrent Protection

Manufacturer		*	_____
Type Designation		*	_____
Microprocessor based	Yes/No.	*	_____
Rated Current (In)	(A)	*	_____
Range of current settings (% of In)		*	_____
Operating time at:			
2x setting current	(ms)		_____
5x setting current	(ms)		_____
10x setting current	(ms)		_____
Burden of current circuit on lowest setting at			
1x setting current	(VA)		_____
2x setting current	(VA)		_____
5x setting current	(VA)		_____
10x setting current	(VA)		_____
Burden of current circuit on highest setting at:			
1x setting current	(VA)		_____
2x setting current	(VA)		_____
5x setting current	(VA)		_____
10x setting current	(VA)		_____
Relay incorporated in same relay case as IDMT overcurrent relay	(Yes/No)	*	_____
No. of serial ports	(nos.)	*	_____
Quantity	(nos.)	*	_____

2.9.4.15 Start-up Time Delayed Earth Fault Protection

Manufacturer		*	_____
Type Designation		*	_____
Microprocessor based	(Yes/No)	*	_____
Rated current (In)	(A)	*	_____
Current setting range (% of In)		*	_____
Time characteristic at time multiplier of 1.0 and at current equal to:			
20x relay setting			_____
50x relay setting			_____
Burden of current circuit on lowest setting	(VA)		_____
highest setting	(VA)		_____
Characteristic curve description		*	_____
No. of serial ports	(nos.)	*	_____
Quantity	(nos.)	*	_____

2.9.4.16 Excitation Transformer Overcurrent Protection

Manufacturer		*	_____
Type Designation		*	_____
Microprocessor based	(Yes/No)	*	_____
Rated current (In)		*	_____
Range of current settings (% of In)		*	_____
Time characteristic at time multiplier of 1.0 and at current equal to:			
20 x setting current	(ms)		_____
50 x setting current	(ms)		_____

Burden of current circuit on:

lowest setting	(VA)	_____
highest setting	(VA)	_____
Characteristic curve descriptions		* _____
No. of serial ports	(nos.)	* _____
Quantity	(nos.)	* _____

2.9.4.17 Excitation Transformer Differential Protection

Manufacturer		* _____
Type Designation		* _____
Basic operating principle of main element		_____
C.T. Burden at rated current	(VA)	_____
C.T. Burden at 5 x rated current	(VA)	_____
Required C.T. knee point voltage	(V)	_____
Setting range (or value of fixed setting)		* _____
Basic		_____
Load bias		_____
Second harmonic bias		_____
Other harmonic bias		_____
Operating time for:		
Current equal to 2 x setting		
Current equal to 5 x setting	(ms)	_____
Current equal to 10 x setting	(ms)	_____
	(ms)	_____
No. of serial ports	(nos.)	* _____
Quantity	(nos.)	* _____

2.9.4.18 Tripping Relays

Manufacturer		*	_____
Type Designation		*	_____
Operating time	(ms)	*	_____
Method of resetting	%	*	_____
Method of indication			_____
Method of indicator resetting			_____
Minimum operating voltage	(V DC)	*	_____
Operating current at rated voltage	(A)		_____
Rated Voltage	(V DC)	*	_____
Mechanical life (no. of switching operations)			_____
Maximum no. of contacts		*	_____
Quantity	(nos.)	*	_____

2.9.4.19 Relay Panel

Manufacturer		*	_____
Type (Model) designation		*	_____
Standard to which manufactured			_____
Height	(mm)		_____
Width	(mm)		_____
Depth	(mm)		_____
Form of construction			_____
Degree of protection			_____
Thickness of M.S. Sheet	(mm)		_____
Quantity	(nos.)	*	_____

2.9.5 Transformer Protection

2.9.5.1 Generator Transformer

Generator Transformer Biased Differential Protection

Manufacturer		*	_____
Type Designation		*	_____
Basic operating principle of main element		-	_____
CT burden at:			_____
rated current	(VA)		_____
5 x rated current	(VA)		_____
Required CT knee point voltage	(V)		_____
Setting range (or value of fixed setting)			
Basic		*	_____
Load bias		-	_____
second harmonic bias		*	_____
Other harmonic bias		-	_____
Operating times for:			
current equal to 2 x setting	(ms)		_____
current equal to 5 x setting	(ms)		_____
current equal to 10 x setting	(ms)		_____
No. of serial ports	(nos.)	*	_____
Quantity	(nos.)	*	_____

Generator Transformer Standby Earth Fault Protection

Manufacturer		*	_____
Type Designation		*	_____

Microprocessor based	(Yes/No)	* _____
		-
Rated current (In)	(A)	* _____
		-
Range of current settings (% of In)		* _____
		-
Time characteristic at time multiplier of 1.0 and at current equal to:		
20 x setting current	(ms)	_____
50 x setting current	(ms)	_____
Burden of current circuit on:		
lowest setting	(VA)	_____
highest setting	(VA)	_____
Characteristic curve descriptions		_____
No. of serial ports	(nos.)	* _____
		-
Quantity	(nos.)	* _____
		-

Generator Transformer Restricted Earth Fault Protection

Manufacturer		* _____
		-
Type Designation		* _____
Rated current (In)	(A)	* _____
Setting range		* _____
Sensitivity (% of In)	(%)	* _____
Relay burden at setting:		
lowest setting	(VA)	_____
highest setting	(VA)	_____
Series / Shunt resistors required		_____
Voltage limiting non-linear resistors required and characteristic constant		_____
Method of stabilising relay against mal-operation due to dc/dc		_____
		-

component of fault current

Operating time at twice minimum setting	(ms)	_____
Operating time at 10 x In	(ms)	_____
Magnitude of external phase-phase and phase-earth fault current up to which protection is stable	(x In)	_____
No. of serial ports	(nos.)	* _____
Quantity	(nos.)	* _____

High Set Instantaneous Overcurrent Protection

Manufacturer		* _____
Type Designation		* _____
Microprocessor based	(YES/No)	* _____
Rated current (In)	(A)	* _____
Range of current settings (% of In)		* _____
Operating time at:		
2 x setting current	(ms)	_____
5 x setting current	(ms)	_____
10 x setting current	(ms)	_____
Burden of current circuit on lowest setting at:		
1 x setting current	(VA)	_____
2 x setting current	(VA)	_____
5 x setting current	(VA)	_____
10 x setting current	(VA)	_____
Burden of current circuit on highest setting at:		
1 x setting current	(VA)	_____
2 x setting current	(VA)	_____
5 x setting current	(VA)	_____

10 x setting current	(VA)	_____
Relay incorporated in the same relay case as IDMT overcurrent relay	(Yes/No)	* _____
No. of serial ports	(nos.)	* _____
Quantity	(nos.)	* _____

Time-Delayed Overcurrent Protection

Manufacturer		* _____
Type Designation		* _____
Microprocessor based	(Yes/No)	* _____
Rated current (In)	(A)	* _____
Range of current settings (% of In)		* _____
Time characteristic at time multiplier of 1.0 and at current equal to:		
20 x setting current	(ms)	_____
50 x setting current	(ms)	_____
Burden of current circuit on:		
lowest setting	(VA)	_____
highest setting	(VA)	_____
Characteristic curve descriptions		_____
No. of serial ports	(nos.)	* _____
Quantity	(nos.)	* _____

2.9.5.2 Unit Transformer

Transformer Biased Differential Protection

Manufacturer		* _____
Type Designation		* _____

Basic operating principle of main element		*	_____
CT burden at:			
rated current	(VA)		_____
5 x rated current	(VA)		_____
Required CT knee point voltage	(V)		_____
Setting range (or value of fixed setting)			
Basic			_____
Load bias			_____
second harmonic bias			_____
Other harmonic bias			_____
Operating times for:			
current equal to 2 x setting	(ms)		_____
current equal to 5 x setting	(ms)		_____
current equal to 10 x setting	(ms)		_____
No. of serial ports	(nos.)	*	_____
Quantity	(nos.)	*	_____

Transformer Standby Earth Fault Protection

Manufacturer		*	_____
Type Designation		*	_____
Microprocessor based	(Yes/No)	*	_____
Rated current (In)	(A)	*	_____
Range of current settings (% of In)		*	_____
Time characteristic at time multiplier of 1.0 and at current equal to:			
20 x setting current	(ms)		_____
50 x setting current	(ms)		_____

Burden of current circuit on:

lowest setting	(VA)	_____
highest setting	(VA)	_____
Characteristic curve descriptions		
No. of serial ports	(nos.)	* _____
Quantity	(nos.)	* _____

Transformer Restricted Earth Fault Protection (Primary Side)

Manufacturer		* _____
Type Designation		* _____
Rated current (In)	(A)	* _____
Setting range		* _____
Sensitivity (% of In)	(%)	* _____
Relay burden at setting:		
lowest setting	(VA)	_____
highest setting	(VA)	_____
Series / Shunt resistors required		_____
Voltage limiting non-linear resistors required and characteristic constant		_____
Method of stabilising relay against maloperation due to dc/dc component of fault current		_____
Operating time at twice minimum setting	(ms)	_____
Operating time at 10 x In	(ms)	_____
Magnitude of external phase-phase and phase-earth fault current up to which protection is stable	(x In)	_____
No. of serial ports	(nos.)	* _____
Quantity	(nos.)	* _____

Transformer Restricted Earth Fault Protection (Secondary Side)

Manufacturer		* _____
Type Designation		* _____
Rated current (In)	(A)	* _____
Setting range		* _____
Sensitivity (% of In)	(%)	* _____
Relay burden at setting:		
lowest setting	(VA)	_____
highest setting	(VA)	_____
Series / Shunt resistors required		_____
Voltage limiting non-linear resistors required and characteristic constant		_____
Method of stabilising relay against maloperation due to dc/dc component of fault current		_____
Operating time at twice minimum setting	(ms)	_____
Operating time at 10 x In	(ms)	_____
Magnitude of external phase-phase and phase-earth fault current up to which protection is stable	(x In)	_____
No. of serial ports	(nos.)	* _____
Quantity	(nos.)	* _____

High Set Instantaneous Overcurrent Protection

Manufacturer		* _____
Type Designation		* _____
Type of Relay (static/electro-mechanical)		* _____
Rated current (In)		* _____

Range of current settings (% of In)		* _____
Operating time at:		
2 x setting current	(ms)	_____
5 x setting current	(ms)	_____
10 x setting current	(ms)	_____
Burden of current circuit on lowest setting at:		
1 x setting current	(VA)	_____
2 x setting current	(VA)	_____
5 x setting current	(VA)	_____
10 x setting current	(VA)	_____
Burden of current circuit on highest setting at:		
1 x setting current	(VA)	_____
2 x setting current	(VA)	_____
5 x setting current	(VA)	_____
10 x setting current	(VA)	_____
Relay incorporated in the same relay case as IDMT overcurrent relay (YES/NO)		* _____
No. of serial ports	(nos.)	* _____
Quantity	(nos.)	* _____

Time-Delayed Overcurrent Protection

Manufacturer		* _____
Type Designation		* _____
Type of Relay (static/electro-mechanical)		* _____
Rated current (In)		* _____
Range of current settings (% of In)		* _____

Time characteristic at time multiplier of 1.0 and at current equal to:			
20 x setting current	(ms)	_____	
50 x setting current	(ms)	_____	
Burden of current circuit on:			
lowest setting	(VA)	_____	
highest setting	(VA)	_____	
Characteristic curve descriptions		_____	
No. of serial ports	(nos.)	* _____	
Quantity	(nos.)	* _____	

2.9.5.3 Tripping Relays

Tripping Relays			
Manufacturer		* _____	
Type Designation		* _____	
Operating time	(ms)	* _____	
Method of resetting	(%)	_____	
Method of indication		_____	
Method of indicator resetting		_____	
Minimum operating voltage	(V dc)	_____	
Operating current at rated voltage	(A)	_____	
Rated Voltage	(V dc)	_____	
Mechanical life (no. of switching operations)		* _____	
Maximum no. of contacts		* _____	
Quantity	(nos.)	* _____	
Relay Panel			
Manufacturer		* _____	
Type (Model) designation		* _____	
Standard to which manufactured		* _____	
Height	(mm)	_____	

Width	(mm)	_____
Depth	(mm)	_____
Form of construction		_____
Degree of protection		_____
Thickness of M.S. Sheet	(mm)	_____
Quantity	(nos.)	* _____

2.9.6 220 KV Switchyard Equipment

2.9.6.1 Circuit Breakers

Manufacturer		_____
Type designation		_____
Operating voltage	(kV)	* _____
Maximum design voltage	(kV)	* _____
Type		* _____
Frequency/Phase		* _____
Continuous current rating	(A)	* _____
Maximum symmetrical interrupting Current rating	(kA)	* _____
BIL Impulse withstand voltage	(kV)	* _____
Low frequency withstand voltage	(kV)	* _____
Minimum leakage distance	(mm)	* _____
Number of trip coils		* _____
Applicable standard		* _____

2.9.6.2 Disconnecting Switches

Manufacturer _____

Type designation		_____
Operating voltage	(kV)	* _____
Continuous current rating	(A)	* _____
BIL Impulse withstand voltage	(kV)	* _____
Minimum leakage distance	(mm)	* _____
Insulator type		* _____
Applicable standard		* _____

2.9.6.3 Surge Arresters

Manufacturer		_____
Type designation		_____
Operating voltage	(kV)	_____
Maximum design voltage	(kV)	_____
Duty cycle	(kA)	_____
Maximum continuous operating voltage	(kV)	_____
Minimum leakage distance	(mm)	_____
Discharge counter		_____
Applicable standard		_____

2.9.6.4 Voltage transformer

Manufacturer		_____
Type designation		_____
Operating voltage	(kV)	_____
Maximum design voltage	(kV)	_____
Rated frequency	(Hz)	_____
BIL Impulse withstand voltage	(kVp)	_____
Accuracy class		_____

Applicable standard _____

2.9.6.5 Current Transformer

Manufacturer _____

Type designation _____

Operating voltage (kV) _____

Maximum design voltage (kV) _____

Primary current (A) _____

Secondary current (A) _____

Rated frequency (Hz) _____

BIL Impulse withstand voltage (kV) _____

Minimum leakage distance (mm) _____

Ratio _____

Applicable standard _____

2.9.6.6 Bus Bar Zone Protection Equipment

Manufacturer _____

Type designation _____

Rated current (A) _____

Rated frequency (Hz) _____

Method of coordination with the existing bus bar zone protection equipment (Bidder to specify in detail in his Bid)

2.9.6.7 Line suspension insulation

Manufacturer _____

Type of insulators _____

Size of insulators _____

Number of insulators per a string _____
 Insulation class or insulation creepage distance _____

2.9.6.8 Line post-type insulation (bus support)

Manufacturer _____
 Type of insulators _____
 Size of insulators _____
 Insulation class or insulation creepage distance _____
 Number of insulators per a post _____
 Mechanical strength _____
 Dimensions _____
 Wind estimated speed m/s _____
 Horizontal wire tension _____

2.9.6.9 220 kV Bus Conductors

Contractor shall submit details of 220 kV bus conductors, supporting structures etc. during design stage _____

2.9.7 Station Batteries and Battery Chargers

2.9.7.1 Batteries

Manufacturer * _____
 Type/model * _____
 Cell Type * _____
 Minimum cell voltage (V) * _____
 No. of cells per battery * _____

Plate Type		*	_____
Rated discharge Capacity		*	_____
Out put Voltage	(V)	*	_____
Discharge Time		*	_____
Weight	(kg)		_____
Dimensions (Height x Width x Depth)	(mm)		_____
No. of batteries		*	_____
Active material			
+ Plate			_____
- Plate			_____
Catalogues enclosed	(Yes/No)	*	_____
IEC 60896-1 or equivalent	(Yes/No)	*	_____
Specified capacity	(Ah)	*	_____
Operating temperature range	(°C)		_____
Operating relative humidity range	(%)		_____
Rated temperature	(°C)		_____
Capacity of each battery	(Ah)	*	_____
Float voltage	(V)	*	_____
Maximum current			
Charge	(A)		_____
Discharge	(A)		_____
Boost Voltage/Cell	(V)	*	_____
Battery rack			
Weight			_____
Material			_____
Required number			_____
Batteries per rack			_____
Tiers per rack			_____

2.9.7.2 Battery Charger

Manufacturer's name		*	_____
Type/model		*	_____
Applicable standard or recommendation		*	_____
Dimensions of battery charger (Height x Width x Depth)	(mm)		_____
Weight	(kg)		_____
Input voltage range	(V)	*	_____
Input frequency range	(Hz)	*	_____
Input Power	(KVA)	*	_____
Power Factor	(%)	*	_____
Efficiency	(%)	*	_____
Output voltage	(V)	*	_____
Output Voltage Variation	(%)		_____
Output current range	(A)		_____
RMS ripple factor			_____
Input voltage protection	(Yes/No)	*	_____
Output voltage protection	(Yes/No)	*	_____
Current limiting at output	(Yes/No)	*	_____
Value of current limited	(A)		_____
Charging type	Constant		_____
Audible noise at 1m	(V/I) (dB)		_____
Operating temperature range	(°C)		_____
Operating relative humidity range	(%)		_____
Rated temperature range	(°C)		_____
Meters	(Yes/No)	*	_____
Indication	(Yes/No)	*	_____
Quantity		*	_____

2.9.7.3 Panels for Battery Charger

Manufacturer's name		* _____
Type/Model		* _____
Level of Protection		* _____
Thickness of cabinet	(mm)	_____
Dimensions (Height x Weight x Depth)	(mm)	_____
Rated voltage	(V)	_____
Rust prevention method		_____
Rated continuous current	(A)	_____
Rated short circuit current	(kA)	_____
Quantity		* _____

2.9.8 Uninterruptible Power Supply

2.9.8.1 General

Total load expected	(kVA)	*	_____
UPS capacity rating to be supplied for the load	(kVA)	*	_____
Input requirement for UPS			_____
Voltage range	(V)	*	_____
Frequency range	(Hz)	*	_____
Rating of rectifier (converter)	(kVA)	*	_____
Rating of inverter	(kVA)	*	_____
Rating of static switch	(kVA)	*	_____
UPS efficiency	(%)	*	_____
Total RFI(Radio Interference) emission	Frequency (dB)		_____
Cabinet construction			_____
Rectifier			
Manufacturer		*	_____
Model		*	_____
Dimension (Height x Width x Depth)	(mm)		_____
Weight	(kg)		_____
Input voltage range	(V)	*	_____
Output voltage (DC): float	(V)	*	_____
Output voltage (DC): boost	(V)	*	_____
Output current	(A)	*	_____

Input frequency range	(Hz)	* _____
Input voltage protection	(Yes/No)	* _____
Output voltage protection	(Yes/No)	* _____
Current limiting at output	(Yes/No)	* _____
Value of current limited	(A)	* _____
Cooling method		_____
Audible noise at one (1) meter	(dB)	_____
Operating temperature range	(°C)	_____
Operating relative humidity range	(%)	_____
Maximum input current	(A)	_____
Input power factor		_____
Maximum inrush current	(A)	_____
Surge clamping level	(kV)	_____
Spike clamping level	(kV)	_____
Total harmonic at input	(%)	_____
Maximum ripple content on DC	(%)	_____
Load DC voltage range	(V)	_____
Efficiency at maximum power	(%)	_____
Heat generated at maximum power	(J/h)	_____
Quantity		* _____

2.9.8.2 Inverter

Manufacturer	* _____
Model	* _____

Dimension (Height x Width x Depth)	(mm)	_____
Weight	(kg)	_____
Inversion Element		_____
Switching frequency	(kHz)	* _____
Input voltage protection	(Yes/No)	* _____
Output voltage protection	(Yes/No)	* _____
Output short-circuit protection	(Yes/No)	* _____
Audible noise at one (1) meter	(dB)	_____
Operating temperature range	(°C)	_____
Operating relative humidity range	(%)	_____
Maximum power output	(kVA)	_____
Input current	(A)	* _____
Input DC voltage	(V)	* _____
Output AC voltage	(V)	* _____
Output frequency range	(Hz)	* _____
Output current	(A)	* _____
Maximum sustained overload		_____
One (1) minute	(%)	_____
Fifteen (15) minute	(%)	_____
Continuous	(%)	_____
Efficiency at maximum power	(%)	_____
Heat generated at maximum power	(J/h)	_____
Quantity		* _____

2.9.8.3 Static Switch

Manufacturer		*	_____
Model			_____
Dimension (Height x Width x Depth)	(mm)		_____
Weight	(kg)		_____
Type of switching element			_____
Number of switching element			_____
Switching switch between inverters	(ms)		_____
Anti-hunting Provision	(Yes/No)	*	_____
Fully redundant	(Yes/No)	*	_____
Interlocked to changeover	(Yes/No)	*	_____
Quantity		*	_____

2.9.9 Motors

2.9.9.1 Medium Voltage Motors

NO.	SERVICE NAME	Q'TY	VOLTAGE	kW	RPM	ENCLOSURE	INSULATION

2.9.9.2 LOW VOLTAGE MOTORS

NO.	SERVICE NAME	Q'TY	VOLTAGE	kW	RPM	ENCLOSURE	INSULATION

**For Medium voltage and Low voltage motors,
following information shall be submitted during design stage**

- Technological assignment;
- Availability of variable-frequency electric drive;
- Method of installation;
- Explosion-, dust-, damp-proofness;
- Cooling system;
- Operational mode (operation-to-idling period ratio);
- Torque performances;
- Reverse power;
- Protective tripping;
- Journal and ball bearings manufacturer;
- Actuator performances;
- System and scope of maintenance operation;
- System and scope of maintenance operation;
- Necessity and periodicity of maintenance;
- Warranty lifetime;
- Equipment and system guarantee maintenance;
- Systems and equipment improved features for Plant performance build-up;
- Selfstarting of important load electric motors.

2.9.9.3 DC MOTORS

NO.	SERVICE NAME	Q'TY	VOLTAGE	kW	RPM	ENCLOSURE	INSULATION

Following information shall be submitted during design stage

- Technological assignment;
- Power supply source;
- Rotation speed control;
- Method of installation;
- Explosion-, dust-, damp-proofness;
- Cooling system;
- Operational mode (operation-to-idling period ratio);
- Torque performances;
- Reverse power;
- Protective tripping;
- Journal and ball bearings manufacturer;
- Actuator performances;
- System and scope of maintenance operation;

2.9.10 Communication System

2.9.10.1 Telephone System

Telephone

Manufacturer _____

Type _____

2.9.10.2 Signal Cables

Manufacturer _____

Type _____

Model Numbers _____

Pairing of cores _____

Shielding _____

Applicable standard _____

Communication pair Y/N _____

Conductor material _____

Conductor construction _____

Insulation material _____

Shielding material _____

Drain wire material _____

Inner sheath material _____

Outer sheath material _____

Armor material & type _____

Voltage grade (V) _____

Maximum conductor resistance at 20°C	(Ω)	_____
Maximum mutual capacitance between adjacent cores	(pF/m)	_____
Minimum insulation resistance at 20° C	(Ω/km)	_____

2.9.10.3 Speaker System

Speaker

Manufacturer _____

Type _____

Amplifier

Manufacturer _____

Type _____

Output signal _____

Feeder Cable

Manufacturer _____

Type _____

Model Numbers _____

Applicable standard _____

Communication pair Y/N _____

Conductor material _____

Conductor construction _____

Insulation material _____

Inner sheath material _____

Outer sheath material _____

Armor material & type		_____
Voltage grade	(V)	_____
Maximum conductor resistance at 20°C	(Ω)	_____
Maximum mutual capacitance between adjacent cores	(pF/m)	_____
Minimum insulation resistance at 20° C	(Ω/km)	_____

2.9.10.4 Internal Telephone System

Telephone

Manufacturer _____

Type _____

Amplifier

Manufacturer _____

Type _____

Output signal _____

PABX (Private Automatic Branch Exchanger)

Manufacturer _____

Type _____

Numbersy line _____

Signal Cable to Communication Center

Manufacturer _____

Type _____

Model Numbers _____

Pairing of cores		_____
Shielding		_____
Applicable standard		_____
Communication pair	Y/N	_____
Conductor material		_____
Conductor construction		_____
Insulation material		_____
Shielding material		_____
Drain wire material		_____
Inner sheath material		_____
Outer sheath material		_____
Armor material & type		_____
Voltage grade	(V)	_____
Maximum conductor resistance at 20°C	(Ω)	_____
Maximum mutual capacitance between adjacent cores	(pF/m)	_____
Minimum insulation resistance at 20°C	(Ω/km)	_____

Signal Cable to booth

Manufacturer	_____
Type	_____
Model Numbers	_____
Pairing of cores	_____

Shielding		_____
Applicable standard		_____
Communication pair	Y/N	_____
Conductor material		_____
Conductor construction		_____
Insulation material		_____
Shielding material		_____
Drain wire material		_____
Inner sheath material		_____
Outer sheath material		_____
Armor material & type		_____
Voltage grade	(V)	_____
Maximum conductor resistance at 20°C	(Ω)	_____
Maximum mutual capacitance between adjacent cores	(pF/m)	_____
Minimum insulation resistance at 20° C	(Ω/km)	_____

Booth

Height	(m)
Length	(m)
Width	(m)
Panel Thickness	(m)

Bidder's Data Sheet

Bidder's Name

2.10 INSTRUMENTATION AND CONTROL

2.10.1 General Requirements for Instrumentation and Control

Item No.	Description		Bidder to fill in
1.1	Main Standards And Codes		*
(1)	For control equipment		to list here
(2)	For instrumentation equipment		to list here
1.2	Proposed Manufactures Of The Instrumentation and Control Equipment		*
1.3	Information has been submitted in sufficient detail to permit full understanding and evaluation of equipment offered		to describe for Autonomous System
1.4	Has a description been submitted of its Quality Control and Inspection Department and that of its major contractors	Y/N	*
1.5	Has the following information, data and drawings been included :	Y/N	*
(1)	Availability/Reliability analysis of the proposed system and sub-systems	Y/N	
(2)	Description of hardware and software tests that will be used to check the equipment and program at the factory and on the plant site	Y/N	
(3)	Hardware and software protective techniques used to detect errors in the system and provide file and program protection. Description of a method for simple and convenient re-initialization of the system	Y/N	
(4)	Drawings of cabinet, local instrumentation and control panels to be furnished, showing outline dimensions, weights, methods of		

Item No.	Description		Bidder to fill in
	access to the interior, wiring or cabling entrance and functional layout	Y/N	
(5)	Has a drawing showing the functional layout of the control systems	Y/N	
(6)	Have system configuration drawings showing all cabinets, panels and peripheral devices as well as all data highway connections, interface devices and prefab-cabling been included	Y/N	
(7)	Has a description of control systems operation supplementing the above configuration drawing been included	Y/N	

Bidder's Data Sheet

Bidder's Name

The Bidder shall enter all items and data that correspond to each system.

The censors shall be referred to Section 2.10.7"Field Instrument, Panel Mounted Instrument".

The control valves shall be referred to Section 2.10.8"Control Valves & Motorized Valves".

2.10.2 Gas Turbine Control, protection and Monitoring System

Item NO.	Description	Units	Gas turbine control system	Electro-hydraulic Governor Control System (if applied)	Gas Turbine Supervisory System	Dynamic Pressure Pulsation System (if applied)	
1.0	Control Panel		*				
(1)	Manufacture						
(2)	Model No.						
(3)	CPU						
	a) Microprocessor size	bit					
	b) Memory size	MB					
	c) Back-up CPU						
(4)	Power Supply						
	a) Model type						
	b) Supply voltage(s)	V					
	c) Redundant						
	d) Power consumption	kW					
(5)	Analogue Input Module						
	a) Model type						
	b) DC 4-20mA dc inputs with transmitter power supply						

Item NO.	Description	Units	Gas turbine control system	Electro-hydraulic Governor Control System (if applied)	Gas Turbine Supervisory System	Dynamic Pressure Pulsation System (if applied)	
	- No. of inputs/module						
	- Intelligent SMART Tx. interface						
	c) DC 4-20mA inputs(4 - wire type)						
	- No. of inputs/module						
	- SMART Tx. interface						
	d) 3 - wire RTD inputs						
	- No. of inputs/module						
	e) Thermocouple inputs						
	- No. of inputs/module						
	f) Electrical isolation						
	g) Broken wire monitoring						
	h) Earth fault isolation						
(6)	Analogue Output Module						
	a) Model type						
	b) No. of outputs/module						
	c) Type of output signals						
	d) Electrical isolation						
	e) Reverse polarity protection						
(7)	Digital Input Module						
	a) Model type						
	b) No. of inputs/module						

Item NO.	Description	Units	Gas turbine control system	Electro-hydraulic Governor Control System (if applied)	Gas Turbine Supervisory System	Dynamic Pressure Pulsation System (if applied)	
	c) Electrical isolation						
	d) Earth fault isolation						
(8)	Digital Output Module						
	a) Model type						
	b) No. of outputs/module						
(9)	Control System block diagram						
(10)	Turbine/Generator interlock system						
(11)	Interface device to MCMS						
	a) Type						
	b) Manufacturer & Model No.						
	c) Transmission rate	MB					
	d) Back-up system						
(12)	Operating condition						
	a) Temperature	°C					
	b) Relative humidity	%					
(13)	System Cabinet						
	a) Dimension (W x D x H)	mm					
	b) Anti-vibration rubber						
	c) Index of protection (IP)						
	d) Number of cabinet						
(14)	MTBF	Hours					

Item NO.	Description	Units	Gas turbine control system	Electro-hydraulic Governor Control System (if applied)	Gas Turbine Supervisory System	Dynamic Pressure Pulsation System (if applied)	
2.0	Marshalling/Relay Cabinets (if applicable)						
(1)	Manufacturer						
(2)	Model No.						
(3)	Type						
(4)	Dimension (W x D x H)	mm					
(5)	Index of protection (IP)						
(6)	Number of cabinets						
(7)	Interposing relay						
	a) Type						
	b) Manufacturer and Model No.						
	c) Contact rating	A V					
3.0	Maintenance Tool						
(1)	Manufacture						
(2)	Model No.						
(3)	CPU						
	a) Microprocessor size	bit					
	b) Memory size	MB					
(4)	Hard disk capacity						
(5)	CD R/RW drive						
(6)	DVD-R/RW drive						

Item NO.	Description	Units	Gas turbine control system	Electro-hydraulic Governor Control System (if applied)	Gas Turbine Supervisory System	Dynamic Pressure Pulsation System (if applied)	
(7)	Network interface						
(8)	External modem						
(9)	High voltage isolation						
(10)	Keyboard						
	a) Keyboard and mouse						
	b) No. of special function keys						
	c) Soft keys						
(11)	CRT						
	a) Manufacturer						
	b) Model No.						
	c) Supply Voltage	V					
	d) Supply Voltage Frequency	Hz					
	e) Screen size	inch					
	f) Resolution	pixels					
(12)	Printer						
	a) Manufacturer						
	b) Model No.						
	c) Supply Voltage	V					
	d) Supply Voltage Frequency	Hz					
	e) Type						
	f) Resolution	dpi					
	g) Printing speed	ppm					

Bidder's Data Sheet

Bidder's Name

The Bidder shall enter all items and data that correspond to each system.

The censors shall be referred to Section 2.10.7"Field Instrument, Panel Mounted Instrument".

The control valves shall be referred to Section 2.10.8"Control Valves & Motorized Valves"

2.10.3 Steam Turbine Control, Protection and monitoring System

Item NO.	Description	Units	Steam Turbine Control System	Electro-hydraulic Governor Control System (if applied)	Steam Turbine Supervisory System		
1.0	Control Panel		*				
(1)	Manufacture						
(2)	Model No.						
(3)	CPU						
	a) Microprocessor size	bit					
	b) Memory size	MB					
	c) Back-up CPU						
(4)	Power Supply						
	a) Model type						
	b) Supply voltage(s)	V					
	c) Redundant						
	d) Power consumption	kW					
(5)	Analogue Input Module						
	a) Model type						
	b) DC 4-20mA dc inputs with transmitter power supply						

Item NO.	Description	Units	Steam Turbine Control System	Electro-hydraulic Governor Control System (if applied)	Steam Turbine Supervisory System		
	- No. of inputs/module						
	- Intelligent SMART Tx. interface						
	c) DC 4-20mA inputs(4 - wire type)						
	- No. of inputs/module						
	- SMART Tx. interface						
	d) 3 - wire RTD inputs						
	- No. of inputs/module						
	e) Thermocouple inputs						
	- No. of inputs/module						
	f) Electrical isolation						
	g) Broken wire monitoring						
	h) Earth fault isolation						
(6)	Analogue Output Module						
	a) Model type						
	b) No. of outputs/module						
	c) Type of output signals						
	d) Electrical isolation						
	e) Reverse polarity protection						
(7)	Digital Input Module						
	a) Model type						
	b) No. of inputs/module						
	c) Electrical isolation						

Item NO.	Description	Units	Steam Turbine Control System	Electro-hydraulic Governor Control System (if applied)	Steam Turbine Supervisory System		
	d) Earth fault isolation						
(8)	Digital Output Module						
	a) Model type						
	b) No. of outputs/module						
(9)	Control System block diagram						
(10)	Turbine/Generator interlock system						
(11)	Interface device to MCMS						
	a) Type						
	b) Manufacturer & Model No.						
	c) Transmission rate	MB					
	d) Back-up system						
(12)	Operating condition						
	a) Temperature	°C					
	b) Relative humidity	%					
(13)	System Cabinet						
	a) Dimension (W x D x H)	mm					
	b) Anti-vibration rubber						
	c) Index of protection (IP)						
	d) Number of cabinet						
(14)	MTBF	Hours					
2.0	Marshalling/Relay Cabinets (if applicable)						

Item NO.	Description	Units	Steam Turbine Control System	Electro-hydraulic Governor Control System (if applied)	Steam Turbine Supervisory System		
(1)	Manufacturer						
(2)	Model No.						
(3)	Type						
(4)	Dimension (W x D x H)	mm					
(5)	Index of protection (IP)						
(6)	Number of cabinets						
(7)	Interposing relay						
	a) Type						
	b) Manufacturer and Model No.						
	c) Contact rating	A V					
3.0	Maintenance Tool						
(1)	Manufacture						
(2)	Model No.						
(3)	CPU						
	a) Microprocessor size	bit					
	b) Memory size	MB					
(4)	Hard disk capacity						
(5)	CD R/RW drive						
(6)	DVD-R/RW drive						
(7)	Network interface						
(8)	External modem						

Item NO.	Description	Units	Steam Turbine Control System	Electro-hydraulic Governor Control System (if applied)	Steam Turbine Supervisory System		
(9)	High voltage isolation						
(10)	Keyboard						
	a) Keyboard and mouse						
	b) No. of special function keys						
	c) Soft keys						
(11)	CRT						
	a) Manufacturer						
	b) Model No.						
	c) Supply Voltage	V					
	d) Supply Voltage Frequency	Hz					
	e) Screen size	inch					
	f) Resolution	pixels					
(12)	Printer						
	a) Manufacturer						
	b) Model No.						
	c) Supply Voltage	V					
	d) Supply Voltage Frequency	Hz					
	e) Type						
	f) Resolution	dpi					
	g) Printing speed	ppm					

Bidder's Data Sheet

Bidder's Name

The Bidder shall enter all items and data that correspond to each system.

The censors shall be referred to Section 2.10.7"Field Instrument, Panel Mounted Instrument".

The control valves shall be referred to Section 2.10.8"Control Valves & Motorized Valves"

2.10.4 HRSG and BOP Control, Protection and monitoring System

Item NO.	Description	Units	HRSG and BOP Control System (if applicable)	Chemical Injection Control Panel (if applied)	Hot Water Supply System Control Panel (if applied)	Steam and Water Sampling System Control Panel (if applied)	If any
1.0	Control Panel		*				
(1)	Manufacture						
(2)	Model No.						
(3)	CPU						
	a) Microprocessor size	bit					
	b) Memory size	MB					
	c) Back-up CPU	Y/N					
(4)	Power Supply						
	a) Model type						
	b) Supply voltage(s)	V					
	c) Redundant						
	d) Power consumption	kW					
(5)	Analogue Input Module						
	a) Model type						
	b) DC 4-20mA dc inputs with transmitter power supply						
	- No. of inputs/module						
	- Intelligent SMART Tx. interface						

Item NO.	Description	Units	HRSB and BOP Control System (if applicable)	Chemical Injection Control Panel (if applied)	Hot Water Supply System Control Panel (if applied)	Steam and Water Sampling System Control Panel (if applied)	If any
	c) DC 4-20mA inputs(4 - wire type)						
	- No. of inputs/module						
	- SMART Tx. interface						
	d) 3 - wire RTD inputs						
	- No. of inputs/module						
	e) Thermocouple inputs						
	- No. of inputs/module						
	f) Electrical isolation						
	g) Broken wire monitoring						
	h) Earth fault isolation						
(6)	Analogue Output Module						
	a) Model type						
	b) No. of outputs/module						
	c) Type of output signals						
	d) Electrical isolation						
	e) Reverse polarity protection						
(7)	Digital Input Module						
	a) Model type						
	b) No. of inputs/module						
	c) Electrical isolation						
	d) Earth fault isolation						
(8)	Digital Output Module						
	a) Model type						
	b) No. of outputs/module						
(9)	Control System block diagram						

Item NO.	Description	Units	HRS&G and BOP Control System (if applicable)	Chemical Injection Control Panel (if applied)	Hot Water Supply System Control Panel (if applied)	Steam and Water Sampling System Control Panel (if applied)	If any
(10)	Turbine/Generator interlock system						
(11)	Interface device to MCMS						
	a) Type						
	b) Manufacturer & Model No.						
	c) Transmission rate	MB					
	d) Back-up system						
(12)	Operating condition						
	a) Temperature	°C					
	b) Relative humidity	%					
(13)	System Cabinet						
	a) Dimension (W x D x H)	mm					
	b) Anti-vibration rubber						
	c) Index of protection (IP)						
	d) Number of cabinet						
(14)	MTBF	Hours					
2.0	Marshalling/Relay Cabinets (if applicable)						
(1)	Manufacturer						
(2)	Model No.						
(3)	Type						
(4)	Dimension (W x D x H)	mm					
(5)	Index of protection (IP)						
(6)	Number of cabinets						
(7)	Interposing relay						
	a) Type						

Item NO.	Description	Units	HRSB and BOP Control System (if applicable)	Chemical Injection Control Panel (if applied)	Hot Water Supply System Control Panel (if applied)	Steam and Water Sampling System Control Panel (if applied)	If any
	b) Manufacturer and Model No.						
	c) Contact rating	A V					
3.0	Maintenance Tool						
(1)	Manufacture						
(2)	Model No.						
(3)	CPU						
	a) Microprocessor size	bit					
	b) Memory size	MB					
(4)	Hard disk capacity						
(5)	CD R/RW drive						
(6)	DVD-R/RW drive						
(7)	Network interface						
(8)	External modem						
(9)	High voltage isolation						
(10)	Keyboard						
	a) Keyboard and mouse						
	b) No. of special function keys						
	c) Soft keys						
(11)	CRT						
	a) Manufacturer						
	b) Model No.						
	c) Supply Voltage	V					
	d) Supply Voltage Frequency	Hz					
	e) Screen size	inch					

Item NO.	Description	Units	HRSG and BOP Control System (if applicable)	Chemical Injection Control Panel (if applied)	Hot Water Supply System Control Panel (if applied)	Steam and Water Sampling System Control Panel (if applied)	If any
	f) Resolution	pixels					
(12)	Printer						
	a) Manufacturer						
	b) Model No.						
	c) Supply Voltage	V					
	d) Supply Voltage Frequency	Hz					
	e) Type						
	f) Resolution	dpi					
	g) Printing speed	ppm					

Bidder's Data Sheet

Bidder's Name

The Bidder shall enter all items and data that correspond to each system.
The censors shall be referred to Section 2.10.7"Field Instrument, Panel Mounted Instrument".
The control valves shall be referred to Section 2.10.8"Control Valves & Motorized Valves"

2.10.5 Other Control, Protection and Monitoring System

Item NO.	Description	Units	Fuel Gas Compressor Control System (if applied)	Water Treatment Control System	Waste Water Treatment Control System	If any	If any
1.0	Control Panel		*				
(1)	Manufacture						
(2)	Model No.						
(3)	CPU						
	a) Microprocessor size	bit					
	b) Memory size	MB					
	c) Back-up CPU						
(4)	Power Supply						
	a) Model type						
	b) Supply voltage(s)	V					
	c) Redundant						
	d) Power consumption	kW					
(5)	Analogue Input Module						
	a) Model type						
	b) DC 4-20mA dc inputs with transmitter power supply						
	- No. of inputs/module						
	- Intelligent SMART Tx. interface						
	c) DC 4-20mA inputs(4 - wire type)						

Item NO.	Description	Units	Fuel Gas Compressor Control System (if applied)	Water Treatment Control System	Waste Water Treatment Control System	If any	If any
	- No. of inputs/module						
	- SMART Tx. interface						
	d) 3 - wire RTD inputs						
	- No. of inputs/module						
	e) Thermocouple inputs						
	- No. of inputs/module						
	f) Electrical isolation						
	g) Broken wire monitoring						
	h) Earth fault isolation						
(6)	Analogue Output Module						
	a) Model type						
	b) No. of outputs/module						
	c) Type of output signals						
	d) Electrical isolation						
	e) Reverse polarity protection						
(7)	Digital Input Module						
	a) Model type						
	b) No. of inputs/module						
	c) Electrical isolation						
	d) Earth fault isolation						
(8)	Digital Output Module						
	a) Model type						
	b) No. of outputs/module						
(9)	Control System block diagram						
(10)	Turbine/Generator interlock system						
(11)	Interface device to MCMS						

Item NO.	Description	Units	Fuel Gas Compressor Control System (if applied)	Water Treatment Control System	Waste Water Treatment Control System	If any	If any
	a) Type						
	b) Manufacturer & Model No.						
	c) Transmission rate	MB					
	d) Back-up system	Y/N					
(12)	Operating condition						
	a) Temperature	°C					
	b) Relative humidity	%					
(13)	System Cabinet						
	a) Dimension (W x D x H)	mm					
	b) Anti-vibration rubber						
	c) Index of protection (IP)						
	d) Number of cabinet						
(14)	MTBF	Hours					
2.0	Marshalling/Relay Cabinets (if applicable)						
(1)	Manufacturer						
(2)	Model No.						
(3)	Type						
(4)	Dimension (W x D x H)	mm					
(5)	Index of protection (IP)						
(6)	Number of cabinets						
(7)	Interposing relay						
	a) Type						
	b) Manufacturer and Model No.						
	c) Contact rating	A V					

Item NO.	Description	Units	Fuel Gas Compressor Control System (if applied)	Water Treatment Control System	Waste Water Treatment Control System	If any	If any
3.0	Maintenance Tool						
(1)	Manufacture						
(2)	Model No.						
(3)	CPU						
	a) Microprocessor size	bit					
	b) Memory size	MB					
(4)	Hard disk capacity						
(5)	CD R/RW drive						
(6)	DVD-R/RW drive						
(7)	Network interface						
(8)	External modem						
(9)	High voltage isolation						
(10)	Keyboard						
	a) Keyboard and mouse						
	b) No. of special function keys						
	c) Soft keys						
(11)	CRT						
	a) Manufacturer						
	b) Model No.						
	c) Supply Voltage	V					
	d) Supply Voltage Frequency	Hz					
	e) Screen size	inch					
	f) Resolution	pixels					
(12)	Printer						
	a) Manufacturer						
	b) Model No.						

Item NO.	Description	Units	Fuel Gas Compressor Control System (if applied)	Water Treatment Control System	Waste Water Treatment Control System	If any	If any
c)	Supply Voltage	V					
d)	Supply Voltage Frequency	Hz					
e)	Type						
f)	Resolution	dpi					
g)	Printing speed	ppm					

Bidder's Data Sheet

Bidder's Name

2.10.6 Master Control and Monitoring System

Item NO.	Description	Units	Bidder to fill in
1.1	General		
(1)	Manufacturer		
(2)	Model No		
(3)	Number of Control Stations		*
(4)	Number of Remote I/O Cabinets		*
(5)	Number of Operator Workstations		*
(6)	Number of Engineer's Workstation		*
(7)	Number of Shift Supervisor's Workstations		*
(8)	Number of servers		*
(9)	Number of CRT		*
(10)	Number of large screen		*
(11)	Number of PC (personal computer)		*
(12)	Number of printer		*
(13)	Number of color hard copy		*
(14)	Operator Console		*
(15)	Desk for chief shift		*
1.2	Field Control Station/Remote I/O Cabinets		*
(1)	No. of field control station		
(2)	Manufacturer		
(3)	Model No.		
(4)	CPU		
	a) Microprocessor size	bit	

Item NO.	Description	Units	Bidder to fill in
	b) Memory size	MB	
	c) No of loops per controller		
	d) Back-up CPU		
	e) Switch over time	ms	
	f) Scan time for open and closed loops	ms	
	g) Memory protection during power failure		
(5)	Power Supply		
	a) Model type		
	b) Supply voltage(s)	V	
	c) Frequency	Hz	
	d) Redundant		
(6)	Analogue Input Module		
	a) Model type		
	b) DC 4-20mA inputs with transmitter power supply		
	- No. of inputs/module		
	- Intelligent tx. interface		
	c) DC 4-20mA inputs(4 - wire type)		
	- No. of inputs/module		
	- Intelligent tx. interface		
	d) 3 - wire RTD inputs		
	- No. of inputs/module		
	e) Thermocouple inputs		
	- No. of inputs/module		
	f) Electrical isolation		
	g) Broken wire monitoring		
	h) Earth fault isolation		
(7)	Analogue Output Module		

Item NO.	Description	Units	Bidder to fill in
	a) Model type		
	b) No. of outputs/module		
	c) Type of output signals		
	d) Electrical isolation		
	e) Reverse polarity protection		
(8)	Digital Input Module		
	a) Model type		
	b) No. of inputs/module		
	c) Interrogation voltage	V	
	d) Electrical isolation		
	e) Earth fault isolation		
(9)	Digital Output Module		
	a) Model type		
	b) No. of outputs/module		
1.3	Operator Workstations		*
(1)	No. of operator workstation		
(2)	Manufacturer		
(3)	Model No.		
(4)	Supply Voltage	V	
(5)	Supply Voltage Frequency	Hz	
(6)	CPU clock	MHz	
(7)	Data bus size	bit	
(8)	Multi CPU support		
(9)	Hard Disk capacity	MB	
(10)	Full interchangeability between operators' consoles		
(11)	High voltage isolation		
(12)	Floppy Disk Drive		

Item NO.	Description	Units	Bidder to fill in
(13)	CD-R/RW Drive		
(14)	DVD-R/RAW Drive		
1.4	Engineering Workstation		*
(1)	No. of engineering workstation		
(2)	Manufacturer		
(3)	Model No.		
(4)	Supply Voltage	V	
(5)	Supply Voltage Frequency	Hz	
(6)	CPU clock	MHz	
(7)	Data bus size	bit	
(8)	Multi CPU support		
(9)	Hard Disk capacity	MB	
(10)	Full interchangeability between operators' consoles		
(11)	High voltage isolation		
(12)	Floppy disk drive		
(13)	CD-R/RW drive		
(14)	DVD-R/RAW drive		
(15)	Magneto-Optical/Streamer/DAT drive		
	a) Capacity	MB	
	b) Transfer rate	MB/s	
1.5	Server		*
(1)	No. of server		
(2)	Manufacturer		
(3)	Model No.		
(4)	Supply Voltage	V	
(5)	Supply Voltage Frequency	Hz	

Item NO.	Description	Units	Bidder to fill in
(6)	CPU clock	MHz	
(7)	Data bus size	bit	
(8)	Main memory capacity & type		
(9)	Data bus size	MB	
(10)	Hard disk capacity		
(11)	CD R/RW drive		
(12)	DVD-R/RW drive		
(13)	Network interface		
(14)	External modem		
(15)	High voltage isolation		
1.6	Keyboard		*
(1)	Keyboard and mouse		
(2)	No. of special function keys		
(3)	Soft keys		
1.7	CRT		*
(1)	No. of CRT		
(2)	Manufacturer		
(3)	Model No.		
(4)	Supply Voltage	V	
(5)	Supply Voltage Frequency	Hz	
(6)	Screen size	inch	
(7)	Resolution	pixels	
1.8	Engineering Workstation Printer (color laser printer)		*
(1)	No. of printer		

Item NO.	Description	Units	Bidder to fill in
(2)	Manufacturer		
(3)	Model No.		
(4)	Supply Voltage	V	
(5)	Supply Voltage Frequency	Hz	
(6)	Type		
(7)	Resolution	dpi	
(8)	Printing speed	ppm	
1.9	Engineering Workstation PC (lap-top)		*
(1)	No. of PC		
(2)	Manufacturer		
(3)	Model No.		
(4)	Supply Voltage	V	
(5)	Processor type		
(6)	CPU clock	MHz	
(7)	Main memory capacity & type	MB	
(8)	Data bus size	bit	
(9)	Hard Disk capacity	MB	
(10)	CD R/RW drive		
(11)	DVD-R/RAW drive		
(12)	Network interface		
(13)	External modem		
(14)	High voltage isolation		
1.10	Alarm & Event Printer		*
(1)	Manufacturer		
(2)	Model No.		

Item NO.	Description	Units	Bidder to fill in
(3)	Supply Voltage	V	
(4)	Supply Voltage Frequency	Hz	
(5)	Type		
(6)	Resolution	cp1	
(7)	Printing speed	cps	
1.11	Log and Report Printer		*
(1)	Manufacturer		
(2)	Model No.		
(3)	Supply Voltage	V	
(4)	Supply Voltage Frequency	Hz	
(5)	Type		
(6)	Resolution	dpi	
(7)	Printing speed	ppm	
1.12	Color Hard Copy Unit		*
(1)	Manufacturer		
(2)	Model No.		
(3)	Supply Voltage	V	
(4)	Supply Voltage Frequency	Hz	
(5)	Type		
(6)	Resolution	dpi	
(7)	Printing speed	ppm	
(8)	Screen lock-out time	s	
1.13	Workstation Functionality		*
(1)	Display call-up time	s	
(2)	Screen update time	s	

Item NO.	Description	Units	Bidder to fill in
(3)	No. of characters for tag no.		
(4)	No. of characters for description		
(5)	No. of overview displays		
(6)	No. of groups per overview display		
(7)	No. of messages per Operator Message Display		
(8)	Zooming facility		
(9)	Multi-window function		
1.14	Data Highway		*
(1)	Manufacturer		
(2)	Model No.		
(3)	Access Method		
(4)	Transport Medium		
(5)	Transmission Speed	MB/s	
(6)	Protocol		
(7)	Redundant Design	Y/N	
1.15	Local Area Network		*
(1)	Manufacturer		
(2)	Model No.		
(3)	Access Method		
(4)	Transmission Speed	MB/s	
(5)	Protocol		
(6)	Redundant Design	Y/N	
1.16	Real Time Master Clock		*
(1)	Manufacturer		
(2)	Model No.		

Item NO.	Description	Units	Bidder to fill in
(3)	Accuracy	ms	
(4)	GPS time reference unit		
(5)	Decoder		
(6)	GPS antenna		
(7)	No. & type of outputs		
(6)	Resolution	pixels	
1.17	Large Screen		*
(1)	No. of large screen		
(2)	Manufacturer		
(3)	Type		
(4)	Model Numbers		
(5)	Size	inch	
(6)	Resolution	dot	
(7)	Luminosity	cd/cm	
(8)	RGB input		
(9)	VIDEO input		
(10)	Other interface		
1.20	Operator Console		
(1)	Manufacturer		
(2)	Power supply voltage requirement	mm	
(3)	Dimension (WxDxH)		
(4)	Anti\ vibration rubber		
(5)	Paint color		
1.19	Maintenance Tool		*
(1)	Manufacture		

Item NO.	Description	Units	Bidder to fill in
(2)	Model No.		
(3)	CPU		
	a) Microprocessor size	bit	
	b) Memory size	MB	
(4)	Hard disk capacity		
(5)	CD R/RW drive		
(6)	DVD-R/RW drive		
(7)	Network interface		
(8)	External modem		
(9)	High voltage isolation	Y/N	
(10)	Keyboard		
	a) Keyboard and mouse		
	b) No. of special function keys		
	c) Soft keys		
(11)	CRT		
	a) Manufacturer		
	b) Model No.		
	c) Supply Voltage	V	
	d) Supply Voltage Frequency	Hz	
	e) Screen size	inch	
	f) Resolution	pixels	
(12)	Printer		
	a) Manufacturer		
	b) Model No.		
	c) Supply Voltage	V	
	d) Supply Voltage Frequency	Hz	
	e) Type		
	f) Resolution	dpi	

Item NO.	Description	Units	Bidder to fill in
	g) Printing speed	ppm	

